

MATHEMATICS

SOLVED QUESTION

— PUSHPENDER SIR

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MATHEMATICS

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Type-1 (Basic Format with Square and Cube Formula)

1. If $\left(x + \frac{1}{x}\right) = \frac{11}{5}$, what is the value of $\left(x^3 + \frac{1}{x^3}\right)$?
SSC CHSL 2023 (Evening)

- (a) $4\frac{6}{125}$ (b) $5\frac{101}{125}$
(c) $10\frac{81}{125}$ (d) $17\frac{31}{125}$

2. $x + \frac{1}{x} = 7$ find the value of $x^3 + \frac{1}{x^3}$
SSC CGL 07/12/2022 (4th Shift)

- (a) 343 (b) 322
(c) 340 (d) 332

3. If $\left(x + \frac{1}{x}\right) = 7.5$, what is the value of $\left(x^2 + \frac{1}{x^2}\right)$?
SSC CHSL 25/05/2022 (Afternoon)

- (a) 54.25 (c) 56.25
(b) 52.25 (d) 58.25

4. If $\frac{x-y}{x\sqrt{y}+y\sqrt{x}} = \frac{1}{\sqrt{x}}$; ($x > 0, y > 0$) then what is the value of $\frac{x}{y}$?
[CDS-2022-I]

- (a) 1 (b) 2
(c) 4 (d) 8

5. If $x - 11 = 3\sqrt{11}$, then $\sqrt{x-1} - \frac{1}{\sqrt{x-1}} = ?$
(a) $3\sqrt{2}$ (b) $4\sqrt{5}$ (c) $2\sqrt{3}$ (d) $2\sqrt{5}$

6. If $x^2 + \frac{1}{x^2} = 66$, the value of $x - \frac{1}{x}$ is.
SSC CGL 09/12/2022 (2nd Shift)

- (a) 10 (b) 8
(c) 9 (d) 6

7. $a = \frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$ and $b = \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$ then value of $a^2 + b^2 - ab = ?$

- (a) 97 (b) $2\sqrt{3} + 2$
(c) $4\sqrt{6} + 1$ (d) 98

8. If $x^{3/4} + \frac{1}{x^{3/4+9}} = 0$, then find out the value of $(x^{3/4} + 9)^2 - \frac{1}{(x^{3/4+9})^2} = ?$

- (a) $\sqrt{76}$ (b) $\sqrt{70}$
(c) $\sqrt{79}$ (d) $9\sqrt{77}$

9. If $x = \frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}}$ and $y = \frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}}$ then $\frac{x^2+xy+y^2}{x^2-xy+y^2} = ?$

- (a) 63/61 (b) 67/65
(c) 65/63 (d) 69/67

10. If $x^2 - 5x + 1 = 0$, then the value of $\frac{x^6+x^4+x^2+1}{5x^3}$
SSC CGL 01/12/2022 (1st Shift)

- (a) 30 (b) 25
(c) 23 (d) 28

11. If $x - 5\sqrt{x} - 1 = 0$, then $x^2 + \frac{1}{x^2}$ is equal to -

- (a) 625 (b) 731
(c) 729 (d) 727

12. If, for a non-zero x , $5x^2 + 7x + 5 = 0$ then the value of $x^3 + \frac{1}{x^3}$ is:

SSC CGL 06/12/2022 (4th Shift)

- (a) $\frac{496}{125}$ (b) $\frac{532}{343}$
(c) $\frac{125}{532}$ (d) $\frac{182}{125}$

13. If $\left(a + \frac{1}{a}\right)^2 - 2\left(a - \frac{1}{a}\right) = 12, a = ?$

- (a) $\sqrt{5} + 6$ (b) $\pm\sqrt{5} + 2$
(c) $\pm\sqrt{5} + 4$ (d) $\sqrt{5} + 3$

14. If $x + \frac{1}{x} = -13$, what is the value of $x^4 + \frac{1}{x^4}$?
SSC CHSL 25/05/2022 (Afternoon)

- (a) 27887 (c) 29243
(b) 27891 (d) 28561

15. If $x^2 - 8x + 1 = 0$, what is the value of $x^8 - 3842x^4 + 1$?

SSC CHSL 27/05/2022 (Evening)

- (a) -1 (b) 0
(c) 2 (d) 1

16. If $x = \sqrt{3} + \sqrt{2}$, then the value of $(x^3 + \frac{1}{x^3})$ is:-

- (a) $6\sqrt{3}$ (b) $12\sqrt{3}$
(c) $18\sqrt{3}$ (d) $24\sqrt{3}$

17. If $3x - \frac{1}{4x} = 3, 4x + \frac{1}{3x} = ?$

- (a) ± 5 (b) ± 3
(c) ± 8 (d) None

18. If $x + \frac{1}{x} = 3$, then the value of $\frac{3x^2 - 4x + 3}{x^2 - x + 1}$ is

- (a) $\frac{4}{3}$ (b) $\frac{3}{2}$
(c) $\frac{5}{2}$ (d) $\frac{5}{3}$

19. If $x + \frac{1}{x} = 3$, then find out the value of $\frac{x^4 + 5x^3 + 3x^2 + 5x + 1}{x^4 + 1}$ is

- (a) $25/7$ (b) $20/7$
(c) $15/7$ (d) $12/7$

20. If $(x + \frac{1}{x}) = 5\sqrt{2}$, then what is the value of $(x^4 + x^{-4})$?

SSC CGL 01/12/2022 (2nd Shift)

- (a) 2542 (b) 2650
(c) 2452 (d) 2302

21. If $x + \frac{1}{x+7} = 0, x - \frac{1}{x+7} = ?$

- (a) $3\sqrt{5} - 5$ (b) $3\sqrt{5} - 7$
(c) $3\sqrt{7} - 5$ (d) $3\sqrt{7} - 7$

22. if $x^{2019} = 11 - 2\sqrt{30}$, then $x^{4038} + \frac{1}{x^{4038}} = ?$

- (a) 443 (b) 439
(c) 486 (d) 482

23. If $x + \frac{1}{x} = 5$, then the value of $\frac{3x}{2x^2 + 2 - 5x}$ will be

SSC CHSL 31/05/2022 (Evening)

- (a) $\frac{5}{2}$ (b) $\frac{2}{5}$
(c) $\frac{3}{5}$ (d) $\frac{5}{3}$

24. If $\frac{x^2}{y^2} + \frac{y^2}{x^2} = 7$, then possible value of $\frac{x^3}{y^3} + \frac{y^3}{x^3}$ is:

SSC CHSL 26/05/2022 (Morning)

- (a) 18 (b) 15
(c) 16 (d) 17

25. If $r + \frac{1}{r} = 11$, then the value of $\frac{r^3 + \frac{1}{r}}{r^2 - r + 1}$ is.....

SSC CHSL 07/06/2022 (Evening)

- (a) $\frac{119}{10}$ (b) $\frac{10}{119}$
(c) $\frac{19}{10}$ (d) $\frac{10}{109}$

26. If $x - \frac{1}{x} = 13$ then, what will be the value of $x^4 + \frac{1}{x^4}$

SSC CGL 03/12/2022 (1st Shift)

- (a) 28561 (b) 29243
(c) 27887 (d) 29239

27. If $c + \frac{1}{c} = 3$, then $(c - 3)^7 + \frac{1}{c^7} = ?$

- (a) 2 (b) 0
(c) 3 (d) 1

28. If $x^4 + (\frac{1}{x^4}) = 322$ then what is the value of $x^3 - (\frac{1}{x^3})$

SSC CHSL 01/06/2022 (Afternoon)

- (a) 16 (b) 76
(c) 96 (d) 46

29. If $a + \frac{1}{b} = 1$ and $b + \frac{1}{c} = 1$ then $c + \frac{1}{a}$ is equal to:-

- (a) 0 (b) $\frac{1}{2}$
(c) 1 (d) 2

30. If $p^4 = 4354 - \frac{1}{p^4}$, then the value of $p^3 - \frac{1}{p^3}$ can be:

SSC CHSL 31/05/2022 (Morning)

- (a) 536 (b) 436
(c) 416 (d) 516
31. If $5x^{7/4} - 3x^{7/8} + 5 = 0$, then $x^{7/4} + x^{-7/4}$
(a) $-\frac{41}{25}$ (b) $-\frac{21}{25}$
(c) $\frac{41}{25}$ (d) 0
32. If $k^4 + \frac{1}{k^4} = 194$, then what is the value of $k^3 + \frac{1}{k^3}$?
SSC CGL 02/12/2022 (3rd Shift)
(a) 42 (b) 52
(c) 36 (d) 18
33. If $(4a + \frac{5}{a} + 5) = 14$, what is the value of $(16a^2 + \frac{25}{a^2})$?
SSC CGL 03/12/2022 (1st Shift)
(a) 25 (b) 36
(c) 41 (d) 40
34. If $x^{150} = \frac{6-\sqrt{21}}{6+\sqrt{21}}$, then $x^{150} + \frac{1}{x^{150}} = ?$
(a) 8.7 (b) 8.6
(c) 6.7 (d) 7.6
35. If $x + \frac{1}{x} = 5$, then the value of $\frac{x^4+3x^3+5x^2+3x+1}{x^4+1}$?
(a) $\frac{43}{23}$ (b) $\frac{47}{21}$
(c) $\frac{41}{23}$ (d) $\frac{45}{21}$
36. If $x - \frac{1}{x} = 5$, $x \neq 0$, then what is the value of $\frac{x^6-5x^3-1}{x^6+7x^3-1}$?
SSC CGL 13/8/2021 (Afternoon)
(a) $\frac{41}{45}$ (b) $\frac{45}{41}$
(c) $\frac{45}{49}$ (d) $\frac{49}{45}$
37. If $x^4 + x^{-4} = 2207$, ($x > 0$) then the value of $x + x^{-1}$ is:-
(a) 19 (b) 7
(c) 11 (d) 9
38. If $x^4 + \frac{1}{x^4} = 6887$, then the positive value of $x - \frac{1}{x}$ is:

SSC CHSL 12/04/2021 (Evening)

- (a) 12 (b) 9
(c) 15 (d) 8
39. If $x - \frac{1}{x} = 1$, then the value of $\frac{x^4 - \frac{1}{x^2}}{3x^2 + 5x - 3} = ?$
(a) $\frac{1}{4}$ (b) $\frac{1}{2}$
(c) $\frac{3}{4}$ (d) 0
40. If $x + \frac{1}{x} = \sqrt{13}$, then one of the values of $x^3 - \frac{1}{x^3}$ is:
SSC CHSL 12/8/2021 (Evening)
(a) $4\sqrt{11}$ (b) 32
(c) $4\sqrt{13}$ (d) 36
41. If $\frac{12x^2-27x+28}{4x^2-9x+9} = 3.2$, then $\sqrt{x^2 + \frac{1}{x^2}} = ?$
(a) $7/4$ (b) $9/4$
(c) $5/4$ (d) $3/2$
42. If $x + \frac{1}{15x} = 3$, then the value of $9x^3 + \frac{1}{375x^3}$ will be:
SSC CHSL 10/8/2021 (Morning)
(a) 237.6 (b) 376.2
(c) 273.6 (d) 367.2
43. If $x + \frac{81}{x} = 18$ where $x > 0$ then the value of $x^2 + \frac{162}{x^2}$ is:
SSC CHSL 6/8/2021 (Evening)
(a) 78 (b) 83
(c) 85 (d) 81
44. If $x + \frac{1}{x} = 99$, find the value of $\frac{100x}{2x^2+102x+2} = ?$
(a) $\frac{1}{6}$ (b) $\frac{1}{2}$
(c) $\frac{1}{3}$ (d) $\frac{1}{4}$
45. If $x^2 - 3\sqrt{2}x + 1 = 0$, then what is the value of $x^3 + \frac{1}{x^3}$?

SSC CHSL 4/8/2021 (Evening)

- (a) $30\sqrt{6}$ (b) $45\sqrt{2}$
 (c) $15\sqrt{6}$ (d) $30\sqrt{2}$
46. If $\sqrt{x} - \frac{1}{\sqrt{x}} = \sqrt{7}$, then the value of $x^2 + \frac{1}{x^2}$ is:
SSC CGL 20/8/2021 (Afternoon)
 (a) 60 (b) 75
 (c) 81 (d) 79
47. If $x + \frac{1}{x} = 5$, then $\frac{2x}{3x^2 - 5x + 3}$ is equal to:-
 (a) 5 (b) $\frac{1}{5}$
 (c) 3 (d) $\frac{1}{3}$
48. If $x^4 + \frac{16}{x^4} = 27217$, $x > 0$, then the value of $x + \frac{2}{x}$ is:
SSC CHSL 15/4/2021 (Evening)
 (a) 17 (b) 11
 (c) 15 (d) 13
49. If $x^2 - 5\sqrt{2}x + 1 = 0$, then what is the value of $\frac{(x^3 + \frac{1}{x})}{x^2 + 1}$?
SSC CGL 18/08/2021 (Afternoon)
 (a) $\frac{12\sqrt{2}}{5}$ (b) $\frac{24\sqrt{2}}{5}$
 (c) $\frac{26\sqrt{2}}{5}$ (d) $\frac{18\sqrt{2}}{5}$
50. If $x^2 - 3x - 1 = 0$, then the value of $(x^2 + 8x - 1)(x^3 + x^{-1})^{-1}$ is:-
 (a) $3/8$ (b) 8
 (c) 1 (d) 3
51. If $x^4 + \frac{1}{x^4} = 119$, ($x > 0$), then the value of $(2x - 3)^2$ is
 (a) 12 (b) 13
 (c) 15 (d) 14
52. If $a - \frac{12}{a} = 1$, where $a > 0$, then the value of $a^2 + \frac{16}{a^2}$ is:
SSC CGL 16/8/2021 (Afternoon)
 (a) 15 (b) 17
 (c) 11 (d) 19

53. If $x^4 - 142x^2 + 1 = 0$, then the value of $x^3 + \frac{1}{x^3}$ is:
SSC CHSL 13/4/2021 (Afternoon)
 (a) 1962 (b) 1952
 (c) 1692 (d) 1592
54. If $a = \frac{\sqrt{5}+1}{\sqrt{5}-1}$ & $b = \frac{\sqrt{5}-1}{\sqrt{5}+1}$, then the value of $\frac{a^2+ab+b^2}{a^2-ab+b^2}$ is
 (a) $\frac{3}{4}$ (b) $\frac{4}{3}$
 (c) $\frac{3}{5}$ (d) $\frac{5}{3}$
55. If $x + \frac{1}{x} = 3$, then the value of $\frac{x^3 + \frac{1}{x}}{x^2 - x + 1}$ is:-
 (a) $\frac{3}{2}$ (b) $\frac{5}{2}$
 (c) $\frac{7}{2}$ (d) $\frac{11}{2}$
56. If $9b^2 + \frac{1}{b^2} = 3$, find $27b^2 + \frac{1}{b^2} = ?$
 (a) 2 (b) 0
 (c) 1 (d) 3
57. If $+\frac{1}{16x} = 3$, $16x^3 + \frac{1}{256x^3} = ?$
 (a) 425 (b) 420
 (c) 423 (d) 419
58. If $x + \frac{1}{x} = \frac{5}{2}$, then what is $x^4 - \frac{1}{x^4}$ equal to?
[2021-I]
 (a) $\frac{195}{16}$ (b) $\frac{255}{16}$
 (c) $\frac{625}{16}$ (d) 0
59. If $\frac{5x}{2x^2+5x+1} = \frac{1}{3}$, then the value of $(x + \frac{1}{2x}) = ?$
 (a) 15 (b) 10
 (c) 20 (d) 5
60. If $x - \frac{3}{x} = 6$, $x \neq 0$, then the value of $\frac{x^4 - \frac{27}{x^2}}{x^2 - 3x - 3}$ is:
SSC CGL Tier II (18/11/2020)
 (a) 90 (b) 270
 (c) 80 (d) 54

61. If $x^4 + \frac{1}{x^4} = \frac{257}{16}$, then find $\frac{8}{13} \left(x^3 + \frac{1}{x^3} \right)$, where $x > 0$.
SSC CHSL 13/10/2020 (afternoon)

(a) 5 (b) 4
(c) 6 (d) 8

62. If $x - \frac{1}{x} = 5$, $x \neq 0$, then what is the value of $\frac{x^6 + 3x^3 - 1}{x^6 - 8x^3 - 1}$?

SSC CGL Tier II (16/11/2020)

(a) $\frac{13}{12}$ (b) $\frac{11}{13}$
(c) $\frac{3}{8}$ (d) $\frac{4}{9}$

63. If $x^4 + x^{-4} = 194$, $x > 0$, then what is the value of $x + \frac{1}{x} + 2$?

SSC CPO 25/11/2020 (Morning)

(a) 14 (b) 8
(c) 4 (d) 6

64. If $x + \frac{1}{x} = 8$, then find the value of $\frac{5x}{x^2 + 1 - 6x}$

SSC CHSL 14/10/2020 (evening)

(a) 2.5 (b) 6
(c) 5 (d) 6.5

65. If $x + \frac{1}{x} = 5$, $x \neq 0$ then the value of $\frac{x^4 + \frac{1}{x}}{x^2 - 3x + 1}$ is equal to:

SSC CHSL 20/10/2020 (morning)

(a) 55 (b) 60
(c) 65 (d) 50

66. If $x^2 - 5x + 1 = 0$, then the value of $\left(x^4 + \frac{1}{x^2} \right) \div (x^2 + 1)$ is:

SSC CPO 23/11/2020 (Evening)

(a) 25 (b) 24
(c) 22 (d) 21

67. If $2x^2 - 7x + 5 = 0$, then what is the value of $x^2 + \frac{25}{4x^2}$?

SSC CGL Tier II (16/11/2020)

(a) $9\frac{1}{2}$ (b) $7\frac{1}{4}$

(c) $9\frac{3}{4}$ (d) $5\frac{1}{2}$

68. If $3x^2 - 5x + 1 = 0$, then the value of $\left(x^2 + \frac{1}{9x^2} \right)$ is:
SSC CGL Tier II (15/11/2020)

(a) $1\frac{2}{3}$ (b) $1\frac{1}{3}$
(c) $2\frac{1}{3}$ (d) $2\frac{1}{9}$

69. If $a + \frac{1}{a} = 3$, then $\left(a^4 + \frac{1}{a^4} \right)$ is equal to :
SSC CGL 6/06/2019 (Evening)

(a) 77 (b) 47
(c) 81 (d) 27

70. If $x^2 - \sqrt{7}x + 1 = 0$, then $(x^3 + x^{-3}) = ?$
SSC CPO 9/12/19 (Evening)

(a) $10\sqrt{7}$ (b) $4\sqrt{7}$
(c) $7\sqrt{7}$ (d) $3\sqrt{7}$

71. If $\sqrt{x} - \frac{1}{\sqrt{x}} = 4$, then $x^2 + \frac{1}{x^2}$ is equal to:
SSC CGL 10/06/2019 (Afternoon)

(a) 192 (b) 326
(c) 322 (d) 256

72. If $x^4 + x^{-4} = 194$, $x > 0$ then the value of $(x - 2)^2$ is:
SSC CGL 4/06/2019 (Morning)

(a) 1 (b) 6
(c) 2 (d) 3

73. If $\sqrt{x} + \frac{1}{\sqrt{x}} = 3$, $x > 0$, then $x^2(x^2 - 47) = ?$
SSC CPO 11/12/19 (Evening)

(a) 0 (b) 2
(c) -2 (d) -1

74. If $x + \frac{1}{16x} = 3$, then the value of $16x^3 + \frac{1}{256x^3}$ is :
SSC CGL TIER II (12/09/2019)

(a) 423 (b) 441
(c) 432 (d) 414

75. If $\frac{x^4-5x^2+1}{x^3+x^2+x} = 3$, then find the value of $x^2 - 5x + 7$ (where x is positive number)
- (a) 0 (b) 1
(c) 4 (d) 6

76. If $x = 2 + \sqrt{3}$, then find the value of $\frac{x^6+3x^4+24x^3+3x^2-1}{2x^5-6x^4+10x^3+6x^2-2x} = ?$
- (a) $\frac{30\sqrt{3}+12}{26\sqrt{3}+7}$ (b) $3\sqrt{3}$
(c) $7\sqrt{3}$ (d) $\frac{14\sqrt{3}+7}{16\sqrt{3}+11}$

Type-1 (Basic Format with Square and Cube Formula) ANSWER KEY													
1	A	2	B	3	A	4	C	5	A	6	B	7	A
8	D	9	A	10	C	11	D	12	D	13	B	14	A
15	B	16	C	17	D	18	C	19	A	20	D	21	B
22	D	23	C	24	A	25	A	26	D	27	B	28	B
29	C	30	A	31	A	32	B	33	C	34	D	35	A
36	C	37	B	38	B	39	B	40	D	41	A	42	A
43	B	44	C	45	B	46	D	47	B	48	D	49	B
50	C	51	B	52	B	53	C	54	B	55	C	56	B
57	C	58	B	59	D	60	A	61	A	62	A	63	D
64	A	65	A	66	C	67	B	68	D	69	B	70	B
71	C	72	D	73	D	74	A	75	D	76	B		

Type-1 (Basic Format with Square and Cube Formula) Solution

1. Sol. (a)

$$x^3 + \frac{1}{x^3} = \left(\frac{11}{5}\right)^3 - 3 \times \frac{11}{5}$$

$$= \frac{1331}{125} - \frac{33}{5} = \frac{506}{125} = 4 \frac{6}{125}$$

2. Sol. (b)

$$x + \frac{1}{x} = 7 \text{ then, } x^3 + \frac{1}{x^3} = 7^3 - 7 \times 3 = 343 - 21$$

$$= 322$$

3. Sol. (a)

$$x^2 + \frac{1}{x^2} = (7.5)^2 - 2 = 56.25 - 2 = 54.25$$

4. Sol. (c)

$$\frac{x-y}{x\sqrt{y}+y\sqrt{x}} = \frac{1}{\sqrt{x}}$$

$$\frac{(\sqrt{x}-\sqrt{y})(\sqrt{x}+\sqrt{y})}{\sqrt{xy}(\sqrt{x}+\sqrt{y})} = \frac{1}{\sqrt{x}}$$

$$\sqrt{x} - \sqrt{y} = \frac{\sqrt{xy}}{\sqrt{x}}$$

$$\sqrt{x} = 2\sqrt{y} \Rightarrow \frac{x}{y} = 4$$

5. Sol. (a)

$$x = 11 + 3\sqrt{11}$$

$$\text{Let } y = x - 1 = 10 + 3\sqrt{11}$$

$$\sqrt{y} - \frac{1}{\sqrt{y}} = ?$$

$$y = 10 + 3\sqrt{11}$$

$$y + \frac{1}{y} = 2 \times 10 = 20,$$

$$(\sqrt{y})^2 + \frac{1}{(\sqrt{y})^2} = 20 - 2 = 18$$

$$\left(\sqrt{y} - \frac{1}{\sqrt{y}}\right)^2 = 18$$

$$\sqrt{y} - \frac{1}{\sqrt{y}} = \sqrt{18} = 3\sqrt{2}$$

6. Sol. (b)

$$\text{If } x^2 + \frac{1}{x^2} = 66$$

$$\left(x - \frac{1}{x}\right)^2 = 66 - 2 = 64 \Rightarrow x - \frac{1}{x} = \sqrt{64} = 8$$

7. Sol. (a)

$$b = 1/a, a + \frac{1}{a} = k$$

$$a^2 + \frac{1}{a^2} = k^2 - 2 \Rightarrow a^2 + \frac{1}{a^2} - a \times \frac{1}{a}$$

$$k^2 - 2 - 1 = k^2 - 3 = 97$$

8. Sol. (d)

$$x^{3/4} + \frac{1}{x^{3/4+9}} = 0 \dots (i)$$

(Add 9 both side in eq. (i))

$$x^{3/4} + 9 + \frac{1}{x^{3/4+9}} = 9$$

$$(x^{3/4} + 9)^2 - \frac{1}{(x^{3/4+9})^2} = 9\sqrt{77}$$

$$(\because x + \frac{1}{x} = k, x - \frac{1}{x} = \sqrt{k^2 - 4})$$

$$(x^{3/4} + 9)^2 - \frac{1}{(x^{3/4+9})^2}$$

$$(\because (a^2 - b^2) = (a+b)(a-b) \Rightarrow 9\sqrt{77}$$

9. Sol. (a)

$$\frac{x^2+xy+y^2}{x^2-xy+y^2} = \frac{x^2+\frac{1}{x^2}+1}{x^2+\frac{1}{x^2}-1} = \frac{k^2-1}{k^2-3} = \frac{63}{61}$$

10. Sol. (c)

$$x^2 - 5x + 1 = 0$$

$$x + \frac{1}{x} = 5 \dots \dots (eq. 1)$$

$$\text{When } x + \frac{1}{x} = k \text{ then } x^3 + \frac{1}{x^3} = k^3 - 3k\}$$

$$x^3 + \frac{1}{x^3} = 110 \dots \dots (eq. 2)$$

$$\text{Now, given eq.} = \frac{x^6+x^4+x^2+1}{5x^3}$$

Divide numerator and denominator by

$$\frac{x^3+x+\frac{1}{x}+\frac{1}{x^3}}{5} = \frac{110+5}{5} = 23$$

11. Sol. (d)

$$x - 5\sqrt{x} - 1 = 0$$

$$\sqrt{x} - 5 - \frac{1}{\sqrt{x}} = 0$$

$$\sqrt{x} - \frac{1}{\sqrt{x}} = 5, \rightarrow x + \frac{1}{x} = 5^2 + 2 = 27,$$

$$x^2 + \frac{1}{x^2} = 27^2 - 2 = 729 - 2 = 727$$

12. Sol. (d)

$$5x^2 + 7x + 5 = 0$$

Dividing both sides by 5x.

$$x + \frac{1}{x} = \frac{-7}{5}$$

$$x^3 + \frac{1}{x^3} = \left(\frac{-7}{5}\right)^3 - \left(\frac{-7}{5}\right) \times 3$$

$$= \frac{-343}{125} + \frac{21}{5} = \frac{182}{125}$$

13. Sol. (b)

$$\text{Let } a - \frac{1}{a} = P$$

$$p^2 - 2p + 4 - 12 = 0 (\because (a+b)^2 - (a-b)^2 = 4)$$

$$P^2 - 2P - 8 = 0$$

$$(P-1)^2 = 9$$

$$P-1 = \pm?$$

$$P = \pm 3 + 1$$

$$P = 4, 2$$

$$\frac{a^2-1}{a} = 4$$

$$a^2 - 1 = 4a$$

$$a^2 - 4a - 1 = 0 \Rightarrow (a-2)^2 = 8$$

$$\Rightarrow (a-2) = \pm\sqrt{8}$$

$$a_2 \pm \sqrt{5} + 2$$

14. Sol. (a)

$$x + \frac{1}{x} = -13$$

On squaring, we get

$$x^2 + \frac{1}{x^2} + 2 = 169 \Rightarrow x^2 + \frac{1}{x^2} = 167$$

On squaring again, we get

$$x^4 + \frac{1}{x^4} + 2 = 27889$$

$$x^4 + \frac{1}{x^4} = 27887$$

15. Sol. (b)

$$x^2 - 8x + 1 = 0$$

Dividing both sides by x. We get

$$x + \frac{1}{x} = 8 \Rightarrow x^2 + \frac{1}{x^2} = 64 - 2 = 62$$

$$x^4 + \frac{1}{x^4} = 3844 - 2 = 3842$$

Multiplying both sides by x^4

$$x^8 + 1 = 3842x^4 \Rightarrow x^8 - 3842x^4 + 1 = 0$$

16. Sol. (c)

$$x = \sqrt{3} + \sqrt{2}$$

$$\frac{1}{x} = \sqrt{3} - \sqrt{2}$$

$$\text{and } x + \frac{1}{x} = \sqrt{3} + \sqrt{2} + \sqrt{3} - \sqrt{2} = 2\sqrt{3}$$

$$x^3 + \frac{1}{x^3} = \left(x + \frac{1}{x}\right)^3 - 3\left(x + \frac{1}{x}\right)$$

$$= (2\sqrt{3})^3 - 3(2\sqrt{3}) = 24\sqrt{3} - 6\sqrt{3} = 18\sqrt{3}$$

17. Sol. (d)

$$3x - \frac{1}{4x} = 3 \quad \dots(i)$$

Multiply by $\frac{4}{3}$ in eq. (i)

$$\Rightarrow 4x + \frac{1}{3x} = 4$$

$$\Rightarrow 4x + \frac{1}{3x} = \pm \sqrt{16 + 4 \times \frac{1}{3} \times 4}$$

$$= \pm 4 \sqrt{1 + \frac{1}{3}} = \pm \frac{8}{\sqrt{3}}$$

18. Sol. (c)

$$x + \frac{1}{x} = 3$$

$$\frac{3x^2 + 3 - 4x}{x^2 + 1 - x} = \frac{\frac{3x^2}{x} + \frac{3}{x} - 4}{\frac{x^2}{x} + \frac{1}{x} - \frac{x}{x}}$$

$$= \frac{3\left(x + \frac{1}{x}\right) - 4}{\left(x + \frac{1}{x}\right) - 1} = \frac{3 \times 3 - 4}{3 - 1} = \frac{9 - 4}{3 - 1} = \frac{5}{2}$$

19. Sol. (a)

$$\frac{x^4 + 5x^3 + 3x^2 + 5x + 1}{x^4 + 1} \quad \dots(i)$$

Divided by x^2 in eqn (i)

$$\frac{\left(x^2 + \frac{1}{x^2}\right) + 5\left(x + \frac{1}{x}\right) + 3}{x^2 + \frac{1}{x^2}}$$

$$\frac{7 + 15 + 3}{7} = \frac{25}{7}$$

20. Sol. (d)

Formula :- When, $x + \frac{1}{x} = k$

$$\text{Then } x^2 + \frac{1}{x^2} = k^2 - 2$$

$$\text{Given that, } x + \frac{1}{x} = 5\sqrt{2} \text{ then, } x^2 + \frac{1}{x^2} = 48$$

$$\text{And } x^4 + \frac{1}{x^4} = 2302$$

21. Sol. (b)

$$4 + \left(a - \frac{1}{a}\right)^2 - 2\left(a - \frac{1}{a}\right) = 12$$

$$\text{Let } a - \frac{1}{a} = p$$

$$p^2 - 2p - 8 = 0$$

$$\begin{array}{c} \swarrow \searrow \\ -4 \quad 2 \end{array}$$

$$+4 \quad -2$$

$$a - \frac{1}{a} = 4$$

$$a^2 - 4a - 1 = 0$$

$$a^2 - 4a + 4 - 5 = 0$$

$$(a - 2)^2 = 5$$

$$a = \pm\sqrt{5} + 2$$

22. Sol. (d)

$$x^{2019} = 11 - 2\sqrt{30}$$

↓

$$121 - 120 = 1$$

$$1/x^{2019} = 11 + 2\sqrt{30}$$

$$x^{2019} + \frac{1}{x^{2019}} = 2 \times 11 = 22,$$

$$x^{4038} + \frac{1}{x^{4038}} = 22^2 - 2^2$$

$$= 484 - 2 = 482$$

23. Sol. (c)

$$x + \frac{1}{x} = 5$$

Multiplying both side by 2

$$2x + \frac{2}{x} = 10$$

$$\text{Now, } \frac{3x}{2x^2 + 2 - 5x} = \frac{3x}{x\left(2x + \frac{2}{x} - 5\right)}$$

$$= \frac{3}{10 - 5} = \frac{3}{5}$$

24. Sol. (a)

$$\frac{x^2}{y^2} + \frac{y^2}{x^2} = 7$$

$$\text{Let } \frac{x}{y} = k \text{ then } \frac{y}{x} = \frac{1}{k}$$

$$k^2 + \frac{1}{k^2} = 7 \Rightarrow k^2 + \frac{1}{k^2} + 2 = 7 + 2$$

$$k + \frac{1}{k} = 3 \Rightarrow \frac{x^3}{y^3} + \frac{y^3}{x^3} = k^3 + \frac{1}{k^3}$$

$$k^3 + \frac{1}{k^3} = 3^3 - 3 \times 3$$

$$k^3 + \frac{1}{k^3} = 18 \text{ So, } \frac{x^3}{y^3} + \frac{y^3}{x^3} = 18$$

25. Sol. (a)

$$r + \frac{1}{r} = 11$$

$$r^2 + \frac{1}{r^2} = 11^2 - 2 = 121 - 2 = 119$$

$$\frac{r^3 + \frac{1}{r}}{r^2 - r + 1} = \frac{\frac{r^3 + \frac{1}{r}}{r}}{\frac{r^2 - r + 1}{r}} = \frac{r^2 + \frac{1}{r^2}}{r + \frac{1}{r} - 1} = \frac{119}{11 - 1} = \frac{119}{10}$$

26. Sol. (d)

Identity : = when $x - \frac{1}{x} = k$,

$$\text{then } x^2 + \frac{1}{x^2} = k^2 + 2 \Rightarrow x - \frac{1}{x} = 13$$

$$\text{then, } x^2 + \frac{1}{x^2} = 13^2 + 2 = 171$$

$$\text{And } x^4 + \frac{1}{x^4} = (171)^2 - 2$$

$$= 29241 - 2 = 29239$$

27. Sol. (b)

$$c + \frac{1}{c} = 3,$$

$$(c - 3) + \frac{1}{c} = 0$$

$$(c - 3) = -\frac{1}{c}$$

$$(c - 3)^7 + \frac{1}{c^7} = \frac{-1}{c^7} + \frac{1}{c^7} = 0$$

28. Sol. (b)

$$x^4 + \frac{1}{x^4} = 322$$

Adding 2 on both the sides, we get

$$x^4 + \frac{1}{x^4} + 2 = 322 + 2$$

$$\left(x^2 + \frac{1}{x^2}\right)^2 = 324 \Rightarrow x^2 + \frac{1}{x^2} = 18$$

Subtracting 2 from both the sides, we get

$$x^2 + \frac{1}{x^2} - 2 = 18 - 2 \Rightarrow \left(x - \frac{1}{x}\right)^2 = 16$$

$$x - \frac{1}{x} = 4$$

On cubing both the sides, we get

$$x^3 - \frac{1}{x^3} - 3\left(x\right)\left(\frac{1}{x}\right)\left(x - \frac{1}{x}\right) = 64$$

$$x^3 - \frac{1}{x^3} - 3\left(x\right)\left(\frac{1}{x}\right)\left(x - \frac{1}{x}\right) = 64$$

$$x^3 - \frac{1}{x^3} - 3(4) = 64 \Rightarrow x^3 - \frac{1}{x^3} - 12 = 64$$

$$x^3 - \frac{1}{x^3} = 76$$

29. Sol. (c)

$$\Rightarrow a + \frac{1}{b} = 1 \dots (i)$$

$$\Rightarrow a = 1 - \frac{1}{b} = \frac{b-1}{b}$$

$$\frac{1}{a} = \frac{b}{b-1} \Rightarrow b + \frac{1}{c} = 1$$

$$\frac{1}{c} = 1 - b, c = \frac{1}{1-b}$$

$$\therefore c + \frac{1}{a} = \frac{1}{1-b} + \frac{b}{b-1}$$

$$= \frac{1}{1-b} - \frac{b}{1-b} = \frac{1-b}{1-b} = 1$$

30. Sol. (a)

$$p^4 + \frac{1}{p^4} + 2 = 4354 + 2 = 4356$$

$$p^2 + \frac{1}{p^2} = \sqrt{4356} = 66$$

$$p^2 + \frac{1}{p^2} - 2 = 66 - 2$$

$$p - \frac{1}{p} = \sqrt{64} = 8$$

$$p^3 - \frac{1}{p^3} = 8^3 + 3 \times 8 = 512 + 24 = 536$$

31. Sol. (a)

$$5x^{7/4} - 3x^{7/8} + 5 = 0 \dots (i)$$

Divide by $x^{7/8}$ in eq. (i)

$$5\left[x^{7/8} + \frac{1}{x^{7/8}}\right] - 3 = 0$$

$$x^{7/8} + \frac{1}{x^{7/8}} = \frac{3}{5}$$

$$x^{7/4} + x^{-7/4} = \left(\frac{3}{5}\right)^2 - 2 = \frac{-41}{25}$$

32. Sol. (b)

If $x + \frac{1}{x} = k$, then $x^2 + \frac{1}{x^2} = k^2 - 2$ and $x^3 + \frac{1}{x^3}$

$$= k^3 - 3k$$

Given that, $k^4 + \frac{1}{k^4} = 194$ then, $k^2 + \frac{1}{k^2} = 14$

$$k + \frac{1}{k} = 4, \text{ Now, } k^3 + \frac{1}{k^3} = 52$$

33. Sol. (c)

Identities :- when $ax + \frac{y}{a} = k$

$$\text{then } (ax)^2 + \frac{y^2}{a^2} = k^2 - 2xy$$

Now,

$$4a + \frac{5}{a} + 5 = 14 \Rightarrow 4a + \frac{5}{a} = 9 \dots \text{e.q} \quad (1)$$

On squaring e.q.(1), we get

$$16a^2 + \frac{25}{a^2} = 9^2 - 2 \times 4 \times 5 = 41$$

34. Sol. (d)

$$x^{150} + \frac{1}{x^{150}} = \frac{\sqrt{36}-\sqrt{21}}{\sqrt{36}+\sqrt{21}} + \frac{\sqrt{36}+\sqrt{21}}{\sqrt{36}-\sqrt{21}} = \frac{2(36+21)}{36-21}$$

$$= \frac{2 \times 57}{15} = \frac{2 \times 19}{5} = 7.6$$

35. Sol. (a)

$$x + \frac{1}{x} = 5 \Rightarrow x^2 + \frac{1}{x^2} + 2 = 25$$

$$x^2 + \frac{1}{x^2} = 23$$

$$\text{now, } \frac{x^4 + 3x^3 + 5x^2 + 3x + 1}{x^4 + 1}$$

divided by x^2 ,

$$= \frac{\frac{x^4}{x^2} + \frac{3x^3}{x^2} + \frac{5x^2}{x^2} + \frac{3x}{x^2} + \frac{1}{x^2}}{\frac{x^4}{x^2} + \frac{1}{x^2}}$$

$$= \frac{x^2 + 3x + 5 + \frac{3}{x} + \frac{1}{x^2}}{x^2 + \frac{1}{x^2}}$$

$$= \frac{x^2 + \frac{1}{x^2} + 3\left(x + \frac{1}{x}\right) + 5}{x^2 + \frac{1}{x^2}}$$

$$= \frac{23 + 3(5) + 5}{23} = \frac{43}{23}$$

36. Sol. (c)

$$\text{If } x - \frac{1}{x} = 5 \text{ then } x^3 - \frac{1}{x^3} = 125 + 15 = 140$$

$$\frac{x^6 - 5x^3 - 1}{x^6 + 7x^3 - 1} \text{ dividing the numerator and denominator by } x^3$$

$$\frac{x^3 - 5 - \frac{1}{x^3}}{x^3 + 7 - \frac{1}{x^3}} = \frac{x^3 - \frac{1}{x^3} - 5}{x^3 - \frac{1}{x^3} + 7}$$

$$= \frac{140 - 5}{140 + 7} = \frac{45}{147}$$

37. Sol. (b)

$$x^4 + \frac{1}{x^4} = 2207$$

$$x^2 + \frac{1}{x^2} = \sqrt{2207 + 2}$$

$$= \sqrt{2209} = 47$$

$$x + \frac{1}{x} = \sqrt{47 + 2} = \sqrt{49} = 7$$

38. Sol. (b)

$$x^4 + \frac{1}{x^4} + 2 = 6887 + 2$$

$$x^2 + \frac{1}{x^2} - 2 = 83 - 2 \Rightarrow x - \frac{1}{x} = 9$$

39. Sol. (b)

$$x - \frac{1}{x} = 1$$

$$\Rightarrow \frac{x^4 - \frac{1}{x^2}}{3x^2 + 5x - 3}$$

divide and multiply by x

$$\Rightarrow \frac{\frac{x^4}{x} - \frac{1}{x^3}}{\frac{3x^2}{x} + \frac{5x}{x} - \frac{3}{x}}$$

$$= \frac{x^3 - \frac{1}{x^3}}{3x - \frac{3}{x} + 5} \Rightarrow \frac{x^3 - \frac{1}{x^3}}{\left(x - \frac{1}{x}\right) + 5}$$

$$\Rightarrow x - \frac{1}{x} = 1$$

Take cube on both sides

$$\left(x - \frac{1}{x}\right)^3 = (1)^3$$

$$\Rightarrow x^3 - \frac{1}{x^3} - 3\left(x - \frac{1}{x}\right) = 1$$

$$x^3 - \frac{1}{x^3} - 3 = 1$$

$$\Rightarrow x^3 - \frac{1}{x^3} = 4$$

$$= \frac{x^3 - \frac{1}{x^3}}{3\left(x - \frac{1}{x}\right) + 5} = \frac{4}{3 \times 1 + 5} = \frac{4}{8} = \frac{1}{2}$$

40. Sol. (d)

$$x + \frac{1}{x} = \sqrt{13}$$

$$\left(x + \frac{1}{x}\right)^2 = (\sqrt{13})^2 \Rightarrow x^2 + \frac{1}{x^2} = 11$$

$$x^2 + \frac{1}{x^2} - 2 = 11 - 2 \Rightarrow x - \frac{1}{x} = 3$$

$$x^3 - \frac{1}{x^3} = 3^3 + 3 \times 3 = 36$$

41. Sol. (a)

$$\frac{12x^2 - 27x + 27 + 1}{4x^2 - 9x + 9} = \frac{16}{5}$$

$$\Rightarrow \frac{12x^2 - 27x + 27}{4x^2 - 9x + 9} + \frac{1}{4x^2 - 9x + 9} = \frac{16}{5}$$

$$\Rightarrow 3 + \frac{1}{4x^2 - 9x + 9} = \frac{16}{5}$$

$$\Rightarrow \frac{1}{4x^2 - 9x + 9} = \frac{1}{5}$$

$$4x^2 - 9x + 9 = 5$$

$$4x^2 + 4 = 9x$$

$$4x + \frac{4}{x} = 9 \Rightarrow x + \frac{1}{x} = \frac{9}{4}, \sqrt{x^2 + \frac{1}{x^2}} = \sqrt{\left(\frac{9}{4}\right)^2 - 2}$$

$$= \sqrt{\frac{81}{16} - 2} = \sqrt{\frac{49}{16}} = \frac{7}{4}$$

42. Sol. (a)

$$x + \frac{1}{15x} = 3$$

$$3x + \frac{1}{5x} = 9$$

$$27x^3 + \frac{1}{125x^3} = 729 - 16.2$$

$$27x^3 + \frac{1}{125x^3} = 712.8$$

Divide both side by 3

$$9x^3 + \frac{1}{375x^3} = 237.6$$

43. Sol. (b)

$$x + \frac{81}{x} = 18$$

$$\Rightarrow x^2 + 81 = 18x \Rightarrow x^2 - 18x + 81 = 0$$

$$\Rightarrow x^2 - 9x - 9x + 81 = 0$$

$$\Rightarrow x(x-9) - 9(x-9) = 0 \Rightarrow x = 9$$

$$x^2 + \frac{162}{x^2} = 9^2 + \frac{162}{81} = 83$$

44. Sol. (c)

$$x + \frac{1}{x} = 99$$

$$\therefore x^2 + 1 = 99x$$

$$2(x^2 + 1) = 2 \times 99x$$

$$2x^2 + 2 = 198x$$

$$= \frac{100x}{2x^2 + 2 + 102x}$$

$$= \frac{100x}{198x + 102x} = \frac{100x}{300x} = \frac{1}{3}$$

45. Sol. (b)

$$x^2 - 3\sqrt{2}x + 1 = 0$$

$$x + \frac{1}{x} = 3\sqrt{2}$$

Cubing both side

$$x^3 + \frac{1}{x^3} + 3 \times 3\sqrt{2} = 54\sqrt{2} \Rightarrow x^3 + \frac{1}{x^3} = 45\sqrt{2}$$

46. Sol. (d) $\sqrt{x} - \frac{1}{\sqrt{x}} = \sqrt{7}$

Squaring both side

$$x + \frac{1}{x} = 9$$

Squaring both side

$$x^2 + \frac{1}{x^2} = 79$$

47. Sol. (b)

$$x + \frac{1}{x} = 5$$

$$\therefore \frac{2x}{3x^2 - 5x + 3}$$

(Divide by x)

$$= \frac{\frac{2x}{x}}{\frac{3x^2}{x} - \frac{5x}{x} + \frac{3}{x}} = \frac{2}{3x + \frac{3}{x} - 5}$$

$$= \frac{2}{3(x + \frac{1}{x}) - 5} = \frac{2}{3 \times 5 - 5} = \frac{2}{10} = \frac{1}{5}$$

48. Sol. (d)

$$x^4 + \frac{16}{x^4} + 8 = 27217 + 8$$

$$x^2 + \frac{4}{x^2} = \sqrt{27225} = 165$$

$$x^2 + \frac{4}{x^2} + 4 = 169 \Rightarrow \left(x + \frac{2}{x}\right) = 13$$

49. Sol. (b)

$$x^2 + 1 = 5\sqrt{2}x \text{ (dividing both side by } x)$$

$$x + \frac{1}{x} = 5\sqrt{2} \Rightarrow x^2 + \frac{1}{x^2} = 48$$

$$\frac{\left(x^3 + \frac{1}{x}\right)}{x^2 + 1} = \frac{\left(x^2 + \frac{1}{x^2}\right)}{x + \frac{1}{x}}$$

$$= \frac{48}{5\sqrt{2}} = \frac{24\sqrt{2}}{5}$$

50. Sol. (c)

$$x - \frac{1}{x} = 3$$

$$x^2 + \frac{1}{x^2} = 11$$

$$\frac{(x^2 + 8x - 1)}{\left(x^3 + \frac{1}{x}\right)}$$

$$= \frac{(x^2 + 8x - 1)}{x} \cdot \frac{x \cdot x}{x^4 + 1}$$

$$= \left(x - \frac{1}{x} + 8\right) \left(\frac{1}{x^2 + \frac{1}{x^2}}\right) = \frac{3+8}{11} = \frac{11}{11} = 1$$

51. Sol. (b)

$$x^4 + \frac{1}{x^4} = 119$$

$$x^2 + \frac{1}{x^2} = \sqrt{119 + 2} = 11$$

$$x - \frac{1}{x} = \sqrt{11 - 2} = 3$$

$$\Rightarrow x^2 - 1 = 3x$$

$$\Rightarrow x^2 - 3x = 1$$

$$\Rightarrow 4x^2 - 12x + 9$$

$$\Rightarrow 4(x^2 - 3x) + 9$$

$$\Rightarrow 4 \times 1 + 9 = 4 + 9 = 13$$

52. Sol. (b)

$$a - \frac{12}{a} = 1$$

$$a^2 - 12 = a \Rightarrow a^2 - a - 12 = 0$$

$$a^2 - 4a + 3a - 12 =$$

$$a(a - 4) + 3(a - 4) = 0$$

$$(a + 3)(a - 4) = 0 \Rightarrow a = -3 \text{ and } 4$$

Put $a = 4$

$$a^2 + \frac{16}{a^2} = 16 + \frac{16}{16} = 16 + 1 = 17$$

53. Sol. (c)

$$x^4 - 142x^2 + 1 = 0$$

$$x^4 + 1 = 142x^2 \text{ dividing the equation by } x^2$$

$$x^2 + \frac{1}{x^2} = 142 \text{ adding two to both side}$$

$$x^2 + \frac{1}{x^2} + 2 = 142 + 2$$

$$\left(x + \frac{1}{x}\right)^2 = 12^2 \Rightarrow x + \frac{1}{x} = 12$$

$$x^3 + \frac{1}{x^3} = 12^3 - 3 \times 12 = 1728 - 36 = 1692$$

54. Sol. (b)

$$a = \frac{\sqrt{5}+1}{\sqrt{5}-1} \quad b = \frac{\sqrt{5}-1}{\sqrt{5}+1}$$

$$\therefore a = \frac{1}{b}$$

$$a + b = a + \frac{1}{a}$$

$$\Rightarrow \frac{\sqrt{5}+1}{\sqrt{5}-1} + \frac{\sqrt{5}-1}{\sqrt{5}+1}$$

$$\Rightarrow \frac{5+1+2\sqrt{5}+5+1-2\sqrt{5}}{(\sqrt{5})^2-(1)^2}$$

$$\Rightarrow \frac{6+2\sqrt{5}+6-2\sqrt{5}}{5-1} = \frac{12}{4} = 3$$

$$\therefore \frac{a^2+ab+b^2}{a^2-ab+b^2}$$

$$\frac{a^2+\frac{1}{a^2}+ab}{a^2+\frac{1}{a^2}-ab}$$

$$\Rightarrow a + \frac{1}{a} = 3$$

$$a^2 + \frac{1}{a^2} = 9 - 2 = 7 \quad (ab = 1)$$

$$\therefore \frac{a^2+\frac{1}{a^2}+ab}{a^2+\frac{1}{a^2}-ab} = \frac{7+1}{7-1} = \frac{8}{6} = \frac{4}{3}$$

55. Sol. (c)

$$x + \frac{1}{x} = 3 \quad (\text{Given})$$

$$\frac{x^3+\frac{1}{x}}{x^2-x+1} \quad (\text{Divide by } x)$$

$$\Rightarrow \frac{\frac{x^3}{x} + \frac{1}{x^2}}{\frac{x^2}{x} - \frac{x}{x} + \frac{1}{x}} = \frac{x^2 + \frac{1}{x^2}}{x-1+\frac{1}{x}} = \frac{x^2 + \frac{1}{x^2}}{x + \frac{1}{x} - 1} = 3$$

$$\therefore x + \frac{1}{x} = 3$$

$$\therefore x^2 + \frac{1}{x^2} = 9 - 2 = 7$$

$$\therefore \frac{x^2+\frac{1}{x^2}}{x+\frac{1}{x}-1} = \frac{7}{3-1} = \frac{7}{2}$$

56. Sol. (b)

$$9b^2 + \frac{1}{b^2} = 3 \quad \dots (i)$$

(Add 6 both side in eq. (i))

$$3b^2 + \frac{1}{3b^2} + 6 = 9$$

$$\left(3b + \frac{1}{b}\right)^2 = 9$$

$$3b + \frac{1}{b} = 3$$

$$(3b)^3 + \left(\frac{1}{b}\right)^3 = 27 - 3 \times 3 \times 3 = 0$$

$$\left[\because \left(x + \frac{1}{x}\right)^3 = x^3 + \frac{1}{x^3} + 3x + \frac{3}{x} \right]$$

57. Sol. (c)

$$x + \frac{1}{16x} = 3 \quad \dots (i)$$

(multiply by 2 in eq. (i))

$$2x + \frac{1}{8x} = 6$$

$$16x^3 + \frac{1}{256x^3}$$

$$= 2 \left[(2x)^3 + \frac{1}{(8x)^3} \right]$$

$$= 2 \left[216 - 3 \times 6 \times 2 \times \frac{1}{8} \right]$$

$$= 432 - 9$$

$$= 423$$

58. Sol. (b) $x + \frac{1}{x} = \frac{5}{2} \Rightarrow \frac{x^2+1}{x} = \frac{4+1}{2} = \frac{(2)^2+1}{2}$

$$\therefore x = 2$$

$$\text{Now, } x^4 - \frac{1}{x^4} = (2)^4 - \frac{1}{(2)^4} = \frac{256-1}{16}$$

$$= \frac{255}{16}$$

59. Sol. (d)

$$\frac{5x}{2x^2+5x+1} = \frac{1}{3}$$

$$\frac{5}{\frac{2x^2}{x} + \frac{5x}{x} + \frac{1}{x}} = \frac{1}{3}$$

$$\frac{5}{2x + \frac{1}{x} + 5} = \frac{1}{3}$$

$$\left(2x + \frac{1}{x} + 5\right) = 15$$

$$2x + \frac{1}{x} = 10$$

Divide by 2 both sides

$$x + \frac{1}{2x} = \frac{10}{2} = 5$$

60. Sol. (a)

$$x - \frac{3}{x} = 6$$

Cubing both side

53. Sol. (c)

$$x^4 - 142x^2 + 1 = 0$$

$$x^4 + 1 = 142x^2 \text{ dividing the equation by } x^2$$

$$x^2 + \frac{1}{x^2} = 142 \text{ adding two to both side}$$

$$x^2 + \frac{1}{x^2} + 2 = 142 + 2$$

$$\left(x + \frac{1}{x}\right)^2 = 12^2 \Rightarrow x + \frac{1}{x} = 12$$

$$x^3 + \frac{1}{x^3} = 12^3 - 3 \times 12 = 1728 - 36 = 1692$$

54. Sol. (b)

$$a = \frac{\sqrt{5}+1}{\sqrt{5}-1} \quad b = \frac{\sqrt{5}-1}{\sqrt{5}+1}$$

$$\therefore a = \frac{1}{b}$$

$$a + b = a + \frac{1}{a}$$

$$\Rightarrow \frac{\sqrt{5}+1}{\sqrt{5}-1} + \frac{\sqrt{5}-1}{\sqrt{5}+1}$$

$$\Rightarrow \frac{5+1+2\sqrt{5}+5+1-2\sqrt{5}}{(\sqrt{5})^2 - (1)^2}$$

$$\Rightarrow \frac{6+2\sqrt{5}+6-2\sqrt{5}}{5-1} = \frac{12}{4} = 3$$

$$\therefore \frac{a^2+ab+b^2}{a^2-ab+b^2}$$

$$\frac{a^2 + \frac{1}{a^2} + ab}{a^2 + \frac{1}{a^2} - ab}$$

$$\Rightarrow a + \frac{1}{a} = 3$$

$$a^2 + \frac{1}{a^2} = 9 - 2 = 7 \quad (ab = 1)$$

$$\therefore \frac{a^2 + \frac{1}{a^2} + ab}{a^2 + \frac{1}{a^2} - ab} = \frac{7+1}{7-1} = \frac{8}{6} = \frac{4}{3}$$

55. Sol. (c)

$$x + \frac{1}{x} = 3 \quad (\text{Given})$$

$$\frac{x^3 + \frac{1}{x}}{x^2 - x + 1} \quad (\text{Divide by } x)$$

$$\Rightarrow \frac{\frac{x^3}{x} + \frac{1}{x^2}}{\frac{x^2}{x} - \frac{x}{x} + \frac{1}{x}} = \frac{x^2 + \frac{1}{x^2}}{x - 1 + \frac{1}{x}} = \frac{x^2 + \frac{1}{x^2}}{x + \frac{1}{x} - 1} = 3$$

$$\therefore x + \frac{1}{x} = 3$$

$$\therefore x^2 + \frac{1}{x^2} = 9 - 2 = 7$$

$$\therefore \frac{x^2 + \frac{1}{x^2}}{x + \frac{1}{x} - 1} = \frac{7}{3-1} = \frac{7}{2}$$

56. Sol. (b)

$$9b^2 + \frac{1}{b^2} = 3 \quad \dots (i)$$

(Add 6 both side in eq. (i))

$$3b^2 + \frac{1}{3b^2} + 6 = 9$$

$$\left(3b + \frac{1}{b}\right)^2 = 9$$

$$3b + \frac{1}{b} = 3$$

$$(3b)^3 + \left(\frac{1}{b}\right)^3 = 27 - 3 \times 3 \times 3 = 0$$

$$\left[\because \left(x + \frac{1}{x}\right) = k \left(x^3 + \frac{1}{x^3} = k^3 - 3k\right) \right]$$

57. Sol. (c)

$$x + \frac{1}{16x} = 3 \quad \dots (i)$$

(multiply by 2 in eq. (i))

$$2x + \frac{1}{8x} = 6$$

$$16x^3 + \frac{1}{256x^3}$$

$$= 2 \left[(2x)^3 + \frac{1}{(8x)^3} \right]$$

$$= 2 \left[216 - 3 \times 6 \times 2 \times \frac{1}{8} \right]$$

$$= 432 - 9$$

$$= 423$$

58. Sol. (b) $x + \frac{1}{x} = \frac{5}{2} \Rightarrow \frac{x^2+1}{x} = \frac{4+1}{2} = \frac{(2)^2+1}{2}$

$$\therefore x = 2$$

$$\text{Now, } x^4 - \frac{1}{x^4} = (2)^4 - \frac{1}{(2)^4} = \frac{256-1}{16}$$

$$= \frac{255}{16}$$

59. Sol. (d)

$$\frac{5x}{2x^2+5x+1} = \frac{1}{3}$$

$$\frac{5}{\frac{2x^2}{x} + \frac{5x}{x} + \frac{1}{x}} = \frac{1}{3}$$

$$\frac{5}{2x + \frac{1}{x} + 5} = \frac{1}{3}$$

$$\left(2x + \frac{1}{x} + 5\right) = 15$$

$$2x + \frac{1}{x} = 10$$

Divide by 2 both sides

$$x + \frac{1}{2x} = \frac{10}{2} = 5$$

60. Sol. (a)

$$x - \frac{3}{x} = 6$$

Cubing both side

$$\Rightarrow x^3 + \frac{1}{x^3} = (\sqrt{7})^3 - 3\sqrt{7}$$

$$= 7\sqrt{7} - 3\sqrt{7} = 4\sqrt{7}$$

71. Sol. (c)

$$\sqrt{x} - \frac{1}{\sqrt{x}} = 4$$

$$\Rightarrow x + \frac{1}{x} = 4^2 + 2 = 18$$

$$\left(\text{If } a - \frac{1}{a} = k, \text{ then } a^2 + \frac{1}{a^2} = k^2 + 2\right)$$

$$\Rightarrow x^2 + \frac{1}{x^2} = 18^2 - 2 = 322$$

72. Sol. (d)

$$x^4 + \frac{1}{x^4} = 194$$

$$\Rightarrow x^2 + \frac{1}{x^2} = \sqrt{194 + 2} = 14$$

$$\Rightarrow x + \frac{1}{x} = \sqrt{14 + 2} = 4$$

$$= x^2 + 1 = 4x = x^2 - 4x = -1$$

$$(x - 2)^2 = 4 - 1 = 3$$

73. Sol. (d)

$$\sqrt{x} + \frac{1}{\sqrt{x}} = 3$$

Now squaring both sides of the equation we get,

$$x + \frac{1}{x} = 9 - 2 \Rightarrow x + \frac{1}{x} = 7$$

On squaring again

$$x^2 + \frac{1}{x^2} = 47$$

$$\Rightarrow x^4 + 1 = 47x^2$$

Now,

$$x^2(x^2 - 47) = -1$$

74. Sol. (a)

$$\text{Given, } x + \frac{1}{16x} = 3$$

Multiplying both sides by 4

$$\Rightarrow 4x + \frac{1}{4x} = 12$$

$$64x^3 + \frac{1}{64x^3} = (12^3 - 3 \times 12)$$

$$\left(\text{If } a + \frac{1}{a} = k, \text{ then } a^3 + \frac{1}{a^3} = k^3 - 3k\right) = 1692$$

Exploring question term

$$16x^3 + \frac{1}{256x^3} = \frac{1}{4} \times 4 \times$$

$$\left(16x^3 + \frac{1}{256x^3}\right)$$

$$= \frac{1}{4} \left(64x^3 + \frac{1}{64x^3}\right) \Rightarrow \frac{1}{4} \times 1692 = 423$$

75. Sol. (d)

$$\frac{x^4 - 5x^2 + 1}{x^3 + x^2 + x} = 3$$

Divide numerator and denominator by x^2

$$\Rightarrow \frac{x^2 - 5 + \frac{1}{x^2}}{x + 1 + \frac{1}{x}} = 3$$

Add and subtract 2 from numerator

$$\Rightarrow \frac{x^2 + \frac{1}{x^2} - 5 + 2 - 2}{x + 1 + \frac{1}{x}} = 3$$

$$\Rightarrow \frac{\left(x + \frac{1}{x}\right)^2 - 7}{x + 1 + \frac{1}{x}} = 3$$

$$\text{Let } x + \frac{1}{x} = t$$

$$\text{Then, } \frac{\left(x + \frac{1}{x}\right)^2 - 7}{x + 1 + \frac{1}{x}} = \frac{t^2 - 7}{t + 1} = 3$$

$$\Rightarrow t^2 - 3t - 10 = 0$$

$$\Rightarrow t = 5 \text{ or } -2$$

$$x + \frac{1}{x} = 5 \text{ or } x + \frac{1}{x} = -2$$

(can't be -2 because x is a positive number)

$$\Rightarrow x^2 + 1 - 5x = 0$$

Add 6 on both sides of the eq.

$$\Rightarrow x^2 - 5x + 1 + 6 = 0 + 6$$

$$\Rightarrow x^2 - 5x + 7 = 6$$

76. Sol. (b)

$$x = 2 + \sqrt{3} \Rightarrow \frac{1}{x} = 2 - \sqrt{3}$$

$$x + \frac{1}{x} = 4 \text{ and } x - \frac{1}{x} = 2\sqrt{3}$$

$$= \frac{x^6 + 3x^4 + 14x^3 + 3x^2 - 1}{2x^5 - 6x^4 + 10x^3 + 6x^2 - 2x}$$

Divide numerator and denominator by x^3

$$= \frac{\left(x^3 - \frac{1}{x^3}\right) + 3\left(x + \frac{1}{x}\right) + 24}{2\left(x^2 - \frac{1}{x^2}\right) - 6\left(x - \frac{1}{x}\right) + 10}$$

$$\text{We know, } x + \frac{1}{x} = 4$$

$$x - \frac{1}{x} = 2\sqrt{3} \text{ or } \sqrt{12}$$

$$= \frac{15\sqrt{12} + 3 \times 4 + 24}{2 \times 4\sqrt{12} - 6 \times \sqrt{12} + 10}$$

$$= \frac{30\sqrt{3} + 36}{16\sqrt{3} - 12\sqrt{3} + 10} = \frac{3\sqrt{3}(10 + 4\sqrt{3})}{4\sqrt{3} + 10}$$

$$= 3\sqrt{3}$$

Type-2 (Formula Based Algebra)

1. If $x + y + z = 8$, and $x^2 + y^2 + z^2 = 20$ then the value of $x^3 + y^3 + z^3 - 3xyz$ is

SSC CPO 2023 (Evening)

- (a) 16 (b) 10
(c) 15 (d) -16

2. If $x = 222, y = 223$ and $z = 224$, then find the value of $x^3 + y^3 + z^3 - 3xyz$

SSC CGL 12/12/2022 (4th Shift)

- (a) 2007 (b) 2004
(c) 2006 (d) 2005

3. If $x = 32, y = 33$ and $z = 35$, then evaluate the expression $x^3 + y^3 + z^3 - 3xyz$

SSC CHSL 01/06/2022 (Evening)

- (a) 1120 (b) 1000
(c) 900 (d) 700

4. Simplify the following expression.

$$\frac{[(0.99)^3 - (0.01)^3] \times 0.45}{[(0.99)^2 + (0.01)^2 + 0.0099] \times 0.49}$$

ICAR Assistant 29/07/2022 (Shift- 03)

- (a) 0.5 (b) 0.4
(c) 0.7 (d) 0.9

5. The value of $\frac{(x-y)^3 + (y-z)^3 + (z-x)^3}{(x^2-y^2)^3 + (y^2-z^2)^3 + (z^2-x^2)^3}$ where $x \neq y \neq z$, is:

SSC CPO 09/11/2022 (Afternoon)

- (a) 0 (b) $\frac{1}{(x+y+z)}$
(c) $\frac{1}{(x+y)(y+z)(z+x)}$ (d) 1

6. If $8x^3 - 27y^3 = (Ax + By)(Cx^2 - Dy^2 + 6xy)$. then $+B + C - D = ?$

- (a) -12 (b) 12
(c) 9 (d) 15

7. If $8x^2 + 9x + 8 = 0$, then the value of $x^3 + \frac{1}{x^3}$ is:

SSC CHSL 01/06/2022 (Morning)

- (a) $\frac{999}{212}$ (b) $\frac{199}{212}$

- (c) $\frac{999}{512}$ (d) $\frac{199}{512}$

8. If $x^3 + y^3 = 1344$ and $x + y = 28$, then $(x + y)^2 - 3xy$ is equal to

- (a) 24 (b) 16
(c) 32 (d) 48

9. The value $\frac{(p-q)^3 + (q-r)^3 + (r-p)^3}{12(p-q)(q-r)(r-p)}$ where $p \neq q \neq r$, is equal to:

SSC CGL 09/12/2022 (1st Shift)

- (a) $\frac{1}{9}$ (b) $\frac{1}{3}$
(c) $\frac{1}{4}$ (d) $\frac{1}{2}$

10. What is the value of $(a + b)^2 - (a - b)^2$?

SSC CGL 08/12/2022 (1st Shift)

- (a) $2(a^2 + b^2)$ (b) $4(a^2 + b^2)$
(c) $8ab$ (d) $4ab$

11. If $a = 225, b = 197$, and $c = 178$, then find $\frac{a^3 + b^3 + c^3 - 3abc}{(a-b)^2 + (b-c)^2 + (c-a)^2}$

- (a) 122 (b) 300
(c) 200 (d) 159

12. If $(x^3 + y^3) : (x^2 - xy + y^2) = 3 : 1$ and $(x^2 - y^2) : (x + y) = 5 : 6$, then what is $2x : 3y$?

DP Head Constable 10/10/2022 (Shift- 02)

- (a) 36:43 (b) 38:47
(c) 45:32 (d) 46:39

13. If $a + b + c = 0$, then the value of $\frac{(a^2 + b^2 + c^2)^2}{a^2b^2 + b^2c^2 + c^2a^2}$ is

- (a) 0 (b) 1
(c) 2 (d) 4

14. If $2x - \frac{5}{9x} = 3$, then $36x^2 - \frac{25}{9x^2} = ?$

- (a) 99 (b) 119 (c) 123 (d) 101

15. If $x + \frac{1}{x} = 2\cos \theta$, then $x^3 + \frac{1}{x^3} = ?$

SSC CGL 03/12/2022 (2nd Shift)

- (a) $2\cos 2\theta$ (b) $\cos 3\theta$

- (c) $2\cos 3\theta$ (d) $\cos 2\theta$
16. If $4(z+7)(2z-1) = Az^2 + Bz + C$ then the value of $A+B+C$ is:

SSC CGL 08/12/2022 (3rd Shift)

- (a) 28 (b) 32
(c) 74 (d) 81
17. If $x+y+z=11$, $xy+yz+zx=-6$ and $x^3+y^3+z^3=1604$, then the value of xyz is:

SSC CGL 12/04/2022 (Morning)

- (a) 25 (b) 4
(c) 1 (d) 5
18. If $\frac{a^2+b^2+c^2-1024}{ab-bc-ca} = -2$ and $a+b=5c$, where $c > 0$, then the value of c is

SSC CGL 01/12/2022 (4th Shift)

- (a) 8 (b) 4
(c) 12 (d) 5
19. If $a+b=11$ and $ab=35$, then what is the value of (a^4+b^4) ?

SSC CGL 01/12/2022 (3rd Shift)

- (a) 151 (b) 261
(c) 124 (d) 102
20. If $(11x+8)^3 + (2-x)^3 - 27(2x-5)^3 = 9(11x+8)(x-2)(2x-5)$, then what is the value of $\sqrt{x^2-36}$?

ICAR Assistant 29/07/2022 (Shift-02)

- (a) $\frac{9}{2}$ (b) $\frac{7}{2}$
(c) $\frac{9}{4}$ (d) $\frac{7}{4}$
21. If $x^2+y^2+z^2=133$, $xy+yz+zx=114$, and $xyz=216$, then the value of $x^3+y^3+z^3$ is -
- (a) 948 (b) 999
(c) 942 (d) 1009

22. If $x=9999$, then what is the value of the following?

$$\frac{4x^3-x}{(2x+1)(6x-3)}$$

- (a) 1111 (b) 2222
(c) 3333 (d) 6666

23. If $x(x-3\sqrt{3})=1$, then find out the value of $x^3(x^3-90\sqrt{3})$ is -

- (a) 1 (b) 0
(c) -1 (d) -3

24. If $a-b=2$ and $a^3-b^3=80$, then what will be the value of ab ?

SSC CGL 05/12/2022 (2nd Shift)

- (a) 12 (b) -24
(c) 24 (d) -12

25. If $x^{12} + \frac{1}{x^{12}} = 10\sqrt{2}$, then $x^{36} - \frac{1}{x^{36}} = ?$

- (a) 2786 (b) 2702
(c) 2744 (d) 2828

26. If $(a+b+c)=17$ and $(a^2+b^2+c^2)=117$ what is the value of $(a-b)^2 + (b-c)^2 + (c-a)^2$?

DP Head Constable 10/10/2022 (Shift-03)

- (a) 57 (b) 72
(c) 42 (d) 62

27. If $a+b+c=5$, $a^3+b^3+c^3=85$ and $abc=25$, then find the value of $a^2+b^2+c^2-ab-bc-ca$.

SSC CGL 13/12/2022 (4th Shift)

- (a) 2 (b) 4
(c) 6 (d) 8

28. If $3\sqrt{\frac{1-a}{a}} + 9 = 19 - 3\sqrt{\frac{a}{1-a}}$, then what is the value of a ?

- (a) $\frac{3}{10}, \frac{7}{10}$ (b) $\frac{1}{10}, \frac{9}{10}$
(c) $\frac{2}{5}, \frac{3}{5}$ (d) $\frac{1}{5}, \frac{4}{5}$

29. If $x^6 - 512y^6 = (x^2 + Ay^2)(x^4 - Bx^2y^2 + Cy^4)$, find $A+B-C$

- (a) -80 (b) -72
(c) 72 (d) 48

30. If $a=2022$, $b=2021$ and $c=2020$, then value of $a^2+b^2+c^2-ab-bc-ca$ is:

SSC CHSL 26/05/2022 (Evening)

- (a) 2 (b) 4
(c) 3 (d) 1

31. If $a + b + c = 6$, $a^2 + b^2 + c^2 = 14$ and $ab + bc + ca = 11$, then what is the value of $a^3 + b^3 + c^3 - 3abc$?

SSC CGL 02/12/2022 (3rd Shift)

- (a) 31 (b) 12
(c) 18 (d) 42

32. If $(x + y) = 17$, $xy = 9$, then what is the value of $x^3 + y^3$?

Higher Secondary 02/08/2022 (Shift - 2)

- (a) 4454 (b) 5461
(c) 4265 (d) 5405

33. x and y are positive integers. If $x^4 + y^4 + x^2y^2 = 481$ and $xy = 12$, Then what is the value of $x^2 - xy + y^2$?

- (a) 16 (b) 13
(c) 11 (d) 15

34. If $p + q = 6$ and $pq = 4$, then what is the value of $p^3 + q^3$?

SSC CGL 01/12/2022 (4th Shift)

- (a) 81 (b) 64
(c) 144 (d) 256

35. If $x - y = 5$ and $x^3 - y^3 = 520$, then the value of xy is:

Higher Secondary 05/08/2022 (Shift - 2)

- (a) $\frac{79}{3}$ (b) $\frac{36}{5}$
(c) $\frac{34}{3}$ (d) $\frac{76}{5}$

36. If $4x - \frac{1}{5x} = 6$, then $1000x^3 - \frac{1}{8x^3} = ?$

- (a) 3400 (b) 3375
(c) 3600 (d) 3575

37. Factorize the given algebraic expression.
 $x^3 + 27y^3 + 64z^3 - 36xyz$

Graduate Level 02/08/2022 (Shift - 3)

- (a) $(x - 3y - 4z)(x^2 + 9y^2 + 16z^2 - 3xy - 12yz - 4xz)$
(b) $(x + 3y + 4z)(x^2 + 9y^2 + 16z^2 - 3xy - 12yz - 4xz)$
(c) $(x - 3y - 4z)(x^2 + 9y^2 + 16z^2 - 3xy - 12yz - 12xz)$
(d) None

38. The value of $\frac{\{(m^2+n^2)(m-n)-(m-n)^3\}}{(m^2n-mn^2)}$ is:

SSC CPO 09/11/2022 (Evening)

- (a) $m + n$ (b) $m - n$
(c) 2 (d) $\frac{m}{n}$

39. If $a = 26$ and $b = 22$, then the value of $\frac{a^3-b^3}{a^2-b^2} - \frac{3ab}{a+b}$ is

SSC CGL 12/12/2022 (1st Shift)

- (a) $\frac{5}{3}$ (b) $\frac{13}{11}$
(c) $\frac{1}{3}$ (d) $\frac{11}{13}$

40. If $x + y + z = 0$, then find the value of $\frac{x^2}{x^2-yz} + \frac{y^2}{y^2-xz} + \frac{z^2}{z^2-xy}$

SSC CHSL 07/06/2022 (Evening)

- (a) 2 (b) 1
(c) 3 (d) 0

41. If $a^3 + b^3 = 218$ and $a + b = 2$, then the value of ab is -

- (a) 32 (b) -35
(c) 34 (d) 31

42. If $40\sqrt{5}x^3 - 3\sqrt{3}y^3 = (2\sqrt{5}x - \sqrt{3}y)(Ax^2 + Bxy + Cy^2)$, then what is the value of $\sqrt{B^2 + C^2} - A = ?$

- (a) 11 (b) 7
(c) 8 (d) 9

- Q.43. If $x^3 + y^3 = 468$ and $x + y = 12$, then the value of $x^4 + y^4$ will be:

SSC CHSL 13/4/2021 (Evening)

- (a) 3620 (b) 2036
(c) 3025 (d) 3026

44. If $x + y + z = 2$, $x^3 + y^3 + z^3 - 3xyz = 74$, then $(x^2 + y^2 + z^2)$ is equal to

SSC CGL 23/8/2021 (Evening)

- (a) 22 (b) 29
(c) 26 (d) 24

45. Given that $x^8 - 34x^4 + 1 = 0$, $x > 0$. What is the value of $(x^3 - x^{-3})$?

SSC CGL 24/8/2021 (Evening)

- (a) 12 (b) 14
(c) 18 (d) 16

46. If $(x + y)^3 + 27(x - y)^3 = (Ax - 2y)(Bx^2 + Cxy + 13y^2)$, then the value of $A - B - C$ is:

SSC CGL 17/8/2021 (Afternoon)

- (a) 27 (b) 20
(c) 15 (d) 13

47. If $a + b + c = 5$ and $a^3 + b^3 + c^3 - 3abc = 185$, then the value of $ab + bc + ca$ lies between:

SSC CHSL 13/4/2021 (Morning)

- (a) 5 and 9 (b) -3 and 1
(c) 1 and 5 (d) -7 and -3

48. Simplify the following expression.

$$\frac{(375+125)^2 - (125-375)^2}{375 \times 375 - 125 \times 125}$$

SSC CGL 18/08/2021 (Morning)

- (a) 15/8 (b) 3/4
(c) 3/2 (d) 27/28

49. If $a^3 + 4a^2 + 16a = 1$, then what is the value of $a^3 + \frac{4}{a} = ?$

- (a) 63 (b) 65
(c) 67 (d) 68

50. If $8(x + y)^3 - 27(x - y)^3 = (5y - x)(Ax^2 + By^2 + Cxy)$, then what is the value of $(A + B - C)$?

SSC CGL 13/8/2021 (Morning)

- (a) 16 (b) -26
(c) 36 (d) -16

51. If $\frac{1}{\sqrt[3]{9} + \sqrt[3]{3} + 1} = a\sqrt[3]{9} + b\sqrt[3]{3} + c$ (a, b, c are rational numbers), then $a + b + c$ is equal to -

- (a) 0 (b) 1
(c) 2 (d) 3

52. if $x - \frac{1}{x} = 5$, then $x^6 - \frac{1}{x^6} = ?$

- (a) $3644\sqrt{29}$ (b) $3640\sqrt{29}$
(c) $3648\sqrt{29}$ (d) $3650\sqrt{29}$

53. That is the value of

$$\frac{(1.3)^3 + (0.8)^3 + (0.7)^3 - 2.016}{(1.35)[(1.2)^2 + (0.8)^2 - (0.7)^2 - 0.96 - 0.84 - 0.56]}$$

- (a) $\frac{1}{4}$ (b) $\frac{1}{2}$
(c) 1 (d) 2

54. If $a + b + c = 0$, then which of the following are correct?

1. $a^3 + b^3 + c^3 = 3abc$
2. $a^2 + b^2 + c^2 = -2(ab + bc + ca)$
3. $a^3 + b^3 + c^3 = -3ab(a + b)$

Select the correct answer using the code given below.

- (a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

55. If $x + y + z = 7$, $x^2 + y^2 + z^2 = 85$ and $x^3 + y^3 + z^3 = 913$, then the value of $\sqrt[3]{xyz}$ is:

SSC CGL 17/8/2021 (Morning)

- (a) 4 (b) 2
(c) 1 (d) 8

56. If $x + y + z = 2$, $x^3 + y^3 + z^3 - 3xyz = 74$, then $(x^2 + y^2 + z^2)$ is equal to -

SC CGL 23/8/2021 (Evening)

- (a) 22 (b) 29
(c) 26 (d) 24

57. If $x^2 - \sqrt{7}x - 1 = 0$, then $x^{10} - 78x^6 - 75x^2$ will be-

- (a) -5 (b) 7
(c) -9 (d) 10

58. If $(56\sqrt{7}x^3 - 2\sqrt{2}y^3) \div (2\sqrt{7}x - \sqrt{2}y) = Ax^2 + By^2 - Cxy$, then find the value of $A + B - \sqrt{14}C$.

SSC CGL 20/8/2021 (Afternoon)

- (a) 19 (b) 10
(c) 58 (d) 38

59. If $x + y + z = 22$ and $xyz + zx = 35$, then what is the value of $(x - y)^2 + (y - z)^2 + (z - x)^2$?

- (a) 793 (b) 681
(c) 758 (d) 715

60. If $x + y = 4$ and $x^3 + y^3 = 12$, then the value of $x^4 + y^4 = ?$

SSC CHSL 16/10/2020 (evening)

- (a) $\frac{146}{9}$ (b) $\frac{146}{3}$
(c) $\frac{146}{7}$ (d) $\frac{146}{5}$

61. If $x + y + xy = 29$, $y + z + zy = 41$, and $z + x + xz = 34$, then find $3z - 4x + 5y = ?$

(a) 23 (b) 27
(c) 25 (d) 20

62. If $a^2 + 4b^2 + 25c^2 + 18 = 2(a - 2b + 20c)$, then what is the value of $(a + 2b + 5c)$?

SSC CHSL 16/4/2021 (Afternoon)

(a) 3 (b) 4
(c) 6 (d) 5

63. The value is equal to $\frac{6.35 \times 6.35 \times 6.35 + 3.65 \times 3.65 \times 6.35}{63.5 \times 63.5 + 36.5 \times 36.5 - 63.5 \times 36.5}$

SSCCPO 23/11/2020 (Morning)

(a) 0.01 (b) 10
(c) 1 (d) 0.1

64. If a and b are two positive real numbers such that $a + b = 20$ and $ab = 4$, then the value of $a^3 + b^3$ is:

SSC CHSL 15/10/2020 (morning)

(a) 7760 (b) 240
(c) 8000 (d) 8240

65. If $\frac{1}{x} = 3$, $x^8 + x^7 - 18x^4 - 123x^3 + x^2 + x = ?$

(a) $5\sqrt{5}$ (b) $3\sqrt{5}$
(c) $5\sqrt{3}$ (d) None

66. If $x + y + z = 19$, $x^2 + y^2 + z^2 = 133$ and $xz = y^2$, $x > z > 0$, what is the value of $(x - z)$?

SSC CPO 25/11/2020 (Morning)

(a) -2 (b) 0
(c) -5 (d) 5

67. If $x + y + z = 6$, $xyz = -10$ and $x^2 + y^2 + z^2 = 30$, then what is the value of $(x^3 + y^3 + z^3)$?

SSC CGL TIER II (13/09/2019)

(a) 132 (b) 135
(c) 130 (d) 127

68. If $a - b = 4$ and $a^3 - b^3 = 88$, then find the value of $a^2 - b^2$.

SSC CHSL 12/10/2020 (afternoon)

(a) $6\sqrt{6}$ (b) $9\sqrt{6}$
(c) $7\sqrt{6}$ (d) $8\sqrt{6}$

69. If $x^2 - 22x + 111 = 0$, then what is the value of $(x - 8)^2 - \frac{1}{(x-8)^2} = ?$

(a) $12\sqrt{10}$ (b) $8\sqrt{5}$
(c) $8\sqrt{3}$ (d) 18

70. If $(x + y)^3 + 8(x - y)^3 = (3x + Ay)(3x^2 + Bxy + Cy^2)$, then the value of $A + B + C$ is:

SSC CGL Tier II (16-11-2020)

(a) 0 (b) 4
(c) 2 (d) 3

71. If $(5\sqrt{5}x^3 - 81\sqrt{3}y^3) \div \sqrt{5}x - 3\sqrt{3}y = Ax^2 + By^2 + Cxy$, then the value of $(6A + B - \sqrt{15}C)$ is:

SSC CGL 4/06/2019 (Morning)

(a) 10 (b) 9
(c) 15 (d) 12

72. If $(2x - 5y)^3 - (2x + 5y)^3 = y(Ax^2 + By^2)$, then what is the value of $(2A - B)$?

(a) 25 (b) 40
(c) 15 (d) 10

73. If $x + y + z = 6$ and $xy + yz + zx = 10$, then the value of $x^3 + y^3 + z^3 - 3xyz$ is:

(a) 36 (b) 40
(c) 42 (d) 48

74. What is $\frac{(x-y)^3 + (y-z)^3 + (z-x)^3}{3(x-y)(y-z)(z-x)}$ equal to?

[CDS-2019-I]

(a) 1 (b) 0
(c) $\frac{1}{3}$ (d) 3

75. The value of the expression $\frac{1}{4} \left\{ \left(a + \frac{1}{a} \right)^2 - \left(a - \frac{1}{a} \right)^2 \right\}$ is:

SSC CHSL 9/07/2019 (Evening)

(a) $\frac{1}{2}$ (b) $\frac{1}{4}$
(c) 1 (d) 4

76. The value of $\frac{2.8^3 + 2.2^3}{28^2 - 28 \times 22 + 484}$ is

SSC CPO 12/12/2019 (Evening)

(a) 0.02 (b) 0.05
(c) 0.01 (d) 0.5

78. If $x^2 - 3x - 1 = 0$, then the value of $(x^2 + 8x - 1)(x^3 + x^{-1})^{-1}$ is:

SSC CGL N06/2019 (Afternoon)

- (a) $\frac{3}{8}$ (b) 8
(c) 1 (d) 3

78. If $x + y + z = 19, xy + yz + zx = 114$ then the value of $\sqrt{x^3 + y^3 + z^3 - 3xyz}$ is

SSC CGL 4/06/2019 (Afternoon)

- (a) 21 (b) 17
(c) 19 (d) 13

79. If $(2x - 5y)^3 - (2x + 5y)^3 = y[Ax^2 + By^2]$, then what is the value of $(2A - B)$?

SSC CPO 11/12/19 (Morning)

- (a) 25 (b) 40

- (c) 15 (d) 10

80. If $5\sqrt{5}x^3 + 2\sqrt{2}y^3 = (Ax + \sqrt{2}y)(Bx^2 + 2y^2 + Cxy)$, then the value of $(A^2 + B^2 - C^2)$ is:

SSC CGL TIER II (13/09/2019)

- (a) 15 (b) 20
(c) 30 (d) 40

81. Find the square root of $21 - 4\sqrt{5} + 8\sqrt{3} - 4\sqrt{15}$

- (a) $\pm(2\sqrt{3} + 2 - \sqrt{5})$ (b) $\pm(2\sqrt{3} - 2 - \sqrt{5})$
(c) $2\sqrt{3} - 2 - \sqrt{5}$ (d) $\pm(\sqrt{5} - 2 - 2\sqrt{3})$

82. What is the value of $\frac{(x-y)^3 + (y-z)^3 + (z-x)^3}{9(x-y)(y-z)(z-x)}$?

- (a) 0 (b) $\frac{1}{3}$
(c) $\frac{1}{9}$ (d) 1

Type-2 (Formula Based Algebra) ANSWER KEY

1	D	2	A	3	D	4	D	5	C	6	A	7	C
8	D	9	C	10	D	11	B	12	D	13	D	14	A
15	C	16	B	17	A	18	A	19	A	20	D	21	D
22	*	23	A	24	A	25	A	26	D	27	A	28	B
29	A	30	C	31	C	32	A	33	B	34	C	35	A
36	C	37	B	38	C	39	C	40	A	41	B	42	B
43	D	44	C	45	B	46	D	47	D	48	C	49	B
50	C	51	A	52	B	53	D	54	D	55	A	56	C
57	C	58	C	59	C	60	A	61	B	62	B	63	D
64	A	65	B	66	D	67	A	68	D	69	A	70	A
71	D	72	D	73	A	74	A	75	C	76	B	77	C
78	C	79	D	80	B	81	D	82	B				

Type-2 (Formula Based Algebra) Solution

1. Sol. (d) Formula used

$$(x + y + z)^2 = x^2 + y^2 + z^2 + 2(xy + yz + zx)$$

$$x^3 + y^3 + z^3 - 3xyz = (x + y + z)$$

$$[x^2 + y^2 + z^2 - (xy + yz + zx)]$$

$$x + y + z = 8, x^2 + y^2 + z^2 = 20$$

$$\text{Now, } xy + yz + zx = \frac{8^2 - 20}{2} = 22$$

$$\text{So, } x^3 + y^3 + z^3 - 3xyz = 8(20 - 22) = 8x$$

$$(-2) = -16$$

2. Sol. (a) Formula used

$$x^3 + y^3 + z^3 - 3xyz = \frac{1}{2}(x + y + z)$$

$$[(x - y)^2 + (y - z)^2 + (z - x)^2]$$

$$= \frac{(222 + 223 + 224)}{2}$$

$$[(222 - 223)^2 + (223 - 224)^2 + (224 - 222)^2]$$

$$= \frac{669}{2} [(-1)^2 + (-1)^2 + (2)^2]$$

$$= \frac{669}{2} \times 6 = 2007$$

3. Sol. (d)

Formula used :

$$= x^3 + y^3 + z^3 - 3xyz = \frac{1}{2}(x + y + z)$$

$$[(x - y)^2 + (y - z)^2 + (z - x)^2]$$

$$x^3 + y^3 + z^3 - 3xyz$$

$$= \frac{1}{2} \times (32 + 33 + 35)[1^2 + 2^2 + 3^2]$$

$$= \frac{1}{2} \times 100 \times 14 = 700$$

4. Sol. (d)

Applying $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

$$\Rightarrow \frac{(0.99 - 0.01)[(0.99)^2 + (0.01)^2 + 0.0099] \times 0.45}{[(0.99)^2 + (0.01)^2 + 0.0099] \times 0.49}$$

$$\Rightarrow \frac{0.98 \times 0.45}{0.49} \Rightarrow 2 \times 0.45 \Rightarrow 0.9$$

5. Sol. (c)

Formula used :

$$a^3 + b^3 + c^3 = 3abc \text{ (when } a + b + c = 0)$$

$$a^3 + b^3 + c^3 = 3abc \text{ (when } a + b + c = 0)$$

$$a^2 - b^2 = (a - b)(a + b)$$

$$\text{Now, } (x - y) + (y - z) + (z - x) = 0$$

$$\Rightarrow (x - y)^3 + (y - z)^3 + (z - x)^3 = 3(x - y)(y - z)(z - x)$$

$$(x^2 - y^2) + (y^2 - z^2) + (z^2 - x^2) = 0$$

$$\Rightarrow (x^2 - y^2)^3 + (y^2 - z^2)^3 + (z^2 - x^2)^3 =$$

$$3(x^2 - y^2)(y^2 - z^2)(z^2 - x^2)$$

$$\text{So, } \frac{(x-y)^3 + (y-z)^3 + (z-x)^3}{(x^2-y^2)^3 + (y^2-z^2)^3 + (z^2-x^2)^3}$$

$$= \frac{3(x-y)(y-z)(z-x)}{3(x^2-y^2)(y^2-z^2)(z^2-x^2)} = \frac{1}{(x+y)(y+z)(z+x)}$$

6. Sol. (a)

$$8x^3 - 27y^3 = (Ax + By)(Cx^2 - Dy^2 + 6xy)$$

$$(Ax + By)(Cx^2 - Dy^2 + 6xy)$$

$$(2x - 3y)(4x^2 + 9y^2 + 6xy)$$

$$A = 2, B = -3, C = 4, D = -9$$

$$\Rightarrow A + B + C - D = 2 - 3 + 4 + 9 = 12$$

7. Sol. (c)

Formula used:

$$a^3 + b^3 = (a + b)^3 - 3ab(a + b)$$

$$8x^2 + 9x + 8 = 0$$

Dividing both sides by $8x$. We get

$$x + \frac{1}{x} = -\frac{9}{8}$$

$$x^3 + \frac{1}{x^3} = \left(-\frac{9}{8}\right)^3 - 3 \times x \times \frac{1}{x} \times \left(-\frac{9}{8}\right)$$

$$= -\frac{729}{512} + \frac{27}{8} = \frac{999}{512}$$

8. Sol. (d)

$$(x + y)^2 - 3xy$$

$$x^2 + y^2 + 2xy - 3xy$$

$$x^2 + y^2 - xy$$

$$\frac{x^3 + y^3}{x + y} = x^2 + y^2 - xy \text{ (using formula)}$$

$$= \frac{1344}{28} = 48$$

9. Sol. (c)

Formula :

$$a^3 + b^3 + c^3 = 3abc, \text{ if } a + b + c = 0$$

$$(p - q) + (q - r) + (r - p) = 0$$

$$\text{So, } \frac{(p-q)^3 + (q-r)^3 + (r-p)^3}{12(p-q)(q-r)(r-p)}$$

$$= \frac{3(p-q)(q-r)(r-p)}{12(p-q)(q-r)(r-p)} = \frac{1}{4}$$

10. Sol. (d)

$$(a + b)^2 - (a - b)^2$$

$$= (a^2 + b^2 + 2ab) - (a^2 + b^2 - 2ab)$$

$$= a^2 + b^2 + 2ab - a^2 - b^2 + 2ab = 4ab$$

11. Sol. (b)

$$\frac{a^3 + b^3 + c^3 - 3abc}{(a-b)^2 + (b-c)^2 + (c-a)^2} = \frac{(a+b+c)\left(\frac{1}{2}((a-b)^2 + (b-c)^2 + (c-a)^2)\right)}{(a-b)^2 + (b-c)^2 + (c-a)^2}$$

$$= \frac{a+b+c}{2} = \frac{225+197+178}{2} = \frac{600}{2} = 300$$

12. Sol. (d)

$$\frac{(x^3 + y^3)}{x^2 - xy + y^2} = \frac{3}{1} \Rightarrow \frac{(x+y)(x^2 - xy + y^2)}{(x^2 - xy + y^2)} = \frac{3}{1}$$

$$x + y = 3$$

$$= \frac{(x^2 - y^2)}{(x+y)} = \frac{5}{6} \Rightarrow x - y = \frac{5}{6}$$

on dividing equation (1) by equation (2)

By C & D

$$\frac{x+y}{x-y} = \frac{3 \times 6}{5} \Rightarrow \frac{x+y}{x-y} = \frac{18}{5}$$

$$\frac{2 \times x}{3 \times y} = \frac{23 \times 2}{13 \times 3} = \frac{46}{39}$$

13. Sol. (d)

$$a + b + c = 0$$

on squaring both sides of the eqn

$$\Rightarrow a^2 + b^2 + c^2 + 2(ab + bc + ca) = 0$$

$$\Rightarrow a^2 + b^2 + c^2 = -2(ab + bc + ca)$$

Square both sides of the eqn again

$$\Rightarrow (a^2 + b^2 + c^2)^2 = 4(a^2b^2 + b^2c^2 + c^2a^2 + 2ab^2c + 2abc^2 + 2a^2bc)$$

$$= 4(a^2b^2 + b^2c^2 + c^2a^2 + 2abc(a + b + c))$$

$$= 4(a^2b^2 + b^2c^2 + c^2a^2) (\because a + b + c = 0)$$

$$\frac{(a^2 + b^2 + c^2)^2}{a^2b^2 + b^2c^2 + c^2a^2} = \frac{4(a^2b^2 + b^2c^2 + c^2a^2)}{a^2b^2 + b^2c^2 + c^2a^2} = 4$$

14. Sol. (a)

$$3\left(2x - \frac{5}{9x}\right) = 3 \times 3$$

$$6x - \frac{5}{3x} = 9$$

$$6x + \frac{5}{3x} = \sqrt{9^2 + 4 \times 6 \times \frac{5}{3}} = \sqrt{81 + 40} = 11$$

$$36x^2 - \frac{25}{9x^2} = 9 \times 11 = 99$$

15. Sol. (c)

$$\cos 3\theta = (4\cos^3 \theta - 3\cos \theta)$$

$$x + \frac{1}{x} = 2\cos \theta \text{ (given)}$$

$$\text{Then } x^3 + \frac{1}{x^3} = (2\cos \theta)^3 - 3 \times 2\cos \theta$$

$$= 2(4\cos^3 \theta - 3\cos \theta) = 2\cos 3\theta$$

16. Sol. (b)

$$4(z + 7)(2z - 1) = (4z + 28)(2z - 1)$$

$$= 8z^2 - 4z + 56z - 28 = 8z^2 + 52z - 28$$

$$\text{Now, } 8z^2 + 52z - 28 = Az^2 + Bz + C$$

On comparing both side, we have :

$$A = 8, B = 52, C = -28$$

$$\text{So, } A + B + C = 8 + 52 - 28 = 32$$

17. Sol. (a)

$$x^3 + y^3 + z^3 - 3xyz$$

$$= (x + y + z)$$

$$[x^2 + y^2 + z^2 - xy - yz - zx]$$

$$x^3 + y^3 + z^3 - 3xyz$$

$$= (x + y + z)$$

$$[(x + y + z)^2 - 3(xy + yz + zx)]$$

$$1604 - 3xyz = (11)[(11)^2 - 3(-6)]$$

$$1604 - 3xyz = (11)[121 + 18]$$

$$1604 - 3xyz = (11)[139]$$

$$3xyz = 1604 - 1529 \Rightarrow 3xyz = 75$$

$$xyz = 25$$

18. Sol. (a)

Formula:-

$$(a + b - c)^2 = a^2 + b^2 + c^2 + 2ab - 2bc - 2ca$$

$$\text{Given, } \frac{a^2 + b^2 + c^2 - 1024}{ab - bc - ca} = -2$$

$$a^2 + b^2 + c^2 - 1024 =$$

$$-2ab + 2bc + 2ca$$

$$a^2 + b^2 + c^2 + 2ab - 2bc - 2ca = 1024$$

$$(a + b - c)^2 = 1024$$

$$(5c - c)^2 = 1024$$

$$(\text{Given, } +b = 5c) \Rightarrow c = 8$$

19. Sol. (a)

Formula :-

$$a^4 + b^4 + 2a^2b^2 = (a^2 + b^2)^2$$

$$a^2 + b^2 = 121 - 70 = 51$$

$$\text{Now, } a^4 + b^4 = 51^2 - 2 \times (35)^2$$

$$= 2601 - 2450 = 151$$

20. Sol. (d)

$$(11x + 8)^3 + (2 - x)^3 - 27(2x - 5)^3 = 9(11x + 8$$

$$(x - 2)(2x - 5)$$

We know that when $a + b + c = 0$ Then, $a^3 + b^3 + c^3 = 3abc$ or vice versa

$$\Rightarrow (11x + 8)^3 + (2 - x)^3 - 3^3(2x - 5)^3 = 3x(11$$

$$+ 18) \times (x - 2) \times 3(2x - 5)$$

$$a = 11x + 8, b = 2 - x \text{ \& } c = -3(2x - 5)$$

$$\Rightarrow (11x + 8) + (2 - x) - 3(2x - 5) = 0$$

$$\Rightarrow 11x + 8 + 2 - x - 6x + 15 = 0$$

$$\Rightarrow 4x + 25 = 0$$

$$\Rightarrow x = \frac{-25}{4}$$

$$\Rightarrow \text{Then } \sqrt{x^2 - 36} \Rightarrow \sqrt{\frac{625 - 576}{16}}$$

$$\Rightarrow \sqrt{\frac{49}{16}} \Rightarrow \frac{7}{4}$$

21. Sol. (d)

$$(x + y + z)(x^2 + y^2 + z^2 - (xy + yz + zx)) = x^3 + y^3 + z^3 - 3xyz$$

$$(x + y + z)^2$$

$$= 133 + 2 \times 114 = 361$$

$$x + y + z = \sqrt{361} = 19$$

$$\Rightarrow 19(133 - 114) = x^3 + y^3 + z^3 - 3 \times 216$$

$$x^3 + y^3 + z^3 - 648 = 19 \times 99 = 361$$

$$x^3 + y^3 + z^3 = 361 + 648$$

$$= 1009$$

22. sol. (c)

$$\frac{4x^3 - x}{3(2x+1)(2x-1)} = \frac{x}{3} \left(\frac{4x^2 - 1}{4x^2 - 1} \right) = \frac{x}{3} = 3333.$$

23. Sol. (a)

$$x(x - 3\sqrt{3}) = 1$$

$$x - 3\sqrt{3} = \frac{1}{x}$$

$$x - \frac{1}{x} = 3\sqrt{3}$$

$$x^3 - \frac{1}{x^3} = 81\sqrt{3} + 9\sqrt{3}$$

$$x^3 - 90\sqrt{3} = \frac{1}{x^3} \quad \dots (i)$$

$$x^3 \times \frac{1}{x^3} = 1 \quad (\text{from eq. (i)})$$

24. Sol. (a)

Formula:-

$$(a - b)^3 = a^3 - b^3 - 3ab(a - b)$$

$$a - b = 2 \text{ and } a^3 - b^3 = 80 \text{ (given)}$$

$$\text{Now, } (2)^3 = 80 - 3ab(2) \Rightarrow ab = 12$$

25. Sol. (a)

$$x^{12} - \frac{1}{x^{12}} = \sqrt{(10\sqrt{2})^2 - 4} = 14$$

$$x^{36} - \frac{1}{x^{36}} = 14^3 + 3 \times 14 = 2786$$

26. Sol. (d)

$$(a + b + c) = 17 \text{ \& } (a^2 + b^2 + c^2) = 117$$

$$= (a + b + c)^2 = (17)^2$$

$$= a^2 + b^2 + c^2 + 2(a + b + bc + ca) = 289$$

$$= 117 + 2(ab + bc + ca) = 289$$

$$\Rightarrow 2(ab + bc + ca) = 172$$

$$\text{Now, } (a - b)^2 + (b - c)^2 + (c - a)^2$$

$$\Rightarrow a^2 + b^2 - 2ab + b^2 + c^2 - 2bc + c^2 + a^2 - 2ac$$

$$\Rightarrow 2(a^2 + b^2 + c^2) - 2(ab + bc + ca)$$

$$\Rightarrow 2(117) - (172) \Rightarrow 234 - 172 \Rightarrow 62$$

27. Sol. (a)

Formula

$$a^3 + b^3 + c^3 - 3abc$$

$$= (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$$

$$85 - 3 \times 25 = 5(a^2 + b^2 + c^2 - ab - bc - ca)$$

$$85 - 75 = 5(a^2 + b^2 + c^2 - ab - bc - ca)$$

$$10 = 5(a^2 + b^2 + c^2 - ab - bc - ca)$$

$$a^2 + b^2 + c^2 - ab - bc - ca = \frac{10}{5} = 2$$

28. Sol. (b)

$$3\sqrt{\frac{1-a}{a}} + 9 = 19 - 3\sqrt{\frac{a}{1-a}}$$

$$\sqrt{\frac{1-a}{a}} + \sqrt{\frac{a}{1-a}} = \frac{10}{3} = 3 + \frac{1}{3}$$

$$\Rightarrow \sqrt{\frac{1-a}{a}} = 3, \frac{1-a}{a} = 9 \Rightarrow a = 1/10$$

29. Sol. (a)

$$(x^2)^3 - (8y^2)^3 = (x^2 - 8y^2)(x^4 + 64y^4 + 8a^2y^2)$$

Compare with Eqn given in question

$$A = -8, B = -8, C = 64$$

$$A + B - C$$

$$-8 - 8 - 64 \Rightarrow -80$$

30. Sol. (c)

Formula used

$$a^2 + b^2 + c^2 - ab - bc - ca$$

$$= \frac{1}{2}[(a - b)^2 + (b - c)^2 + (c - a)^2]$$

$$= a^2 + b^2 + c^2 - ab - bc - ca$$

$$= \frac{1}{2}[(2022 - 2021)^2 +$$

31. Sol. (c)Given that, $a + b + c = 6$

$$a^2 + b^2 + c^2 = 14 \text{ and } ab + bc + ca = 11$$

$$a^3 + b^3 + c^3 - 3abc = (a + b + c)$$

$$\{(a^2 + b^2 + c^2) - (ab + bc + ca)\}$$

$$a^3 + b^3 + c^3 - 3abc = (6)\{(14 - 11)\} = 18$$

32. Sol. (a)

$$(x + y) = 17, xy = 9$$

$$(x + y)^3 = x^3 + y^3 + 3xy(x + y)$$

$$\Rightarrow (17)^3 = x^3 + y^3 + 3 \times 9 \times 17$$

$$\Rightarrow x^3 + y^3 = 4913 - 459 = 4454$$

33. Sol. (b)

$$x^4 + y^4 + x^2y^2 = 481, xy = 12$$

$$x^4 + y^4 + 2x^2y^2 = 481 + x^2y^2$$

$$(x^2 + y^2)^2 = 481 + 144$$

$$x^2 + y^2 = 25$$

$$x^2 - xy + y^2 = ?$$

$$25 - 12 = 13$$

34. Sol. (c)

$$(a^3 + b^3) = (a + b)^3 - 3ab(a + b)$$

$$\text{Given That, } (p + q) = 6, pq = 4$$

$$(p^3 + q^3) = (p + q)^3 - 3pq(p + q)$$

$$(p^3 + q^3) = 216 - 3 \times 4 \times 6$$

$$(p^3 + q^3) = 144$$

35. Sol. (a)

$$\text{Formula used: } x^3 - y^3 = (x - y)$$

$$[(x - y)^2 + 3xy]$$

$$\Rightarrow 520 = 5[5^2 + 3xy] \Rightarrow 104 = 25 + 3xy$$

$$\Rightarrow 79 = 3xy \Rightarrow xy = \frac{79}{3}$$

36. Sol. (c)

$$4x - \frac{1}{5x} = 6$$

$$\frac{5}{2} \left(4x - \frac{1}{5x} \right) = 6 \times \frac{5}{2}$$

$$10x - \frac{1}{2x} = 15 \Rightarrow 1000x^3 - \frac{1}{8x^3}$$

$$= 15^3 + 3 \times 15 \times 10 \times \frac{1}{2} = 15^3 + 15^2$$

$$= 15^2(15 + 1) = 225 \times 16 = 3600$$

37. Sol. (b)

$$\text{Formula: } a^3 + b^3 + c^3 - 3abc$$

$$= (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$$

$$x^3 + 27y^3 + 64z^3 - 36xyz$$

$$= (x)^3 + (3y)^3 + (4z)^3 - 3 \cdot x \cdot 3y \cdot 4z$$

$$= (x + 3y + 4z)(x^2 + 9y^2 + 16z^2$$

$$- 3xy - 12yz - 4xz)$$

38. Sol. (c)

Formula used :

$$\frac{(m-n)^3 - m^3 - n^3 - 3mn(m-n)}{(m^2+n^2)(m-n) - (m-n)^3}$$

$$= \frac{\{m^3 - m^2n + n^2m - n^3 - (m^3 - n^3 - 3m^2n + 3mn^2)\}}{\{m^2n - mn^2\}}$$

$$= \frac{2(m^2n - mn^2)}{m^2n - mn^2} = 2$$

39. Sol. (c)

$$\frac{a^3 - b^3}{a^2 - b^2} - \frac{3ab}{a+b}$$

$$= \frac{(a-b)(a^2+b^2+ab)}{(a-b)(a+b)} - \frac{3ab}{a+b}$$

$$= \frac{(a^2+b^2+ab)}{a+b} - \frac{3ab}{a+b} = \frac{a^2+b^2-2ab}{a+b}$$

$$= \frac{(a-b)^2}{a+b} = \frac{(26-22)^2}{26+22} = \frac{16}{48} = \frac{1}{3}$$

40. Sol. (a)

$$\text{Formula used: } (x + y + z)^2$$

$$= x^2 + y^2 + z^2 + 2(xy + yz + zx)$$

$$\text{Since } x + y + z = 0$$

$$\text{So, } x^2 + y^2 + z^2 = -2(xy + yz + zx)$$

$$x^2 + y^2 + z^2 = -2\{y(x + z) + zx\}$$

$$= -2(-y^2 + zx) = 2(y^2 - zx)$$

$$(x + z = -y)$$

$$\text{Similarly, } x^2 + y^2 + z^2 = 2(x^2 - yz) \text{ and } 2(z^2 - xy)$$

$$\text{Now, } \frac{x^2}{x^2 - yz} + \frac{y^2}{y^2 - zx} + \frac{z^2}{z^2 - xy}$$

$$= \frac{2x^2}{x^2 + y^2 + z^2} + \frac{2y^2}{x^2 + y^2 + z^2}$$

$$\frac{2z^2}{x^2 + y^2 + z^2} = \frac{2(x^2 + y^2 + z^2)}{x^2 + y^2 + z^2} = 2$$

41. Sol. (b)

$$(a + b)((a + b)^2 - 3ab) = a^3 + b^3$$

$$2(4 - 3ab) = 218$$

$$4 - 3ab = 109$$

$$-3ab = 105$$

$$ab = 105/-3 = -35$$

42. Sol. (b)

$$40\sqrt{5}x^3 - 3\sqrt{3}y^3 = (2\sqrt{5}x - \sqrt{3}y)(Ax^2 + Bxy + Cy^2)$$

$$\downarrow \quad \downarrow \quad \downarrow$$

$$20x^2 + 2\sqrt{15}xy + 3y^2$$

$$= \sqrt{B^2 + C^2 - A} = \sqrt{60 + 9 - 20} = \sqrt{49} = 7$$

43. Sol. (d)

$$(x + y)^3 = x^3 + y^3 + 3xy(x + y)$$

$$(12)^3 = 468 + 3xy \times 12$$

$$1728 - 468 = 36xy$$

$$\frac{1260}{36} = xy, xy = 35$$

$$(x + y)^2 = x^2 + y^2 + 2xy$$

$$x^2 + y^2 = 144 - 70 = 74$$

$$(x^2 + y^2)^2 = x^4 + y^4 + 2x^2y^2$$

$$x^4 + y^4 = (74)^2 - 2(35)^2 = 5476 - 2450$$

$$= 3026$$

44. Sol. (c)

$$x^3 + y^3 + z^3 - 3xyz = (x + y + z)\{(x + y + z)^2$$

$$- 3(xy + yz + zx)\}$$

$$74 = 2\{4 - 3(xy + yz + zx)\}$$

$$xy + yz + zx = \frac{37 - 4}{-3} = -11$$

$$(x + y + z)^2 = x^2 + y^2 + z^2 + 2(xy + yz + zx)$$

$$x^2 + y^2 + z^2 = 4 + 22 = 26$$

45. Sol. (b)

$$x^8 - 34x^4 + 1 = 0 \text{ dividing both side by } x^4$$

$$x^4 + \frac{1}{x^4} = 34 \text{ adding 2 and taking root on both side}$$

$$x^2 + \frac{1}{x^2} = 6 \text{ subtracting 2 and taking root on both}$$

$$\text{side } x - \frac{1}{x} = 2 \text{ taking cube on both side } x^3 - \frac{1}{x^3} =$$

$$2^3 + 2 \times 3 = 8 + 6 = 14$$

46. Sol. (d)

$$(x + y)^3 + 27(x - y)^3$$

$$= (Ax - 2y)(Bx^2 + Cxy + 13y^2)$$

$$\text{Since, } a^3 + b^3 = (a + b)(a^2 + b^2 - ab)$$

$$\text{So, } (x + y + 3x - 3y)\{x^2 + y^2 + 2xy + 9x^2 +$$

$$9y^2 - 18xy - (x + y)(3x - 3y)\}$$

$$(4x - 2y)(7x^2 + 13y^2 - 16xy) =$$

$$A = 4, B = 7 \text{ and } C = -16$$

$$\text{So, } A - B - C = 4 - 7 - (-16)$$

$$= 20 - 7 = 13$$

47. Sol. (d)

$$a^3 + b^3 + c^3 - 3abc = (a + b + c)$$

$$\{(a + b + c)^2 - 3(ab + bc + ca)\}$$

$$185 = 5(25 - 3(ab + bc + ca))$$

$$37 = 25 - 3(ab + bc + ca)$$

$$12 = -3(ab + bc + ca) \Rightarrow ab + bc + ca = -4$$

-4 lies between -3 and -7

48. Sol. (c)

Short-Trick:

$$(a + b)^2 - (a - b)^2 = 4ab$$

$$\frac{(375+125)^2 - (125-375)^2}{375 \times 375 - 125 \times 125}$$

$$= \frac{4 \times 375 \times 125}{500 \times 250} = \frac{3}{2}$$

49. Sol. (b)

$$a^3 + 4a^2 + 16a = 1a^3 + \frac{4}{a}$$

$$a^2 + 4a + 16 = \frac{1}{a} = a^3 + 4(a^2 + 4a + 16)$$

$$= a^3 + 4a^2 + 16a + 64$$

$$= 1 + 64 = 65$$

II MD METHOD:-

$$(a^3 + 4a^2 + 16a = 1) \times 4 \Rightarrow 4a^3 + 16a^2 + 64a = 4$$

$$a^4 + 4a^3 + 16a^2 = a \Rightarrow \frac{a^4 + 4a^3 + 16a^2 = a}{a^4 - 64a = a - 4}$$

$$a^4 + 4 = 65a \Rightarrow a^3 + \frac{4}{a} = 65$$

50. Sol. (c)

$$a^3 - b^3 = (a - b)(a^2 + b^2 + ab)$$

$$a = 2x + 2y \text{ and } b = 3x - 3y$$

$$(a - b) = 2x + 2y - 3x + 3y = (5y - x)$$

$$(a^2 + b^2 + ab) = (4x^2 + 4y^2 + 8xy + 9x^2 +$$

$$9y^2 - 18xy + 6x^2 - 6xy + 6xy - 6y^2)$$

$$(a^2 + b^2 + ab) = (19x^2 + 7y^2 - 10xy)$$

$$8(x + y)^3 - 27(x - y)^3 =$$

$$(5y - x)(19x^2 + 7y^2 - 10xy)$$

$$A = 19, B = 7 \text{ and } C = -10$$

51. Sol. (a)

$$\frac{1 \times (3)^{1/3} - 1}{((3)^{2/3} + (3)^{1/3} + 1) \times ((3)^{1/3} - 1)}$$

$$\frac{3^{1/3} - 1}{3 - 1} = \frac{1}{2} 3\sqrt{3} - \frac{1}{2}$$

Compare with given Eqⁿ in question

$$a = 0, b = \frac{1}{2}, c = -\frac{1}{2}$$

$$a + b + c = -\frac{1}{2} + \frac{1}{2} + 0 = 0$$

52. Sol. (b)

$$x + \frac{1}{x} = \sqrt{5^2 + 4} = \sqrt{29}$$

$$x^3 + \frac{1}{x^3} = 29\sqrt{29} - 3\sqrt{29}$$

$$= 26\sqrt{29}$$

$$x^3 - \frac{1}{x^3} = 5^3 + 3 \times 5 = 140$$

$$x^6 - \frac{1}{x^6} = \left(x^3 + \frac{1}{x^3}\right)\left(x^3 - \frac{1}{x^3}\right)$$

$$= 26\sqrt{29} \times 140 = 3640\sqrt{29}$$

53. Sol. (d)

$$\frac{(1.2)^3 + (0.8)^3 + (0.7)^3 - 2.016}{(1.35)[(1.2)^2 + (0.8)^2 + (0.7)^2 - 0.96 - 0.84 - 0.56]}$$

$$a = 1.2, b = 0.8, c = 0.7$$

$$= \frac{a^3 + b^3 + c^3 - 3abc}{\frac{(a+b+c)}{2}[a^2 + b^2 + c^2 - ab - bc - ca]} = 2$$

$$[\therefore a^3 + b^3 + c^3 - 3abc =$$

$$(a + b + c)[a^2 + b^2 + c^2 - ab - bc - ca]]$$

54. Sol. (d)

$$1. a^3 + b^3 + c^3 - 3abc = (a + b + c)$$

$$(a^2 + b^2 + c^2 - ab - bc - ca)$$

$$\text{if } a + b + c = 0$$

$$\text{Then, } a^3 + b^3 + c^3 = 3abc \text{ [Correct]}$$

$$2. (a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$$

$$\text{if } a + b + c = 0$$

$$\text{Then, } a^2 + b^2 + c^2 = -2(ab + bc + ca) \text{ [Correct]}$$

$$3. (a + b + c)^3 = a^3 + b^3 + c^3 + 3(a + b)(b + c)$$

$$(c + a)(c + a)$$

$$\text{if } a + b + c = 0$$

$$\text{Then, } a^3 + b^3 + c^3 = -3ab(a + b) \text{ [Correct]}$$

So, 1, 2 and 3 all are correct.

55. Sol. (a)

$$(x + y + z)^2$$

$$= x^2 + y^2 + z^2 + 2(xy + yz + zx)$$

$$49 = 85 + 2(xy + yz + zx)$$

$$xy + yz + zx = -18$$

$$x + y + z = 7$$

$$x^2 + y^2 + z^2 = 85 \Rightarrow x^3 + y^3 + z^3 = 913$$

$$x^3 + y^3 + z^3 - 3abc = (x + y + z)\{x^2 + y^2 + z^2$$

$$-(xy + yz + zx)\}$$

$$913 - 3xyz = 7(85 - (-18))$$

$$913 - 721 = 3xyz$$

$$xyz = 64 \Rightarrow \sqrt[3]{xyz} = 4$$

56. Sol. (c)

$$x^3 + y^3 + z^3 - 3xyz = (x + y + z)\{(x + y + z)^2 - 3(xy + yz + zx)\}$$

$$74 = 2\{4 - 3(xy + yz + zx)\}$$

$$xy + yz + zx = \frac{37 - 4}{-3} = -11$$

$$(x + y + z)^2 = x^2 + y^2 + z^2 + 2(xy + yz + zx)$$

$$x^2 + y^2 + z^2 = 4 + 22 = 26$$

57. Sol. (c)

$$x^2 - \sqrt{7}x - 1 = 0 \quad (1)$$

divide by x in eq (1)

$$x - \sqrt{7} = \frac{1}{x}$$

$$x - \frac{1}{x} = \sqrt{7}$$

$$x^2 + \frac{1}{x^2} = 9$$

$$x^4 + \frac{1}{x^4} = 78$$

$$\Rightarrow x^{10} - 78x^6 - 79x^2$$

$$x^{10} - x^6\left(x^4 + \frac{1}{x^4} - 1\right)$$

$$-x^2\left(x^4 + \frac{1}{x^4}\right)$$

$$\Rightarrow x^{10} - x^{10} - x^2 + x^6 - x^6 - \frac{1}{x^2}$$

$$\Rightarrow -\left(x^2 + \frac{1}{x^2}\right) = -8$$

58. Sol. (c)

$$(56\sqrt{7}x^3 - 2\sqrt{2}y^3) \div (2\sqrt{7}x - \sqrt{2}y)$$

$$= Ax^2 + By^2 - Cxy$$

$$[(2\sqrt{7}x)^3 - (\sqrt{2}y)^3] \div (2\sqrt{7}x - \sqrt{2}y)$$

$$= Ax^2 + By^2 - Cxy$$

$$28x^2 + 2y^2 + 2\sqrt{14}xy$$

$$= Ax^2 + By^2 - Cxy$$

$$A = 28, B = 2, C = -2\sqrt{14}$$

$$A + B - \sqrt{14}C = 28 + 2 + 28 = 58$$

59. Sol. (c)

$$x + y + z = 22$$

$$xy + yz + zx = 35$$

$$(x + y + z)^2 = x^2 + y^2 + z^2 + 2(xy + yz + zx)$$

$$(22)^2 = x^2 + y^2 + z^2 + 2 \times 35$$

$$484 - 70 = x^2 + y^2 + z^2$$

$$x^2 + y^2 + z^2 = 414$$

$$(x - y)^2 + (y - z)^2 + (z - x)^2 = 2(x^2 + y^2 + z^2 - xy - yz - zx)$$

$$= 2(414 - 35)$$

$$= 2 \times 379 = 758$$

60. Sol. (a)

$$x^3 + y^3$$

$$= (x + y)(x + y)^2 - 3xy$$

$$\Rightarrow 12 = 4(16 - 3xy)$$

$$\Rightarrow 3 = 16 - 3xy$$

$$\Rightarrow xy = \frac{13}{3} \Rightarrow x^2y^2 = \frac{169}{9}$$

$$x^3 + y^3 = (x + y)\{(x^2 + y^2 - xy)\}$$

$$\Rightarrow 12 = 4\left(x^2 + y^2 - \frac{13}{3}\right) \Rightarrow x^2 + y^2 = \frac{22}{3}$$

$$x^4 + y^4 = (x^2)^2 + (y^2)^2$$

$$\Rightarrow (x^2)^2 + (y^2)^2 = (x^2 + y^2)^2 - 2x^2y^2$$

$$\Rightarrow (x^2)^2 + (y^2)^2 = \frac{484}{9} - \frac{338}{9}$$

$$\Rightarrow (x^2)^2 + (y^2)^2 = \frac{146}{9}$$

$$\Rightarrow x^4 + y^4 = \frac{146}{9}$$

61. Sol. (b)

$$x + y + xy = 29 \Rightarrow 1 + x + y + xy = 30$$

$$(1 + x)(1 + y) = 30 \rightarrow 6 \times 5$$

$$y + z + zy = 41 \Rightarrow 1 + y + z + zy = 42$$

$$(1 + y)(1 + z) = 42 \rightarrow 6 \times 7$$

$$z + x + xz = 34 \Rightarrow 1 + z + x + xz = 35$$

$$(1 + z)(1 + x) = 35 \rightarrow 7 \times 5$$

$$x = 4, y = 5, z = 6,$$

$$3z - 4x + 5y$$

$$= 18 - 16 + 25 = 27$$

62. Sol. (b)

$$a^2 + 4b^2 + 25c^2 + 18 =$$

$$2(a - 2b + 20c)$$

$$\Rightarrow (a^2 - 2a + 1) + (4b^2 + 4b + 1)$$

$$+ (25c^2 - 40c + 16) = 0$$

$$(a - 1)^2 + (2b + 1)^2 + (5c - 4)^2 = 0$$

$$a = 1, b = -0.5, c = 0.8$$

$$\text{Now, } a + 2b + 5c = 1 - 1 + 4 = 4$$

63. Sol. (d)

$$\frac{6.35 \times 6.35 \times 6.35 + 3.65 \times 3.65 \times 3.65}{63.5 \times 63.5 + 36.5 \times 36.5 - 63.5 \times 36.5}$$

Multiplying both numerator and denominator by 10^6 and applying $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

$$\text{Let } a = 635, b = 365$$

$$\Rightarrow \frac{a^3 + b^3}{(a^2 + b^2 - ab) \times 10^4} = \frac{(a + b)(a^2 - ab + b^2)}{(a^2 + b^2 - ab) \times 10^4}$$

$$= \frac{(a + b)}{10^4} \Rightarrow \frac{635 + 365}{10000} = \frac{1000}{10000} = 0.1$$

64. Sol. (a)

$$a^3 + b^3 = (a + b)\{(a + b)^2 - 3ab\}$$

$$\Rightarrow a^3 + b^3 = 20(400 - 12) \Rightarrow a^3 + b^3 = 7760$$

65. Sol. (b)

$$x + \frac{1}{x} = 3$$

$$x - \frac{1}{x} = \pm\sqrt{9 - 4} = \pm\sqrt{5}$$

$$x^3 + \frac{1}{x^3} = 18$$

$$x^5 + \frac{1}{x^5} = 123 \text{ (using formula)}$$

$$x^8 + x^7 - x^4\left(x^3 + \frac{1}{x^3}\right) - x^3\left(x^5 + \frac{1}{x^5}\right) + x^2 + x$$

$$x^2 - \frac{1}{x^2}$$

$$\left(x + \frac{1}{x}\right)\left(x - \frac{1}{x}\right) = 3\sqrt{5}$$

66. Sol. (d)

$$x + y + z = 19$$

$$x^2 + y^2 + z^2 = 133 \text{ and } xz = y^2$$

$$\text{Using } (x + y + z)^2 = x^2 + y^2 + z^2$$

$$+ 2xy + 2yz + 2xz$$

And putting the values we get

$$361 = 133 + 2(xy + yz + xz)$$

$$228 = 2(xy + yz + xz) \Rightarrow (xy + yz + xz)$$

$$= 114$$

Now putting $xz = y^2$ and taking out y common simultaneously

$$\text{We get } y(x + y + z) = 114$$

$$\text{Putting } x + y + z = 19 \text{ we get } y = 6$$

$$\text{Now } x + z = 13 \text{ and } x^2 + z^2 = 97$$

Solving these equations we get $x = 9$ and $z = 4$ As

$$x > z > 0 \text{ (given)}$$

$$\text{So } x - z = 9 - 4 = 5$$

67. Sol. (a)

$$\text{Given, } x + y + z = 6$$

$$xyz = -10 \text{ and } x^2 + y^2 + z^2 = 30$$

We know that,

$$\Rightarrow (x + y + z)^2 = x^2 + y^2 + z^2 + 2(xy + yz + zx)$$

$$\Rightarrow (6)^2 = 30 + 2(xy + yz + zx)$$

$$\Rightarrow 3 = (xy + yz + zx)$$

Now

$$x^3 + y^3 + z^3 - 3xyz =$$

$$(x + y + z)(x^2 + y^2 + z^2 - xy - yz - zx)$$

$$x^3 + y^3 + z^3 - 3(-10) = (6)\{30 - (3)\}$$

$$x^3 + y^3 + z^3 = 162 - 30 = 132$$

68. Sol. (d)

$$a^3 - b^3 = (a - b)(a^2 + b^2 + ab)$$

$$a^2 + b^2 + ab = 22 \dots \dots \text{eq(1)}$$

$$(a - b)^2 = a^2 + b^2 - 2ab$$

$$a^2 + b^2 - 2ab = 16 \dots \dots \text{eq(2)}$$

Sub eq(2) from eq (1), we get

$$ab = 2, \text{ Now, } (a - b)^2 = a^2 + b^2 - 2ab$$

$$a^2 + b^2 = 20$$

$$\text{And } (a + b)^2 = a^2 + b^2 + 2ab$$

$$(a + b) = 2\sqrt{6}$$

therefore,

$$a^2 - b^2 = (a + b)(a - b) = (2\sqrt{6})4 = 8\sqrt{6}$$

69. Sol. (a)

$$x^2 - 22x + 111 = 0$$

$$x^2 - 8x - 14x + 111 + 1 = 0 + 1$$

$$x(x - 8) - 14(x - 8) = 1$$

$$(x - 8)(x - 14) = 1$$

$$x - 14 = \frac{1}{(x - 8)}$$

$$(x - 8) - 6 = \frac{1}{x - 8}$$

$$(x - 8) - \frac{1}{(x - 8)} = 6$$

$$(x - 8) - \frac{1}{(x - 8)} = 6$$

$$\rightarrow (x - 8) + \frac{1}{(x - 8)} = \sqrt{36 + 4} = 2\sqrt{10}$$

$$= (x - 8)^2 - \frac{1}{(x - 8)^2} = 12\sqrt{10}$$

70. Sol. (a)

Applying the formula

$$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$

$$(x + y)^3 + (2x - 2y)^3 = (x + y + 2x - 2y)$$

$$(x^2 + y^2 + 2xy - 2x^2 +$$

$$2y^2 + 4x^2 + 4y^2 - 8xy)$$

$$\Rightarrow (x + y)^3 + (2x - 2y)^3 = (3x - y)$$

$$(3x^2 + 7y^2 - 6xy)$$

Comparing a, b and c

$$A = -1, B = 7, C = -6$$

$$A + B + C = 0$$

71. Sol. (d)

We know that,

$$(a^3 - b^3) = (a - b)(a^2 + b^2 + ab)$$

$$\text{So, } 5\sqrt{5}x^3 - 81\sqrt{3}y^3$$

$$= (\sqrt{5}x - 3\sqrt{3}y)[(\sqrt{5}x)^2 + (3\sqrt{3}y)^2 +$$

$$\sqrt{5}x \times 3\sqrt{3}y]$$

$$= (\sqrt{5}x - 3\sqrt{3}y)(5x^2 + 27y^2 + 3\sqrt{15}xy)$$

Put this value in question term,

$$\frac{5\sqrt{5}x^3 - 81\sqrt{3}y^3}{(\sqrt{5}x - 3\sqrt{3}y)} = Ax^2 + By^2 + Cxy$$

$$\frac{(\sqrt{5}x - 3\sqrt{3}y)(5x^2 + 27y^2 + 3\sqrt{15}xy)}{(\sqrt{5}x - 3\sqrt{3}y)}$$

$$Ax^2 + By^2 + Cxy$$

$$(5x^2 + 27y^2 + 3\sqrt{15}xy)$$

Comparing the coefficients of x^2 , y^2 and xy

$$A = 5, B = 27 \text{ and } C = 3\sqrt{15}$$

$$(6A + B - \sqrt{15}C) = 6(5) + 27 - (\sqrt{15} \times 3\sqrt{15}) \\ = 12$$

72. Sol. (d)

$$-10y((2x - 5y)^2 + (2x + 5y)^2 + (2x - 5y)(2x + 5y))$$

$$= -10y(2 \cdot (4x^2 + 25y^2) + 4x^2 - 25y^2)$$

$$= -10y(12x^2 + 25y^2)$$

$$= [-120x^2 - 250y^2] \times y$$

$$A = -120, B = -250.$$

$$2A - B = -240 + 250 = 10$$

73. Sol. (a)

Given

$$\Rightarrow x + y + z = 6$$

$$\Rightarrow xy + yz + zx = 10$$

$$x^3 + y^3 + z^3 - 3xyz = ?$$

$\Rightarrow$ Using formula.

$$\Rightarrow (x + y + z)^2 = x^2 + y^2 + z^2 + 2$$

$$(xy + yz + zx)$$

$$\Rightarrow 6^2 = x^2 + y^2 + z^2 + 2 \times 10$$

$$\Rightarrow 36 = x^2 + y^2 + z^2 + 20$$

$$\Rightarrow x^2 + y^2 + z^2 = 16$$

$$\Rightarrow x^3 + y^3 + z^3 - 3xyz =$$

$$(x + y + z)[x^2 + y^2 + z^2 - xy - yz - zx]$$

$$= 6[16 - (xy + yz + zx)]$$

$$= 6[16 - 10]$$

$$= 6 \times 6 = 36$$

74. Sol. (a)

We know that when $a + b + c = 0$, then

$$a^3 + b^3 + c^3 = 3abc$$

In the above question,

$$(x - y) + (y - z) + (z - x) = 0$$

$$\text{Therefore, } (x - y)^3 + (y - z)^3 + (z - x)^3$$

$$= 3(x - y)(y - z)(z - x)$$

$$\frac{(x-y)^3 + (y-z)^3 + (z-x)^3}{3(x-y)(y-z)(z-x)}$$

$$= \frac{3(x-y)(y-z)(z-x)}{3(x-y)(y-z)(z-x)} = 1$$

75. Sol. (c)

$$\frac{1}{4} \left(a + \frac{1}{a} \right)^2 - \left(a - \frac{1}{a} \right)^2$$

$$\Rightarrow \frac{1}{4} \left\{ \left(a^2 + \left(\frac{1}{a} \right)^2 + 2a \times \frac{1}{a} \right) - \right.$$

$$\left. \left\{ \left(a^2 + \left(\frac{1}{a} \right)^2 - 2a \times \frac{1}{a} \right) \right\} \right\}$$

$$\Rightarrow \frac{1}{4} \left(a^2 + \frac{1}{a^2} + 2 - a^2 - \frac{1}{a^2} + 2 \right)$$

$$\Rightarrow \frac{1}{4} \times 4 = 1$$

Short-Trick:

We know that,

$$(a + b)^2 - (a - b)^2 = 4ab$$

$$= \frac{1}{4} \left\{ \left(a + \frac{1}{a} \right)^2 - \left(a - \frac{1}{a} \right)^2 \right\}$$

$$= \frac{1}{4} \times 4a \times \frac{1}{a} = 1$$

76. Sol. (b)

$$\frac{2.8^3 + 2.2^3}{28^2 - 28 \times 22 + 484}$$

The above equation is in the form

$$= \frac{1}{1000} \left[\frac{a^3 + b^3}{a^2 - ab + b^2} \right]$$

$$= \frac{1}{1000} \left[\frac{(28+22)(28^2 - 28 \times 22 + 484)}{(28)^2 - 28 \times 22 + 484} \right]$$

$$= \frac{50}{1000} = 0.05$$

77. Sol. (c)

$$\text{Given, } x^2 - 3x - 1 = 0$$

$$\Rightarrow x^2 - 1 = 3x \Rightarrow x - \frac{1}{x} = 3$$

Now,

$$(x^2 + 8x - 1)(x^3 + x^{-1})^{-1}$$

$$\Rightarrow \frac{(x^2 + 8x - 1)}{\left(x^3 + \frac{1}{x} \right)}$$

$$\Rightarrow \frac{(x^3 + 8x^2 - x)}{(x^4 + 1)}$$

$$\Rightarrow \frac{x^2 \left(x - \frac{1}{x} + 8 \right)}{x^2 \left(x^2 + \frac{1}{x^2} \right)}$$

$$\Rightarrow \frac{x - \frac{1}{x} + 8}{x^2 + \frac{1}{x^2}} \Rightarrow \frac{3+8}{3^2+2} = 1$$

$$\left(\text{If } x - \frac{1}{x} = k, \text{ then } x^2 + \frac{1}{x^2} = k^2 + 2 \right)$$

78. Sol. (c)

$$(x + y + z)^2 = x^2 + y^2 + z^2 + 2(xy + yz + zx)$$

$$\Rightarrow x^2 + y^2 + z^2 = 361 - 228 = 133$$

$$\sqrt{x^3 + y^3 + z^3 - 3xyz}$$

$$\sqrt{(x + y + z)(x^2 + y^2 + z^2 - xy - yz - zx)}$$

$$\sqrt{19(133 - 144)} = \sqrt{19 \times 19} = 19$$

79. Sol. (d)

As per question

$$(2x - 5y)^3 - (2x + 5y)^3$$

$$\text{Let, } (2x - 5y)^3 = (a - b)^3$$

$$((2x + 5y))^3 = (a + b)^3$$

Now, on expansion we get

$$a^3 - b^3 - 3a^2b + 3ab^2 -$$

$$[a^3 + b^3 + 3a^2b + 3ab^2]$$

On solving

$$= -2b^2 - 6a^2b \{a = 2x \text{ and } b = 5y\}$$

$$= b[-2b^2 - 6a^2]$$

$$= 5y[-2 \times 25y^2 - 6 \times 4x^2]$$

As per question

$$\Rightarrow 5y[-50y^2 - 24x^2] = y[Ax^2 + By^2]$$

$$\Rightarrow [Ax^2 + By^2] = -24x^2 = y[Ax^2 + By^2 - 120x^2]$$

Now, (2A.B)

$$-240 \cdot [-250] = 10$$

80. Sol. (b)

Given,

$$5\sqrt{5}x^3 + 2\sqrt{2}y^3 = (Ax + \sqrt{2}y)$$

$$(Bx^2 + 2y^2 + Cxy)$$

We know that,

$$5\sqrt{5}x^3 + 2\sqrt{2}y^3 = (\sqrt{5}x + \sqrt{2}y)$$

$$(5x^2 + 2y^2 - \sqrt{10}xy)$$

$$\Rightarrow (\sqrt{5}x + \sqrt{2}y)(5x^2 + 2y^2 - \sqrt{10}xy)$$

$$= (Ax + \sqrt{2}y)(Bx^2 + 2y^2 + Cxy)$$

Comparing given terms

$$\Rightarrow A = \sqrt{5}, B = 5 \text{ and } C = -\sqrt{10}$$

$$(A^2 + B^2 - C^2) = ((\sqrt{5})^2 + (5)^2 - (-\sqrt{10})^2) = 20$$

81. Sol. (d)

By formula, $x^2 + y^2 + z^2$

$$+ 2yz + 2zx = (x + y + z)^2$$

$$\text{Similarly, } x + y + z + 2\sqrt{xy} + 2\sqrt{yz} + 2\sqrt{zx}$$

$$= (\sqrt{x} + \sqrt{y} + \sqrt{z})^2$$

on comparing, with $21 + 8\sqrt{3} -$

$$4\sqrt{5} - 4\sqrt{15},$$

$$\Rightarrow x + y + z = 21 \dots\dots\dots(1)$$

$$\text{and } 2\sqrt{xy} = 8\sqrt{3} \dots\dots\dots(2)$$

$$\text{and } 2\sqrt{yz} = -4\sqrt{5} \dots\dots\dots(3)$$

$$\text{and } 2\sqrt{2x} = -4\sqrt{15} \dots\dots\dots(4)$$

on multiplying eqn. (2), (3) and (4),

$$\Rightarrow 2\sqrt{xy} \times 2\sqrt{yz} \times 2\sqrt{zx} = 8\sqrt{3} \times$$

$$(-4\sqrt{5}) \times (-4\sqrt{15})$$

$$xyz = 4 \times 4 \times \sqrt{15} \times \sqrt{15}$$

$$xyz = 240$$

$$\text{or } \sqrt{xyz} = \sqrt{240} = 4\sqrt{15}$$

$$\therefore \sqrt{x} = \frac{\sqrt{xyz}}{\sqrt{yz}}, \sqrt{y} = \frac{\sqrt{xyz}}{\sqrt{xz}},$$

$$\sqrt{z} = \frac{\sqrt{xyz}}{\sqrt{xy}}$$

$$\Rightarrow \sqrt{x} = \frac{4\sqrt{15}}{-2\sqrt{5}}, \sqrt{y} = \frac{4\sqrt{15}}{-2\sqrt{15}}, \sqrt{z} = \frac{4\sqrt{15}}{4\sqrt{3}}$$

$$\Rightarrow \sqrt{x} = -2\sqrt{3}, \sqrt{y} = -2\sqrt{z} = \sqrt{5}$$

$$\Rightarrow x = 12, y = 4, z = 5$$

$$\therefore x + y + z = 21 \text{ is satisfied}$$

Hence, required square root

$$\Rightarrow \pm(\sqrt{5} - 2 - 2\sqrt{3})$$

82. Sol. (b)

We know if $a + b + c = 0$, then $a^3 + b^3 + c^3 = 3abc$

Here

$$(x - y) + (y - z) + (z - x) = 0$$

$$\Rightarrow (x - y)^3 + (y - z)^3 + (z - x)^3$$

$$= 3(x - y)(y - z)(z - x)$$

$$\therefore \frac{(x-y)^3 + (y-z)^3 + (z-x)^3}{9(x-y)(y-z)(z-x)}$$

$$= \frac{3(x-y)(y-z)(z-x)}{9(x-y)(y-z)(z-x)} = \frac{1}{3}$$

Type-3 (Three Identities)

1. If $x + \frac{1}{x} = 1$, then the value of $x^{12} + x^9 + x^6 + x^3 + 1$ is:

SSC CGL 2023 (1st Shift)

- (a) 1 (b) -1
(c) 0 (d) -2

2. If $x + \frac{1}{x} = \sqrt{2}$, then $x^{81} + \frac{1}{x^{81}}$?

- (a) 2 (b) $\sqrt{2}$
(c) 1 (d) 3

3. If $K + \frac{1}{K} + 2 = 0$ and $K < 0$, then what is the value of $K^{11} + \frac{1}{K^4}$?

SSC CGL 13/12/2022 (1st Shift)

- (a) 0 (b) -2
(c) -1 (d) -17

4. If $a + \frac{1}{a} = -1$, then $(1 - a + a^2)(1 + a - a^2)$?

- (a) 3 (b) 2
(c) 1 (d) 4

5. If $x + \frac{1}{x} = -2$, then what is the value of $x^{17} + x^{-17} + x^{12} + x^{-12}$? ($x < 0$)

SSC CGL 03/12/2022 (2nd Shift)

- (a) -2 (b) -1
(c) 1 (d) 0

6. If $x + \frac{1}{x} = 2$, then the value of $x^{57} + \frac{1}{x^{57}}$ is:

SSC CGL 06/12/2022 (4th Shift)

- (a) 1 (b) -2
(c) 0 (d) 2

7. If $a + \frac{1}{a} = -2$, Find the value of $a^{200} + \frac{1}{a^{200}}$

- (a) -3 (b) 2
(c) 3 (d) -2

8. x is a negative number such that $k + k^{-1} = -2$, then what is the value of $\frac{k^2 + 4k - 2}{k^2 + k - 5}$

SSC CGL 01/12/2022 (2nd Shift)

- (a) 7 (b) 1
(c) -7 (d) -1

9. If $x + \frac{1}{x} = 1$, then find the value of $x^{239} + \frac{1}{x^{161}}$.

- (a) 1 (b) -1
(c) 2 (d) 0

10. If $x^2 + 3x + (3 - \sqrt{3})x + (9 - 3\sqrt{3}) = -1$, Then $(x + 3)^{17} + \frac{1}{(x+3)^{17}}$

- (a) $\sqrt{3}$ (b) $-\sqrt{3}$
(c) $\sqrt{2}$ (d) 4

11. If $a + \frac{1}{a} = 1$ find the value of $a^{100} + a^{99} + a^{98} + a^{97} + a^{96} + a^{95}$

- (a) 0 (b) 1
(c) 3 (d) 2

12. If $x + \frac{1}{x} = \sqrt{3}$, then find $x^{48} + x^{42} + x^{36} + x^{30} + x^{27} + x^{21} + x^{18} + x^{12} + x^6 + 5$.

- (a) 2 (b) 3
(c) 5 (d) 4

13. If $a + \frac{1}{a} = \pm\sqrt{3}$, then find $a^{212}(a^6 + 1)$

- (a) 0 (b) 1
(c) 212 (d) 10

14. If $x^6 + \frac{1}{x^6} = -2$, then find the value of $x^{114} + \frac{1}{x^{156}}$

- (a) 0 (b) -1
(c) 1 (d) 2

15. If $x + \frac{1}{x} = \sqrt{3}$, then the value of $x^{18} + x^{12} + x^6 + 1$ is:

SSC CHSL 21/10/2020 (evening)

- (a) 0 (b) 2
(c) 3 (d) 1

16. If $x + \frac{1}{x} = 1$ and $y + \frac{1}{y} = -1$ then $x^{6y} + y^{3x}$?

- (a) 0 (b) 3
(c) 2 (d) None

17. If $x(x-1) = -1$, then $x^4 - 6x^3 + 9x^2 - 8x + 11$
 (a) 7 (b) 0
 (c) 8 (d) 5
18. If $x + \frac{1}{x} = 2$, then find the value of $x^{531} + x^{524} + x^{324} - x^{117} + 2$.
 (a) -4 (b) 4
 (c) 6 (d) 2
19. If $x^2 - x + 1 = 0$, then find the value of $x^{205} + x^{208}$
 (a) 1 (b) -1
 (c) 2 (d) 0
20. If $\sqrt{x} + \frac{1}{\sqrt{x}} = 1$, then find the value of $x^{509} + \frac{1}{x^{509}}$
 (a) -1 (b) 2
 (c) -2 (d) 0
21. If $x + \frac{1}{x} = \sqrt{3}$ find the value of $x^{102} + x^{96} + x^{101} + x^{95} + x^{100} + x^{94}$
 (a) 2 (b) 0
 (c) 4 (d) None of these
22. If $x^4 - x^2 + 1 = 0$, then find the value of $x^{413} + \frac{1}{x^{209}}$
 (a) 0 (b) -1
 (c) 2 (d) $\sqrt{3}$

Type-3 ANSWER KEY

1	A	2	B	3	A	4	D	5	D	6	D	7	B
8	B	9	A	10	B	11	A	12	D	13	A	14	A
15	A	16	C	17	C	18	B	19	D	20	A	21	B
22	D												

Type-3 (Three Identities) Solution

1. Sol. (a)

$$\text{When, } x + \frac{1}{x} = 1$$

$$\text{then } x^3 = -1$$

$$x^3 + 1 = 0 \quad \dots (i)$$

$$\text{Now, } x^{12} + x^9 + x^6 + x^3 + 1$$

$$\Rightarrow x^9(x^3 + 1) + x^3(x^3 + 1) + 1 \Rightarrow 1$$

2. Sol. (b)

$$x + \frac{1}{x} = \sqrt{2}$$

$$x^4 = -1$$

$$x^{81} + \frac{1}{x^{81}}$$

$$\Rightarrow (x^{20})x + \frac{1}{(x^{20})x}$$

$$\Rightarrow x + \frac{1}{x}$$

$$= \sqrt{2}$$

3. Sol. (a)

$$K + \frac{1}{K} + 2 = 0$$

$$K + \frac{1}{K} = -2 \Rightarrow k = -1$$

$$\text{So, } K^{11} + \frac{1}{K^4} = (-1)^{11} + (-1)^4 = (-1) + 1 = 0$$

4. Sol. (d)

$$a + \frac{1}{a} = -1$$

$$(a^3 = 1)$$

$$a^2 + 1 = -a$$

$$-a^2 = 1 + a$$

$$(1 - a + a^2)(1 + a - a^2)$$

$$(-a \times (-a)) \cdot (-a^2 \times (-a^2))$$

$$2a \cdot 2a^2 = 4a^3 = 4$$

5. Sol. (d)

$$\text{when } x + \frac{1}{x} = -2 \text{ then } x = -1$$

Now,

$$x^{17} + x^{-17} + x^{12} + x^{-12} = -1 - 1 + 1 + 1 = 0$$

6. Sol. (d)

$$x + \frac{1}{x} = 2, \text{ it is only possible when } x = 1$$

$$x^{57} + \frac{1}{x^{57}} = 1 + 1 = 2$$

7. Sol. (b)

$$a + \frac{1}{a} = -2$$

$$\text{Now, } a = -1$$

$$\begin{aligned} a^{200} + \frac{1}{a^{200}} \\ = (-1)^{200} + \frac{1}{(-1)^{200}} \\ = 1 + 1 = 2 \end{aligned}$$

8. Sol. (b)

$$k + k^{-1} = -2$$

$$k + \frac{1}{k} = -2$$

$$\text{Clearly, } k = -1$$

Putting the value in given equation :-

$$\frac{k^2 + 4k - 2}{k^2 + k - 5} = \frac{1 - 4 - 2}{1 - 1 - 5} = \frac{-5}{-5} = 1$$

9. Sol. (a)

$$\text{If } x + \frac{1}{x} = 1 \text{ then, } x^3 = -1$$

$$\text{And } x + \frac{1}{x} = 1$$

On squaring both sides

$$x^2 + \frac{1}{x^2} + 2 = 1 \Rightarrow x^2 + \frac{1}{x^2} = -1$$

$$x^{239} + \frac{1}{x^{161}} = x^2(x^3)^{79} + \frac{1}{x^2(x^3)^{53}}$$

$$= x^2(-1)^{79} + \frac{1}{x^2(-1)^{53}} = -x^2 - \frac{1}{x^2}$$

$$= -\left(x^2 + \frac{1}{x^2}\right) = -(-1) = 1$$

10. Sol. (b)

$$x^2 + 3x + (3 - \sqrt{3})x + (9 - 3\sqrt{3}) = -1$$

$$(x + 3)(x + 3 - \sqrt{3}) = -1$$

$$x + 3 - \sqrt{3} = \frac{-1}{x+3}$$

$$(x + 3) + \frac{1}{(x+3)} = \sqrt{3}$$

Then

$$(x + 3)^6 = -1$$

$$(x + 3)^{18} = -1$$

Now

$$(x + 3)^{17} + \frac{1}{(x+3)^{17}}$$

$$\frac{x^{18}}{x} = x^{17}$$

↓

$$\frac{-1}{(x+3)} - (x + 3)$$

$$-[\sqrt{3}]$$

$$\Rightarrow -\sqrt{3}$$

11. Sol. (a)

$$a + \frac{1}{a} = 1$$

Then,

$$a^3 + 1 = 0$$

$$a^{100} + a^{99} + a^{98} + a^{97} + a^{96} + a^{95}$$

$$= a^{100} + a^{97} + a^{99} + a^{96} + a^{98} + a^{95}$$

$$= a^{97}(a^3 + 1) + a^{96}(a^3 + 1) + a^{95}(a^3 + 1)$$

$$= a^{97} \times 0 + a^{96} \times 0 + a^{95} \times 0 = 0$$

12. Sol. (d)

$$x + \frac{1}{x} = \sqrt{3}$$

$$x^6 = -1$$

$$x^{48} + x^{42} + x^{36} + x^{30} + x^{27} + x^{21} + x^{18} + x^{12} + x^6 + 5$$

$$= x^6 + 5$$

$$= -1 + 5$$

$$= 4$$

13. Sol. (a)

$$a + \frac{1}{a} = \pm\sqrt{3}$$

$$a^6 + 1 = 0$$

$$a^6 = -1$$

14. Sol. (a)

$$x^6 + \frac{1}{x^6} = -2$$

$$\text{Let } x^6 = t$$

$$\Rightarrow t + \frac{1}{t} = -2 \Rightarrow t = -1 \text{ or } x^6 = -1$$

$$x^{114} + \frac{1}{x^{156}} = (x^6)^{19} + \frac{1}{(x^6)^{26}}$$

$$= (-1)^{19} + \frac{1}{(-1)^{26}} = -1 + 1 = 0$$

15. Sol. (a)

$$\text{If } x + \frac{1}{x} = \sqrt{3} \text{ then, } x^6 = -1$$

Put this value in $x^{18} + x^{12} + x^6 + 1$, we get,

$$-1 + 1 - 1 + 1 = 0$$

16. Sol. (c)

$$x + \frac{1}{x} = 1$$

$$x^3 = -1$$

$$y + \frac{1}{y} = -1$$

$$y^3 = 1$$

$$x^{6y} + y^{3x}$$

$$(x^3)^{2y} + (y^3)^x$$

$$(-1)^{2y} + (1)^x$$

$$1 + 1 = 2$$

17. Sol. (c)

$$x(x-1) = -1$$

$$x + \frac{1}{x} = 1$$

$$x^3 = -1$$

$$x^4 - 6x^3 + 9x^2 + 8x + 11$$

$$x^3 \cdot x - 6x^3 + \frac{9x^3}{x} + 8x + 11$$

$$-x + 6 + \frac{-9}{x} + 8x + 11$$

$$-9\left(x + \frac{1}{x}\right) + 17$$

$$-9 + 17 = 8$$

18. Sol. (b)

$$\text{If } x + \frac{1}{x} = 2 \Rightarrow x^2 + 1 = 2x$$

$$\Rightarrow x^2 + 1 - 2x = 0 \Rightarrow (x-1)^2 = 0$$

$$\Rightarrow x - 1 = 0 \Rightarrow x = 1$$

$$x^{531} + x^{524} + x^{324} - x^{117} + 2$$

$$\Rightarrow (1)^{531} + (1)^{524} + (1)^{324} - (1)^{117} + 2$$

$$\Rightarrow 5 - 1 = 4$$

19. Sol. (d)

$$\text{If } x^2 - x + 1 = 0$$

$$\text{Then, } x^3 = -1$$

$$\Rightarrow x^{205} + x^{208} = x(x^3)^{68} + x(x^3)^{69} = x(-1)^{68} +$$

$$x(-1)^{69}$$

$$= x - x = 0$$

20. Sol. (a)

$$\sqrt{x} + \frac{1}{\sqrt{x}} = 1$$

On squaring both sides of the eq.

$$\Rightarrow \left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)^2 = 1$$

$$\Rightarrow x + \frac{1}{x} + 2 = 1 \Rightarrow x + \frac{1}{x} = -1$$

Square both sides of the eq. again

$$\Rightarrow \left(x + \frac{1}{x}\right)^2 = 1$$

$$\Rightarrow x^2 + \frac{1}{x^2} + 2 = 1$$

$$\Rightarrow x^2 + \frac{1}{x^2} = -1$$

$$x^{509} + \frac{1}{x^{509}} = x^2(x^3)^{169} + \frac{1}{x^2(x^3)^{169}}$$

$$= x^2(-1)^{169} + \frac{1}{x^2(-1)^{169}} = x^2 + \frac{1}{x^2} = -1$$

21. Sol. (b)

$$x^{102} + x^{96} + x^{101} + x^{95} + x^{100} + x^{94}$$

$$x^{96}(x^6 + 1) + x^{95}(x^6 + 1) + x^{94}(x^6 + 1)$$

$$= x^{96} \times 0 + x^{95} \times 0 + x^{94} \times 0 = 0$$

22. Sol. (d)

$$x^4 - x^2 + 1 = 0$$

$$\Rightarrow x^2 + \frac{1}{x^2} = 1$$

Add 2 on both sides

$$\Rightarrow x^2 + \frac{1}{x^2} + 2 = 3$$

$$\Rightarrow \left(x + \frac{1}{x}\right)^2 = 3$$

$$\Rightarrow x + \frac{1}{x} = \sqrt{3}$$

$$\text{If } x + \frac{1}{x} = \sqrt{3} \text{ then } x^6 = -1$$

$$x + \frac{1}{x} = \sqrt{3}$$

On cubing both sides

$$\Rightarrow x^3 + \frac{1}{x^3} + 3\left(x + \frac{1}{x}\right) = 3\sqrt{3}$$

$$\Rightarrow x^3 + \frac{1}{x^3} = 0$$

Multiply eq. (i) and (ii)

$$\Rightarrow \left(x^2 + \frac{1}{x^2}\right)\left(x^3 + \frac{1}{x^3}\right) = 0$$

$$\Rightarrow x^5 + \frac{1}{x^5} + \left(x + \frac{1}{x}\right) = 0$$

$$\Rightarrow x^5 + \frac{1}{x^5} = -\sqrt{3}$$

$$x^{413} + \frac{1}{x^{209}} = x^5(x^6)^{68} + \frac{1}{x^5(x^6)^{34}}$$

$$= x^5(-1)^{68} + \frac{1}{x^5(-1)^{34}} = x^5 + \frac{1}{x^5} = -\sqrt{3}$$

Type-4 (Inverse and Root Function)

1. If $x = 4 + \sqrt{15}$, what is the value of $\left(x^2 + \frac{1}{x^2}\right)$?

- (a) 48 (b) 54
(c) 72 (d) 62

2. If $x = \sqrt{10} + \sqrt{11}$, $y = \sqrt{10} - \sqrt{11}$, then value of $7x^2 - 50xy + 7y^2$ ____

- (a) 344 (b) 704
(c) 1360 (d) 386

3. If $p = 7 + 4\sqrt{3}$, then what is the value of $\frac{p^6 + p^4 + p^2 + 1}{p^3}$?

SSC CGL 2023 (2nd Shift)

- (a) 2617 (b) 2167
(c) 2716 (d) 2176

4. If $x = \frac{\sqrt{5}-2}{\sqrt{5}+2}$, then the value of $x^2 + x^{-2}$ is:

SSC CGL 02/12/2022 (1st Shift)

- (a) 350 (b) 345
(c) 284 (d) 322

5. If $x = \frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}}$ and $y = \frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}}$ then $\frac{x^2+xy+y^2}{x^2-xy+y^2} = ?$

- (a) 63/61 (b) 67/65
(c) 65/63 (d) 69/67

6. If $y = 1 + \sqrt{3} + \sqrt{4}$, then the value of $2y^4 - 8y^3 - 6y^2 + 28y - 84$ is:

SSC CGL 08/12/2022 (2nd Shift)

- (a) $40\sqrt{3}$ (b) $80\sqrt{3}$
(c) $20\sqrt{3}$ (d) $60\sqrt{3}$

7. If $x = \frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$, $y = \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$, then $\frac{x^2}{y} + \frac{y^2}{x}$.

- (a) 488 (b) 970
(c) 840 (d) 520

8. If $x = 5 + 2\sqrt{6}$, then the value of $x^{3/2} + x^{-3/2}$ is

- (a) $14\sqrt{3}$ (b) $12\sqrt{3}$

- (c) $18\sqrt{3}$ (d) $16\sqrt{3}$

9. If $x = \frac{\sqrt{5}-\sqrt{4}}{\sqrt{5}+\sqrt{4}}$ and $y = \frac{\sqrt{5}+\sqrt{4}}{\sqrt{5}-\sqrt{4}}$ then the value of $\frac{x^2-xy+y^2}{x^2+xy+y^2}$?

SSC CGL 08/12/2022 (2nd Shift)

- (a) $\frac{361}{363}$ (b) $\frac{341}{343}$
(c) $\frac{384}{387}$ (d) $\frac{321}{323}$

10. If $x = 7 + 4\sqrt{3}$, then what is the value of $\sqrt{x} + \frac{1}{\sqrt{x}}$?

[CDS-2022-I]

- (a) 1 (b) 2
(c) 3 (d) 4

11. $x^{300} = \frac{6-\sqrt{21}}{6+\sqrt{21}}$ then $x^{300} + \frac{1}{x^{300}}$?

- (a) 8.6 (b) 6.7
(c) 8.7 (d) 7.6

12. If $x - \sqrt{3} - \sqrt{2} = 0$ and $y - \sqrt{3} + \sqrt{2} = 0$, then $(x^3 - 20\sqrt{2}) - (y^3 + 2\sqrt{2})$?

- (a) 3 (b) 0
(c) 1 (d) 2

13. If $x = (\sqrt{5}) + 1$ and $y = (\sqrt{5}) - 1$, then what is the value of $(x^2/y^2) + (y^2/x^2) + 4[(x/y) + (y/x)] + 6$?

- (a) 31 (b) $23\sqrt{5}$
(c) $27\sqrt{5}$ (d) 25

14. If $x = \sqrt{5} + \sqrt{3}$ and $y = \sqrt{5} - \sqrt{3}$, then the value of $x^4 - y^4$ is

- (a) $64\sqrt{15}$ (b) $72\sqrt{5}$
(c) $72\sqrt{15}$ (d) None

15. If $x = 3 + 2\sqrt{2}$ and $xy = 1$, then the value of $\frac{x^2+3xy+y^2}{x^2-3xy+y^2}$ is:-

- (a) $\frac{30}{31}$ (b) $\frac{70}{31}$

(c) $\frac{35}{31}$

(d) $\frac{37}{31}$

16. If $x = \sqrt{5} + 1$, and $y = \sqrt{5} - 1$, then what is the value of $\frac{x^2}{y^2} + \frac{y^2}{x^2} + 4\frac{x}{y} + 4\frac{y}{x} + 6 = ?$

(a) 31

(b) $23\sqrt{5}$

(c) $27\sqrt{5}$

(d) 25

17. If $x = 3 + 2\sqrt{2}$ and $x \cdot y = 1$ find $\frac{x^3 + 3xy + y^3}{x^2 - 2xy + y^2} ?$

(a) $\frac{201}{32}$

(b) $\frac{240}{29}$

(c) $\frac{204}{23}$

(d) None

18. If $a = \frac{\sqrt{5}+2}{\sqrt{5}-2}$ and $b = \frac{\sqrt{5}-2}{\sqrt{5}+2}$, then the value of $2a^2 + 2b^2 - 5ab$ is equal to:

SSC CHSL 12/8/2021 (Afternoon)

(a) 693

(b) 649

(c) 635

(d) 639

19. If $\frac{\sqrt{7}-2}{\sqrt{7}+2} = a\sqrt{7} + b$, then the value of a is:-

(a) $\frac{11}{3}$

(b) $-\frac{4}{3}$

(c) $\frac{4}{3}$

(d) $-\frac{4\sqrt{7}}{3}$

20. If $x = 1 + \sqrt{2}$, then find the value of $\sqrt{x} + \left(\frac{1}{\sqrt{x}}\right)$

SSC CHSL 17/03/2020 (evening)

(a) 2.1014

(c) 1.9876

(b) 2.1973

(d) 1.9996

21. If $x = \frac{\sqrt{2}+1}{\sqrt{2}-1}$ and $y = \frac{\sqrt{2}-1}{\sqrt{2}+1}$, then the value of $3x^3 - 5xy + 3y^3$ is

(a) 589

(b) 598

(c) 198

(d) 594

22. If $x = \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$ and $y = \frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$, then the value of $x^3 + y^3$ is:-

(a) 950

(b) 730

(c) 650

(d) 970

23. If $a = \frac{2+\sqrt{3}}{2-\sqrt{3}}$ and $b = \frac{2-\sqrt{3}}{2+\sqrt{3}}$, then the value of $a^2 + b^2 + ab$ is:

SSC CHSL 26/10/2020 (evening)

(a) 195

(b) 185

(c) 196

(d) 186

24. If $x = 2 + \sqrt{3}$, then find the value of $\frac{x^6 + 3x^4 + 24x^3 + 3x^2 - 1}{2x^5 - 6x^4 + 10x^3 + 6x^2 - 2x}$

(a) $\frac{30\sqrt{3}+12}{26\sqrt{3}+7}$

(b) $3\sqrt{3}$

(c) $7\sqrt{3}$

(d) $\frac{14\sqrt{3}+7}{16\sqrt{3}+11}$

25. If $x = 2 - \sqrt{3}$ then the value of $x^3 - x^{-3}$ is:

SSC CHSL 5/07/2019 (Evening)

(a) $-30\sqrt{3}$

(b) $30\sqrt{3}$

(c) $-30\sqrt{2}$

(d) $30\sqrt{2}$

26. If $x = 2 + \sqrt{3}$, $y = 2 - \sqrt{3}$, $z = 1$, then what is the value of $(x/yz) + (y/xz) + (z/xy) + 2[(1/x) + (1/y) + (1/z)]?$

(a) 25

(b) 22

(c) 17

(d) 43

27. If $x = 3 + 2\sqrt{2}$ then $\frac{x^6 + x^4 + x^2 + 1}{x^3}$ is equal to

(a) 216

(b) 192

(c) 198

(d) 204

28. If $x = \sqrt{5} + 2$, then the value $\frac{2x^2 - 3x - 2}{3x^2 - 4x - 3}$ is equal to

(a) 0.1785

(b) 0.525

(c) 0.625

(d) 0.785

29. If $x = 1 + \sqrt{2} + \sqrt{3}$, then find the value of $(2x^4 - 8x^3 - 5x^2 + 26x - 28)$.

(a) $3\sqrt{2}$

(b) $4\sqrt{3}$

(c) $\sqrt{6}$

(d) $6\sqrt{6}$

30. If $a = \sqrt{8} - \sqrt{7}$ and $a = \frac{1}{b}$, then $\frac{a^2 + b^2 - 3ab}{a^2 + ab + b^2}$ is equal to

SSC CHSL 11/07/2019 (Evening)

(a) $\frac{27}{31}$

(b) $\frac{27}{32}$

(c) $\frac{29}{33}$

(d) $\frac{29}{31}$

31. If $n = 7 + 4\sqrt{3}$, then the value of $\left(\sqrt{n} + \frac{1}{\sqrt{n}}\right)$ is:-

(a) $2\sqrt{3}$

(b) 4

(c) -4

(d) $-2\sqrt{3}$

32. If $a = 7 + 4\sqrt{3}$, then the value of $\frac{a^6 + a^4 + a^2 + 1}{a^3}$ is

(a) 2718

(b) 2712

(c) 2726

(d) 2716

33. If $x - 3 - 2\sqrt{2} = 0$ and $y - 3 + 2\sqrt{2} = 0$, then the value of $(x^3 - 16\sqrt{2}) - (y^3 - 3\sqrt{2})$ is

(a) $125\sqrt{2}$

(c) $127\sqrt{2}$

(b) $121\sqrt{2}$

(d) $132\sqrt{2}$

34. If $x = \frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}}$ and y is the reciprocal of x , then what is the value of $(x^3 + y^3)$?

SSC CGL TIER II (12/09/2019)

(a) 488

(b) 504

(c) 472

(d) 476

35. If $x - \sqrt{3} - \sqrt{2} = 0$ and $y - \sqrt{3} + \sqrt{2} = 0$, then value of $(x^3 - 20\sqrt{2}) - (y^3 + 2\sqrt{2})$

(a) 2

(b) 3

(c) 1

(d) 0

36. If $a = \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$ and $b = \frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$ then $\frac{a^2}{b} + \frac{b^2}{a}$ value of :

(a) 1030

(b) 970

(c) 1025

(d) 930

37. If $x = \frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}}$ and $y = \frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}}$ then the value of :

$\frac{x^2+y^2+xy}{x^2+y^2-xy} = ?$

(a) $\frac{65}{63}$

(b) $\frac{67}{65}$

(c) $\frac{69}{67}$

(d) $\frac{63}{61}$

Type-4 (Inverse and Root Function) ANSWER KEY

1	D	2	A	3	C	4	D	5	A	6	A	7	B
8	C	9	D	10	D	11	D	12	B	13	D	14	A
15	D	16	D	17	A	18	D	19	B	20	B	21	A
22	D	23	A	24	B	25	A	26	A	27	D	28	C
29	D	30	A	31	B	32	D	33	C	34	A	35	D
36	B	37	D										

Type-4 (Inverse and Root Function) Solution

1. Sol. (d)

$x = 4 + \sqrt{15}$

So, $\frac{1}{x} = \frac{1}{4 + \sqrt{15}} \times \frac{4 - \sqrt{15}}{4 - \sqrt{15}}$

$= 4 - \sqrt{15}$

$\left(x + \frac{1}{x}\right)^2 = x^2 + \frac{1}{x^2} + 2$

$x^2 + \frac{1}{x^2} = \left(x + \frac{1}{x}\right)^2 - 2$

$= (4 + \sqrt{15} + 4 - \sqrt{15})^2 - 2$

$(8)^2 - 2 = 64 - 2 = 62$

2. Sol. (a)

$x = \sqrt{10} + \sqrt{11}, y = \sqrt{10} - \sqrt{11}$

$x^2 = (\sqrt{10} + \sqrt{11})^2 = 10 + 11 + 2\sqrt{110}$

$= 21 + 2\sqrt{110}$

$y^2 = (\sqrt{10} - \sqrt{11})^2 = 10 + 11 - 2\sqrt{110}$

$= 21 - 2\sqrt{110}$

$xy = (\sqrt{10} + \sqrt{11})(\sqrt{10} - \sqrt{11}) = -1$

$7x^2 - 50xy + 7y^2$

$= 7(21 + 2\sqrt{110}) - 50(-1) + 7(21 - 2\sqrt{110})$

$= 147 + 14\sqrt{110} + 50 + 147 - 14\sqrt{110} = 344$

Alternate method:

Formula used:

$$(a+b)^2 + (a-b)^2 = 2(a^2 + b^2)$$

Here, $x = \sqrt{10} + \sqrt{11}$, $y = \sqrt{10} - \sqrt{11}$ and $xy = -1$

Now, $7x^2 - 50xy + 7y^2$

$$= 7(\sqrt{10} + \sqrt{11})^2 - 50xy + 7(\sqrt{10} - \sqrt{11})^2$$

$$= 7[(\sqrt{10} + \sqrt{11})^2 + (\sqrt{10} - \sqrt{11})^2] - 50xy$$

$$= 7 \times 2 \times (10 + 11) - 50 \times (-1)$$

$$= 294 + 50 = 344$$

3. Sol. (c)

$$p = 7 + 4\sqrt{3} \dots (\text{given})$$

$$\frac{1}{p} = 7 - 4\sqrt{3} \dots (\text{conjugate pairs})$$

$$\Rightarrow p + \frac{1}{p} = 14$$

$$\Rightarrow p^3 + \frac{1}{p^3} = (14)^3 - 3 \times 14 = 2702$$

$$\frac{p^6 + p^4 + p^2 + 1}{p^3} = p^3 + p + \frac{1}{p} + \frac{1}{p^3}$$

$$\Rightarrow p^3 + \frac{1}{p^3} + p + \frac{1}{p} = 2702 + 14 = 2716$$

4. Sol. (d)

$$x = \frac{\sqrt{5}-2}{\sqrt{5}+2} = \frac{\sqrt{5}-\sqrt{4}}{\sqrt{5}+\sqrt{4}}$$

Rationalizing,

$$x = \frac{\sqrt{5}-\sqrt{4}}{\sqrt{5}+\sqrt{4}} \times \frac{\sqrt{5}-\sqrt{4}}{\sqrt{5}-\sqrt{4}} = \frac{9-4\sqrt{5}}{1}$$

$$= 9 - 4\sqrt{5} \dots (i)$$

$$\text{Then, } \frac{1}{x} = 9 + 4\sqrt{5} \dots (ii)$$

Adding eq. (1) and eq. (2), we get $x + \frac{1}{x} = 18$,

$$\text{Then, } x^2 + \frac{1}{x^2} = 322$$

Short Tricks:

$$\text{If } x = \frac{\sqrt{a}-\sqrt{b}}{\sqrt{a}+\sqrt{b}}, \text{ Then } x + \frac{1}{x} = \frac{2(a+b)}{(a-b)}$$

According to question,

$$x = \frac{\sqrt{5}-\sqrt{4}}{\sqrt{5}+\sqrt{4}}, \text{ Then } x + \frac{1}{x} = \frac{2(5+4)}{(5-4)} = 18$$

$$\text{Then, } x^2 + \frac{1}{x^2} = 322$$

5. Sol. (a)

$$\frac{x^2+xy+y^2}{x^2-xy+y^2} = \frac{x^2+\frac{1}{x^2}+1}{x^2+\frac{1}{x^2}-1} = \frac{k^2-1}{k^2-3} = \frac{63}{61}$$

6. Sol. (a)

$$y = 1 + \sqrt{3} + \sqrt{4}$$

$$y - 1 = \sqrt{3} + \sqrt{4}$$

Squaring both side, we have :

$$(y-1)^2 = (\sqrt{3} + \sqrt{4})^2$$

$$y^2 + 1 - 2y = 3 + 4 + 4\sqrt{3}$$

$$y^2 + 1 - 2y = 7 + 4\sqrt{3} \Rightarrow y^2 - 2y - 6 = 4\sqrt{3}$$

Again, squaring both side, we have :

$$(y^2 - 2y - 6)^2 = (4\sqrt{3})^2$$

$$y^4 + 4y^2 + 36 - 4y^3 + 24y - 12y^2 = 48$$

$$y^4 - 8y^2 - 12 - 4y^3 + 24y = 0$$

Multiplying both side by 2 ,

$$2y^4 - 16y^2 - 24 - 8y^3 + 48y = 0$$

$$2y^4 - 8y^3 - 6y^2 + 28y - 84 - 10y^2 + 60 + 20y = 0$$

$$2y^4 - 8y^3 - 6y^2 + 28y - 84 - 10(y^2 - 6 - 2y) = 0$$

$$2y^4 - 8y^3 - 6y^2 + 28y - 84 = 10(y^2 - 6 - 2y)$$

$$= 10 \times 4\sqrt{3} = 40\sqrt{3}$$

7. Sol. (b)

$$\frac{1}{x} = \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$$

$$x + \frac{1}{x} = \frac{2(3+2)}{3-2} = 10$$

$$\frac{x^2}{y} + \frac{y^2}{x}$$

$$\Rightarrow \frac{x^3 + \frac{1}{x^3}}{x \cdot y} = 970$$

8. Sol. (c)

$$x = 5 + 2\sqrt{6}$$

$$\Rightarrow x = 3 + 2 + 2(\sqrt{3})(\sqrt{2})$$

$$\Rightarrow x = (\sqrt{3} + \sqrt{2})^2$$

$$\Rightarrow \sqrt{x} = \sqrt{3} + \sqrt{2}$$

$$\frac{1}{\sqrt{x}} = \frac{1}{\sqrt{3} + \sqrt{2}} = \frac{\sqrt{3} - \sqrt{2}}{(\sqrt{3} + \sqrt{2})(\sqrt{3} - \sqrt{2})} = \sqrt{3} - \sqrt{2}$$

$$\Rightarrow \sqrt{x} + \frac{1}{\sqrt{x}} = \sqrt{3} + \sqrt{2} + \sqrt{3} - \sqrt{2} = 2\sqrt{3}$$

$$\sqrt{x} + \frac{1}{\sqrt{x}} = 2\sqrt{3}$$

On cubing both sides

$$\Rightarrow (x)^{3/2} + \frac{1}{(x)^{3/2}} + 3(\sqrt{x})\left(\frac{1}{\sqrt{x}}\right)\left(\sqrt{x} + \frac{1}{\sqrt{x}}\right) = 24\sqrt{3}$$

$$\Rightarrow x^{3/2} + \frac{1}{x^{3/2}} + 3(2\sqrt{3}) = 24\sqrt{3}$$

$$\Rightarrow x^{3/2} + \frac{1}{x^{3/2}} = 18\sqrt{3}$$

$$\Rightarrow x^{3/2} + x^{-3/2} = 18\sqrt{3}$$

9. Sol. (d)

$$x = \frac{\sqrt{5}-\sqrt{4}}{\sqrt{5}+\sqrt{4}} = \frac{\sqrt{5}-\sqrt{4}(\sqrt{5}-\sqrt{4})}{\sqrt{5}+\sqrt{4}(\sqrt{5}-\sqrt{4})} = (\sqrt{5}-\sqrt{4})^2$$

$$y = \frac{\sqrt{5}+\sqrt{4}}{\sqrt{5}-\sqrt{4}} = \frac{\sqrt{5}+\sqrt{4}(\sqrt{5}+\sqrt{4})}{\sqrt{5}-\sqrt{4}(\sqrt{5}+\sqrt{4})}$$

$$x^2 + y^2 = [\sqrt{5}-\sqrt{4}]^4 + [\sqrt{5}+\sqrt{4}]^4$$

$$= \{(\sqrt{5}-\sqrt{4})^2 + (\sqrt{5}+\sqrt{4})^2\}^2 - 2(\sqrt{5}-\sqrt{4})^2$$

$$(\sqrt{5}+\sqrt{4})^2$$

$$= 18^2 - 2 = 324 - 2 = 322$$

$$\frac{x^2 - xy + y^2}{x^2 + xy + y^2} = \frac{322 - 1}{322 + 1} = \frac{321}{323}$$

10. Sol. (d)

$$x = 7 + 4\sqrt{3} = 4 + 3 + 2 \times 2\sqrt{3}$$

$$= 2 + (\sqrt{3})^2 + 2 \times 2 \times \sqrt{3} = (2 + \sqrt{3})^2$$

$$\therefore \sqrt{x} = 2 + \sqrt{3} \Rightarrow \frac{1}{\sqrt{x}} = \frac{1}{2+\sqrt{3}}$$

$$= \frac{2-\sqrt{3}}{(2+\sqrt{3})(2-\sqrt{3})} = 2 - \sqrt{3}$$

$$\text{Hence, } \sqrt{x} + \frac{1}{\sqrt{x}} = 2 + \sqrt{3} + 2 - \sqrt{3} = 4$$

11. Sol. (d)

$$x^{300} = \frac{6-\sqrt{21}}{6+\sqrt{21}}$$

$$x^{300} = \frac{\sqrt{36}-\sqrt{21}}{\sqrt{36}+\sqrt{21}}$$

$$x^{300} + \frac{1}{x^{300}} = \frac{2(36+21)}{36-21} = \frac{2(57)}{15} = \frac{38}{5} = 7.6$$

12. Sol. (b)

$$x - \sqrt{3} - \sqrt{2} = 0$$

$$x = \sqrt{3} + \sqrt{2} \dots$$

$$y = \sqrt{3} - \sqrt{2}$$

$$x + \frac{1}{x} = 2\sqrt{3}$$

$$x - \frac{1}{x} = 2\sqrt{2}$$

$$(x^3 - 20\sqrt{2}) - (y^3 + 2\sqrt{2})$$

$$x^3 - 20\sqrt{2} - y^3 - 2\sqrt{2}$$

$$(x^3 - \frac{1}{x^3}) - 22\sqrt{2}$$

$$(16\sqrt{2} + 6\sqrt{2}) - 22\sqrt{2}$$

$$22\sqrt{2} - 22\sqrt{2} = 0$$

13. Sol. (d)

$$x = \sqrt{5} + 1$$

$$y = \sqrt{5} - 1$$

$$= \frac{x^2}{y^2} + \frac{y^2}{x^2} + 4\left[\frac{x}{y} + \frac{y}{x}\right] + 6$$

$$= \left[\frac{x}{y} + \frac{y}{x}\right]^2 - 2 + 4\left[\frac{x}{y} + \frac{y}{x}\right] + 6$$

$$= \left[\frac{\sqrt{5}+1}{\sqrt{5}-1} + \frac{\sqrt{5}-1}{\sqrt{5}+1}\right]^2 + 4\left[\frac{\sqrt{5}+1}{\sqrt{5}-1} + \frac{\sqrt{5}-1}{\sqrt{5}+1}\right] + 4$$

$$= \left[\frac{5+1+2\sqrt{5}+5+1-2\sqrt{5}}{5-1}\right]^2 + 4 + \left[\frac{5+1+2\sqrt{5}+5+1-2\sqrt{5}}{5-1}\right] + 4$$

$$= \left[\frac{12}{4}\right]^2 + 4\left[\frac{12}{4}\right] + 4$$

$$= (3)^2 + 12 + 4$$

$$= 25$$

14. Sol. (a)

$$x^4 - y^4$$

$$(x^2)^2 - (y^2)^2$$

$$(x^2 + y^2)(x + y)(x - y)$$

$$(16 \times 2\sqrt{5}) \times (2\sqrt{3}) = 64\sqrt{15}$$

15. Sol. (d)

$$x = 3 + 2\sqrt{2}, xy = 1, y^2$$

$$= \frac{1}{x^2}$$

$$y = \frac{1}{x} = \frac{1}{3+2\sqrt{2}} = 3 - 2\sqrt{2}$$

$$\therefore x + \frac{1}{x} = 3 + 2\sqrt{2} + 3 - 2\sqrt{2} = 6$$

$$\therefore x^2 + \frac{1}{x^2} = 36 - 2 = 34$$

$$= \frac{x^2 + 3xy + y^2}{x^2 - 3xy + y^2} = \frac{x^2 + \frac{1}{x^2} + 3}{x^2 + \frac{1}{x^2} - 3}$$

$$= \frac{34+3}{34-3} = \frac{37}{31}$$

16. Sol. 16(d)

$$\frac{x}{y} + \frac{y}{x} = \frac{\sqrt{5}+1}{\sqrt{5}-1} + \frac{\sqrt{5}-1}{\sqrt{5}+1}$$

$$= \frac{2(5+1)}{5-1} = 3$$

$$\left(\frac{x}{y}\right)^2 + \left(\frac{y}{x}\right)^2 + 2 + 2 \cdot 2 \left(\frac{x}{y} + \frac{y}{x}\right) + 4$$

$$= \frac{2(5+1)}{5-1} = 3$$

$$= \left(\frac{x}{y} + \frac{y}{x}\right)^2 + 2 \times 2 \left(\frac{x}{y} + \frac{y}{x}\right) + 2^2$$

$$\Rightarrow \left(\frac{x}{y} + \frac{y}{x} + 2\right)^2$$

$$\Rightarrow (3+2)^2 = 5^2 = 25$$

17. Sol. (a)

$$x = 3 + 2\sqrt{2}$$

$$\frac{1}{x} = 3 - 2\sqrt{2}$$

$$x + \frac{1}{x} = 6$$

$$\frac{x^3 + 3xy + y^3}{x^2 - 2xy + y^2} \Rightarrow \frac{\left(x^3 + \frac{1}{x^3}\right) + 3}{\left(x^2 + \frac{1}{x^2}\right) - 2}$$

$$= \frac{198+3}{34-2} = \frac{201}{32}$$

18. Sol. (d)

$$\text{On rationalizing, } a = \frac{\sqrt{5}+2}{\sqrt{5}-2} \times \frac{\sqrt{5}+2}{\sqrt{5}+2} = (\sqrt{5}+2)^2 = 9 +$$

$$4\sqrt{5}$$

$$\text{Similarly } b = 9 - 4\sqrt{5} \text{ and } ab = 1$$

$$2a^2 + 2b^2 - 5ab = 2(9 + 4\sqrt{5})^2 + 2(9 - 4\sqrt{5})^2 - 5$$

$$(\sqrt{5})^2 - 5$$

$$= 2(81 + 80 + 72\sqrt{5}) + 2(81 + 80 - 72\sqrt{5}) - 5$$

$$= 2 \times 161 + 2 \times 161 - 5 = 644 - 5 = 639$$

19. Sol. (b)

$$\frac{\sqrt{7}-2}{\sqrt{7}+2} = a\sqrt{7} + b$$

$$\text{L.H.S} = \frac{\sqrt{7}-2}{\sqrt{7}+2} \times \frac{\sqrt{7}-2}{\sqrt{7}-2}$$

(Rationalisation)

$$= \frac{(\sqrt{7}-2)^2}{(\sqrt{7})^2 - (4)} = \frac{7+4-4\sqrt{7}}{7-4}$$

$$= \frac{11-4\sqrt{7}}{3}$$

$$\frac{11}{3} - \frac{4}{3}\sqrt{7} = -\frac{4}{3}\sqrt{7} + \frac{11}{3}$$

$$= a\sqrt{7} + b = \text{R.H.S}$$

Compare the coefficients of $\sqrt{7}$ and constant term

$$a = -\frac{4}{3}$$

$$b = \frac{11}{3}$$

20. Sol. (b)

$$x = 1 + \sqrt{2} \text{ or } \sqrt{2} + 1$$

$$\frac{1}{x} = \sqrt{2} - 1 \text{ (after rationalization)}$$

On squaring of $\sqrt{x} + \left(\frac{1}{\sqrt{x}}\right)$ we get,

$$\left(\sqrt{x} + \left(\frac{1}{\sqrt{x}}\right)\right)^2 = x + \frac{1}{x} + 2$$

$$\left(\sqrt{x} + \left(\frac{1}{\sqrt{x}}\right)\right)^2 = \sqrt{2} + 1 + \sqrt{2} - 1 + 2$$

$$\left(\sqrt{x} + \left(\frac{1}{\sqrt{x}}\right)\right)^2 = 2 + 2\sqrt{2}$$

$$\left(\sqrt{x} + \left(\frac{1}{\sqrt{x}}\right)\right)^2 = 4.828$$

$$\sqrt{x} + \left(\frac{1}{\sqrt{x}}\right) = 2.1973$$

21. Sol. (a)

$$x = \frac{\sqrt{2}+1}{\sqrt{2}-1} \text{ and } y = \frac{\sqrt{2}-1}{\sqrt{2}+1}$$

$$\Rightarrow x = \frac{1}{y} \Rightarrow xy = 1$$

$$x + y = \frac{\sqrt{2}+1}{\sqrt{2}-1} + \frac{\sqrt{2}-1}{\sqrt{2}+1} = \frac{(\sqrt{2}+1)^2 + (\sqrt{2}-1)^2}{(\sqrt{2})^2 - (1)^2}$$

$$= \frac{3+2\sqrt{2}+3-2\sqrt{2}}{1} = 6$$

$$x + y = 6$$

On cubing both sides

$$\Rightarrow (x + y)^3 = (6)^3$$

$$\Rightarrow x^3 + y^3 + 3xy(x + y) = 216$$

$$\Rightarrow x^3 + y^3 + 3 \times 6 = 216$$

$$\Rightarrow x^3 + y^3 = 198$$

$$3(x^3 + y^3) - 5xy = 3(198) - 5 = 589$$

22. Sol. (d)

$$x = \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$$

$$y = \frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$$

$$\therefore x = \frac{1}{y}$$

$$y = \frac{1}{x} \Rightarrow xy = 1$$

$$\therefore x + y = \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}} + \frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$$

$$\Rightarrow \frac{(\sqrt{3}-\sqrt{2})^2 + (\sqrt{3}+\sqrt{2})^2}{1}$$

$$\Rightarrow \frac{3+2-2\sqrt{6}+3+2+2\sqrt{6}}{1} = 10$$

$$\Rightarrow (x+y)^3 = x^3 + y^3 + 3xy(x+y)$$

$$\Rightarrow (10)^3 = x^3 + y^3 + 3 \times 1(10) = 970$$

$$\Rightarrow x^3 + y^3 = 1000 - 30 = 970$$

23. Sol.(a)

$$a = \frac{2+\sqrt{3}}{2-\sqrt{3}} \text{ and } b = \frac{2-\sqrt{3}}{2+\sqrt{3}} \dots \text{ (Given)}$$

$$a = \frac{1}{b}, ab = 1$$

$$a + b = \frac{2+\sqrt{3}}{2-\sqrt{3}} + \frac{2-\sqrt{3}}{2+\sqrt{3}}$$

$$= \frac{(2+\sqrt{3})^2 + (2-\sqrt{3})^2}{4-3} = \frac{2(4+3)}{1} = 14$$

$$a + b = 14$$

Squaring both sides, we get:-

$$a^2 + b^2 + 2ab = 196$$

$$a^2 + b^2 = 196 - 2ab = 196 - 2 = 194$$

$$a^2 + b^2 + ab = 194 + 1 = 195$$

24. Sol.(b)

$$x = 2 + \sqrt{3} \Rightarrow \frac{1}{x} = 2 - \sqrt{3}$$

$$x + \frac{1}{x} = 4 \text{ and } x - \frac{1}{x} = 2\sqrt{3}$$

$$= \frac{x^6 + 3x^4 + 14x^3 + 3x^2 - 1}{3x^5 - 6x^4 + 10x^3 + 6x^2 - 2x}$$

Divide numerator and denominator by x^3

$$= \frac{x^3 + 3x + 14 + \frac{3}{x} - \frac{1}{x^3}}{2x^2 - 6x + 10 + \frac{6}{x} - \frac{2}{x^2}}$$

$$= \frac{\left(x^3 - \frac{1}{x^3}\right) + 3\left(x + \frac{1}{x}\right) + 14}{2\left(x^2 - \frac{1}{x^2}\right) - 6\left(x - \frac{1}{x}\right) + 10}$$

$$= \frac{\left(x - \frac{1}{x}\right)\left(\left(x + \frac{1}{x}\right) - 1\right) + 3\left(x + \frac{1}{x}\right) + 14}{2\left(x - \frac{1}{x}\right)\left(x + \frac{1}{x}\right) - 6\left(x - \frac{1}{x}\right) + 10}$$

$$= \frac{(2\sqrt{3})(4^2 - 1) + 3(4) + 14}{2(2\sqrt{3})(4) - 6(2\sqrt{3}) + 10}$$

$$= \frac{30\sqrt{3} + 36}{4\sqrt{3} + 10} = \frac{3\sqrt{3}(10 + 4\sqrt{3})}{4\sqrt{3} + 10} = 3\sqrt{3}$$

25. Sol.(a)

$$\text{Given, } x = 2 - \sqrt{3} \Rightarrow \frac{1}{x} = \frac{1}{2 - \sqrt{3}}$$

Applying rationalization

$$\Rightarrow \frac{1}{2 - \sqrt{3}} \times \frac{2 + \sqrt{3}}{2 + \sqrt{3}} = 2 + \sqrt{3}$$

$$\Rightarrow x - \frac{1}{x} = (2 - \sqrt{3}) - (2 + \sqrt{3}) = -2\sqrt{3}$$

$$\Rightarrow x^3 - \frac{1}{x^3} = (-2\sqrt{3})^3 + 3(-2\sqrt{3})$$

$$\left(\text{If } x + \frac{1}{x} = k, \text{ then } x^3 - \frac{1}{x^3} = k^3 + 3k \right)$$

$$= -24\sqrt{3} - 6\sqrt{3} = -30\sqrt{3}$$

26. Sol.(a)

$$x = 2 + \sqrt{3}, y = 2 - \sqrt{3}, z = 1$$

$$= \frac{x}{yz} + \frac{y}{xz} + \frac{z}{xy} + 2\left[\frac{1}{x} + \frac{1}{y} + \frac{1}{z}\right]$$

$$= \frac{x^2 + y^2 + z^2}{xyz} + 2\left[\frac{1}{x} + \frac{1}{y} + \frac{1}{z}\right]$$

$$= \frac{(2+\sqrt{3})^2 + (2-\sqrt{3})^2 + (1)^2}{(2+\sqrt{3})(2-\sqrt{3})(1)} + 2\left[\frac{1}{2+\sqrt{3}} + \frac{1}{2-\sqrt{3}} + 1\right]$$

$$= \frac{4+3+4\sqrt{3}+4+3-4\sqrt{3}+1}{1} + 2[2 - \sqrt{3} + 2 + \sqrt{3} + 1]$$

$$= 15 + 10 = 25$$

27. Sol.(d)

$$x = 3 + 2\sqrt{2}$$

$$\therefore \frac{1}{x} = 3 - 2\sqrt{2}$$

$$x + \frac{1}{x} = 3 + 2\sqrt{2} + 3 - 2\sqrt{2}$$

$$x + \frac{1}{x} = 6$$

$$\left(x + \frac{1}{x}\right)^3 = (6)^3$$

$$x^3 + \frac{1}{x^3} + 3 \times 6 = 216$$

$$x^3 + \frac{1}{x^3} = 216 - 18 = 198$$

$$\therefore \frac{x^6 + x^4 + x^2 + 1}{x^3}$$

$$= x^3 + x + \frac{1}{x} + \frac{1}{x^3}$$

$$= x^3 + \frac{1}{x^3} + x + \frac{1}{x}$$

$$= 198 + 6 = 204$$

28. Sol.(c)

$$x = \sqrt{5} + 2$$

$$\Rightarrow \frac{1}{x} = \frac{1}{\sqrt{5}+2} \times \frac{\sqrt{5}-2}{\sqrt{5}-2}$$

$$\Rightarrow \frac{\sqrt{5}-2}{5-4} = \sqrt{5} - 2$$

$$\Rightarrow x - \frac{1}{x} = \sqrt{5} + 2 - \sqrt{5} + 2 = 4$$

$$\begin{aligned} \therefore \frac{2x^2-3x-2}{3x^2-4x-3} &= \frac{\frac{2x^2}{x} - \frac{3x}{x} - \frac{2}{x}}{\frac{3x^2}{x} - \frac{4x}{x} - \frac{3}{x}} \Rightarrow \frac{2x - \frac{3}{x} - \frac{2}{x}}{3x - \frac{4}{x} - \frac{3}{x}} \\ &= \frac{2\left(x - \frac{1}{x}\right) - 3}{3\left(x - \frac{1}{x}\right) - 4} \Rightarrow \frac{2 \times 4 - 3}{3 \times 4 - 4} \\ &= \frac{8-3}{12-4} = \frac{5}{8} = 0.625 \end{aligned}$$

29. Sol. (d)

$$x = 1 + \sqrt{2} + \sqrt{3} \quad x - 1 = \sqrt{2} + \sqrt{3}$$

On squaring both sides

$$\Rightarrow x^2 + 1 - 2x = 2 + 3 + 2\sqrt{6}$$

$$\Rightarrow x^2 - 2x - 4 = 2\sqrt{6}$$

On squaring both sides again

$$\Rightarrow x^4 + 4x^2 + 16 - 4x^3 - 8x^2 + 16x = 24$$

$$\Rightarrow x^4 - 4x^3 - 4x^2 + 16x - 8 = 0$$

Multiply eq. by 2

$$\Rightarrow 2x^4 - 8x^3 - 8x^2 + 32x - 16 = 0$$

$$\Rightarrow 2x^4 - 8x^3 - 5x^2 + 26x - 28 - 3x^2 + 6x + 12 = 0$$

$$\Rightarrow 2x^4 - 8x^3 - 5x^2 + 26x - 28 = 3(x^2 - 2x - 4)$$

$$\Rightarrow 3(2\sqrt{6}) = 6\sqrt{6}$$

30. Sol. (a)

$$\text{Given, } a = \sqrt{8} - \sqrt{7} \text{ and } a = \frac{1}{b} \Rightarrow b = \frac{1}{\sqrt{8} - \sqrt{7}}$$

Apply rationalization

$$\Rightarrow b = \frac{1}{\sqrt{8} - \sqrt{7}} \times \frac{\sqrt{8} + \sqrt{7}}{\sqrt{8} + \sqrt{7}} = \sqrt{8} + \sqrt{7}$$

$$\Rightarrow a + b = a + \frac{1}{a} \dots \left(a = \frac{1}{b}\right)$$

$$= \sqrt{8} - \sqrt{7} + \sqrt{8} + \sqrt{7} = 2\sqrt{8}$$

$$\Rightarrow a^2 + \frac{1}{a^2} = a^2 + b^2 = (2\sqrt{8})^2 - 2 = 30$$

$$\text{Now, } ab = (\sqrt{8} - \sqrt{7})(\sqrt{8} + \sqrt{7}) = 1$$

$$\Rightarrow \frac{a^2 + b^2 - 3ab}{a^2 + ab + b^2} = \frac{30 - 3(1)}{30 + 1} = \frac{27}{31}$$

31. Sol. (b)

$$n = 7 + 4\sqrt{3}$$

$$n = 4 + 3 + 4\sqrt{3}$$

$$n = (2)^2 + (\sqrt{3})^2 + 2 \times 2 \times \sqrt{3}$$

$$n = (2 + \sqrt{3})^2$$

$$\sqrt{n} = 2 + \sqrt{3}$$

$$\therefore \frac{1}{\sqrt{n}} = 2 - \sqrt{3}$$

$$\sqrt{n} + \frac{1}{\sqrt{n}} = 2 + \sqrt{3} + 2 - \sqrt{3} = 4$$

32. Sol. (d)

$$a = 7 + 4\sqrt{3} \Rightarrow \frac{1}{a} = 7 - 4\sqrt{3}$$

$$a + \frac{1}{a} = 7 + 4\sqrt{3} + 7 - 4\sqrt{3} = 14$$

$$a^3 + \frac{1}{a^3} = P^3 - 3P = (14)^3 - 3 \times 14 = 154$$

$$\frac{a^6 + a^4 + a^2 + 1}{a^3} = a^3 + a + \frac{1}{a} + \frac{1}{a^3}$$

$$= \left(a^3 + \frac{1}{a^3}\right) + \left(a + \frac{1}{a}\right) = 154 + 14 = 168$$

33. Sol. (c)

$$x = 3 + 2\sqrt{2} \text{ and } y = 3 - 2\sqrt{2}$$

$$\Rightarrow x = \frac{1}{y} \Rightarrow xy = 1$$

$$x - y = (3 + 2\sqrt{2}) - (3 - 2\sqrt{2}) = 4\sqrt{2}$$

$$x^3 - 16\sqrt{2} - y^3 + 3\sqrt{2}$$

$$= (x - y)^3 + 3xy(x - y) - 13\sqrt{2}$$

$$= (4\sqrt{2})^3 + 3(1)(4\sqrt{2}) - 13\sqrt{2}$$

$$= 128\sqrt{2} + 12\sqrt{2} - 13\sqrt{2} = 127\sqrt{2}$$

34. Sol. (a)

$$x = \frac{\sqrt{5} - \sqrt{3}}{\sqrt{5} + \sqrt{3}}$$

$$\Rightarrow x = \frac{\sqrt{5} - \sqrt{3}}{\sqrt{5} + \sqrt{3}} \times \frac{\sqrt{5} - \sqrt{3}}{\sqrt{5} - \sqrt{3}}$$

$$\Rightarrow \frac{(\sqrt{5} - \sqrt{3})^2}{2} = 4 - \sqrt{15}$$

$$\text{Now, } y = \frac{1}{x} = \frac{1}{4 - \sqrt{15}}$$

Applying rationalization

$$= \frac{1}{4 - \sqrt{15}} \times \frac{4 + \sqrt{15}}{4 + \sqrt{15}} = 4 + \sqrt{15}$$

$$\text{Now, } x + y = x + \frac{1}{x} = 4 - \sqrt{15} + 4 + \sqrt{15} = 8$$

$$(x^3 + y^3) = x^3 + \frac{1}{x^3} = 8^3 - 3(8)$$

$$(\text{if } a + \frac{1}{a} = k, \text{ then, } a^3 + \frac{1}{a^3} = k^3 - 3k) = 488$$

35. Sol. (d)

According to the Question

$$x = \sqrt{3} + \sqrt{2}$$

$$y = \sqrt{3} - \sqrt{2}$$

$$(x^3 - 20\sqrt{2}) - (y^3 + 2\sqrt{2})$$

$$\begin{aligned}
 &= [(\sqrt{3} + \sqrt{2})^3 - 20\sqrt{2} - (\sqrt{3} - \sqrt{2})^3 - 2\sqrt{2}] \\
 &= 3\sqrt{3} + 2\sqrt{2} + 9\sqrt{2} + 6\sqrt{3} - \\
 &20\sqrt{2} - 3\sqrt{3} + 2\sqrt{2} + 9\sqrt{2} - \\
 &6\sqrt{3} - 2\sqrt{2} \\
 &= 9\sqrt{3} - 9\sqrt{2} - 9\sqrt{3} + 9\sqrt{2} = 0
 \end{aligned}$$

36. Sol.(b)

$$\therefore a = \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}, b = \frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$$

$$\text{to find } \frac{a^2}{b} + \frac{b^2}{a} = ?$$

$$\Rightarrow \frac{a^3+b^3}{ab} = ?$$

$$\Rightarrow \frac{(a+b)^3 - 3ab(a+b)}{ab} = ?$$

$$\Rightarrow a+b = \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}} + \frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$$

$$\Rightarrow \frac{(\sqrt{3}-\sqrt{2})^2 + (\sqrt{3}+\sqrt{2})^2}{\sqrt{3}^2 - \sqrt{2}^2}$$

$$\Rightarrow \frac{2(\sqrt{3}^2 + \sqrt{2}^2)}{1} \Rightarrow 2 \times (5) \Rightarrow a+b = 10$$

Again

$$\Rightarrow a \times b = \frac{(\sqrt{3}-\sqrt{2})}{(\sqrt{3}+\sqrt{2})} \times \frac{(\sqrt{3}+\sqrt{2})}{(\sqrt{3}-\sqrt{2})}$$

$$\Rightarrow ab = 1$$

$$\Rightarrow \frac{(a+b)^3 - 3ab(a+b)}{ab}$$

$$\Rightarrow \frac{10^3 - 3 \times 1 \times 10}{1}$$

$$\Rightarrow 1000 - 30 = 970$$

37. Sol. (d)

$$\text{Given, } x = \frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}}, y = \frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}}$$

$$\text{Find: } \frac{x^2+y^2+xy}{x^2+y^2-xy} = ?$$

$$\Rightarrow \frac{x^2+y^2+2xy-xy}{x^2+y^2-2xy+xy}$$

$$\Rightarrow \frac{(x+y)^2 - xy}{(x-y)^2 + xy} = ?$$

$$\text{Now, } x+y = \frac{(\sqrt{5}-\sqrt{3})}{(\sqrt{5}+\sqrt{3})} + \frac{(\sqrt{5}+\sqrt{3})}{(\sqrt{5}-\sqrt{3})}$$

$$\Rightarrow x+y = \frac{(\sqrt{5}-\sqrt{3})^2 + (\sqrt{5}+\sqrt{3})^2}{\sqrt{5}^2 - \sqrt{3}^2}$$

$$\Rightarrow x+y = \frac{2(\sqrt{5}^2 + \sqrt{3}^2)}{2}$$

$$\Rightarrow x+y = 8 \quad \dots (i)$$

$$\text{Again, } x-y = \frac{(\sqrt{5}-\sqrt{3})}{(\sqrt{5}+\sqrt{3})} - \frac{(\sqrt{5}+\sqrt{3})}{(\sqrt{5}-\sqrt{3})} = \frac{4 \times \sqrt{5} \times \sqrt{3}}{2}$$

$$\Rightarrow (x-y) = 2\sqrt{15}$$

$$\text{And, } xy = \frac{(\sqrt{5}-\sqrt{3})}{(\sqrt{5}+\sqrt{3})} \times \frac{(\sqrt{5}+\sqrt{3})}{(\sqrt{5}-\sqrt{3})} = 1$$

Substitutes values in the question.

$$\Rightarrow \frac{(x+y)^2 - xy}{(x-y)^2 + xy}$$

$$\Rightarrow \frac{8^2 - 1}{(2\sqrt{15})^2 + 1} \Rightarrow \frac{63}{61}$$

* * * * *

Type-5 (Algebra Quadratic Equation)

1. How many quadratic equations have the sum of their roots equal to the product of their roots?

[CDS - 2023-I]

- (a) Zero (b) One
(c) Two (d) Infinitely many

2. If $b^2 - 4b - 1 = 0$, then find the value of $b^2 + \frac{1}{b^2} + 3b - \frac{3}{b}$

SSC CHSL 2023 (Evening)

- (a) 32 (b) 30
(c) 18 (d) 24

3. If $x^2 + x = 5$, $(x+3)^3 + \frac{1}{(x+3)^3} = ?$

- (a) 110 (b) 125
(c) 140 (d) 0

4. What is the condition that the roots of the equation $ax^2 + bx + c = 0$ are in the ratio $c : 1$?

[CDS - 2022-I]

- (a) $b^2 = a(c+1)^2$ (b) $a^2 = b(c+1)^2$
(c) $b^2 = a(c-1)^2$ (d) $ab^2 = (c+1)^2$

5. If $4x^2 - 18x - 35 = 0$, $(2x+3)^3 - \frac{1}{(2x+3)^3} = ?$

- (a) $224\sqrt{221}$ (b) $226\sqrt{227}$
(c) $224\sqrt{229}$ (d) $225\sqrt{226}$

6. If $2x^2 + 5x + 1 = 0$, then one of the values of $x - \frac{1}{2x}$ is:

SSC CGL Tier II 29/01/2022

- (a) $\frac{\sqrt{13}}{2}$ (b) $\frac{\sqrt{17}}{2}$
(c) $\frac{5}{2}$ (d) $\frac{13}{2}$

7. If $x^2 - 3x + 1 = 0$, then find the value of $x^2 + x + \frac{1}{x} + \frac{1}{x^2}$.

- (a) 2 (b) 4
(c) 8 (d) 10

8. What is the solution of the following equations?

$$2X + 3Y = 12 \text{ and } 3X - 2Y = 5$$

SSC CGL Tier II 08/08/2022

- (a) $X = 3, Y = 2$ (b) $X = 2, Y = 3$
(c) $X = -2, Y = 3$ (d) $X = 3, Y = -2$

9. If $x^2 - 5x - 1 = 0$, what is the value of $\frac{x^6 - x^4 + x^2 - 1}{x^3}$?

SSC CGL 19/4/2022 (Afternoon)

- (a) 145 (b) 140
(c) 130 (d) 135

10. If $x^2 + 6x + 1 = 0$ then the value of $(x+6)^3 + \frac{1}{(x+6)^3} = ?$

SSC CPO 10/11/2022 (Evening)

- (a) 245 (b) 216
(c) 186 (d) 198

11. If $a^2 - 4a + 1 = 0$, then the value of $a^2 + a + \frac{1}{a} + \frac{1}{a^2}$ is:

SSC CHSL 26/05/2022 (Afternoon)

- (a) 10 (b) 1
(c) 18 (d) 16

12. The roots of the equation $12x^2 + mx + 5 = 0$, will be in the ratio 3:2, if M equals to:

- (a) $1/12$ (b) $\pm \frac{5}{15}\sqrt{10}$
(c) $\pm 5\sqrt{10}$ (d) $\pm 5/\sqrt{10}$

13. Expand $x^2 + 2x + 3$ about $x = -2$

SSC CHSL 01/06/2022 (Afternoon)

- (a) $(x-2)^2 - 2(x+2) + 3$
(b) $(x+2)^2 - 2(x+2) + 3$
(c) $(x+2)^2 + 2(x+2) + 3$
(d) $(x-2)^2 - 2(x-2) - 3$

[CDS - 2022-I]

14. If $x^2 + 3x - \sqrt{2} = 0$, then find the value of $x(x+1)(x+2)(x+3) - 2\sqrt{2}$

- (a) 3 (b) 1
(c) 2 (d) $\sqrt{2}$

15. If $x^2 - 3x + 1 = 0$, then the value of $x^2 + x + \frac{1}{x} + \frac{1}{x^2}$ is:-

- (a) 10 (b) 2
(c) 6 (d) 8

16. If $x^2 = 17x + y$ and $y^2 = x + 17y, x \neq y$, then what is the value of $\sqrt{x^2 + y^2 + 1}$?

[CDS - 2022-I]

- (a) 17 (b) 19
(c) 23 (d) 27

17. If the equation $k(21x^2 + 24) + rx + (14x^2 - 9) = 0$
 $k(7x^2 + 8) + px + (2x^2 - 3) = 0$ have both roots common, then the value of $\frac{p}{r}$ is:

SSC CPO 11/11/2022 (Evening)

- (a) $\frac{1}{3}$ (b) $\frac{2}{5}$
(c) $\frac{4}{3}$ (d) $\frac{7}{5}$

18. If α, β are the roots of $6x^2 + 13x + 7 = 0$, then the equation whose roots are α^2, β^2 is:

SSC CGL 12/12/2022 (4th Shift)

- (a) $36x^2 - 87x + 49 = 0$
(b) $36x^2 - 85x + 49 = 0$
(c) $36x^2 - 85x - 49 = 0$
(d) $36x^2 + 87x - 49 = 0$

19. $144x^2 - 36x + \frac{9}{4}$ can be expressed as the square of

SSC CHSL 27/05/2022 (Evening)

- (a) $14x - \frac{3}{2}$ (b) $12x - \frac{9}{4}$
(c) $12x - \frac{3}{2}$ (d) $12x - 9$

20. If α and β are the roots of the quadratic equation $x^2 + ax + b = 0$, where $b \neq 0$, then what is the value of $\alpha - \beta$?

- (a) 4 (b) 3
(c) -1 (d) -3

21. If a and b are the roots of the equation $PX^2 - QX + R = 0$, then what is the value of $1/a^2 + 1/b^2 + a/b + b/a$?

- (a) $(Q^2 - 2P)(2R + P)/PR^2$
(b) $(Q^2 - 2PR)(R + P)/PR^2$
(c) $(Q^2 - 2R)(2P + R)/P^2R^2$
(d) $\frac{(Q^2 - 2P)(2R + 2P)}{P^2R^2}$

22. If $x^2 + x = 19$, find value of $(x+5)^2 + \frac{1}{(x+5)^2}$

- (a) 78 (b) 158
(c) 79 (d) 81

23. Which of the following are the factors of $x^{39} - x^{22} + x^{11} - 1$?

- (a) $x + 1$ only
(b) $x - 1$ only
(c) Both $(x + 1)$ and $(x - 1)$
(d) None of above

24. If $a^2 - 15a + 45 = 0$, then find the value of $(a - 4)^2 + \frac{1}{(a-4)^2}$.

- (a) 45 (b) 47
(c) 51 (d) 56

25. Which of the following has real roots of equation $ax^2 + bx + c = 0$

- (a) $b^2 < 4ac$ (b) $b^2 > 4ac$
(c) $b^2 = 4ac$ (d) None

26. Two quadratic equation $x^2 + ax + 8 = 0$ and $x^2 + bx - 8 = 0$ have a common root then find the Value of $a^2 - b^2$?

- (a) 48 (b) 32
(c) 16 (d) 36

27. If $4x^4 - 37x^2 + 9 = 0, x > \sqrt{\frac{3}{2}}$, then what is the value of $8x^3 - \frac{27}{x^3}$?

SSC CGL 16/8/2021 (Afternoon)

- (a) 215 (b) -215
(c) 35 (d) -35

28. If $2x^2 - 8x - 1 = 0$, then what is the value of $8x^3 - \frac{1}{x^3}$?

SSC CGL 13/8/2021 (Evening)

- (a) 560 (b) 540
(c) 524 (d) 464

29. If $x^2 - 4x + 1 = 0$, then what is the value of $x^9 + x^7 - 194x^5 - 194x^3$?

- (a) 4 (b) -4
(c) 1 (d) -1

30. If $x^2 + (4 - \sqrt{3})x - 1 = 0$, then what is the value of $x^2 + \frac{1}{x^2}$?

SSC CHSL 12/8/2021 (Evening)

- (a) $9 - 8\sqrt{3}$ (b) $21 - 12\sqrt{3}$
(c) $21 - 8\sqrt{3}$ (d) $17 - 8\sqrt{3}$

31. If $m - 5n = 2$, then the value of $(m^3 - 125n^3 - 30mn)$ is:

- (a) 6 (b) 7
(c) 8 (d) 9

32. If p, q and r are the roots of equation $12x^3 - 999x + 3572 = 0$, then $(p + q)^3 + (q + r)^3 + (r + p)^3 = ?$

- (a) 999 (b) 763
(c) 893 (d) 805

33. If $x^2 + x = 5$, then find the value of $(x + 3)^2 + \frac{1}{(x+3)^2}$

- (a) 7 (b) 3
(c) 23 (d) 27

34. $(1 + m^2)x^2 + 2mcx + c^2 - a^2 = 0$ has equal roots if

- (a) $a^2 = c^2(1 + m^2)$ (b) $c^2 = a^2(1 + m^2)$
(c) $m^2 = c^2(1 + a^2)$ (d) $c^2 = m^2(1 + a^2)$

35. If α and β are the roots of the equation $3x^2 - 13x + 14 = 0$, then what is the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$?

- (a) 65/28 (b) 53/14
(c) 9 (d) 85/42

36. If $2x^2 - 7x + 5 = 0$, then what is the value of $x^3 + \frac{125}{8x^3}$?

SSC CGL 23/8/2021 (Morning)

- (a) $12\frac{5}{8}$ (b) $16\frac{5}{8}$
(c) $10\frac{5}{8}$ (d) $18\frac{5}{8}$

37. If α and β are the roots of the equation $x^2 + x - 1 = 0$, then what is the value of equation whose roots are α^5 and β^5 .

- (a) $x^2 + 7x - 1 = 0$ (b) $x^2 - 11x - 1 = 0$
(c) $x^2 - 7x - 1 = 0$ (d) $x^2 + 11x - 1 = 0$

38. If $12x^2 - 21x + 1 = 0$, then what is the value of $9x^2 + (16x^2)^{-1}$?

SSC CGL 4/03/2020 (Evening)

- (a) $\frac{429}{8}$ (b) $\frac{465}{16}$
(c) $\frac{417}{16}$ (d) $\frac{453}{8}$

39. If $x^2 + ax + b$ is a perfect square, then which one of the following relations between a and b is true:-

- (a) $a^2 = b$ (b) $a^2 = 4b$
(c) $b = 4a$ (d) $b^2 = a$

40. If α and β are the roots of equation $x^2 - 14x + 1 = 0$, then the equation whose roots are $\sqrt{\alpha}$ and $\sqrt{\beta}$ is

- (a) $x^2 + 4x - 1$ (b) $x^2 - 4x - 1$
(c) $x^2 - 4x + 1$ (d) $x^2 + 4x + 1$

41. What is the square root of $4x^4 + 8x^3 - 4x + 1$?

[CDS - 2020-II]

- (a) $2x^2 - 2x - 1$ (b) $2x^2 - x - 1$
(c) $2x^2 + 2x + 1$ (d) $2x^2 + 2x - 1$

42. Find the number of roots common to the equations $x^3 - 5x^2 + 3x - 9 = 0$ and $x^3 - 6x^2 + 8x - 15 = 0$

- (a) 1 (b) 2

- (c) 0 (d) 3

43. The factors of the expression $2x^2 - 5x - 12$ are:
SSC CHSL 15/10/2020 (Morning)

- (a) $(x - 4)$ and $(2x - 3)$
(b) $(x + 4)$ and $(2x + 3)$
(c) $(x - 4)$ and $(2x + 3)$
(d) $(x + 4)$ and $(2x - 3)$

44. If $x^2 - 4x + 4 = 0$, then the value of $16\left(x^4 - \frac{1}{x^4}\right)$ is:
SSC CGL 6/03/2020 (Evening)

- (a) $\frac{127}{16}$ (b) 255
(c) $\frac{255}{16}$ (d) 127

45. If the equations $x^2 + 5x + 6 = 0$ and $x^2 + kx + 1 = 0$ have a common root, then what is the value of k ?

[CDS - 2019-II]

- (a) $-\frac{5}{2}$ or $-\frac{10}{3}$ (b) $\frac{5}{2}$ or $\frac{10}{3}$
(c) $\frac{5}{2}$ or $-\frac{10}{3}$ (d) $-\frac{5}{2}$ or $\frac{10}{3}$

46. The equation $x^2 + px + q = 0$ has roots equal to p and q where $q \neq 0$. What are the values of p and q respectively?

[CDS - 2019-II]

- (a) 1, -2 (b) 1, 2
(c) -1, 2 (d) -1, -2

47. If the roots of the equation $a(b - c)x^2 + b(c - a)x + c(a - b) = 0$ are equal, then which of the following is true?

- (a) $b = (a + c)/ac$

(b) $2/b = (1/a) + (1/c)$

(c) $2b = (1/a) + (1/c)$

(d) $abc = ab + bc + ca$

48. For the inequation $x^2 - 7x + 12 > 0$, which one of the following is correct?

[CDS - 2019-I]

- (a) $3 < x < 4$
(b) $-\infty < x < 3$ only
(c) $4 < x < \infty$ only
(d) $-\infty < x < 3$ or $4 < x < \infty$

49. If roots of $x^2 - 4x + a = 0$ are equal, then $a = ?$

SSC CPO 16/03/2019 (Evening)

- (a) -4 (b) 4
(c) 8 (d) -8

50. If x is real, and $x^4 - 5x^2 - 1 = 0$, then the value of $\left(x^6 - 3x^2 + \frac{3}{x^2} - \frac{1}{x^6} + 1\right)$ is:

SSC CHSL 3/07/2019 (Morning)

- (a) 126 (b) 110
(c) 116 (d) 96

51. If α, β and γ are the zeroes of the polynomial $f(x) = ax^3 + bx^2 + cx + d$, then $\alpha^2 + \beta^2 + \gamma^2$ is equal to

[CDS - 2018-II]

- (a) $\frac{b^2 - ac}{a^2}$ (b) $\frac{b^2 - 2ac}{a}$
(c) $\frac{b^2 + 2ac}{h^2}$ (d) $\frac{b^2 - 2ac}{a^2}$

Type-5 (Algebra Quadratic Equation) ANSWER KEY

1	D	2	B	3	A	4	A	5	A	6	B	7	D
8	A	9	D	10	D	11	C	12	C	13	B	14	C
15	A	16	A	17	A	18	B	19	C	20	B	21	B
22	C	23	B	24	B	25	C	26	B	27	A	28	A
29	B	30	C	31	C	32	C	33	B	34	D	35	D
36	B	37	D	38	C	39	B	40	C	41	D	42	C
43	C	44	B	45	B	46	A	47	B	48	D	49	B
50	A	51	D										

Type-5 (Algebra Quadratic Equation) Solution

1. **Sol. (d)**

Let the Q.E. : $ax^2 + bx + c = 0$

Sum of roots = Product of the roots.

$$\frac{-b}{a} = \frac{c}{a} \Rightarrow c = -b \text{ and } a \neq 0$$

Thus, infinite many Q.E. have the sum and products their roots are equal.

2. **Sol. (b)**

$$b^2 - 4b - 1 = 0 \text{ Dividing both side by } b$$

$$b - \frac{1}{b} = 4 \Rightarrow b^2 + \frac{1}{b^2} = 4^2 + 2 = 18$$

Again, multiplying both sides by 3, we get

$$3b - \frac{3}{b} = 12$$

$$b^2 + \frac{1}{b^2} + 3b - \frac{3}{b} = 18 + 12 = 30$$

3. **Sol. (a)**

$$x + 3 = m \text{ (let)}$$

$$x = m - 3$$

$$m^2 + 9 - 6m + m - 3 = 5 \text{ (put value of } x \text{ in given eqn)}$$

$$m^2 + 1 = 5m$$

$$m + \frac{1}{m} = 5$$

$$m^3 + \frac{1}{m^3} = k^3 - 3k$$

$$= 125 - 3 \times 5$$

$$= 110$$

4. **Sol. (a)**

$$\text{Sum of the roots } (ck + k) = \frac{-b}{a}$$

$$k = \frac{-b}{a(c+1)}$$

$$\text{Product of the roots } k \cdot ck = \frac{c}{a}$$

$$c \cdot \left(\frac{-b}{a(c+1)} \right)^2 = \frac{c}{a}$$

$$\therefore b^2 = a \cdot (c+1)^2$$

5. **Sol(a)**

$$2x + 3 = m \text{ let}$$

$$x = \frac{m-3}{2}$$

$$4x^2 - 18x - 35 = 0$$

$$4 \left(\frac{m^2+9-6m}{4} \right) - 18 \left(\frac{m-3}{2} \right) - 35 = 0$$

$$m^2 + 9 - 6m - 9m + 27 - 35 = 0$$

$$m^2 + 1 = 15m$$

$$m + \frac{1}{m} = 15$$

$$m - \frac{1}{m} = \pm \sqrt{221}$$

$$m^3 - \frac{1}{m^3} = 224\sqrt{221}$$

6. **Sol. (b)**

$$2x^2 + 5x + 1 = 0$$

On dividing by $2x$,

$$x + \frac{5}{2} + \frac{1}{2x} = 0 \Rightarrow x + \frac{1}{2x} = -\frac{5}{2}$$

$$x - \frac{1}{2x} = \sqrt{\left(x + \frac{1}{2x}\right)^2 - 4 \times \frac{1}{2}}$$

$$x - \frac{1}{2x} = \sqrt{\left(-\frac{5}{2}\right)^2 - 2}$$

$$x - \frac{1}{2x} = \sqrt{\frac{25}{4} - 2} = \frac{\sqrt{17}}{2}$$

7. **Sol. (d)**

$$x^2 - 3x + 1 = 0$$

$$x^2 + 1 = 3x \Rightarrow x + \frac{1}{x} = 3$$

On squaring both sides

$$\Rightarrow x^2 + \frac{1}{x^2} + 2 = 9 \Rightarrow x^2 + \frac{1}{x^2} = 7$$

$$x^2 + x + \frac{1}{x} + \frac{1}{x^2} = \left(x^2 + \frac{1}{x^2}\right) + \left(x + \frac{1}{x}\right)$$

$$= 7 + 3 = 10$$

8. **Sol. (a)**

$$2X + 3Y = 12 \quad \dots (1)$$

$$3X - 2Y = 5 \quad \dots (2)$$

Multiplying eq. (1) by 3 and eq. (2) by 2, we get

$$6X + 9Y = 36 \quad \dots (3)$$

$$6X - 4Y = 10 \quad \dots (4)$$

Subtracting eq. (4) from eq. (3), we get $X = 3$ and

$$Y = 2$$

So, option (a) is the correct answer.

9. Sol. (d)

$$x^2 - 5x - 1 = 0$$

 $\Rightarrow x^2 - 1 = 5x \dots \dots$ dividing both sides by x

$$\Rightarrow x - \frac{1}{x} = 5 \Rightarrow \frac{x^6 - x^4 + x^2 - 1}{x^3}$$

$$= x^3 - x + \frac{1}{x} - \frac{1}{x^3}$$

$$\left(x^3 - \frac{1}{x^3}\right) - \left(x - \frac{1}{x}\right)$$

Use identity

$$\left(x^3 - \frac{1}{x^3}\right) = \left(x - \frac{1}{x}\right)^3 + 3x\left(x - \frac{1}{x}\right)$$

$$= (5^3 + 3 \times 5) - 5 = 140 - 5 = 135$$

10. Sol. (d)

$$x^2 + 6x + 1 = 0$$

Dividing both side by x ,

$$x + 6 + \frac{1}{x} = 0 \Rightarrow x + \frac{1}{x} = -6$$

$$x^3 + \frac{1}{x^3} = (-6)^3 - 3x(-6) = -216 + 18 =$$

$$-198 \text{ Also, } x + 6 = -\frac{1}{x}$$

$$\text{Now, } (x + 6)^3 + \frac{1}{(x+6)^3} = -\left(\frac{1}{x^3} + x^3\right) = 198$$

11. Sol. (c)

$$a^2 - 4a + 1 = 0 \text{ Dividing both side by } a$$

$$a + \frac{1}{a} = 4; a^2 + \frac{1}{a^2} = 4^2 - 2 = 14$$

$$a^2 + \frac{1}{a^2} + a + \frac{1}{a} = 14 + 4 = 18$$

12. Sol. (C)

Let $\Rightarrow 3\alpha, 2\alpha$ are roots,

$$6\alpha^2 = \frac{5}{12}$$

$$\alpha = \sqrt{\frac{5}{72}} = \pm \frac{1}{6} \sqrt{\frac{5}{2}}$$

$$5\alpha = \frac{-m}{12}$$

$$= 5 + \frac{1}{6} \sqrt{\frac{5}{2}} = \frac{-m}{12}$$

$$m = \pm 5\sqrt{10}$$

13. Sol. (b)

 x can be written as $x + 2 - 2$

$$\text{So, } x^2 + 2x + 3 = \{(x + 2) - 2\}^2 + 2\{(x + 2) - 2\} + 3$$

$$\Rightarrow (x + 2)^2 + 2^2 - 2 \times 2(x + 2) + 2(x + 2) -$$

$$4 + 3$$

$$\Rightarrow (x + 2)^2 + 4 - 4(x + 2) + 2(x + 2) - 4 + 3$$

$$\Rightarrow (x + 2)^2 - 2(x + 2) + 3$$

14. Sol. (c)

$$x^2 + 3x - \sqrt{2} = 0$$

$$\Rightarrow x^2 + 3x = \sqrt{2}$$

$$(x)(x + 3)(x + 1)(x + 2) - 2\sqrt{2}$$

$$= (x^2 + 3x)(x^2 + 3x + 2) - 2\sqrt{2}$$

$$= (\sqrt{2})(\sqrt{2} + 2) - 2\sqrt{2}$$

$$= 2 + 2\sqrt{2} - 2\sqrt{2} = 2$$

15. Sol. (a) $\Rightarrow$

$$x^2 - 3x + 1 = 0$$

$$\Rightarrow x^2 + 1 = 3x$$

$$x + \frac{1}{x} = 3$$

Squaring both sides

$$\Rightarrow x^2 + \frac{1}{x^2} + 2 = 9$$

$$x^2 + \frac{1}{x^2} = 7$$

$$\therefore x^2 + \frac{1}{x^2} + x + \frac{1}{x}$$

$$= 7 + 3 = 10$$

16. Sol. (a)

$$x^2 = 17x + y$$

$$y^2 = x + 17y$$

$$\text{add } x^2 + y^2 = 18(x + y)$$

$$\text{Subtract } x^2 - y^2 = 16(x - y)$$

$$x + y = 16$$

$$\text{Now } \sqrt{x^2 + y^2 + 1}$$

$$\sqrt{18 \times 16 + 1} = 17$$

17. Sol. (a)

$$k(21x^2 + 24) + rx + (14x^2 - 9) = 0 \quad \dots (i)$$

$$k(7x^2 + 8) + px + (2x^2 - 3) = 0 \quad \dots (ii)$$

Multiply equation (ii) by 3 and subtract from equation (i),

$$k(21x^2 + 24) + rx + (14x^2 - 9) - 3 \times [k(7x^2 + 8) + px + (2x^2 - 3)] = 0$$

$$8x^2 - 3px + rx = 0 \quad \dots (iii)$$

So let roots of equation (iii) are α and β

$$\alpha + \beta = \frac{3p}{8}$$

$$\alpha\beta = \frac{r}{8}$$

Equations have both roots common.

$$\text{so } \frac{3p}{8} = \frac{r}{8} \Rightarrow \frac{p}{r} = \frac{1}{3}$$

18. Sol. (b)

Since, α, β are the roots of $6x^2 + 13x + 7 = 0$. then ,

$$\alpha + \beta = \frac{-13}{6} \text{ and } \alpha\beta = \frac{7}{6}$$

$$\alpha^2 + \beta^2 = \left(\frac{-13}{6}\right)^2 - 2 \times \frac{7}{6} = \frac{169}{36} - \frac{7}{3} = \frac{85}{36}$$

So, the equation whose roots are α^2, β^2 is given by :

$$x^2 - \left(\frac{85}{36}\right)x + \frac{49}{36} = 0$$

$$36x^2 - 85x + 49 = 0$$

19. Sol. (c)

$$144x^2 - 36x + \frac{9}{4}$$

$$= (12x)^2 - 2 \times 12 \times \frac{3}{2} + \left(\frac{3}{2}\right)^2$$

$$= \left(12x - \frac{3}{2}\right)^2$$

20. Sol. (b)

$$x^2 + \alpha \cdot x + \beta = 0$$

Sum of the roots, $\alpha + \beta = -\alpha$

$$\beta + 2\alpha = 0$$

Product of the roots $\alpha \cdot \beta = \beta \Rightarrow \beta(1 - \alpha) = 0$

As $\beta \neq 0 \therefore \alpha = 1$

$$\text{and } \beta + 2 = 0 \Rightarrow \beta = -2.$$

$$\text{Now, } \alpha - \beta = 1 - (-2) = 3.$$

21. Sol. (b)

I method

$$PX^2 - QX + R = 0,$$

Let $a = b = 1$, then equation $\Rightarrow x^2 - 2x + 1 = 0$

$$P = 1, Q = 2, R = 1,$$

$$\frac{1}{a^2} + \frac{1}{b^2} + \frac{a}{b} + \frac{b}{a} = 4.$$

Put the value in option, then (B) satisfied

II method

$$a + b = \frac{Q}{P}$$

$$ab = \frac{R}{P},$$

$$\frac{1}{a^2} + \frac{1}{b^2} + \frac{a}{b} + \frac{b}{a} = \frac{a^2 + b^2 + a^3b + ab^3}{a^2b^2}$$

$$= \frac{(a^2 + b^2)(1 + ab)}{a^2b^2}$$

$$= \frac{[(a+b)^2 - 2ab] \times (1+ab)}{a^2b^2}$$

22. Sol. (c)

$$\Rightarrow x^2 + x = 19$$

$$\Rightarrow x = \frac{-1 \pm \sqrt{1 - 4 \times 1 \times (-19)}}{2}$$

$$= \frac{-1 \pm \sqrt{77}}{2}$$

$$\text{By putting value of } x = \frac{\sqrt{77}-1}{2}$$

$$\text{or } \frac{-\sqrt{77}-1}{2} \text{ in } (x+5)^2 + \frac{1}{(x+5)^2}$$

$$\Rightarrow \left(\frac{\sqrt{77}-1}{2} + 5\right)^2 + \frac{1}{\left(\frac{\sqrt{77}-1}{2} + 5\right)^2}$$

$$\Rightarrow \left[\frac{\sqrt{77}+9}{2}\right]^2 + \frac{1}{\left[\frac{\sqrt{77}+9}{2}\right]^2}$$

$$\Rightarrow a^2 + \frac{1}{a^2} = \left(a + \frac{1}{a}\right)^2 - 2$$

$$= \left[\frac{9+\sqrt{77}}{2} + \frac{9-\sqrt{77}}{2}\right]^2 - 2$$

$$= 81 - 2$$

$$= 79$$

23. Sol. (b)

$x + 1$ is a factor,

So, $x = -1$ must satisfy the eqⁿ.

$$\therefore \Rightarrow (-1)^{39} - (-1)^{22} + (-1)^{11} - 1$$

$$\Rightarrow -1 - 1 - 1 - 1$$

$$\Rightarrow -4$$

$$\therefore x + 1 \text{ is not a factor of } x^{39} - x^{22} + x^{11} - 1$$

Now, $x = 1$ must satisfy the eqⁿ.

$$\Rightarrow (1)^{39} - (1)^{22} + (1)^{11} - 1$$

$$\Rightarrow 1 - 1 + 1 - 1$$

$$\Rightarrow 0$$

$\therefore$ Only $(x - 1)$ is factor

24. Sol. (b)

$$a^2 - 15a + 45 = 0$$

$$\Rightarrow a^2 - 4a - 11a + 1 + 44 = 0$$

$$\Rightarrow a^2 - 4a + 1 = 11a - 44$$

$$\Rightarrow a^2(a - 4) + 1 = 11(a - 4)$$

$$\Rightarrow \frac{a(a-4)+1}{a-4} = 11$$

$$\Rightarrow a + \frac{1}{a-4} = 11$$

subtract 4 from both sides

$$\Rightarrow a - 4 + \frac{1}{a-4} = 7$$

$$\text{Let } a - 4 = t$$

Then,

$$t + \frac{1}{t} = 7$$

On squaring both sides

$$\Rightarrow t^2 + \frac{1}{t^2} + 2 = 49$$

$$\Rightarrow t^2 + \frac{1}{t^2} = 47$$

$$(a - 4)^2 + \frac{1}{(a-4)^2} = 47$$

25. Sol. (c)

For real roots $D > 0$

$$b^2 - 4ac > 0$$

$$b^2 > 4ac$$

26. Sol. (b)

Common root = α

$$\alpha^2 + a\alpha + 8 = 0$$

$$\alpha^2 + b\alpha - 8 = 0$$

$$(a - b)\alpha + 16 = 0 \rightarrow a - b = -16/\alpha$$

$$2\alpha^2 + (a + b)\alpha = 0 \rightarrow a + b = 2\alpha$$

$$a^2 - b^2 = 32$$

27. Sol. (a)

$$4x^4 - 37x^2 + 9 = 0 \text{ dividing both side by } x^2$$

$$\text{Then } 4x^2 + \frac{9}{x^2} = 37 \text{ subtracting 12 and taking root}$$

from both side

$$2x - \frac{3}{x} = 5 \text{ taking cube on both side}$$

$$8x^3 - \frac{27}{x^3} = 5^3 + 3 \times 5 \times 2 \times 3 = 125 + 90 = 215$$

28. Sol. (a)

$$2x^2 - 1 = 8x \text{ dividing by } x \quad 2x - \frac{1}{x} = 8 \text{ Taking cube}$$

on both side

$$8x^3 - \frac{1}{x^3} = 8^3 + 3 \times 8 \times 2 \times 8$$

$$8x^3 - \frac{1}{x^3} = 512 + 48 = 560$$

29. Sol. (b)

$$x^2 - 4x + 1 = 0$$

$$x + \frac{1}{x} = 4$$

$$= x^5[x^4 - 194] + x^3[x^4 - 194]$$

$$= [x^5 + x^3][x^4 - 194]$$

$$x + \frac{1}{x} = 4$$

$$x^2 + \frac{1}{x^2} = 14$$

$$x^4 + \frac{1}{x^4} = 194$$

$$x^4(x^4 - 194) = -1$$

Then

$$\Rightarrow [x^5 + x^3][x^4 - 194]$$

$$\Rightarrow x^4 \left[x + \frac{1}{x} \right] [x^4 - 194]$$

$$\Rightarrow \left[x + \frac{1}{x} \right] \cdot x^4 [x^4 - 194]$$

$$= -4$$

30. Sol. (c)

$$x^2 + (4 - \sqrt{3})x - 1 = 0, x - \frac{1}{x} = -(4 - \sqrt{3})$$

On squaring both sides,

$$x^2 + \frac{1}{x^2} = 21 - 8\sqrt{3}$$

31. Sol. (c)

$$\text{Given } m - 5n = 2$$

$$\text{find } m^3 - 125n^3 - 30mn$$

$$\Rightarrow m - 5n = 2$$

$$\Rightarrow (m - 5n)^3 = 2^3 / \text{cubing both sides}$$

$$\Rightarrow m^3 - 125n^3 - 3m \times 5n(m - 5n) = 8$$

$$\Rightarrow m^3 - 125n^3 - 15mn \times 2 = 8$$

$$\Rightarrow m^3 - 125n^3 - 30mn = 8$$

32. Sol. (c)

$$12x^3 - 998x + 3572 = 0$$

$$p + q + r = 0, (p + q)^3 + (q + r)^3 + (r + p)^3$$

$$-r^3 + (-p)^3 + (-q)^3$$

$$\rightarrow -(p^3 + q^3 + r^3)$$

$$\rightarrow -3pqr$$

$$-\frac{3 \times (3572)}{4 \times 3} = 893$$

33. Sol. (b)

$$\text{Let } x + 3 = t \Rightarrow x = t - 3$$

$$x^2 + x = 5$$

$$\Rightarrow (t - 3)^2 + (t - 3) = 5$$

$$\Rightarrow t^2 + 9 - 6t + t - 3 = 5$$

$$\Rightarrow t^2 - 5t + 1 = 0$$

$$\Rightarrow t^2 + 1 = 5t$$

$$\Rightarrow t + \frac{1}{t} = 5$$

On squaring both sides

$$\Rightarrow t^2 + \frac{1}{t^2} + 2 = 5$$

$$\Rightarrow t^2 + \frac{1}{t^2} = 3$$

$$\Rightarrow (x + 3)^2 + \frac{1}{(x+3)^2} = 3$$

34. Sol. (d)

For equal roots $D = 0$

$$b^2 = 4ac$$

$$\Rightarrow (2mc)^2 = 4(1 + m^2)(c^2 - a^2)$$

$$\Rightarrow 4m^2c^2 = 4(c^2 - a^2 + m^2c^2 - m^2a^2)$$

$$\Rightarrow c^2 = a^2(1 + m^2)$$

35. Sol. (d)

$$3x^2 - 13x + 14 = 0$$

$$\alpha + \beta = 13/3$$

$$\alpha\beta = 14/3$$

$$\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2 + \beta^2}{\alpha\beta}$$

$$\Rightarrow \frac{(\alpha + \beta)^2 - 2\alpha\beta}{\alpha\beta}$$

$$\frac{\frac{169}{9} - \frac{28}{3}}{\frac{14}{3}} = \frac{85}{9} \times \frac{3}{14} = \frac{85}{42}$$

36. Sol. (b)

$$2x^2 - 7x + 5 = 0$$

$$\Rightarrow x + \frac{5}{2x} = \frac{7}{2}$$

Cubing both side,

$$\Rightarrow x^3 + \frac{125}{8x^3} = \frac{343}{8} - \left(3 \times \frac{7}{2} \times \frac{5}{2}\right)$$

$$\Rightarrow x^3 + \frac{125}{8x^3} = \frac{133}{8} \Rightarrow x^3 + \frac{125}{8x^3} = 16\frac{5}{8}$$

37. Sol. (d)

$$x^2 + x - 1 = 0$$

$$\alpha + \beta = -1 \quad \alpha^5 + \beta^5 = ? - 11$$

$$\alpha\beta = -1 \quad \alpha^5 \cdot \beta^5 = -1$$

$$x^2 + x - 1 = 0$$

$$x^2 = 1 - x$$

$$x^4 = 2 - 3x$$

$$x^5 = 2x - 3x^2 = 5x - 3$$

$$\alpha^5 = 5\alpha - 3$$

$$\beta^5 = 5\beta - 3$$

$$\alpha^5 + \beta^5 = 5(-1) - 6$$

$$= -11$$

38. Sol. (c)

$$12x^2 - 21x + 1 = 0$$

$$\Rightarrow 12x^2 + 1 = 21x$$

On multiplying both sides by $\left(\frac{3}{4x}\right)$

$$9x + \frac{3}{4x} = \frac{63}{4}$$

$$3x + \frac{1}{4x} = \frac{21}{4} \dots\dots\dots(i)$$

squaring equation (i),

$$9x^2 + (16x^2)^{-1} + 2 \times 3x \times \frac{1}{4x} = \frac{441}{16}$$

$$\Rightarrow 9x^2 + (16x^2)^{-1} = \frac{441}{16} - \frac{3}{2}$$

$$\Rightarrow 9x^2 + \frac{1}{16x^2} = \frac{417}{16}$$

39. Sol. (b)

$$x^2 + ax + b$$

$$\Rightarrow x^2 + 2 \times \frac{1}{2}a \times x + (\sqrt{b})^2$$

$$\Rightarrow A^2 + 2 \times A \times B + B^2 = (A + B)^2$$

$$\therefore A = x, B = \frac{1}{2}a, B^2$$

$$= (\sqrt{b})^2, B = \sqrt{b}$$

$$\Rightarrow \left(x + \frac{1}{2}a\right)^2 \text{ be perfect square}$$

$$\text{at } \sqrt{b} = \frac{1}{2}a \quad b = \frac{1}{4}a^2$$

$$\therefore a^2 = 4b$$

40. Sol. (c)

$$x^2 - 14x + 1 = 0$$

$$x = \frac{14 \pm \sqrt{(14)^2 - 4(1)(1)}}{2}$$

$$x = 7 \pm 4\sqrt{3}$$

$$\alpha = 7 + 4\sqrt{3} \text{ And } \beta = 7 - 4\sqrt{3}$$

$$\Rightarrow \alpha = (2 + \sqrt{3})^2 \Rightarrow \beta = (2 - \sqrt{3})^2$$

$$\Rightarrow \sqrt{\alpha} = 2 + \sqrt{3} \Rightarrow \sqrt{\beta} = 2 - \sqrt{3}$$

$$\sqrt{\alpha} + \sqrt{\beta} = 2 + \sqrt{3} + 2 - \sqrt{3} = 4$$

$$(\sqrt{\alpha})(\sqrt{\beta}) = (2 + \sqrt{3})(2 - \sqrt{3}) = 1$$

So equation of quadratic equation with roots $\sqrt{\alpha}$ and $\sqrt{\beta}$ is

$$x^2 - (\sqrt{\alpha} + \sqrt{\beta})x + \sqrt{\alpha}\sqrt{\beta} = 0$$

$$x^2 - 4x + 1 = 0$$

41. Sol. (d)

$$f(x) = 4x^4 + 8x^3 - 4x + 1$$

Now,

$$(2x^2 + 2x - 1)^2 = 4x^4 + 4x^2 + 1 + 8x^3 - 4x - 4x^2 \\ = 4x^4 + 8x^3 - 4x + 1$$

42. Sol. (c)

To find common roots put $x = t$ and equate both equations,

$$\Rightarrow t^3 - 5t^2 + 3t - 9 = t^3 - 6t^2 + 8t - 15$$

$$\Rightarrow t^2 - 5t + 6 = 0$$

$$\Rightarrow (t - 2)(t - 3) = 0$$

$$\therefore t = 2, 3$$

Now, on putting these values in both equations,

$$\text{first eq. } \Rightarrow x^3 - 5x + 3x - 9 = 0$$

on putting $x = 2$

$$\Rightarrow (2)^3 - 5(2) + 3(2) - 9$$

$$\Rightarrow 8 - 20 + 6 - 9$$

$$\Rightarrow -15 \neq 0$$

on putting $x = 3$

$$\Rightarrow (3)^3 - 5(3) + 3(3) - 9$$

$$\Rightarrow 9 - 45 + 9 - 9$$

$$\Rightarrow -36 \neq 0$$

Since, these are not equal to zero hence, no roots are common.

43. Sol. (c)

$$2x^2 - 5x - 12 = 2x^2 - 8x + 3x - 12$$

$$= 2x(x - 4) + 3(x - 4)$$

$$= (2x + 3)(x - 4)$$

44. Sol. (b)

$$x^2 - 4x + 4 = 0$$

$$\Rightarrow (x - 2)^2 = 0 \Rightarrow x = 2$$

$$16 \left(x^4 - \frac{1}{x^4} \right) = 16 \left(2^4 - \frac{1}{2^4} \right)$$

$$= 16 \left(16 - \frac{1}{16} \right) = 255$$

45. Sol. (b)

We know that two equation

$$a_1x^2 + b_1x + c_1 = 0$$

$$a_2x^2 + b_2x + c_2 = 0$$

have common root when

$$(c_1a_2 - a_1c_2)^2 = (b_1c_2 - c_1b_2)(a_1b_2 - b_1a_2)$$

So, for $x^2 + 5x + 6 = 0$ and $x^2 + kx + 1 = 0$

$$\text{we have } (5)^2 = (5 - 6k)(k - 5)$$

$$\Rightarrow 25 = -6k^2 + 35k - 25$$

$$\Rightarrow 6k^2 - 35k + 50 = 0$$

$$\Rightarrow k = \frac{5}{2} \text{ or } \frac{10}{3}$$

46. Sol. (a)

p and q are roots of

$$x^2 + px + q = 0$$

$$\Rightarrow p + q = -p \text{ and } pq = q$$

$$\Rightarrow pq - q = 0$$

$$\Rightarrow q(p - 1) = 0 \Rightarrow (p - 1) = 0 \Rightarrow p = 1$$

Adding p in equation $p + q = -p$

$$\Rightarrow 1 + q = -1$$

$$\Rightarrow q = -2$$

47. Sol(b)

$$a(b - c)x^2 + b(c - a)x + c(a - b) = 0$$

Roots of the equation are equal,

$$b^2 = 4ac$$

$$[b(c - a)]^2 = 4a(b - c) \times c(a - b)$$

$$b^2(c - a)^2 = 4ac(b - c)(a - b)$$

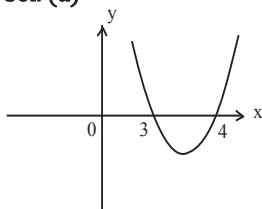
$$b^2(c^2 + a^2 - 2ac) = 4ac(ab - b^2$$

$$ac + bc)$$

$$b^2c^2 + b^2a^2 - 2ab^2c = 4a^2bc -$$

$$\begin{aligned}
 &4ab^2c - 4a^2c^2 + 4abc^2 \\
 &b^2c^2 + b^2a^2 + 2ab^2c = 4a^2bc - \\
 &4a^2c^2 + 4abc^2 \\
 &b^2c^2 + a^2b^2 + 2ab^2c = 4a^2bc - \\
 &4ac^2 + 4abc^2 \\
 &b^2c^2 + a^2b^2 + 2ab^2c - 4a^2bc + \\
 &4a^2c^2 - 4abc^2 = 0 \\
 &a^2b^2 + b^2c^2 + 4a^2c^2 + 2ab^2c - \\
 &4abc^2 - 4a^2bc = 0 \\
 &(ab + bc - 2ac)^2 = 0 \\
 &ab + bc = 2ac \\
 &b(a + c) = 2ac \\
 &\frac{a}{ac} + \frac{c}{ac} = \frac{2}{b} \\
 &\frac{1}{a} + \frac{1}{c} = \frac{2}{b}
 \end{aligned}$$

48. Sol. (d)



Root of the equation

$$x^2 - 7x + 12 = 0$$

$$(x - 3)(x - 4) = 0$$

$$\therefore x = 3 \text{ and } 4$$

$$\text{For, } x^2 - 7x + 12 > 0$$

$$x = (-\infty, 3) \cup (4, \infty).$$

As we can see from the graph of the quadratic equation, that the value of the equation is greater than zero for the values of $x < 3$ and $x > 4$

49. Sol. (b)

We know the roots of an equation

$$= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\text{here, } a = 1, b = -4 \text{ and } c = a$$

According to question

$$\frac{-(-4) \pm \sqrt{(-4)^2 - 4a(1)}}{2(1)} \dots \dots (1)$$

$$= \frac{-(-4) - \sqrt{(-4)^2 - 4a(1)}}{2(1)} \dots \dots (2)$$

Equating eq (1) and (2), we get

$$2\sqrt{16 - 4a} = 0$$

$$16 = 4a \text{ so, } a = 4 \text{ ans.}$$

Alternate Method :

For real and equal roots,

$$D = b^2 - 4ac = 0$$

$$a = 1, b = -4 \text{ and } c = a$$

$$\Rightarrow 4^2 - 4a = 0$$

$$\Rightarrow 4a = 16 \Rightarrow a = 4$$

50. Sol. (a)

Given,

$$x^4 - 5x^2 - 1 = 0 \Rightarrow x^2 - \frac{1}{x^2} = 5$$

$$\left(x^6 - 3x^2 + \frac{3}{x^2} - \frac{1}{x^6} + 1\right)$$

$$\Rightarrow \left\{x^6 - \frac{1}{x^6} - 3\left(x^2 - \frac{1}{x^2}\right) + 1\right\}$$

$$\Rightarrow \left\{(x^2)^3 - \frac{1}{(x^2)^3} - 3\left(x^2 - \frac{1}{x^2}\right) + 1\right\}$$

$$= 5^3 + 3(5) - 3(5) + 1 = 126$$

$$\left(\text{If } x - \frac{1}{x} = k, \text{ then } x^3 - \frac{1}{x^3} = k^3 + 3k\right)$$

51. Sol. (d)

$$f(x) = ax^3 + bx^2 + cx + d \dots (i)$$

 α, β, γ are the zeroes of $f(x)$

Then,

$$\alpha + \beta + \gamma = \frac{-b}{a} \dots (ii)$$

$$\alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a} \dots (iii)$$

Squaring (ii), we get

$$\alpha^2 + \beta^2 + \gamma^2 + 2(\alpha\beta + \beta\gamma + \gamma\alpha) = \frac{b^2}{a^2}$$

$$\alpha^2 + \beta^2 + \gamma^2 + \frac{2c}{a} = \frac{b^2}{a^2}$$

From (iii)

$$\alpha^2 + \beta^2 + \gamma^2 = \frac{b^2}{a^2} - \frac{2c}{a}$$

$$\frac{b^2 - 2ac}{a^2}$$

Type-6 (C & D)

1. What is the value of $\frac{x}{y}$, if $\frac{x-5y}{x+5y} = \frac{7}{8}$?

Graduate Level 2023 (Shift - 4)

- (a) $\frac{35}{33}$ (b) $\frac{72}{5}$
 (c) $\frac{75}{1}$ (d) $\frac{1}{75}$
2. If $\frac{3x+2y}{3x-2y} = \frac{4}{3}$, then find out the value of $\frac{x}{y}$.
 (a) $\frac{7}{3}$ (b) $\frac{14}{3}$
 (c) $\frac{3}{14}$ (d) None
3. If $\frac{x}{y} = \frac{a+2}{a-2}$, then find $\frac{x^2-y^2}{x^2+y^2}$.
 (a) $\frac{2a}{a^2-4}$ (b) $\frac{a^2-4}{2}$
 (c) $\frac{4a}{a^2+4}$ (d) $\frac{a^2-4}{4a}$
4. $\alpha = \frac{\sqrt{x+2}+\sqrt{x-2}}{\sqrt{x+2}-\sqrt{x-2}}$ then find out the value $\alpha^2 - \alpha$.
 (a) 1 (b) 2
 (c) -2 (d) -1
5. If $\frac{x^3+3x}{3x^2+1} = \frac{189}{61}$, then find out the value of x ?
 (a) 3 (b) 5
 (c) 4 (d) 9
6. If $a + b = 1, c + d = 1$ & $a - b = \frac{d}{c}$, then $c^2 - d^2 =$?
 (a) 2 (b) $\frac{a}{b}$
 (c) $\frac{b}{a}$ (d) a
7. If $(a + b) : \sqrt{ab} = 4 : 1, a > b$, then $a : b =$?
 (a) $\frac{1+\sqrt{2}}{1-\sqrt{2}}$ (b) $\frac{3}{2}$
 (c) $\frac{2+\sqrt{3}}{2-\sqrt{3}}$ (d) $\frac{3+\sqrt{4}}{3-\sqrt{4}}$
8. If $(3p + 5q) : (3p - 5q) = 121 : 41$, then find the value of $\left(\frac{\sqrt[3]{p} + \sqrt[3]{q}}{\sqrt[3]{p} - \sqrt[3]{q}}\right)^2$

- (a) 14 (b) 25
 (c) 16 (d) 36

9. If $x = \frac{4ab}{a+b}, a \neq b$, the value of $\frac{x+2a}{x-2a} + \frac{x+2b}{x-2b}$ is:-

- (a) a (b) b
 (c) 2ab (d) 2

10. If x and y are two numbers having opposite signs, and $x^2 : y^2 = 16 : 81$, then the value of $\frac{3x+4y}{2x-3y}$?

SSC MTS 5/10/2021 (Morning)

- (a) $\frac{12}{25}$ (b) $-\frac{27}{40}$
 (c) $-\frac{24}{35}$ (d) $\frac{48}{35}$

11. If $x = \frac{\sqrt{a+2b}+\sqrt{a-2b}}{\sqrt{a+2b}-\sqrt{a-2b}}$, then the value of $bx^2 - ax + b$ will equal to

- (a) a (b) 2b
 (c) b (d) 0

12. If $\frac{x}{y} = \frac{a+2}{a-2}$ then the value of $\frac{x^2-y^2}{x^2+y^2}$

- (a) $\frac{2a}{a^2+2}$ (b) $\frac{4a}{a^2+4}$
 (c) $\frac{2a}{a^2+4}$ (d) $\frac{4a}{a^2+2}$

13. If $x = \frac{2\sqrt{35}}{\sqrt{7}+\sqrt{5}}$ then the value of $\frac{x+\sqrt{7}}{x-\sqrt{7}} + \frac{x+\sqrt{5}}{x-\sqrt{5}}$ is

- (a) 0 (b) 1
 (c) 2 (d) 4

14. If $x = \frac{4\sqrt{15}}{\sqrt{5}+\sqrt{3}}$ the value of $\frac{x+\sqrt{20}}{x-\sqrt{20}} + \frac{x+\sqrt{12}}{x-\sqrt{12}}$ is:

- (a) 1 (b) 2
 (c) $\sqrt{3}$ (d) $\sqrt{5}$

15. If $\frac{x+1}{x-1} = \frac{a}{b}$ and $\frac{1-y}{1+y} = \frac{b}{a}$, then the value of $\frac{x-y}{1+xy}$ is:

- (a) $\frac{a^2-b^2}{ab}$ (b) $\frac{a^2+b^2}{2ab}$
 (c) $\frac{a^2-b^2}{2ab}$ (d) $\frac{2ab}{a^2-b^2}$

16. If $\frac{\sqrt{x+4}+\sqrt{x-4}}{\sqrt{x+4}-\sqrt{x-4}} = 2$, then the value of x is

- (a) 2 (b) 4
(c) 5 (d) 6

17. If $x = \frac{4ab}{a+b}$, $a \neq b$, then the value of $\frac{x+2a}{x-2a} + \frac{x+2b}{x-2b}$ is

- (a) a (b) b
(c) 1 (d) 2

Type-6 (C & D) ANSWER KEY													
1	C	2	B	3	C	4	D	5	D	6	C	7	C
8	B	9	D	10	C	11	D	12	B	13	C	14	B
15	D	16	A	17	D								

Type-6 (C & D) Solution

1. Sol. (c)

$$\frac{x-5y}{x+5y} = \frac{7}{8} \Rightarrow \frac{x+5y}{x-5y} = \frac{8}{7} \Rightarrow \frac{x}{5y} = \frac{8+7}{8-7} = \frac{15}{1}$$

(using componendo dividendo)

$$\Rightarrow \frac{x}{y} = \frac{15 \times 5}{1} = \frac{75}{1}$$

2. Sol. (b)

$$\frac{3x+2y}{3x-2y} = \frac{4}{3}$$

(By applying C & D Rule)

$$\frac{2(3x)}{2(2y)} = \frac{4+3}{4-3}$$

$$\frac{3x}{2y} = \frac{7}{1}$$

$$\frac{x}{y} = \frac{14}{3}$$

3. Sol. (c)

$$\frac{x}{y} = \frac{a+2}{a-2}$$

On squaring both sides

$$\Rightarrow \frac{x^2}{y^2} = \frac{(a+2)^2}{(a-2)^2}$$

$$\Rightarrow \frac{x^2-y^2}{x^2+y^2} = \frac{(a+2)^2-(a-2)^2}{(a+2)^2+(a-2)^2}$$

(by componendo and dividendo)

$$\Rightarrow \frac{x^2-y^2}{x^2+y^2} = \frac{8a}{2a^2+8} = \frac{4a}{a^2+4}$$

4. Sol. (d)

$$\alpha = \frac{\sqrt{x+2}+\sqrt{x-2}}{\sqrt{x+2}-\sqrt{x-2}}$$

By applying C & D Rule

$$\frac{\alpha+1}{\alpha-1} = \frac{\sqrt{x+2}}{\sqrt{x-2}}$$

$$\frac{(\alpha^2+1)+2\alpha}{(\alpha^2+1)-2\alpha} = \frac{x+2}{x-1}$$

$$\frac{\alpha^2+1}{2\alpha} = \frac{x}{2}$$

$$\alpha^2 - \alpha x = -1$$

5. Sol. (d)

$$\frac{x^3+3x}{3x^2+1} = \frac{189}{61}$$

By applying C & D Rule

$$\frac{x^3+3x+3x^2+1}{x^3+3x-(3x^2+1)^2} = \frac{189+61}{188-61}$$

$$\frac{(x+1)^3}{(x-1)^3} = \frac{5^3}{4^3}$$

$$\frac{x+1}{x-1} = \frac{5}{4}$$

$$\frac{x}{1} = \frac{9}{1} \Rightarrow x = 9$$

6. Sol. (c)

$$a+b = 1 \dots (i)$$

$$a-b = \frac{d}{c} \dots (ii)$$

(i) $\div$ (ii)

$$\frac{a+b}{a-b} = \frac{c}{d}$$

$$\frac{a}{b} = \frac{c+d}{c-d}$$

$$c-d = \frac{b}{a} \dots \text{(iii)}$$

$$c^2 - d^2 = (c+d)(c-d)$$

$$= 1(c-d)$$

$$= \frac{b}{a} \text{ from (iii)}$$

7. Sol. (c)

$$\frac{a+b}{\sqrt{ab}} = \frac{4}{1}$$

(multiply by $\frac{1}{2}$ both side)

$$\frac{a+b}{2\sqrt{ab}} = \frac{4}{2}$$

$$\frac{a+b+2\sqrt{ab}}{a+b-2\sqrt{ab}} = \frac{4+2}{4-2}$$

$$\frac{(\sqrt{a}+\sqrt{b})^2}{(\sqrt{a}-\sqrt{b})^2} = \frac{6}{2}$$

$$\frac{(\sqrt{a}+\sqrt{b})^2}{(\sqrt{a}-\sqrt{b})^2} = \frac{(\sqrt{3})^2}{1}$$

$$\frac{\sqrt{a}+\sqrt{b}}{\sqrt{a}-\sqrt{b}} = \frac{\sqrt{3}}{1} \text{ (Again apply C & D Rule)}$$

$$\frac{\sqrt{a}}{\sqrt{b}} = \frac{\sqrt{3}+1}{\sqrt{3}-1} \text{ (Squaring both Side)}$$

$$\frac{a}{b} = \frac{2+\sqrt{3}}{2-\sqrt{3}}$$

8. Sol. (b)

$$\frac{3P+5Q}{3P-5Q} = \frac{121}{41}$$

$$\frac{3P}{5Q} = \frac{121+41}{121-41} \text{ (by componendo and dividendo)}$$

$$\Rightarrow \frac{3P}{5Q} = \frac{162}{80} = \frac{81}{40}$$

$$\Rightarrow \frac{P}{Q} = \frac{27}{8}$$

$$\Rightarrow \left(\frac{3\sqrt{p}+3\sqrt{q}}{3\sqrt{p}-3\sqrt{q}} \right)^2 = \left(\frac{3\sqrt{\frac{p}{q}}+1}{3\sqrt{\frac{p}{q}}-1} \right)^2 = \left(\frac{\frac{3}{2}+1}{\frac{3}{2}-1} \right)^2 = \left(\frac{\frac{5}{2}}{\frac{1}{2}} \right)^2 = 25$$

(by componendo and dividendo)

9. Sol. (d)

$$x = \frac{4ab}{a+b}$$

$$\Rightarrow \frac{x}{2a} = \frac{2b}{a+b}$$

$$\frac{x+2a}{x-2a} = \frac{2b+a+b}{2b-a-b} = \frac{3b+a}{b-a}$$

(By C - D rule)

 $\Rightarrow$ again

$$\frac{x}{2b} = \frac{2a}{a+b}$$

$$\frac{x+2b}{x-2b} = \frac{2a+a+b}{2a-a-b} = \frac{3a+b}{a-b}$$

$$\Rightarrow \frac{x+2a}{x-2a} + \frac{x+2b}{x-2b} = \frac{3b+a}{b-a} + \frac{3a+b}{a-b}$$

$$\Rightarrow \frac{3b+a-3a-b}{b-a}$$

$$\Rightarrow \frac{2b-2a}{b-a} = \frac{2(b-a)}{(b-a)} = 2$$

10. Sol. (c)

According to the question, let x be negative and y be positive.

$$\text{So, } x:y = -4:9 \Rightarrow \frac{3x+4y}{2x-3y}$$

On dividing above by y in both numerator and denominator, we get

$$\begin{aligned} &= \frac{3\left(\frac{x}{y}\right)+4}{2\left(\frac{x}{y}\right)-3} = \frac{3\left(\frac{-4}{9}\right)+4}{2\left(\frac{-4}{9}\right)-3} \\ &= \frac{-12+36}{-8-27} = \frac{24}{-35} = -\frac{24}{35} \end{aligned}$$

11. Sol. (d)

$$\frac{\sqrt{a+2b}+\sqrt{a-2b}}{\sqrt{a+2b}-\sqrt{a-2b}} = x$$

$$\Rightarrow \frac{\sqrt{a+2b}}{\sqrt{a-2b}} = \frac{x+1}{x-1}$$

(by componendo and dividendo)

On squaring both sides of the eqn

$$\Rightarrow \frac{a+2b}{a-2b} = \frac{(x+1)^2}{(x-1)^2}$$

$$\Rightarrow \frac{a}{2b} = \frac{(x+1)^2+(x-1)^2}{(x+1)^2-(x-1)^2}$$

(by componendo and dividendo)

$$\Rightarrow \frac{a}{2b} = \frac{2(x^2+1)}{4x}$$

$$\Rightarrow ax = bx^2 + b \Rightarrow bx^2 - ax + b = 0$$

12. Sol. (b)

$$\frac{x}{y} = \frac{a+2}{a-2}$$

$$\frac{x^2}{y^2} = \frac{(a+2)^2}{(a-2)^2}$$

Applying Componendo & Dividendo

$$\frac{x^2-y^2}{x^2+y^2} = \frac{(a+2)^2-(a-2)^2}{(a+2)^2+(a-2)^2} = \frac{8a}{2a^2+8} = \frac{4a}{a^2+4}$$

13. Sol. (c)

$$x = \frac{2\sqrt{35}}{\sqrt{7}+\sqrt{5}} = \frac{2\sqrt{7}\times\sqrt{5}}{\sqrt{7}+\sqrt{5}}$$

$$\Rightarrow \frac{x}{\sqrt{7}} = \frac{2\sqrt{5}}{\sqrt{7}+\sqrt{5}}$$

$$\Rightarrow \frac{x+\sqrt{7}}{x-\sqrt{7}} = \frac{2\sqrt{5}+\sqrt{7}+\sqrt{5}}{2\sqrt{5}-\sqrt{7}-\sqrt{5}}$$

$$(\text{by componendo and dividendo}) \Rightarrow \frac{x+\sqrt{7}}{x-\sqrt{7}} = \frac{3\sqrt{5}+\sqrt{7}}{\sqrt{5}-\sqrt{7}}$$

Similarly

$$\Rightarrow \frac{x+\sqrt{5}}{x-\sqrt{5}} = \frac{3\sqrt{7}+\sqrt{5}}{\sqrt{7}-\sqrt{5}}$$

$$\begin{aligned} \frac{x+\sqrt{7}}{x-\sqrt{7}} + \frac{x+\sqrt{5}}{x-\sqrt{5}} &= \frac{3\sqrt{5}+\sqrt{7}}{\sqrt{5}-\sqrt{7}} - \frac{3\sqrt{7}+\sqrt{5}}{\sqrt{5}-\sqrt{7}} \\ &= \frac{3\sqrt{5}+\sqrt{7}-3\sqrt{7}-\sqrt{5}}{\sqrt{5}-\sqrt{7}} = \frac{2\sqrt{5}-2\sqrt{7}}{\sqrt{5}-\sqrt{7}} = 2 \end{aligned}$$

14. Sol. (b)

$$x = \frac{4\sqrt{15}}{\sqrt{5}+\sqrt{3}} \Rightarrow \frac{x+\sqrt{20}}{x-\sqrt{20}} + \frac{x+\sqrt{12}}{x-\sqrt{12}} = ?$$

$$\therefore x = \frac{4\times\sqrt{5}\times\sqrt{3}}{\sqrt{5}+\sqrt{3}} = \frac{2\times\sqrt{5}\times\sqrt{12}}{\sqrt{5}+\sqrt{3}}$$

$$\frac{2\times\sqrt{20}\times\sqrt{3}}{\sqrt{5}+\sqrt{3}}$$

$$\frac{x}{\sqrt{12}} = \frac{2\sqrt{5}}{\sqrt{5}+\sqrt{3}}$$

by C - D rule

$$\frac{x+\sqrt{12}}{x-\sqrt{12}} = \frac{2\sqrt{5}+\sqrt{5}+\sqrt{3}}{2\sqrt{5}-\sqrt{5}-\sqrt{3}}$$

$$= \frac{3\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}}$$

$$\frac{x}{\sqrt{20}} = \frac{2\sqrt{3}}{\sqrt{5}+\sqrt{3}}$$

$$\frac{x+\sqrt{20}}{x-\sqrt{20}} = \frac{2\sqrt{3}+\sqrt{5}+\sqrt{3}}{2\sqrt{3}-\sqrt{5}-\sqrt{3}}$$

$$= \frac{3\sqrt{3}+\sqrt{5}}{\sqrt{3}-\sqrt{5}}$$

$$\therefore \frac{x+\sqrt{12}}{x-\sqrt{12}} + \frac{x+\sqrt{20}}{x-\sqrt{20}}$$

$$= \frac{3\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}} + \frac{3\sqrt{3}+\sqrt{5}}{\sqrt{3}-\sqrt{5}}$$

$$= \frac{3\sqrt{5}+\sqrt{3}-3\sqrt{3}-\sqrt{5}}{\sqrt{5}-\sqrt{3}} = \frac{2\sqrt{5}-2\sqrt{3}}{\sqrt{5}-\sqrt{3}} = 2$$

15. Sol. (d)

Given:

$$\Rightarrow \frac{x+1}{x-1} = \frac{a}{b} \Rightarrow \frac{x}{1} = \frac{a+b}{a-b}$$

(using componendo & dividendo)

$$\Rightarrow x = \frac{a+b}{a-b} \quad \dots (i)$$

Again,

$$\Rightarrow \frac{1-y}{1+y} = \frac{b}{a}$$

$$\Rightarrow \frac{1+y}{1-y} = \frac{a}{b}$$

$$\Rightarrow \frac{1}{y} = \frac{a+b}{a-b}$$

$$\Rightarrow y = \frac{a-b}{a+b} \quad \dots (ii)$$

$$\Rightarrow \text{From question, } \frac{x-y}{1+xy}$$

$$\frac{\frac{a+b}{a-b} - \frac{a-b}{a+b}}{1 + \left(\frac{a+b}{a-b}\right)\left(\frac{a-b}{a+b}\right)}$$

$$\Rightarrow \frac{(a+b)^2 - (a-b)^2}{(a^2 - b^2)(1+1)}$$

$$\Rightarrow \frac{4ab}{2(a^2 - b^2)} \Rightarrow \frac{2ab}{a^2 - b^2}$$

16. Sol. (a)

$$\text{Let } x+4 = a^2 \text{ and } x-4 = b^2$$

Then,

$$\frac{\sqrt{x+4} + \sqrt{x-4}}{\sqrt{x+4} - \sqrt{x-4}} = \frac{a+b}{a-b} = \frac{2}{1}$$

$$\frac{a}{b} = \frac{2+1}{2-1} = \frac{3}{1} \quad (\text{by componendo and dividendo})$$

$$\Rightarrow \frac{a^2}{b^2} = \frac{9}{1} = \frac{x+4}{x-4}$$

$$\Rightarrow \frac{x}{4} = \frac{9+1}{9-1} \quad (\text{by componendo and dividendo})$$

$$\Rightarrow \frac{x}{4} = \frac{10}{8} \Rightarrow x = 5$$

Alternate

Go through options

For $x = 5$

$$\frac{\sqrt{x+4} + \sqrt{x-4}}{\sqrt{x+4} - \sqrt{x-4}} = \frac{\sqrt{9} + \sqrt{1}}{\sqrt{9} - \sqrt{1}} = \frac{3+1}{3-1} = 2$$

17. Sol. (d)

$$x = \frac{4ab}{a+b} \Rightarrow \frac{x}{2a} = \frac{2b}{a+b}$$

$$\Rightarrow \frac{x+2a}{x-2a} = \frac{2b+a+b}{2b-a-b} \quad (\text{by componendo dividendo})$$

$$\Rightarrow \frac{x+2a}{x-2a} = \frac{3b+a}{b-a}$$

Similarly

$$\Rightarrow \frac{x+2b}{x-2b} = \frac{3a+b}{a-b}$$

$$\frac{x+2a}{x-2a} + \frac{x+2b}{x-2b} = \frac{3b+a}{b-a} + \frac{3a+b}{a-b}$$

$$= \frac{3b+a-3a-b}{b-a} = \frac{2(b-a)}{b-a} = 2$$

Type-7 (Putting)

1. If a, b and c are positive integers such that $a^2 + b^2 = 82$ and $b^2 + c^2 = 65$, then the value of $2a + 7b - 3c$ is:

SSC CPO 2023 (Morning)

- (a) 2 (b) 5
(c) 49 (d) 1

2. If $(x + 6y) = 8$, and $xy = 2$, where $x > 0$, what is the value of $(x^3 + 216y^3)$?

SSC CGL 11/04/2022 (Morning)

- (a) 288 (b) 224
(c) 368 (d) 476

3. If $x^2 + y^2 + z^2 = xy + yz + zx$ and $x = 1$, then find the value of $\frac{10x^4 + 5y^4 + 7z^4}{13x^2y^2 + 6y^2z^2 + 3z^2x^2}$

SSC CGL 05/12/2022 (4th Shift)

- (a) 2 (b) 0
(c) -1 (d) 1

4. The value of $x^2 + y^2$, when $x = 1, y = 2$ is

SSC CHSL 27/05/2022 (Morning)

- (a) 4 (b) 5
(c) 2 (d) 1

5. $P = \frac{x^4 - 8x}{x^3 - x^2 - 2x}, Q = \frac{x^2 + 2x + 1}{x^2 - 4x - 5}$ and $R = \frac{2x^2 + 4x + 8}{x - 5}$ then $(P \times Q) \div R$ is equal to

- (a) 1 (b) $\frac{1}{3}$
(c) $\frac{1}{4}$ (d) $\frac{1}{2}$

6. Find the value of $a^2 + b^2 + c^2 - 2ab + 2ac - 2bc$, if $a = x + y, b = x - y$ and $c = 2x - 1$.

Graduate Level 04/08/2022 (Shift - 4)

- (a) $(x - y - 1)^2$ (b) 0
(c) $(2x + 2y - 1)^2$ (d) $(2x - 2y - 1)^2$

7. If $x + \frac{1}{x} = 2$ and x is real, then the value of $x^{17} + \frac{1}{x^{19}}$ is-

- (a) 1 (b) 0
(c) 2 (d) -2

8. $x^2 + 4y^2 = 53$ and $x - 2y = 5$, then what is the value of $x^3 - 8y^3$?

- (a) 335 (b) 345
(c) 343 (d) 338

9. If $a + b + c + d = 1$, then the maximum value of $(1 + a)(1 + b)(1 + c)(1 + d)$ is:-

- (a) 1 (b) $\left(\frac{1}{2}\right)^3$
(c) $\left(\frac{3}{4}\right)^3$ (d) $\left(\frac{5}{4}\right)^4$

10. If $abc = 5$, what is the value of $\left(\frac{1}{1+a+b^{-1}} + \frac{1}{1+b+5c^{-1}} + \dots + \frac{1}{1+\frac{c}{5}+\frac{1}{a}}\right)$?

SSC CGL 08/12/2022 (3rd Shift)

- (a) 5 (b) 1
(c) $\frac{1}{5}$ (d) $(a + b + c)$

11. $\left(1 + \frac{1}{x+1}\right)\left(1 + \frac{1}{x+2}\right)\left(1 + \frac{1}{x+3}\right)\left(1 + \frac{1}{x+4}\right)$ is

- (a) $\frac{x+1}{x+4}$ (b) $\frac{x+4}{x+1}$
(c) $\frac{x+1}{x+5}$ (d) $\frac{x+5}{x+1}$

12. If $xy = -6$ and $x^3 + y^3 = 19$ (x and y are integers), then what is the value of $\frac{1}{x^{-1}} + \frac{1}{y^{-1}}$?

SSC CGL Tier II 08/08/2022

- (a) -1 (b) -2
(c) 1 (d) 2

13. If $a + b + c = 6, a^2 + b^2 + c^2 = 14$ and $a^3 + b^3 + c^3 = 36$, then the value of abc is:-

- (a) 3 (b) 6
(c) 9 (d) 12

14. $\left(\frac{x}{y} + 1\right) = 4$, then find $\left(\frac{x^2+y^2}{y^2}\right)$?

- (a) 9 (b) 5
(c) 10 (d) 8

15. $pqr = 1$, then the value of $\frac{1}{1+p+q^{-1}} + \frac{1}{1+q+r^{-1}} + \frac{1}{1+r+p^{-1}}$ will be

- (a) 0 (b) 1
(c) 2 (d) 3

16. If $x + y + z = 2$, $xy + yz + zx = -11$ and $xyz = -12$, then what is the value of $\sqrt{x^3 + y^3 + z^3 - 2}$ = ?

- (a) 9 (b) 6
(c) 12 (d) 8

17. If $\frac{x-a^2}{b+c} + \frac{x-b^2}{c+a} + \frac{x-c^2}{a+b} = 4(a+b+c)$, then x is equal to

- (a) $(a+b+c)^2$
(b) $ab+bc+ca$
(c) $a^2+b^2+c^2$
(d) $a^2+b^2+c^2-ab-bc-ca$

18. if $x = a + \frac{1}{a}$ and $y = a - \frac{1}{a}$, then $\sqrt{x^4 + y^4 - 2x^2y^2}$ is equal to:-

- (a) $16a^2$ (b) 8
(c) $8/a^2$ (d) 4

19. If $x + y + z = 0$, then the value of $\frac{1}{x^2+y^2-z^2} + \frac{1}{y^2+z^2-x^2} + \frac{1}{z^2+x^2-y^2}$ is

- (a) 0 (b) 1
(c) 2 (d) 3

20. If $a^3 + b^3 = 218$ and $a + b = 2$, then the value of $\sqrt{1-ab}$ is:

SSC CGL 19/4/2022 (Morning)

- (a) 5 (b) 3
(c) 4 (d) 6

21. If $r + \frac{64}{r} = 16$, then the value of $r^4 + \frac{1}{r^3}$ is

SSC CHSL 25/05/2022 (Evening)

- (a) $4096\frac{1}{512}$ (b) 512
(c) $512\frac{1}{4096}$ (d) 4096

22. If $x = 2 - p$, then $x^3 + 6 \times p + p^3$ is equal to -

- (a) 12 (b) 6
(c) 8 (d) 4

23. If $x + y = 13$, then $(x-8)^3 + (y-5)^3$ is:

SSC CHSL 07/06/2022 (Morning)

- (a) 2197 (b) 0
(c) 169 (d) 13

24. If $x + y = 14$, then the value of $x^3 + y^3 + 42xy$ is:

SSC CHSL 31/05/2022 (Morning)

- (a) 2744 (b) 2644
(c) 2742 (d) 2714

25. If $a + b + c = 0$, then what is the value of $\frac{a^2+b^2+c^2}{(a-b)^2+(b-c)^2+(c-a)^2}$?

- (a) 0 (b) 1
(c) $\frac{1}{2}$ (d) $\frac{1}{3}$

26. If $2z = x + y$, then the value of $\frac{x}{x-z} + \frac{y}{y-z}$

SSC CHSL 09/06/2022 (Morning)

- (a) 0 (b) 1
(c) 2 (d) 5

27. If $a + b - c = 7$, and $ab - bc - ca = 21$, then $a^3 + b^3 + c^3 + 3abc$

- (a) 124 (b) 117
(c) -98 (d) 98

28. If $\frac{a}{3} = \frac{b}{4} = \frac{c}{7}$ then $\frac{a+b+c}{c}$ is equal to:-

- (a) 0 (b) 1
(c) 2 (d) 3

29. If $k + \frac{1}{k} = 2$, find the value of $8k \times k \times k$

SSC CHSL 09/06/2022 (Afternoon)

- (a) 8 (b) 1
(c) 4 (d) 2

30. if $a + b + c = 0$, then $\frac{a^2}{2a^2+bc} + \frac{b^2}{2b^2+ca} + \frac{c^2}{2c^2+ab} = ?$

- (a) 0 (b) 1
(c) 3 (d) 2

31. If $a + b + c = 4$, $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 3$, then $\frac{a}{b} + \frac{b}{a} + \frac{c}{a} + \frac{a}{c} + \frac{b}{c} + \frac{c}{b} = ?$

- (a) 6 (b) 7
(c) 8 (d) 9

32. If $x^2 = y + z$, $y^2 = z + x$, $z^2 = x + y$, then the value of: $\frac{1}{x+1} + \frac{1}{y+1} + \frac{1}{z+1}$

- (a) -1 (b) 1
(c) 2 (d) 4

33. If $x - y = 11$ and $\frac{1}{x} - \frac{1}{y} = \frac{11}{24}$, then what is the value of $x^3 - y^3 + x^2y^2$?

SSC CGL 13/8/2021 (Afternoon)

- (a) 1331 (b) 1115
(c) 1105 (d) 1307

34. If $x + y + z = 6$, then the value of $(x-1)^3 + (y-2)^3 + (z-3)^3$ is:-

- (a) $3(x-1)(y+2)(z-3)$
(b) $3(x+1)(y-2)(z-3)$
(c) $3(x-1)(y-2)(z+3)$
(d) $3(x-1)(y-2)(z-3)$

35. If $ab + bc + ca = 0$, then what is the value of $\frac{a^2}{a^2-bc} + \frac{b^2}{b^2-ca} + \frac{c^2}{c^2-ab}$?

- (a) 0 (b) 1
(c) 2 (d) 3

36. If $a + b + c + d = 4$, then find the value of

$$\frac{1}{(1-a)(1-b)(1-c)} + \frac{1}{(1-b)(1-c)(1-d)} + \frac{1}{(1-c)(1-d)(1-a)} + \frac{1}{(1-d)(1-a)(1-b)}$$

- (a) 0 (b) 3
(c) 2 (d) 4

37. If $96 - 64a^3 + \frac{8}{a^6} - \frac{48}{a^3} - t^3 = 0$ then what is $a^2t + 4a^3$ equal to?

[CDS - 2021-II]

- (a) 0 (b) 1
(c) 2 (d) 3

38. If $x + \frac{1}{x} = \frac{17}{4}$, $x > 1$, then what is the value of $x - \frac{1}{x}$?

SSC CGL 23/8/2021 (Morning)

- (a) $\frac{9}{4}$ (b) $\frac{3}{2}$
(c) $\frac{8}{3}$ (d) $\frac{15}{4}$

39. Consider the following inequalities:

[CDS - 2021-II]

- $\frac{a^2-b^2}{a^2+b^2} > \frac{a-b}{a+b}$ where $a > b > 0$
- $\frac{a^3+b^3}{a^2+b^2} > \frac{a^2+b^2}{a+b}$ only when $a > b > 0$

Which of the above is/are correct?

- (a) 1 only (b) 2 only
(c) Both I and 2 (d) Neither I nor 2

40. If $a + b + c = 0$, then what is the value of $\frac{(b+c)^2}{bc} + \frac{(c+a)^2}{ca} + \frac{(a+b)^2}{ab}$

SSC CGL 18/08/2021 (Evening)

- (a) 1 (b) -3
(c) -1 (d) 3

41. If $x = (a/b) + (b/a)$, $y = (b/c) + (c/b)$ and $z = (c/a) + (a/c)$, then what is the value of $xyz - x^2 - y^2 - z^2$?

- (a) -4 (b) 2
(c) -1 (d) -6

42. If $x^{y+z} = 1$, $y^{x+z} = 1024$ and $z^{x+y} = 729$ (x, y and z are natural numbers), then what is the value of $(Z + 1)^{y+x+1}$

(a) 6561 (b) 10000
(c) 4096 (d) 14641

43. $a^2 + b^2 = 25$, $x^2 + y^2 = 17$ and $ax + by = 8$ then find the value of $(ay - bx)$

SSC CHSL 13/4/2021 (Afternoon)

(a) 33 (b) 25
(c) 21 (d) 19

44. If $x + y = 2a$, then the value of $\frac{a}{x-a} + \frac{a}{y-a}$ is

(a) 0 (b) -1
(c) 1 (d) 2

45. If $a + b + c = 0$, then find the value of $N = \frac{(a-b)^2 + (b-c)^2 + (c-a)^2}{(a+b)^2 + (b+c)^2 + (c+a)^2}$

(a) 0 (b) 1
(c) 2 (d) 3

46. If $x^3 + y^3 + z^3 = 3(1 + xyz)$, $P = y + z - x$, $Q = z + x - y$, and $R = x + y - z$, then what is the value of $P^3 + Q^3 + R^3 - 3PQR$?

(a) 9 (b) 8
(c) 12 (d) 6

47. If $4x^4 = 5x^2 - 1$, $x > \frac{1}{\sqrt{2}}$ then what is the value of $(2x^2 - x - 1)$?

SSC CGL 17/8/2021 (Evening)

(a) 0 (b) 1
(c) -2 (d) 2

48. If $\frac{x}{a} + \frac{y}{b} = a + b$ and $\frac{x}{a^2} + \frac{y}{b^2} = 2$, then what is $\frac{x}{a^2} - \frac{y}{b^2}$ equal to?

[CDS - 2021-1]

(a) -2 (b) -1
(c) 0 (d) 1

49. If $a + b = 1$, find the value $a^3 + b^3 - ab - (a^2 - b^2)^2$

(a) 0 (b) 1

(c) -1 (d) 2

50. If $x + \frac{1}{x} = 2$ then the value of $\left(x^2 + \frac{1}{x^2}\right)\left(x^3 + \frac{1}{x^3}\right)$ is:-

(a) 20 (b) 4
(c) 8 (d) 16

51. If $\sqrt{x^2 + y^2 + xy} - \sqrt{x^2 + y^2 - xy} = \sqrt{2}$, then $(2 - x^2)(2 - y^2) = ?$

(a) 4 (b) 3
(c) 5 (d) 6

52. If $a + b + c = 0$, then the value of $2b^2c^2 + 2c^2a^2 + 2a^2b^2 - a^4 - b^4 - c^4$ is

(a) 0 (b) 1
(c) 2 (d) 3

53. If $x = \sqrt[3]{a + \sqrt{a^2 + b}} + \sqrt[3]{a - \sqrt{a^2 + b}}$, then $x^3 + 3bx$

(a) 0 (b) a
(c) 2a (d) 1

54. If x and y are natural numbers such that $x + y = 2017$, then what is the value of $(-1)^x + (-1)^y$?

(a) 2 (b) -2
(c) 0 (d) 1

55. If $a^3 + b^3 = 9$ and $a + b = 3$, then the value of $\frac{1}{a} + \frac{1}{b}$ is

(a) $\frac{1}{2}$ (b) $\frac{3}{2}$
(c) $\frac{5}{2}$ (d) -1

56. If $a + \frac{1}{b} = b + \frac{1}{c} = c + \frac{1}{a}$ ($a \neq b \neq c$) then the value of abc is:-

(a) ± 1 (b) ± 2
(c) 0 (d) $\pm \frac{1}{2}$

57. If $x - y = 4$ and $x^3 - y^3 = 316$, $y > 0$ then the value of $x^4 - y^4$ is:

SSC CGL 20/8/2021 (Evening)

- (a) 2482 (b) 2320
(c) 2500 (d) 2401

58. If $x - y - z = 0$, then the value of $(x^2 + y^2 + z^2) \div (y^2 + zx)$ is:

SSC CHSL 12/04/2021 (Evening)

- (a) -1 (b) 2
(c) -2 (d) 1

59. If $\left(\frac{x}{y} + 1\right) = 4$, then what is the value of $\left(\frac{x^2 + y^2}{y^2}\right)$?

SSC CHSL 16/4/2021 (Morning)

- (a) 12 (b) 22
(c) 14 (d) 10

60. If $a + b = p, ab = q$ then $(a^4 + b^4)$ is equal to:

SSC CHSL 4/8/2021 (Morning)

- (a) $p^4 - 2p^2q^2 + q^2$ (b) $p^4 - 4p^2q^2 + 2q^2$
(c) $p^4 - 4p^2q + q^2$ (d) $p^4 - 4p^2q + 2q^2$

61. If $x + y + z = 13, x^2 + y^2 + z^2 = 91$ and $xz = y^2$, then the difference between z and x is:

SSC CHSL 5/8/2021 (Morning)

- (a) 3 (b) 8
(c) 5 (d) 9

62. If $a + b + c = 0$, then the value of $\left(\frac{a+b}{c} + \frac{b+c}{a} + \frac{c+a}{b}\right)\left(\frac{a}{b+c} + \frac{b}{c+a} + \frac{c}{a+b}\right) = ?$

- (a) 8 (b) -3
(c) 9 (d) 0

63. x, y are two positive numbers such that $x > y$. If $x^4 + y^4 = 706$ and $xy = 15$, then the value of $2x + 3y$ is:

SSC CHSL 11/8/2021 (Afternoon)

- (a) 19 (b) 20
(c) 18 (d) 15

64. If $a + b + c = 0$, then the value of $\frac{a^2 + b^2 + c^2}{a^2 - bc}$ is:-

- (a) 0 (b) 1

- (c) 2 (d) 3

65. If $4x^2 + y^2 = 40$ and $xy = 6, (x > 0, y > 0)$ then the value of $2x + y$ is:

SSC CHSL 20/10/2020 (evening)

- (a) 24 (b) 16
(c) 4 (d) 8

66. The expression $(a + b - c)^3 + (a - b + c)^3 - 8a^3$ is equal to:

SSC CGL 03/03/2020 (Afternoon)

- (a) $6a(a - b + c)(c - a - b)$
(b) $3a(a + b - c)(a - b + c)$
(c) $6a(a + b - c)(a - b + c)$
(d) $3a(a - b + c)(c - a - b)$

67. If $a + b = 8$ and $a + a^2b + b + ab^2 = 128$, then the positive value of $a^3 + b^3$ is:

SSC CHSL 13/10/2020 (afternoon)

- (a) 96 (b) 224
(c) 344 (d) 152

68. If $a + b = 10$ and $\frac{3}{7}$ of $ab = 9$, then the value of $a^3 + b^3$ is:

SSC CHSL 13/10/2020 (evening)

- (a) 350 (b) 270
(c) 370 (d) 360

69. If $x^4 + 2x^3 + ax^2 + bx + 9$ is a perfect square, where ' a ' and ' b ' are positive real number, then find a, b .

- (a) $a = 5, b = 6$ (b) $a = 6, b = 7$
(c) $a = 7, b = 6$ (d) $a = 7, b = 8$

70. If ' a ' is a natural number, then $(7a^2 + 7a)$ is always divisible by:

SSC CHSL 16/10/2020 (morning shift)

- (a) 7 and 14 both (b) 7 only
(c) 14 only (d) 21 only

71. If $a + b + c + d = 2$, then the maximum value of $(1 + a)(1 + b)(1 + c)(1 + d)$ is

SSC CHSL 18/03/2020 (Afternoon)

- (a) $\frac{91}{9}$ (b) $\frac{81}{16}$
(c) $\frac{63}{22}$ (d) $\frac{54}{13}$

72. If $27(x + y)^3 - 8(x - y)^3 = (x + 5y)(Ax^2 + By^2 + Cxy)$, then what is the value of $(A + B - C)$?

SSC CGL Tier II (15/11/2020)

- (a) 13 (b) 16
(c) 18 (d) 11

73. If $a + b + c = 0$, then $\left(\frac{2a^2}{3bc} + \frac{2b^2}{3ca} + \frac{2c^2}{3ab}\right)$ is equal to:

SSC CHSL 26/10/2020 (evening)

- (a) 3 (b) 4
(c) 1 (d) 2

74. If $x - 2y = 3$ and $xy = 5$, find the value of $x^2 - 4y^2$.

SSC CHSL 12/10/2020 (morning)

- (a) 22 (b) 20
(c) 23 (d) 21

75. Solve the following $(a + b + c)(ab + bc + ca) - abc = ?$

SSC CPO 13/12/2019 (Evening)

- (a) $(a + b)(b + c)(c - a)$
(b) $(a - b)(b - c)(c - a)$
(c) $(a + b)(b - c)(c + a)$
(d) $(a + b)(b + c)(c + a)$

76. If $x + y + z = 0$, then the value of $(x^2 + y^2 + z^2) \div (z^2 - xy)$ is:

SSC CGL 10/06/2019 (Morning)

- (a) 1 (b) 2
(c) -2 (d) -1

77. If $x = a + \frac{1}{a}$ and $y = a - \frac{1}{a}$ then $\sqrt{x^4 + y^4 - 2x^2y^2}$ is equal to:

SSC CGL 6/06/2019 (Morning)

- (a) $16a^2$ (b) 8
(c) $\frac{8}{a^2}$ (d) 4

78. If $a + b + c = 6$ and $a^2 + b^2 + c^2 = 38$, then what is the value of $a(b^2 + c^2) + b(c^2 + a^2) + c(a^2 + b^2) + 3abc$?

SSC CPO 11/12/19 (Morning)

- (a) 3 (b) -3
(c) -6 (d) -6

79. $(4x^3y - 6x^2y^2 + 4xy^3 - y^4)$ can be expressed as:

SSC CPO 9/12/19 (Morning)

- (a) $(x - y)^4 - x^4$ (b) $(x + y)^4 - y^4$
(c) $(x + y)^4 - x^4$ (d) $x^4 - (x - y)^4$

80. If $x + y = 7$ and $xy = 10$, then the value of $\frac{1}{x^3} + \frac{1}{y^3}$ is:

SSC CHSL 1/07/2019 (Evening)

- (a) 0.543 (b) 0.131
(c) 0.133 (d) 0.453

81. If α and β are two real numbers such that $\alpha + \beta = -\frac{q}{p}$ and $\alpha\beta = \frac{r}{p}$, where $1 < p < q < r$, then which one of the following is the greatest?

[CDS - 2018-II]

- (a) $\frac{1}{\alpha + \beta}$ (b) $\frac{1}{\alpha} + \frac{1}{\beta}$
(c) $-\frac{1}{\alpha\beta}$ (d) $\frac{\alpha\beta}{\alpha + \beta}$

82. Which one of the following is a zero of the polynomial $3x^3 + 4x^2 - 7$?

[CDS - 2018-I]

- (a) 0 (b) 1
(c) 2 (d) -1

Type-7 (Putting) ANSWER KEY													
1	D	2	B	3	D	4	B	5	D	6	C	7	C
8	A	9	D	10	B	11	D	12	C	13	B	14	C
15	B	16	C	17	A	18	D	19	A	20	D	21	A
22	*	23	B	24	A	25	D	26	C	27	C	28	C
29	A	30	B	31	D	32	B	33	B	34	D	35	B
36	A	37	C	38	D	39	A	40	D	41	A	42	B
43	D	44	A	45	D	46	C	47	A	48	C	49	A
50	B	51	B	52	A	53	C	54	C	55	B	56	A
57	B	58	B	59	D	60	D	61	B	62	C	63	A
64	C	65	D	66	A	67	D	68	C	69	C	70	A
71	B	72	B	73	D	74	D	75	D	76	B	77	D
78	D	79	D	80	C	81	C	82	B				

Type-7 (Putting) Solution

1. **Sol. (d)**

Putting $b = 1$, we have ;

$$a^2 = 82 - 1 = 81$$

$$a = 9$$

$$\text{and } c^2 = 65 - 1 = 64$$

$$c = 8$$

$$\text{Now, } 2a + 7b - 3c = 2 \times 9 + 7 \times 1 - 3 \times 8$$

$$= 18 + 7 - 24 = 1$$

2. **Sol. (b)**

$$(x + 6y) = 8$$

On cubing, we get

$$x^3 + 216y^3 + 3(x)(6y)(x + 6y) = 512$$

$$x^3 + 216y^3 + 18xy(8) = 512$$

$$x^3 + 216y^3 + 18(2)(8) = 512$$

$$x^3 + 216y^3 = 512 - 288 = 224$$

Short trick:

$$\text{Put } x = 2, y = 1.$$

$$(x^3 + 216y^3) = 8 + 216 = 224$$

3. **Sol. (d) $x = 1$ (given)**

$$x^2 + y^2 + z^2 = xy + yz + zx$$

(given)

Put, $y = 1$ and $z = 1$. which satisfies the given condition.

$$\frac{10x^4 + 5y^4 + 7z^4}{13x^2y^2 + 6y^2z^2 + 3z^2x^2} = \frac{10+5+7}{13+6+3} = 1$$

4. **Sol.(b)**

Putting $x = 1$ and $y = 2$

$$x^2 + y^2 = 1^2 + 2^2 = 5$$

5. **Soln. (d)**

Put $x = 0$

$$P = \frac{x(x^3-8)}{x(x^2-x-2)} = \frac{x^3-8}{x^2-x-2}$$

put $x = 0$

$$P = \frac{-8}{-2} = 4, Q = -\frac{1}{5}, R = -\frac{8}{5}$$

$$P \times Q \times R^{-1} = 4 \times -\frac{1}{5} \times \frac{5}{8} = \frac{1}{2}$$

6. **Sol. (c)**

Putting $x = y = 1$, we get $a = 2, b = 0$ and $c = 1$

$$\text{So, } a^2 + b^2 + c^2 - 2ab + 2ac - 2bc = 2^2 + 0$$

$$+ 1^2 - 0 + 2 \times 2 \times 1 - 0 = 4 + 1 + 4 = 9$$

Now, on putting $x = y = 1$ in all the options given,

option (c) gets satisfied.

$$(2x + 2y - 1)^2 = (2 + 2 - 1)^2 = 3^2 = 9 \text{ (satisfied)}$$

7. **Sol. (a)**
 $x + \frac{1}{x} = 2$
 (assume $x = 1$, so, $1 + 1 = 2$)
 $\therefore x^{17} + \frac{1}{x^{19}} = (1)^{17} + \frac{1}{(1)^{19}}$
 $= 1 + 1 = 2$
8. **Sol. (a)**
 $x^2 + 4y^2 = 53 \dots (i)$
 $x - 2y = 5 \dots (ii)$
 By hit and trial method put $x = 7, y = 1$ (Both Eq. will satisfied)
 $x^3 - 8y^3 = 343 - 8$
 $= 335$
9. **Sol. (d)** $a + b + c + d = 1$
 $(1 + a)(1 + b)(1 + c)(1 + d)$
 $\Rightarrow$ For maximum value a, b, c, d
 $a = b = c = d = \frac{1}{4}$
 $= \left(1 + \frac{1}{4}\right)\left(1 + \frac{1}{4}\right)\left(1 + \frac{1}{4}\right)\left(1 + \frac{1}{4}\right) = \left(\frac{5}{4}\right)^4$
10. **Sol. (b)**
 $\frac{1}{1+a+\frac{1}{b}} + \frac{1}{1+\frac{c}{5}+\frac{1}{a}} + \frac{1}{1+b+\frac{5}{c}}$
 Putting $a = b = 1$ and $c = 5$ in the given expression
 $\frac{1}{1+1+1} + \frac{1}{1+1+\frac{5}{5}} + \frac{1}{1+\frac{5}{5}+1}$
 $= \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = \frac{3}{3} = 1$
11. **Sol. (d)**
 put $x = 0$
 $(1 + 1)\left(1 + \frac{1}{2}\right)\left(1 + \frac{1}{3}\right)\left(1 + \frac{1}{4}\right)$
 $= 2 \cdot \frac{3}{2} \cdot \frac{4}{3} \cdot \frac{5}{4} \Rightarrow 5$
 Now, by checking option $\frac{x+5}{x+1} \Rightarrow 5$ is satisfied
12. **Sol. (c)**
 Let $x = 3$ and $y = -2$
 Putting above values of x and y , we get $xy =$
 $(3)(-2) = -6 \dots (\text{satisfied})$
 $x^3 + y^3 = 3^3 + (-2)^3 = 27 - 8 = 19$ (satisfied)
 Hence, $x = 3$ and $y = 2$

$$\text{So, } \frac{1}{x-1} + \frac{1}{y-1} = x + y = 3 + (-2) = 3 - 2 = 1$$

13. **Sol. (b)**
 $a + b + c = 6$
 $= a^2 + b^2 + c^2 = 14$
 $a^3 + b^3 + c^3 = 36$
 Put values as
 $a = 1, b = 2, c = 3$
 $1 + 2 + 3 = 6$
 $1 + 4 + 9 = 14$
 $1 + 8 + 27 = 36$
 $abc = 1 \times 2 \times 3 = 6$

14. **Sol. (c)**
 let $\frac{x}{y} = 3$
 $\left(\frac{x^2 + y^2}{y^2}\right)$
 $\Rightarrow \frac{x^2}{y^2} + 1$
 $9 + 1 = 10$

15. **Sol. (b)**
 Use $p = 1, q = 1$ and $r = 1$
 $\frac{1}{3} + \frac{1}{3} + \frac{1}{3} = 1$

16. **Sol. (c)**
 $x \ y \ z = -12$
 $\downarrow \downarrow \downarrow$
 $1 \ 4 \ -3$
 $x + y + z = 2$
 $\downarrow \downarrow \downarrow$
 $1 + 4 - 3$

$$xy + yz + zx = -11$$

$$4 - 12 - 3 = -11$$

$$\sqrt{x^3 + y^3 + z^3 - 2} = \sqrt{1 + 64 - 27 - 2} = \sqrt{36} = 6$$

17. **Sol. (c)**
 Use $a = b = c = 1$
 $\frac{x-1}{2} + \frac{x-1}{2} + \frac{x-1}{2} = 4(3)$
 $\Rightarrow 3x - 3 = 8 \times 3$
 $\Rightarrow 3x = 9 \times 3 \Rightarrow x = 9$
 Options

$$a = (1 + 1 + 1)^2 = 9$$

$$b = 1 + 1 + 1 = 3$$

$$c = 1 + 1 + 1 = 3$$

$$d = 1 + 1 + 1 - 1 - 1 - 1 = 0$$

So, option a is the correct answer

18. Sol. (d)

Put $a = 1$,

then $x = 2, y = 0$

$$\sqrt{x^4 + y^4 - 2x^2y^2} = \sqrt{x^4}$$

$$= \sqrt{16} = 4$$

19. Sol. (a)

Use $x = 1, y = 1$ and $z = -2$

$$= \frac{1}{1+1-4} + \frac{1}{1+4-1} + \frac{1}{4+1-1}$$

$$= -\frac{1}{2} + \frac{1}{4} + \frac{1}{4} = 0$$

20. Sol. (d)

Given $a^3 + b^3 = 218$ and

$$a + b = 2,$$

$$(a + b)^3 = a^3 + b^3 + 3ab(a + b)$$

$$2^3 = 218 + 3ab \times 2$$

$$-210 = 6ab \Rightarrow ab = -35$$

$$\sqrt{(1 - ab)} = \sqrt{1 - (-35)} = \sqrt{36} = 6$$

Shortcut :

by hit and trial $a = 7$ and $b = -5$

$$\sqrt{(1 - ab)}$$

$$= \sqrt{1 - (-35)} = \sqrt{36} = 6$$

21. Sol. (a)

$$r + \frac{64}{r} = 16$$

On putting value, $r = 8$

$$8 + \frac{64}{8} = 16$$

$$16 = 16 \text{ (satisfy)}$$

$$r^4 + \frac{1}{r^3} = 8^4 + \frac{1}{8^3} = 4096 \frac{1}{512}$$

22. Sol. (c)

Put $P = 0, x = 2$

$$x^3 + 0 + 0$$

$$= x^3 = 2^3 = 8$$

23. Sol. (b) $x + y = 13$

By Putting $x = 7$ and $y = 6$, equation gets satisfied

$$(x - 8)^3 + (y - 5)^3 = (7 - 8)^3 + (6 - 5)^3$$

$$= -1^3 + 1^3 = 0$$

24. Sol. (a)

$$x^3 + y^3 = (x + y)[(x + y)^2 - 3xy]$$

$$= 14[14^2 - 3xy] = 2744 - 42xy$$

$$x^3 + y^3 + 42xy = 2744 - 42xy + 42xy$$

$$= 2744$$

Short trick :

Putting $x = 14, y = 0$

$$x^3 + y^3 + 42xy = 14^3 + 0 + 0 = 2744$$

25. Sol. (d)

Use $a = 1, b = 0$ and $c = -1$

$$= \frac{(1)^2 + (0)^2 + (-1)^2}{(1)^2 + (1)^2 + (-2)^2} = \frac{2}{6} = \frac{1}{3}$$

26. Sol. (c)

$$x + y = 2z \Rightarrow x + y - z = 2z - z$$

$$x - z = z - y$$

Again,

$$x + y - 2y = 2z - 2y \Rightarrow x - y = 2(z - y)$$

$$\frac{x}{x-z} + \frac{y}{y-z} = \frac{x}{z-y} - \frac{y}{z-y}$$

$$= \frac{x-y}{z-y} = \frac{2(z-y)}{z-y} = 2$$

Short trick :

Putting $z = 0$, we get $x = -y$

$$\frac{x}{x-z} + \frac{y}{y-z} = \frac{x}{x-0} + \frac{y}{y-0}$$

$$= \frac{x}{x} + \frac{y}{y} = 1 + 1 = 2$$

27. Sol. (c)

Put $c = 0$,

$$a + b = 7$$

$$ab = 21,$$

$$(a + b)((a + b)^2 - 3ab)$$

$$7(49 - 63) = -98$$

28. Sol. (c)

$$\frac{a}{3} = \frac{b}{4} = \frac{c}{7} = k$$

$$\therefore a = 3k$$

$$b = 4k$$

$$c = 7k$$

$$\therefore \frac{a+b+c}{c} = \frac{3k+4k+7k}{7k} = 2$$

29. Sol.(a)

Putting $k = 1$, we get LHS = RHS i.e. $2 = 2$

$$\text{So, } 8 \times k \times k \times k = 8 \times 1^3 = 8$$

30. Sol.(b)

Put $c = 0$,

$$\frac{a^2}{2a^2} + \frac{b^2}{2b^2} + 0 = \frac{1}{2} + \frac{1}{2} = 1$$

31. Sol.(d)

$$a + b + c = 4, \frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 3$$

$$1 + \frac{a}{b} + \frac{a}{c} + 1 + \frac{b}{a} + \frac{b}{c} + 1 + \frac{c}{b} + \frac{c}{a} = 12$$

$$\frac{a}{b} + \frac{b}{a} + \frac{c}{a} + \frac{a}{c} + \frac{b}{c} + \frac{c}{b} = 12 - 3 = 9$$

32. Sol.(b)

$$x = y = z = 2$$

$$\therefore \frac{1}{2+1} + \frac{1}{2+1} + \frac{1}{2+1} = \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = 1$$

33. Sol.(b)

$$\text{Given that, } \frac{1}{x} - \frac{1}{y} = \frac{11}{24}$$

$$\frac{y-x}{xy} = \frac{11}{24} \text{ So, } xy = -24$$

$$x^3 - y^3 + x^2y^2$$

$$= (x-y)\{(x-y)^2 + 3xy\} + x^2y^2$$

$$x^3 - y^3 + x^2y^2 = 11(121 - 72) + (-24)^2$$

$$x^3 - y^3 + x^2y^2 = 11 \times 49 + 576 = 539 + 576$$

$$= 1115$$

Short-trick:

$$\text{Put } x = 8 \text{ and } y = -3$$

$$x - y = 11 \Rightarrow 8 - (-3) = 11 \Rightarrow xy = -24$$

$$x^3 - y^3 + x^2y^2 = 512 - (-27) + 64 \times 9$$

$$= 512 + 27 + 576 = 1115$$

34. Sol.(d)

$$x + y + z = 6$$

$$(x-1)^3 + (y-2)^3 + (z-3)^3$$

$$\therefore \text{ as } x + y + z = 6$$

Take values

$$x = 1, y = 2, z = 3 \quad (1 + 2 + 3) = 6$$

$$(1-1)^3 + (2-2)^3 + (3-3)^3 = 0$$

Now assume values in options. option 'd' satisfies the given relation.

Hence 'd' is correct.

35. Sol.(b)

$$ab + bc + ca = 0$$

Add a^2 on both sides

$$\Rightarrow ab + bc + ca + a^2 = a^2$$

$$\Rightarrow ab + ca + a^2 = a^2 - bc$$

$$\Rightarrow a^2 - bc = a(a + b + c)$$

Similarly

$$b^2 - ca = b(a + b + c)$$

And

$$c^2 - ca = c(a + b + c)$$

$$\frac{a^2}{a^2-bc} + \frac{b^2}{b^2-ca} + \frac{c^2}{c^2-ca}$$

$$= \frac{a^2}{a(a+b+c)} + \frac{b^2}{b(a+b+c)} + \frac{c^2}{c(a+b+c)}$$

$$= \frac{a}{(a+b+c)} + \frac{b}{(a+b+c)} + \frac{c}{(a+b+c)}$$

$$= \frac{a+b+c}{a+b+c} = 1$$

Alternate

$$\text{Use } a = 2, b = 2 \text{ and } c = -1$$

$$= \frac{(2)^2}{(2)^2 - (-2)} + \frac{(2)^2}{(2)^2 - (-2)} + \frac{(-1)^2}{(-1)^2 - (2)(2)}$$

$$= \frac{4}{6} + \frac{4}{6} - \frac{1}{3} = \frac{4}{3} - \frac{1}{3} = 1$$

36. Sol.(a)

$$\text{Use } a = 0, b = 0, c = 0 \text{ and } d = 4$$

$$= \frac{1}{1} + \frac{1}{(1-4)} + \frac{1}{(1-4)} + \frac{1}{(1-4)} = 1 - \frac{1}{3} - \frac{1}{3} - \frac{1}{3} = 0$$

37. Sol.(c)

$$96 - 64a^3 + \frac{8}{a^6} - \frac{48}{a^3} - t^3 = 0$$

Because there is one equation and two variables. So, can put the value of one variable

$$\text{Let, } a=1 \text{ (we can't put } a=0, \text{ because } \frac{1}{0} = \infty)$$

$$= 96 - 64 + 8 - 48 - t^3 = 0$$

$$104 - 112 - t^3 = 0$$

$$-8 - t^3 = 0$$

$$t = -2$$

$$\text{Now, } a^2 t - 4a^3 = 12x(-2) + 4x(1)^3$$

$$= -2 + 4 = 2$$

38. Sol. (d)

Short-Trick:

$$x + \frac{1}{x} = \frac{17}{4}$$

$$x = 4, \text{ satisfy}$$

$$x - \frac{1}{x} = 4 - \frac{1}{4} = \frac{15}{4}$$

39. Sol. (a)

$$I: \frac{a^2-b^2}{a^2+b^2} > \frac{a-b}{a+b} \text{ Where } a > b > 0 \text{ Let } a = 2 \text{ and } b = 1$$

$$\frac{2^2-1}{2^2+1} > \frac{2-1}{2+1}$$

$$\frac{3}{5} > \frac{1}{3} \text{ Which is true.}$$

$$II: \frac{a^3+b^3}{a^2+b^2} > \frac{a^2+b^2}{a+b} \text{ Where, } a > b > 0$$

$$\text{Let, } a = 2 \text{ and } b = 1$$

$$\frac{2^3+1^3}{2^2+1^2} > \frac{2^2+1^2}{2+1}$$

$$\frac{9}{5} > \frac{5}{3}$$

$$\text{It is also true when } a = 1 \text{ and } b = 2$$

$$\text{So, statement } \frac{a^3+b^3}{a^2+b^2} > \frac{a^2+b^2}{a+b} \text{ only when } a > b$$

$$> 0 \text{ is not correct.}$$

40. Sol. (d)

Short-Trick:

$$a = 2, b = -1, c = -1$$

$$\frac{(b+c)^2}{bc} + \frac{(c+a)^2}{ca} + \frac{(a+b)^2}{ab}$$

$$\frac{(-1-1)^2}{(-1) \times (-1)} + \frac{(-1+2)^2}{(-1) \times 2} + \frac{(2-1)^2}{2 \times (-1)}$$

$$\Rightarrow 4 - \frac{1}{2} - \frac{1}{2} \Rightarrow 3$$

41. Sol. (a)

$$\text{Let } a = b = c = 1$$

$$\therefore x = 2$$

$$y = 2$$

$$z = 2$$

$$xyz - x^2 - y^2 - z^2 = 2 \times 2 \times 2 - 4$$

$$-4 - 4$$

$$= 8 - 12 = -4$$

42. Sol. (b)

$$\text{Put } x = 1, y = 2, z = 9$$

$$x^{y+z} = 1, y^{x+z} = 1024, z^{x+y} = 729$$

$$\text{Then, } (z+1)^{y+x+1}$$

$$= (9+1)^4 = 10000$$

43. Sol. (d)

$$\text{Short-Trick: Value putting } a = 4, b = 3, x = -1 \text{ and}$$

$$y = 4$$

$$ay - bx$$

$$4 \times 4 - (-3)(1)$$

$$16 + 3 = 19$$

44. Sol. (a)

$$\text{Given, } x + y = 2a \text{ to}$$

$$\text{Find } \frac{a}{(x-a)} + \frac{a}{(y-a)} = ?$$

$$\Rightarrow \text{Let } x = 3, y = 1, a = 2$$

$$\Rightarrow \frac{a}{(x-a)} + \frac{a}{y-a}$$

$$\Rightarrow \frac{2}{(3-2)} + \frac{2}{(1-2)}$$

$$\Rightarrow \frac{2}{1} + \frac{2}{-1} = 0$$

45. Sol. (d)

$$\text{Use } a = 1, b = 0 \text{ and } c = -1$$

$$\frac{(1)^2 + (1)^2 + (2)^2}{(1)^2 + (1)^2 + 0} = \frac{6}{2} = 3$$

46. Sol. (c)

$$\text{put } y = z = 0,$$

$$P = -x, Q = x, R = x,$$

$$x^3 + 0 + 0 = 3$$

$$x^3 = 3,$$

$$P^3 + Q^3 + R^3 - 3PQR = -x^3 + x^3 + x^3 + 3x^3 = 4x^3$$

$$= 4 \times 3 = 12$$

47. Sol. (a)

$$\text{Short-Trick: Put } x = 1$$

$$4x^4 = 5x^2 - 1 \Rightarrow 4(1) = 5(1) - 1$$

$$4 = 4 \text{ (satisfy)}$$

$$(2x^2 - x - 1) = 2(1) - 1 - 1 = 0$$

48. Sol. (c)

$$\frac{x}{a} + \frac{y}{b} = a + b \text{ and } \frac{x}{a^2} + \frac{y}{b^2} = 2$$

Since there are 4 variables and 2 equations.

So, we can suppose the value of two variables.

$$\text{Let } a = b = 1$$

$$\therefore \frac{x}{a} + \frac{y}{b} = a + b$$

$$\frac{x}{1} + \frac{y}{1} = 1 + 1$$

$$x + y = 2$$

$$\Rightarrow x = y = 1$$

$$\text{And } \frac{x}{a^2} + \frac{y}{b^2} = 2$$

Be putting the values of a and b

$$\frac{x}{1} + \frac{y}{1} = 2$$

$$x + y = 2$$

$$\Rightarrow x = y = 1$$

Putting the values of a, b, x and y in $\frac{x}{a^2} - \frac{y}{b^2}$

$$= \frac{1}{1} - \frac{1}{1} = 0$$

49. Sol. (a)

$$\text{Let } a = 0, b = 1$$

$$\Rightarrow a^3 + b^3 - ab - (a^2 - b^2)^2$$

$$\Rightarrow 0 + 1 - 0 - (0 - 1)^2$$

$$\Rightarrow 1 - 1 = 0$$

50. Sol. (b)

$$x + \frac{1}{x} = 2$$

$$\Rightarrow \text{Put } x = 1$$

$$\therefore 1 + \frac{1}{(1)} = 2$$

$$2 = 2 \text{ (satisfy)}$$

$$\left(x^2 + \frac{1}{x^2}\right)\left(x^3 + \frac{1}{x^3}\right)$$

$$= (1 + 1)(1 + 1)$$

$$= 2 \times 2 = 4$$

51. Sol. (b)

$$\text{Put } x = y,$$

$$\sqrt{x^2 + x^2 + x^2} - \sqrt{x^2 + x^2 - x^2} = \sqrt{2}$$

$$\sqrt{3}x - x = \sqrt{2}$$

$$x = \frac{\sqrt{2}}{\sqrt{3}-1}$$

$$(2 - x^2)(2 - x^2)$$

$$= (2 - x^2)^2$$

$$= \left(2 - \frac{2}{4-2\sqrt{3}}\right)^2 = \left(2 - \frac{1}{2-\sqrt{3}}\right)^2$$

$$= (2 - \sqrt{3} \times \sqrt{3})$$

$$= (\sqrt{3})^2 = \sqrt{3} \times \sqrt{3}$$

$$= 3$$

52. Sol. (a)

$$= 2b^2c^2 + 2c^2a^2 + 2a^2b^2 - a^4 - b^4 - c^4$$

$$= 4b^2c^2 - (2b^2c^2 - 2c^2a^2 - 2a^2b^2 + a^4 + b^4)$$

$$= (2bc)^2 - (a^2 - b^2 - c^2)^2$$

$$= [(2bc) - (a^2 - b^2 - c^2)][(2bc) + (a^2 - b^2 - c^2)]$$

$$= [b^2 + c^2 + 2bc - a^2][a^2 - (b^2 + c^2 - 2bc)]$$

$$= [(b+c)^2 - a^2][a^2 - (b-c)^2]$$

$$= (b+c-a)(b+c+a)(a-b+c)(a+b-c)$$

$$= 0 (\because a+b-c=0)$$

Alternate

$$\text{Use } a = 1, b = 0 \text{ and } c = 1$$

$$= 0 + 2 + 0 - 1 - 0 - 1 = 0$$

53. Sol. (c)

Putting $b = 0$, we get

$$x = \sqrt[3]{a + \sqrt{a^2 + 0}} + \sqrt[3]{a - \sqrt{a^2 - 0}}$$

$$x = \sqrt[3]{a+a} + \sqrt[3]{a-a}$$

$$x = \sqrt[3]{2a}$$

$$x^3 = 2a$$

$$\therefore \text{value of } x^3 + 3bx$$

$$\Rightarrow \text{Putting values of } x^3 \& b$$

$$\Rightarrow 2a + 3 \times 0 \times x$$

$$\Rightarrow 2a$$

54. Sol. (c)

$$x + y = 2017$$

$$(-1)^x + (-1)^y$$

$$\text{Put } x = 2017 \& y = 0$$

$$(-1)^{2017} + (-1)^0$$

$$= -1 + 1 = 0$$

55. Sol. (b)

$$a^3 + b^3 = 9$$

$$a + b = 3$$

Assume values, $a = 2, b = 1$

$$\therefore (2)^3 + 1 = 9$$

$$2 + 1 = 3$$

$$\therefore \frac{1}{a} + \frac{1}{b} = \frac{1}{2} + 1 = \frac{3}{2}$$

56. Sol. (a)

$$a + \frac{1}{b} = b + \frac{1}{c} = c + \frac{1}{a}$$

To save your time assume values of a, b, c according to equation.

$$\text{Let } a = 2, b = -1 \text{ and } c = \frac{1}{2}$$

$$2 + \frac{1}{-1} = -1 + \frac{1}{1/2} = \frac{1}{2} + \frac{1}{2}$$

$$= 1 = 1 = 1$$

$$\therefore abc = 2 \times -1 \times \frac{1}{2} = -1$$

57. Sol. (b)

$x = 7, y = 3$ satisfies given equation

$$x^4 - y^4 = 2401 - 81 = 2320$$

58. Sol. (b)

$$x - y - z = 0$$

$x = 2, y = 1, z = 1$, satisfies given equation

$$(x^2 + y^2 + z^2) \div (y^2 + zx) = 2$$

59. Sol. (d)

$$\left(\frac{x}{y} + 1\right) = 4, = \frac{x}{y} = 3$$

Squaring both side $\frac{x^2}{y^2} = 9$

$$\text{Add 1 both side } \frac{x^2}{y^2} + 1 = 9 + 1$$

$$= \left(\frac{x^2 + y^2}{y^2}\right) = 10$$

Short -trick

$$\text{Put } x=3 \text{ and } y=1$$

$$\frac{x^2 + y^2}{y^2} = \frac{9+1}{1} = 10$$

60. Sol. (d)

$$\text{Let } a = 1, b = 1 \Rightarrow p = 2, q = 1 (a^4 + b^4) = 2$$

Check option d

$$p^4 - 4p^2q + 2q^2 = 2$$

61. Sol. (b)

Given that, $x + y + z = 13$

$$x^2 + y^2 + z^2 = 91$$

$$(x + y + z)^2 = x^2 + y^2 + z^2 + 2(xy + yz + zx)$$

$$13^2 = 91 + 2(xy + yz + zx)$$

$$(xy + yz + zx) = 39$$

$$\text{Put } xz = y^2$$

$$\Rightarrow (xy + yz + y^2) = 39$$

$$\Rightarrow y(x + y + z) = 39 \Rightarrow y(13) = 39$$

$$\Rightarrow y = 3 \text{ If } y = 3, \text{ then } x + z = 10$$

$$\Rightarrow xz = y^2 \dots (\text{Given}) \Rightarrow xz = 9$$

$$\text{Now, } \Rightarrow (x - z)^2 = (x + z)^2 - 4xz$$

$$\Rightarrow (x - z)^2 = 100 - 36 = 64 \Rightarrow (x - z) = 8$$

Short-trick:

$$\text{Put } x = 9, z = 1 \text{ and } y = 3 \Rightarrow xz = y^2 \quad 9 \times 1 = 3^2 \Rightarrow$$

$$9 = 9 \text{ (condition satisfy)}$$

$$\text{Required difference } = x - z = 9 - 1 = 8$$

62. Sol. (c)

$$a + b + c = 0 \text{ Have values}$$

$$a = 1, b = 2, c = -3$$

$$\Rightarrow \left(\frac{a+b}{c} + \frac{b+c}{a} + \frac{c+a}{b}\right) \left(\frac{a}{b+c} + \frac{b}{c+a} + \frac{c}{a+b}\right)$$

$$\Rightarrow \left(\frac{1+2}{-3} + \frac{2-3}{1} + \frac{-3+1}{2}\right) \left(\frac{1}{2-3} + \frac{2}{-3+1} + \frac{-3}{1+2}\right)$$

$$\Rightarrow (-1 - 1 - 1)(-1 - 1 - 1)$$

$$\Rightarrow -3 \times -3 = 9$$

63. Sol. (a)

$$xy = 15$$

Possible value of x and y are (5,3) and (15,1)

Put $x = 5$, and $y = 3$ in given equation

$$x^4 + y^4 = 706$$

$$\Rightarrow 5^4 + 3^4 = 706 \Rightarrow 625 + 81 = 706$$

$$\Rightarrow 706 = 706, \text{ equation satisfies.}$$

$$2x + 3y = 19$$

64. Sol. (c)

$$a + b + c = 0$$

Assume values $a = 2, b = -2, c = 0$

$$a + b + c = 2 - 2 + 0 = 0 \text{ (satisfy)}$$

$$\therefore \frac{a^2 + b^2 + c^2}{a^2 - bc}$$

$$\Rightarrow \frac{4+4+0}{4-0} \Rightarrow \frac{8}{4} = 2$$

65. Sol. (d)

$$4x^2 + y^2 = 40$$

Short-Trick:

Put, $x = 1$, and $y = 6$

$$4x^2 + y^2 = 40 \Rightarrow 4(1)^2 + 6^2 = 40$$

$$40 = 40 \text{ (which satisfy)}$$

$$\text{So, } 2x + y = 2(1) + 6 = 8$$

66. Sol. (a)

Put $a = 1$ and $b = c = 0$

$$(a + b - c)^3 + (a - b + c)^3 - 8a^3$$

$$\Rightarrow (1 + 0 - 0)^3 + (1 - 0 + 0)^3 - 8(1)^3 = 1 + 1 - 8 = -6$$

now go through options - option A $6a(a - b + c)(c -$

$$a - b) \Rightarrow 6(1)(1 - 0 + 0)(0 - 1 - 0) = -6$$

condition satisfied hence option (a) is the right answer.

67. Sol. (d)

$$a + a^2b + b + ab^2 = 128$$

$$\Rightarrow a + b + ab(a + b) = 128$$

$$\Rightarrow (a + b)(1 + ab) = 128$$

$$\Rightarrow 8(1 + ab) = 128 \Rightarrow ab = 15$$

$$(a + b)^2 = a^2 + b^2 + 2ab$$

$$\Rightarrow 64 = a^2 + b^2 + 30$$

$$\Rightarrow a^2 + b^2 = 34$$

$$a^3 + b^3 = (a + b)(a^2 + b^2 - ab)$$

$$a^3 + b^3 = 8(34 - 15) \Rightarrow a^3 + b^3 = 152$$

Short-trick:

Put $a = 5, b = 3$

$$a^3 + b^3 = 5^3 + 3^3 = 152$$

68. Sol.(c)

$$(a + b)^2 = a^2 + b^2 + 2ab$$

$$\Rightarrow 100 = a^2 + b^2 + 42$$

$$\Rightarrow a^2 + b^2 = 58$$

$$a^3 + b^3 = (a + b)(a^2 + b^2 - ab)$$

$$\Rightarrow a^3 + b^3 = 10(58 - 21) \Rightarrow a^3 + b^3 = 370$$

Short-trick:

put $a = 7, b = 3$

$$a + b = 10 \text{ (Which satisfy)}$$

$$a^3 + b^3 = 7^3 + 3^3$$

$$a^3 + b^3 = 343 + 27 = 370$$

69. Sol. (c)

Putting $x = 1$ in the eqⁿ,

$$\Rightarrow 1^4 + 2(1)^3 + a(1)^2 + b(1) + 9$$

$$\Rightarrow 1 + 2 + a + b + 9$$

$$\Rightarrow 12 + a + b$$

So, nearest perfect square according to options, is 25.

$$\therefore a + b = 13$$

Now, Putting $x = 1$ in the eqⁿ,

$$\Rightarrow (-1)^4 + 2(-1)^3 + a(-1)^2 + b(-1) + 9$$

$$\Rightarrow 1 + (-2) + a - b + 9$$

$$\Rightarrow a - b + 8$$

So, nearest perfect Square is 9,

$$\text{So, } a - b = 1 \quad \dots \text{(ii)}$$

 $\therefore$ Option (c) satisfies both the eqⁿs.

$$\therefore a = 7 \text{ and } b = 6$$

70. Sol. (a)

Short-Trick:

Put the value of $a = 1$

$$7a^2 + 7a = 7(1)^2 + 7(1) = 14$$

So, number is divisible by 7 and 14 both

71. Sol. (b)

$$a + b + c + d = 2 \dots \text{(given)}$$

$$\text{Let } a = b = c = d = \frac{1}{2}$$

Therefore, $(1 + a)(1 + b)(1 + c)(1 + d)$

$$= \left(1 + \frac{1}{2}\right) \left(1 + \frac{1}{2}\right) \left(1 + \frac{1}{2}\right) \left(1 + \frac{1}{2}\right)$$

$$= \left(\frac{3}{2}\right) \left(\frac{3}{2}\right) \left(\frac{3}{2}\right) \left(\frac{3}{2}\right) = \frac{81}{16}$$

72. Sol.(b)

(Short-trick: Put $x = -1$ and $y = 1$)

$$27(-1 + 1)^3 - 8(-1 - 1)^3 = (-1 + 5)(A + B + C)$$

$$-8(-8) = 4(A + B - C)$$

$$(-1 + 5)(A + B + C)$$

$$64 = 4(A + B - C) \Rightarrow 16 = (A + B - C)$$

73. Sol. (d)

Given:- $a + b + c = 0$

Let $a = 2, b = -1$ and $c = -1$

$$\text{Then, } \frac{2a^2}{3bc} + \frac{2b^2}{3ca} + \frac{2c^2}{3ab} =$$

$$\frac{2(2)^2}{3(-1)(-1)} + \frac{2(-1)^2}{3(-1)(2)} + \frac{2(-1)^2}{3(2)(-1)}$$

$$= \frac{8}{3} - \frac{1}{3} - \frac{1}{3} = \frac{8-1-1}{3} = \frac{6}{3} = 2$$

74. Sol. (d)

$$x - 2y = 3 \text{ and } xy = 5$$

By hit and trial $x = 5, y = 1$ and $x = 1, y = 5$ is only possible value for $xy = 5$

$$\text{put } x = 5 \text{ and } y = 1$$

$$x - 2y = 3 \Rightarrow 5 - 2(1) = 3 \text{ (satisfy)}$$

$$x^2 - 4y^2 = 5^2 - 4(1) = 21$$

75. Sol. (d)

Short-trick: Put $a = b = c = 1$ $(a + b + c)(ab + bc + ca) - abc = (1 + 1 + 1)(1 + 1 + 1) - 1 = 9 - 1 = 8$

Now, Put $a = b = c = 1$ in all options and check which option gives 8.

$$\text{Option(d) } (a + b)(b + c)(c + a) = 2 \times 2 \times 2 = 8$$

76. Sol. (b)

Short-Trick: Put $x = 1, y = 1$ and $z = -2$

$$x + y + z = 0 \Rightarrow 1 + 1 + (-2) = 0$$

$$0 = 0 \dots \text{(condition satisfied)}$$

$$(x^2 + y^2 + z^2) \div (z^2 - xy)$$

$$\Rightarrow [(1)^2 + (1)^2 + (-2)^2] \div [(-2)^2 - 1 \times 1]$$

$$\Rightarrow 6 \div 3 = 2$$

77. Sol. (d)

Short-Trick: Put $a = 1$ then, $x = 2$ and $y = 0$

$$\sqrt{x^4 + y^4 - 2x^2y^2} = \sqrt{2^4} = 4$$

78. Sol. (d)

In such cases, let's assume the values of $a = 5, b = 3$ and $c = -2$ as $a + b + c = 6$ in order to get the answer easily

On putting these values in the given equation we get

$$a(b^2 + c^2) + b(c^2 + a^2) + c(a^2 + b^2) + 3abc$$

$$= 5(9 + 4) + 3(4 + 25) - 2(25 + 9) + (3 \times 5 \times 3 \times -2)$$

on Solving

$$= 84 - 90 = -6$$

79. Sol. (d)

Short-trick:

Let us assume the value of $x = 3$ and $y = 2$

Now, putting the value in equation

$$(4x^3y - 6x^2y^2 + 4xy^3 - y^4)$$

$$= 4 \times 27 \times 2 - 6 \times 9 \times 4 + 4 \times 3 \times 8 - 16$$

$$= 216 - 216 + 96 - 16 = 80$$

Now, check for these values in the four options.

The only option that satisfies is option(d)

$$= x^4 - (x - y)^4 = 3^4 - (3 - 2)^4 = 80$$

80. Sol. (c)

Short-Trick:

Using hit and trial put $x = 5$ and $y = 2$

$$x + y = 7 \Rightarrow 5 + 2 = 7$$

$$xy = 10 \Rightarrow 5 \times 2 = 10$$

Both conditions satisfied clearly 5 and 2 are the values of x and y respectively.

$$\frac{1}{x^3} + \frac{1}{y^3} \Rightarrow \frac{1}{5^3} + \frac{1}{2^3} \Rightarrow \frac{1}{125} + \frac{1}{8} = \frac{8+125}{125 \times 8} = 0.133$$

81. Sol. (c)

From option {let $P = 2, q = 4$ and $r = 8$ }

$$(a) \frac{1}{\alpha + \beta} = \frac{-P}{q} = -\frac{2}{4} = -0.5$$

$$(b) \frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha + \beta}{\alpha\beta} = \frac{-q}{r} = -\frac{4}{8} = -0.5$$

$$(c) -\frac{1}{\alpha\beta} = -\frac{P}{r} = -\frac{2}{8} = -0.25$$

$$(d) \frac{\alpha\beta}{\alpha + \beta} = -\frac{r}{q} = -\frac{8}{4} = -2$$

$$\therefore -\frac{1}{\alpha\beta} \text{ is greatest}$$

82. Sol. (b)

$$3x^3 + 4x^2 - 7 = 0$$

according to the option

checking option (a)

$$x = 0$$

$$3 \times 0^3 + 4 \times 0^2 - 7 = 0 + 0 - 7 = -7$$

checking option (b)

$$x = 1$$

$$3 \times (1)^3 + 4 \times (1)^2 - 7 = 3 + 4 - 7 = 0$$

Hence, 1 is the zero of polynomial $3x^3 + 4x^2 - 7$

Type-8 (X5, X6, X7, X8)

1. If $\left(x + \frac{1}{x}\right)^2 = 3$, then what is the value of $x^6 + x^{-6}$?

SSC CGL Tier II 2023

- (a) 6 (b) 2
(c) -6 (d) -2

2. If $x > 0$ and $x^4 + \frac{1}{x^4} = 2207$, what is the value of $\left(x^5 + \frac{1}{x^5}\right)$?

SSC CHSL 31/05/2022 (Afternoon)

- (a) 15127 (b) 15134
(c) 15141 (d) 15130

3. If $y + \frac{1}{y} = \sqrt{5}$, then the value of $y^6 + \frac{1}{y^6}$ is:

Graduate Level 05/08/2022 (Shift - 3)

- (a) 18 (b) 15
(c) 10 (d) 12

4. If $x^2 - \sqrt{7}x + 1 = 0$, then what is the value of $x^5 + \frac{1}{x^5}$?

SSC CGL Tier II 29/01/2022

- (a) $25\sqrt{7}$ (b) $21\sqrt{7}$
(c) $27\sqrt{7}$ (d) $19\sqrt{7}$

5. If $x + \frac{1}{x} = 3$, $x \neq 0$, then the value of $x^7 + \frac{1}{x^7}$ is:

SSC CGL Tier II 03/02/2022

- (a) 749 (b) 843
(c) 746 (d) 849

6. If $x - \frac{1}{x} = \sqrt{6}$, then $x^8 - \frac{1}{x^8} = ?$

- (a) $996\sqrt{15}$ (b) $1008\sqrt{15}$
(c) $992\sqrt{15}$ (d) $1000\sqrt{15}$

7. $x + \frac{1}{x} = 3$, $x^6 - \frac{1}{x^6} = ?$

- (a) $144\sqrt{5}$ (b) $172\sqrt{5}$
(c) $78\sqrt{5}$ (d) $142\sqrt{5}$

8. If $x > 0$, and $x^4 + \frac{1}{x^4} = 2207$, what is the value of $x^7 + \frac{1}{x^7}$?

SSC CGL 02/12/2022 (1 st Shift)

- (a) 710649 (b) 710647
(c) 710654 (d) 710661

9. If $x - \frac{1}{x} = 2$, then $x^6 - \frac{1}{x^6} = ?$

- (a) $144\sqrt{3}$ (b) $142\sqrt{2}$
(c) $140\sqrt{2}$ (d) None of these

10. If $x^2 + 13x + 39 = 0$, then $(x + 8)^5 - \frac{1}{(x+8)^5} = ?$

- (a) 393 (b) 396
(c) 392 (d) 394

11. $x^4 + \frac{1}{x^4} = 62$, find $x^6 + \frac{1}{x^6} = ?$

- (a) 478 (b) 468
(c) 488 (d) 498

12. If $\sqrt{x} + \frac{1}{\sqrt{x}} = \sqrt{6}$, then the value of $x^6 + \frac{1}{x^6}$ will be:

SSC CHSL 4/8/2021 (Afternoon)

- (a) 2270 (b) 2502
(c) 2702 (d) 2712

13. If $x + \frac{1}{x} = 5$, then $x^6 + \frac{1}{x^6}$ is

- (a) 12098 (b) 12048
(c) 14062 (d) 12092

14. If $x + \frac{1}{x} = 4$, then $x^7 - \frac{1}{x^7} = ?$

- (a) $5844\sqrt{3}$ (b) $5842\sqrt{3}$
(c) $5824\sqrt{3}$ (d) $5822\sqrt{3}$

15. If $x - \frac{1}{x} = \sqrt{6}$, then find the value of $x^7 - \frac{1}{x^7}$

- (a) $518\sqrt{6}$ (b) $529\sqrt{6}$
(c) $528\sqrt{6}$ (d) $559\sqrt{6}$

16. If $x - \frac{1}{x} = 4$, then find the value of $x^6 - \frac{1}{x^6}$
- (a) $2232\sqrt{5}$ (b) $2584\sqrt{5}$
- (c) $2123\sqrt{5}$ (d) $2426\sqrt{5}$

17. $x + \frac{1}{x} = 3$, $x^7 + \frac{1}{x^7} = ?$
- (a) 840 (b) 842
- (c) 843 (d) None of these

18. $x^4 - \frac{1}{x^4} = 21\sqrt{5}$, $\frac{1+x+x^2+x^8+x^9+x^{10}}{x^5} = ?$
- (a) 198 (b) 178
- (c) 188 (d) 144

19. $\left(x + \frac{1}{x}\right)\left(x - \frac{1}{x}\right)\left(x^2 + \frac{1}{x^2} - 1\right)\left(x^2 + \frac{1}{x^2} + 1\right)$ is equal to:-
- (a) $x^6 + \frac{1}{x^6}$ (b) $x^8 + \frac{1}{x^8}$
- (c) $x^8 - \frac{1}{x^8}$ (d) $x^6 - \frac{1}{x^6}$

20. If $x + \frac{1}{x} = 4$, then the value of $x^5 + \frac{1}{x^5}$ is:

SSC CGL 13/8/2021 (Morning)

- (a) 736 (b) 776
- (c) 684 (d) 724

21. $x^6 + \frac{1}{x^6} = 3$, $x^{30} + \frac{1}{x^{30}} = ?$
- (a) 123 (b) 127
- (c) 135 (d) 95

22. If $x - \frac{1}{x} = 1$, then what is the value of $x^8 + \frac{1}{x^8}$?

SSC CGL 13/8/2021 (Evening)

- (a) 3 (b) 119
- (c) 47 (d) -1

23. If $x - \frac{1}{x} = 3$, $x^{10} - \frac{1}{x^{10}} = ?$
- (a) $109\sqrt{13} \times 393$ (b) $100\sqrt{12} \times 243$
- (c) $102\sqrt{4} \times 483$ (d) None of these

24. If $x - \frac{1}{x} = 5$, then find the value of $x^5 - \frac{1}{x^5}$
- (a) 3780 (b) 3775
- (c) 3715 (d) 3725

25. If $x^2 - 2\sqrt{5}x + 1 = 0$, then what is the value of $x^5 + \frac{1}{x^5}$?

SSC CGL 5/03/2020 (Morning)

- (a) $610\sqrt{5}$ (b) $408\sqrt{5}$
- (c) $612\sqrt{5}$ (d) $406\sqrt{5}$

26. If $\left(x^8 + \frac{1}{x^8}\right) = 47$, what is the value of $\left(x^6 + \frac{1}{x^6}\right)$?

[CDS - 2020-I]

- (a) 36 (b) 27
- (c) 18 (d) 9

27. If $x + \frac{1}{x} = 7$, then find the value of $x^5 - \frac{1}{x^5}$

- (a) $6775\sqrt{5}$ (b) $6712\sqrt{5}$
- (c) $6755\sqrt{5}$ (d) $6765\sqrt{5}$

28. If $x^2 - 4x + 1 = 0$, then what is the value of $(x^6 + x^{-6})$?

SSC CPO 13/12/2019 (Morning)

- (a) 2786 (b) 2702
- (c) 2716 (d) 2744

29. If $x + \frac{1}{x} = 5$, then $x^5 - \frac{1}{x^5} = ?$

- (a) $550\sqrt{21}$ (b) $551\sqrt{21}$
- (c) 545 (d) 551

30. If $x^2 + 3x + 1 = 0$, then what is the value of $x^6 + \frac{1}{x^6}$?

SSC CGL 03/03/2020 (Afternoon)

- (a) 324 (b) 322
- (c) 318 (d) 327

Type-8 ANSWER KEY													
1	D	2	A	3	A	4	D	5	B	6	C	7	A
8	B	9	C	10	A	11	B	12	C	13	A	14	D
15	D	16	B	17	C	18	C	19	D	20	D	21	A
22	C	23	A	24	B	25	A	26	C	27	D	28	B
29	B	30	B										

Type-8 (X5, X6, X7, X8) Solution

1. Sol. (d)

$$\left(x + \frac{1}{x}\right)^2 = 3$$

$$\Rightarrow x^2 + \frac{1}{x^2} + 2 = 3 \Rightarrow x^2 + \frac{1}{x^2} = 1$$

On cubing above equation, we get

$$x^6 + \frac{1}{x^6} + 3\left(x^2 + \frac{1}{x^2}\right) = 1$$

$$x^6 + \frac{1}{x^6} + 3 = 1$$

$$x^6 + \frac{1}{x^6} = -2$$

$$\text{So, } x^6 + x^{-6} = -2$$

2. Sol. (a)

$$x^4 + \frac{1}{x^4} = 2207$$

$$x^2 + \frac{1}{x^2} = \sqrt{2207 + 2} = 47$$

$$x + \frac{1}{x} = \sqrt{47 + 2} = 7$$

$$x^3 + \frac{1}{x^3} = 7^3 - 3 \times 7 = 343 - 21 = 322$$

$$\left(x^5 + \frac{1}{x^5}\right) = \left(x^3 + \frac{1}{x^3}\right)\left(x^2 + \frac{1}{x^2}\right) - x + \frac{1}{x}$$

$$= (47 \times 322) - 7$$

$$= 15134 - 7 = 15127$$

3. Sol. (a)

$$y^6 + \frac{1}{y^6} = \left(y^3 + \frac{1}{y^3}\right)^2 - 2$$

$$\Rightarrow y^3 + \frac{1}{y^3} = (\sqrt{5})^3 - 3 \times \sqrt{5} = 5\sqrt{5} - 3\sqrt{5} = 2\sqrt{5}$$

$$\text{So, } y^6 + \frac{1}{y^6} = (2\sqrt{5})^2 - 2 = 20 - 2 = 18$$

4. Sol. (d)

$$x^2 - \sqrt{7}x + 1 = 0$$

$$x + \frac{1}{x} = \sqrt{7} \Rightarrow x^2 + \frac{1}{x^2} = (\sqrt{7})^2 - 2 = 5$$

$$x^3 + \frac{1}{x^3} = (\sqrt{7})^3 - 3 \times \sqrt{7} = 4\sqrt{7}$$

$$x^5 + \frac{1}{x^5} = \left(x^2 + \frac{1}{x^2}\right)\left(x^3 + \frac{1}{x^3}\right) - \left(x + \frac{1}{x}\right)$$

$$x^5 + \frac{1}{x^5} = 5 \times 4\sqrt{7} - \sqrt{7} = 19\sqrt{7}$$

5. Sol. (b)

$$x + \frac{1}{x} = 3$$

On squaring eq. (1), we get

$$x^2 + \frac{1}{x^2} = 7 \dots \dots (2)$$

On squaring eq. (2), we get

$$x^4 + \frac{1}{x^4} = 47$$

On cubing eq. (1), we get

$$x^3 + \frac{1}{x^3} = (3)^3 - (3)(3) = 27 - 9 = 18$$

$$\text{So, } x^3 + \frac{1}{x^3} = 18$$

On multiplying (3) and (4), we get

$$\left(x^4 + \frac{1}{x^4}\right)\left(x^3 + \frac{1}{x^3}\right) = (47)(18)$$

$$x^7 + \frac{1}{x^7} + x + \frac{1}{x} = 846$$

$$x^7 + \frac{1}{x^7} + 3 = 846 \text{ So, } x^7 + \frac{1}{x^7} = 843$$

6. Sol. (c)

$$x^8 - \frac{1}{x^8} = \left(x^4 + \frac{1}{x^4}\right)\left(x^2 + \frac{1}{x^2}\right)\left(x + \frac{1}{x}\right)\left(x - \frac{1}{x}\right)$$

$$= 62 \times 8 \times \sqrt{10} \times \sqrt{6} = 496\sqrt{60} = 992\sqrt{15}$$

7. Sol. (a)

$$x - \frac{1}{x} = \sqrt{5}$$

$$\left(x^3 + \frac{1}{x^3}\right)\left(x^3 - \frac{1}{x^3}\right)$$

$$18 \times 8\sqrt{5} = 144\sqrt{5}$$

8. Sol. (b)

$$x^4 + \frac{1}{x^4} = 2207 \dots \dots \text{eq}$$

Adding 2 in eq. (1), we get,

$$x^2 + \frac{1}{x^2} = 47 \dots \dots \text{eq. (2)}$$

Adding 2 in eq (2), we get,

$$x + \frac{1}{x} = 7$$

$$\text{Then, } x^3 + \frac{1}{x^3} = 7^3 - 3 \times 7 = 322$$

Now, using Identities :-

$$x^7 + \frac{1}{x^7}$$

$$= \left(x^3 + \frac{1}{x^3}\right)\left(x^4 + \frac{1}{x^4}\right) - \left(x + \frac{1}{x}\right)$$

$$= 322 \times 2207 - 7 = 710647$$

9. Sol. (c)

$$x - \frac{1}{x} = 2$$

$$x + \frac{1}{x} = \sqrt{2^2 + 4} = \sqrt{8}$$

$$\left(x^3 - \frac{1}{x^3}\right)\left(x^3 + \frac{1}{x^3}\right)$$

$$\Rightarrow (2^3 + 3 \times 2)(8\sqrt{8} - 3\sqrt{8})$$

$$\Rightarrow 14 \times 5\sqrt{8} = 140\sqrt{2}$$

10. Sol. (a)

$$x^2 + 13x + 39 = 0$$

$$x^2 + 5x + 8x + 39 + 1 = 1$$

$$(x + 5)(x + 8) = 1$$

$$(x + 5) = \frac{1}{x+8}$$

$$(x + 8) - 3 = \frac{1}{x+8}$$

$$(x + 8) - \frac{1}{(x+8)} = 3,$$

$$y - \frac{1}{y} = 3$$

$$y^5 - \frac{1}{y^5}$$

$$= \left(y^3 - \frac{1}{y^3}\right)\left(y^2 + \frac{1}{y^2}\right) - \left(y + \frac{1}{y}\right)$$

$$36 \times 11 - 3$$

$$= 393$$

11. Sol. (b)

$$x + \frac{1}{x} = 8 \quad k = 8$$

$$(x^2)^2 + \frac{1}{(x^2)^2} = 62$$

$$x^6 + \frac{1}{x^6} = ?$$

$$(x^2)^3 + \frac{1}{(x^2)^3}$$

$$512 - 24 = 488$$

12. Sol. (c)

$$\sqrt{x} + \frac{1}{\sqrt{x}} = \sqrt{6}$$

Squaring both side

$$x + \frac{1}{x} = 4$$

Squaring both side

$$x^2 + \frac{1}{x^2} = 14$$

Taking cube both side

$$x^6 + \frac{1}{x^6} = 14^3 - 14 \times 3$$

$$x^6 + \frac{1}{x^6} = 2702$$

13. Sol. (a)

$$x + \frac{1}{x} = 5$$

Take cube on both sides

$$\Rightarrow \left(x + \frac{1}{x}\right)^3 = (5)^3$$

$$\Rightarrow x^3 + \frac{1}{x^3} + 3 \times 5 = 125$$

$$\Rightarrow x^3 + \frac{1}{x^3} = 110$$

 $\therefore$ Squaring both sides

$$\left(x^3 + \frac{1}{x^3}\right)^2 = (110)^2$$

$$x^6 + \frac{1}{x^6} = 12100 - 2 = 12098$$

14. Sol. (d)

$$x + \frac{1}{x} = 4$$

$$x - \frac{1}{x} = \sqrt{4^2 - 4} = \sqrt{12}$$

$$\left(x^4 + \frac{1}{x^4}\right)\left(x^3 - \frac{1}{x^3}\right) = x^7 - x + \frac{1}{x} - \frac{1}{x^7}$$

$$x^7 - \frac{1}{x^7} = \left(x^4 + \frac{1}{x^4}\right)\left(x^3 - \frac{1}{x^3}\right) + \left(x - \frac{1}{x}\right)$$

$$= 194 \times 15\sqrt{12} + \sqrt{12}$$

$$= 5822\sqrt{3}$$

15. Sol. (d)

$$\text{If } x - \frac{1}{x} = \sqrt{6}$$

Then,

$$x + \frac{1}{x} = \sqrt{P^2 + 4} = \sqrt{(\sqrt{6})^2 + 4} = \sqrt{10}$$

$$x^2 + \frac{1}{x^2} = P^2 + 2 = (\sqrt{6})^2 + 2$$

$$x^2 + \frac{1}{x^2} = 8$$

On squaring both sides of eq. (i)

$$x^4 + \frac{1}{x^4} + 2 = 64 \Rightarrow x^4 + \frac{1}{x^4} = 62$$

$$x^3 - \frac{1}{x^3} = P^3 + 3P = (\sqrt{6})^3 + 3(\sqrt{6}) = 9\sqrt{6}$$

$$\Rightarrow \left(x^4 + \frac{1}{x^4}\right) \left(x^3 - \frac{1}{x^3}\right) = (62)(9\sqrt{6})$$

$$\Rightarrow x^7 - x + \frac{1}{x} - \frac{1}{x^7} = 558\sqrt{6}$$

$$\Rightarrow x^7 - \frac{1}{x^7} = 558\sqrt{6} + \left(x - \frac{1}{x}\right)$$

$$\Rightarrow x^7 - \frac{1}{x^7} = 558\sqrt{6} + \sqrt{6} = 559\sqrt{6}$$

16. Sol. (b)

$$\text{If } x - \frac{1}{x} = 4$$

Then,

$$x + \frac{1}{x} = \sqrt{P^2 + 4} = \sqrt{(4)^2 + 4} = 2\sqrt{5}$$

$$x^2 + \frac{1}{x^2} = P^2 + 2 = (4)^2 + 2 = 18$$

$$x^3 + \frac{1}{x^3} = P^3 - 3P = (2\sqrt{5})^3 - 3(2\sqrt{5})$$

$$= 40\sqrt{5} - 6\sqrt{5} = 34\sqrt{5}$$

$$x^6 - \frac{1}{x^6} = \left(x^3 - \frac{1}{x^3}\right) \left(x^3 + \frac{1}{x^3}\right)$$

$$= \left(x - \frac{1}{x}\right) \left(x^2 + \frac{1}{x^2} + 1\right) \left(x^3 + \frac{1}{x^3}\right)$$

$$= (4)(18 + 1)(34\sqrt{5}) = 2584\sqrt{5}$$

17. Sol. (c)

$$\left(x^4 + \frac{1}{x^4}\right) \left(x^3 + \frac{1}{x^3}\right) - \left(x + \frac{1}{x}\right)$$

$$47 \times 18 - 3$$

$$846 - 3 = 843$$

18. Sol. (c)

$$x^4 + \frac{1}{x^4} = \sqrt{k^2 + 4}$$

$$= \sqrt{2909} = 42$$

$$x^2 + \frac{1}{x^2} = 7$$

$$x^3 + \frac{1}{x^3} = 18$$

$$x^5 + \frac{1}{x^5} = (18)(7) - 3$$

$$= 126 - 3 = 123$$

$$\frac{1}{x^5} + \frac{1}{x^4} + \frac{1}{x^3} + x^3 + x^4 + x^5$$

$$18 + 47 + 123 = 188$$

19. Sol. (d)

$$\left(x + \frac{1}{x}\right) \left(x - \frac{1}{x}\right) \left(x^2 + \frac{1}{x^2} - 1\right) \left(x^2 + \frac{1}{x^2} + 1\right)$$

$$= \left(x + \frac{1}{x}\right) \left(x^2 + \frac{1}{x^2} - 1\right) \left(x - \frac{1}{x}\right) \left(x^2 + \frac{1}{x^2} + 1\right)$$

$$\therefore (A + B)(A^2 - AB + B^2) = A^3 + B^3$$

$$(A - B)(A^2 + AB + B^2) = A^3 - B^3$$

$$= \left(x^3 + \frac{1}{x^3}\right) \left(x^3 - \frac{1}{x^3}\right) = x^6 - \frac{1}{x^6}$$

20. Sol. (d)

$$x + \frac{1}{x} = 4 \text{ so, } x^2 + \frac{1}{x^2}$$

$$= 4^2 - 2 = 16 - 2 = 14$$

$$x^3 + \frac{1}{x^3} = 4^3 - 3 \times 4 = 52 \Rightarrow x^5 + \frac{1}{x^5}$$

$$= \left(x^2 + \frac{1}{x^2}\right) \times \left(x^3 + \frac{1}{x^3}\right) - \left(x + \frac{1}{x}\right)$$

$$x^5 + \frac{1}{x^5} = 14 \times 52 - 4 = 724$$

21. Sol. (a)

$$(x^6)^5 + \frac{1}{(x^6)^5}$$

$$18 \times 7 - 3$$

$$126 - 3 = 123$$

22. Sol. (c)

$$x - \frac{1}{x} = 1 \text{ Squaring on both sides}$$

$$x^2 + \frac{1}{x^2} = 1^2 + 2 = 3 \text{ Squaring on both sides}$$

$$x^4 + \frac{1}{x^4} = 3^2 - 2 = 7$$

$$x^8 + \frac{1}{x^8} = 7^2 - 2 = 47$$

23. Sol. (a)

$$x + \frac{1}{x} = \sqrt{13}, x^{10} - \frac{1}{x^{10}}$$

$$\left(x^5 + \frac{1}{x^5}\right) \left(x^5 - \frac{1}{x^5}\right)$$

$$(10\sqrt{13} \times 11 - \sqrt{3}) \times (36 \times 11 - 3)$$

$$= 109\sqrt{13} \times 393$$

$$= 42837\sqrt{13}$$

24. Sol. (b)

$$x - \frac{1}{x} = 5$$

$$x^3 - \frac{1}{x^3} = P^3 + 3P$$

$$= (5)^3 + 3(5) = 140$$

$$x^2 + \frac{1}{x^2} = P^2 + 2$$

$$= (5)^2 + 2 = 27$$

$$\Rightarrow \left(x^3 - \frac{1}{x^3}\right)\left(x^2 + \frac{1}{x^2}\right) = (140)(27)$$

$$\Rightarrow x^5 + x - \frac{1}{x} - \frac{1}{x^5} = 3780$$

$$\Rightarrow x^5 + x - \frac{1}{x} - \frac{1}{x^5} = 3780$$

$$\Rightarrow x^5 - \frac{1}{x^5} + x - \frac{1}{x} = 3780$$

$$\Rightarrow x^5 - \frac{1}{x^5} = 3780 - 5 = 3775$$

25. Sol. (a)

$$x^2 - 2\sqrt{5}x + 1 = 0$$

$$\Rightarrow x + \frac{1}{x} = 2\sqrt{5}$$

$$\Rightarrow x^5 + \frac{1}{x^5} = \left(x^2 + \frac{1}{x^2}\right)\left(x^3 + \frac{1}{x^3}\right) - \left(x + \frac{1}{x}\right)$$

$$x^2 + \frac{1}{x^2} = 18 \text{ and } x^3 + \frac{1}{x^3} = 34\sqrt{5}$$

$$\Rightarrow x^5 + \frac{1}{x^5} = 610\sqrt{5}$$

26. Sol. (c)

$$x^8 + \frac{1}{x^8} = 47$$

$$\left(x^4 + \frac{1}{x^4}\right)^2 = x^8 + \frac{1}{x^8} + 2$$

$$\Rightarrow x^4 + \frac{1}{x^4} = \sqrt{47 + 2} = 7$$

$$\left(x^2 + \frac{1}{x^2}\right)^2 = x^4 + \frac{1}{x^4} + 2$$

$$\Rightarrow x^2 + \frac{1}{x^2} = \sqrt{7 + 2} = 3$$

$$\left(x^2 + \frac{1}{x^2}\right)^3 = x^6 + \frac{1}{x^6} + 3\left(x^2 + \frac{1}{x^2}\right)$$

$$\Rightarrow x^6 + \frac{1}{x^6} = (3)^3 - 3(3) = 18$$

27. Sol. (d)

$$\text{If } x + \frac{1}{x} = 7$$

Then,

$$x - \frac{1}{x} = \sqrt{P^2 - 4} = \sqrt{7^2 - 4} = 3\sqrt{5}$$

$$x^3 - \frac{1}{x^3} = P^3 + 3P = (3\sqrt{5})^3 + 3(3\sqrt{5})$$

$$= 135\sqrt{5} + 9\sqrt{5} = 144\sqrt{5}$$

$$x^2 + \frac{1}{x^2} = P^2 - 2 = (7)^2 - 2 = 47$$

$$\left(x^3 - \frac{1}{x^3}\right)\left(x^2 + \frac{1}{x^2}\right) = (144\sqrt{5})(47)$$

$$\Rightarrow x^5 - \frac{1}{x^5} + \left(x - \frac{1}{x}\right) = 6768\sqrt{5}$$

$$\Rightarrow x^5 - \frac{1}{x^5} = 6768\sqrt{5} - 3\sqrt{5} = 6765\sqrt{5}$$

28. Sol. (b)

As per the question

$$x + \frac{1}{x} = 4$$

$$x^3 + \frac{1}{x^3} = k^3 - 3K$$

$$x^3 + \frac{1}{x^3} = 4^3 - 3 \times 4$$

$$x^3 + \frac{1}{x^3} = 52$$

On squaring both sides

$$x^6 + \frac{1}{x^6} = 52^2 - 2 = 2704 - 2 = 2702$$

29. Sol. (b)

$$x + \frac{1}{x} = 5, x - \frac{1}{x} = \sqrt{5^2 - 4} = \sqrt{21}, x^3 - \frac{1}{x^3} = 24\sqrt{21}$$

$$\left(x^3 - \frac{1}{x^3}\right)\left(x^2 + \frac{1}{x^2}\right) = x^5 + x - \frac{1}{x} - \frac{1}{x^5}$$

$$\left(x^5 - \frac{1}{x^5}\right) = \left(x^3 - \frac{1}{x^3}\right)\left(x^2 + \frac{1}{x^2}\right) - \left(x - \frac{1}{x}\right)$$

$$= 24\sqrt{21} \times 23 - \sqrt{21}$$

$$= 552\sqrt{21} - \sqrt{21} = 551\sqrt{21}$$

30. Sol. (b)

$$x^2 + 3x + 1 = 0$$

$$\text{Then, } x + \frac{1}{x} = -3 \Rightarrow x^2 + \frac{1}{x^2} = 7$$

$$\Rightarrow x^6 + \frac{1}{x^6} = 322$$

Type-9 (Polynomial)

1. If $x^2 = b - ax$ and $x^3(x^3 + c) = d$, then which of the following can be the values of c and d ?

SSC CHSL 2023 (Morning)

- (a) $c = a^3 - 3ab$ and $d = b^3$
 (b) $c = -a^3 - 3ab$ and $d = b^3$
 (c) $c = a^3 + 3ab$ and $d = b^3$
 (d) $c = a^3 + 3ab$ and $d = -b^3$

2. The factors of $x^4 + x^2 + 25$ are:

SSC CGL 03/12/2022 (1st Shift)

- (a) $(x^2 + 3x - 5)(x^2 - 3x + 5)$
 (b) $(x^2 + 3x + 5)(x^2 - 3x + 5)$
 (c) $(x^2 - 3x + 5)(x^2 - 3x + 5)$
 (d) $(x^2 + 3x + 5)(x^2 + 3x + 5)$

3. If $\frac{L}{M} + \frac{M}{N} + \frac{N}{L} = 0$, then $\frac{NL}{M^2} + \frac{M^2}{LN} - \frac{N^2}{L^3} = ?$

- (a) -1 (b) 1
 (c) 0 (d) -2

4. If $x^3 - x^2 + ax^2 + x + b$ is exactly divisible by $x^2 - 3x + 2$, then the value of a and b are respectively.

- (a) 2, -3 (b) -3, 2
 (c) -2, 3 (d) 2, 3

5. If $x - y = 1$ and $x^2 + y^2 = 41$ where $x, y \geq 0$, then the value of $x + y$ will be:

SSC CGL 03/12/2022 (2nd Shift)

- (a) 9 (b) 8
 (c) 6 (d) 7

6. If $16y^2 - k = \left(4y + \frac{3}{2}\right)\left(4y - \frac{3}{2}\right)$, then the value of k is:

SSC CPO 09/11/2022 (Evening)

- (a) $\frac{9}{4}$ (b) $\frac{11}{4}$
 (c) $\frac{6}{4}$ (d) $\frac{7}{4}$

7. The algebraic expression $25x^2 + 16y^2 + 9z^2 - 40xy + 24yz - 30zx$ is equal to:

Graduate Level 02/08/22(Shift-3)

- (a) $(4y + 3z - 5x)(4x + 5y - 3z)$
 (b) $(4y - 3z - 5x)(4x + 5y + 3z)$
 (c) $(4y + 3z - 5x)^2$
 (d) $(4y - 3z - 5x)^2$

8. If $(x + 2)$ and $(x - 3)$ are the factors of $x^2 + k_1x + k_2$, then:

SSC CHSL 09/06/2022 (Afternoon)

- (a) $k_1 = 1$ and $k_2 = -6$
 (b) $k_1 = -1$ and $k_2 = -6$
 (c) $k_1 = -1$ and $k_2 = 6$
 (d) $k_1 = 1$ and $k_2 = 6$

9. If $\frac{a}{b+c} + \frac{b}{c+a} + \frac{c}{a+b} = 1$, then find $\frac{a^2}{b+c} + \frac{b^2}{c+a} + \frac{c^2}{a+b} = ?$

- (a) 0 (b) -2
 (c) 3 (d) 1

10. $\frac{a^3(b^2-c^2)+b^3(c^2-a^2)+c^3(a^2-b^2)}{a^2(b-c)+b^2(c-a)+c^2(a-b)} = ?$

- (a) $ab + bc + ca$ (b) 1
 (c) 0 (d) $a + b + c$

11. If m and n are two positive real numbers such that $9m^2 + n^2 = 40$ and $mn = 4$, then the value of $3m + n$ is:

SSC CGL 08/12/2022 (1st Shift)

- (a) 160 (b) 64
 (c) 10 (d) 8

12. $\frac{a(b-c)^2}{(c-a)(a-b)} + \frac{b(c-a)^2}{(a-b)(b-c)} + \frac{c(a-b)^2}{(b-c)(c-a)} = ?$

- (a) $a + b + c$ (b) 3
 (c) $a^2 + b^2 + c^2$ (d) abc

13. $\frac{a^3(b+c)}{(a-b)(a-c)} + \frac{b^3(c+a)}{(b-c)(b-a)} + \frac{c^3(a+b)}{(c-a)(c-b)} = ?$

- (a) abc (b) $a + b + c$
 (c) $ab + bc + ca$ (d) 3

14. If $a + b = 2c$ then the value of $\frac{a}{a-c} + \frac{c}{b-c}$ is

SSC CHSL 01/06/2022 (Afternoon)

- (a) $\frac{1}{2}$ (b) 1
 (c) 0 (d) -1

15. If $\sqrt{a^2 + b^2 + ab} + \sqrt{a^2 + b^2 - ab} = 1$, then what is the value of $(1 - a^2)(1 - b^2)$?

- (a) $1/4$ (b) $4/7$
 (c) $5/4$ (d) $3/4$

16. If $a + b + c = 0$, then $\frac{a^2}{2a^2+bc} + \frac{b^2}{2b^2+ca} + \frac{c^2}{2c^2+ab} = ?$

- (a) 0 (b) 1
 (c) 3 (d) 2

17. If $x - y = 2, xy = 24$, then the value of $(x^2 + y^2)$ is:-

- (a) 25 (b) 36
 (c) 63 (d) 52

18. If $x^2 + 4y^2 + 3z^2 + \frac{19}{4} = 2\sqrt{3}(x + y + z)$, then the value of $(x - 4y + 3z) = ?$

SSC CHSL 5/8/2021 (Morning)

- (a) $\frac{\sqrt{3}}{3}$ (b) $2\sqrt{3}$
 (c) $\sqrt{3}$ (d) $\frac{\sqrt{3}}{2}$

19. If $x^2 + 9y^2 + 4z^2 = 12(x - 2y + 2z) - 88$, then the value of $(x - 3y + z)$ is:

SSC CGL 17/8/2021 (Evening)

- (a) 10 (b) 13
 (c) 11 (d) 5

20. What is $\frac{x^4}{(x^2-y^2)(x^2-z^2)} + \frac{y^4}{(y^2-x^2)(y^2-z^2)} + \frac{z^4}{(z^2-x^2)(z^2-y^2)}$ equal to?

[CDS-2021-II]

- (a) -1 (b) 0
 (c) 1 (d) $x^2 + y^2 + z^2$

21. Which one of the following is a factor of the polynomial $(x - 1)(x - 2)(x - 4) - 90$?

[CDS-2021-II]

- (a) $x + 14$ (b) $x - 14$
 (c) $x - 6$ (d) $x - 7$

22. If $x^4 + y^4 + x^2y^2 = 117$ and $x^2 + y^2 - xy = 3(4 + \sqrt{3})$, then the value of $(x^2 + y^2)$ will be:

SSC CHSL 12/04/2021 (Morning)

- (a) 9 (b) $6\sqrt{3}$
 (c) 12 (d) $13\sqrt{3}$

23. If $x(x - 1)(x - 2)(x - 3) + 1 = k^2$, then which one of following is a possible expression for k ?

- (a) $x^2 - 3x + 1$ (b) $x^2 - 3x - 1$
 (c) $x^2 + 3x - 1$ (d) $x^2 - 2x - 1$

24. $(x^2 + 5x + 5)^2 - (x + 1)(x + 2)(x + 3)(x + 4)$ is equal to

- (a) 0 (b) 1
 (c) 5 (d) 2

25. If $p(x) = x^5 + 3x^4 - 2x^3 + 5a - 4$ is exactly divisible by $x - 2$, then the value of a is

- (a) 8 (b) 12
 (c) 14 (d) 10

26. What are the values of p and q respectively, if $(x - 1)$ and $(x + 2)$ divide the polynomial $x^3 + 4x^2 + px + q$?

[CDS-2020-I]

- (a) $1, -6$ (b) $2, -6$
 (c) $1, 6$ (d) $2, 6$

27. If $x = a + \frac{1}{a}$ and $y = a - \frac{1}{a}$ then $\sqrt{x^4 + y^4 - 2x^2y^2}$ is equal to:-

- (a) $16a^2$ (b) 8
 (c) $8/a^2$ (d) 4

28. If $\frac{x}{b+c} = \frac{y}{c+a} = \frac{z}{a+b}$, then:-

- (a) $\frac{x-y}{b-a} = \frac{y-z}{c-b} = \frac{z-x}{a-c}$

(b) $\frac{x}{a} = \frac{y}{b} = \frac{z}{c}$

(c) $\frac{x-y}{c} = \frac{y-z}{b} = \frac{z-x}{c}$

(d) None of the above is true

29. If $\sqrt[3]{x} + \sqrt[3]{y} + \sqrt[3]{z} = 0$, then find the value of $\frac{x^3+y^3+z^3-27xyz}{(x+y)(y+z)(x+z)}$

(a) 1 (b) -1

(c) -3 (d) 0

30. If $b+c=ax$, $c+a=by$ and $a+b=cz$, then the value of $\frac{1}{9}\left[\frac{1}{x+1} + \frac{1}{y+1} + \frac{1}{z+1}\right]$ is: SSC CGL 6/03/2020 (Evening)

(a) $\frac{1}{3}$ (b) 0

(c) $\frac{1}{9}$ (d) 1

31. $(ax+by)$ is a factor of:

SSC CHSL 16/10/2020 (Afternoon)

(a) $a^2x^2 + 2ab - b^2y^2$

(b) $a^2x^2 + 2abxy + b^2y^2$

(c) $a^2x^3 + 2abx + b^2y^2x$

(d) $a^2x^2 + 2ab + b^2y^2$

32. On simplification $\frac{x^3-y^3}{x[(x+y)^2-3xy]} \div \frac{y[(x-y)^2+3xy]}{x^3+y^3} \times$

$\frac{(x+y)^2-(x-y)^2}{x^2-y^2}$ is equal to:

SSC CGL 4/03/2020 (Morning)

(a) 4 (b) 1

(c) $\frac{1}{2}$ (d) $\frac{1}{4}$

33. If $a^2 + b^2 + c^2 + 84 = 4(a-2b+4c)$, then $\sqrt{ab-bc+ca}$ is equal to:

SSC CPO 24/11/2020 (Evening)

(a) $5\sqrt{10}$ (b) $4\sqrt{10}$

(c) $2\sqrt{10}$ (d) $\sqrt{10}$

34. If $a+b+c=4$, $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 3$, then $\frac{a}{b} + \frac{b}{a} + \frac{c}{a} + \frac{a}{c} + \frac{b}{c} + \frac{c}{b} = ?$.

(a) 6

(b) 7

(c) 8

(d) 9

35. If $\sqrt{(1-p^2)(1-q^2)} = \sqrt{3}/2$, then what is the Value of $\sqrt{2p^2+2q^2+2pq} + \sqrt{2p^2+2q^2-2pq}$?

(a) 2

(b) $\sqrt{2}$

(c) 1

(d) None of these

36. If $P = \frac{x^3+y^3}{(x-y)^2+3xy}$, $Q = \frac{(x+y)^2-3xy}{x^3-y^3}$ and $R =$

$\frac{(x+y)^2+(x-y)^2}{x^2-y^2}$, then what is the value of $(P \div Q) \times R$?

SSC CGL 5/03/2020 (Morning)

(a) $2(x^2+y^2)$

(b) $4xy$

(c) x^2+y

(d) $2xy$

37. If the value of $\frac{3x\sqrt{y}+2y\sqrt{x}}{3x\sqrt{y}-2y\sqrt{x}} - \frac{3x\sqrt{y}-2y\sqrt{x}}{3x\sqrt{y}+2y\sqrt{x}}$ is same as that of $\sqrt{x}\sqrt{y}$, then which of the following relations between x and y is correct?

SSC CHSL 18/03/2020 (morning)

(a) $9x-4y=36$

(b) $9x+4y=24$

(a) $ax+4y=36$

(d) $9x-4y=24$

38. Find the factors of the expression $3x^2-5x-8$

SSC CHSL 13/10/2020 (Evening)

(a) $(x-1)$ and $(3x-8)$

(b) $(x+1)$ and $(3x-8)$

(c) $(x+1)$ and $(3x+8)$

(d) $(x-1)$ and $(3x+8)$

39. If $2x^2+y^2+6x-2xy+9=0$, then the value of $4x^3-y^3+x^2y^2$ is:

SSC CGL 6/06/2019 (Afternoon)

(a) 0

(b) 9

(c) -3

(d) -9

40. If $\frac{3(x^2+1)-7x}{3x} = 6, x \neq 0$ then the value of $\sqrt{x} + \frac{1}{\sqrt{x}}$ is:

SSC CGL TIER II (13/09/2019)

(a) $\sqrt{\frac{25}{3}}$

(b) $\frac{\sqrt{11}}{3}$

(c) $\sqrt{\frac{35}{3}}$

(d) $\sqrt{\frac{31}{3}}$

41. If $a = xy$, $b = yz$ and $c = zx$, then $x^2 + y^2 + z^2$ will equal to

(a) $\frac{abc}{a^2+b^2+c^2}$

(c) $a^2 + b^2 + c^2$

(b) $\frac{a^2+b^2+c^2}{abc}$

(d) $\frac{ab}{c} + \frac{bc}{a} + \frac{ca}{b}$

42. If $x^4 + x^2y^2 + y^4 = \frac{21}{256}$ and $x^2 + xy + y^2 = 3/16$ then $2(x^2 + y^2) = ?$

SSC CPO 12/12/2019 (Morning)

(a) $\frac{3}{8}$

(b) $\frac{5}{8}$

(c) $\frac{3}{4}$

(d) $\frac{5}{16}$

43. $(x+y)^{\frac{1}{3}} + (z+y)^{\frac{1}{3}} = -(x+z)^{\frac{1}{3}}$ then $(x^3 + y^3 + z^3)$ can be expressed as :

SSC CHSL 10 /7/ 2019 (Morning)

(a) $\frac{1}{8}xyz$

(b) $(x+y)(y+z)(z+x)$

(c) $\frac{3}{8}(x+y)(y+z)(z+x)$

(d) $3xyz$

44. Given that the polynomial $(x^2 + ax + b)$ leaves the same remainder when divided by $(x-1)$ or $(x+1)$. What are the values of a and b respectively ?

(a) 4 and 0

(b) 0 and 3

(c) 3 and 0

(d) 0 and any integer

45. Which one of the following is a zero of the polynomial $3x^3 + 4x^2 - 7$?

(a) 0

(b) 1

(c) 2

(d) -1

Type-9 (Polynomial) ANSWER KEY													
1	C	2	B	3	C	4	*	5	A	6	A	7	C
8	B	9	A	10	A	11	D	12	A	13	C	14	B
15	*	16	B	17	D	18	C	19	B	20	C	21	D
22	C	23	A	24	B	25	B	26	A	27	D	28	A
29	C	30	C	31	B	32	A	33	C	34	D	35	B
36	A	37	D	38	B	39	A	40	D	41	D	42	B
43	C	44	D	45	A								

Type-9 (Polynomial) Solution

1. Sol. (c)

$x^2 + ax = b$ By cubing both side,

We get: $x^6 + x^3a^3 + 3ax^3 \times b = b^3$

$$x^3(x^3 + a^3 + 3ab) = b^3$$

Now, comparing this equation with the given

equation i.e. $x^3(x^3 + c) = d$ $c = a^3 + 3ab$ and $d = b^3$

2. Sol. (b)

$$(x^4 + x^2 + 25) = (x^4 + x^2 + 5^2)$$

$$[(x^2 + 5)^2 - 2 \times 5 \times x^2] + x^2$$

$$= [(x^2 + 5)^2 - 10x^2 + x^2]$$

$$= [(x^2 + 5)^2 - 9x^2] = [(x^2 + 5)^2 - (3x)^2]$$

$$= (x^2 + 3x + 5)(x^2 - 3x + 5)$$

3. Sol. (d)

Put $N = 1, M = 1,$

$$L + 1 + \frac{1}{L} = 0$$

$$L + \frac{1}{L} = -1 \Rightarrow L^3 = 1$$

$$\text{Now, } L + \frac{1}{L} = \frac{1}{L^3} = -1 - 1 = -2$$

4. **Sol. (b)**

$$x^2 - 3x + 2 = 0$$

$$(x-1)(x-2) = 0$$

If $f(x) = x^4 - x^3 + ax^2 + x + b$ is divisible by

$$(x-1)(x-2)$$

Then, $f(1) = 0$ and $f(2) = 0$

$$f(1) = (1)^4 - (1)^3 + a(1)^2 + 1 + b = 0$$

$$\Rightarrow a + b = -1$$

$$f(2) = (2)^4 - (2)^3 + a(2)^2 + 2 + b = 0$$

$$\Rightarrow 4a + b = -10 \dots (ii)$$

From equation (i) and (ii)

$$a = -3 \text{ and } b = 2$$

5. **Sol. (a)**

Given that, $x - y = 1$ and $x^2 + y^2 = 41$

$$\text{Now, } (x-y)^2 = x^2 + y^2 - 2xy$$

$$1 = 41 - 2xy \Rightarrow xy = 20$$

Now by using formula,

$$(x+y)^2 = x^2 + y^2 + 2xy$$

$$(x+y)^2 = 41 + 2 \times 20 = 81 \Rightarrow x+y = 9$$

6. **Sol. (a)**

$$16y^2 - k = \left(4y + \frac{3}{2}\right)\left(4y - \frac{3}{2}\right)$$

$$\Rightarrow 16y^2 - k = (4y)^2 - \left(\frac{3}{2}\right)^2$$

$$[(a+b)(a-b) = (a^2 - b^2)]$$

$$\Rightarrow 16y^2 - k = 16y^2 - \frac{9}{4} \Rightarrow k = \frac{9}{4}$$

7. **Sol. (c)**

$$25x^2 + 16y^2 + 9z^2 - 40xy + 24yz - 30zx$$

$$= (-5x)^2 + (4y)^2 + (3z)^2 - (2.5x \cdot 4y)$$

$$+ (2.4y \cdot 3z) - (2.5x \cdot 3z)$$

$$= (4y + 3z - 5x)^2$$

8. **Sol. (b)**

$(x+2)$ and $(x-3)$ are the factors of $x^2 + k_1x + k_2$.

$$(x+2) \times (x-3) = x^2 - x - 6$$

Now, equate $x^2 - x - 6$ and $x^2 + k_1x + k_2$

We get, $k_1 = -1$ and $k_2 = -6$

$$= (-5x + 4y + 3z)^2$$

9. **Sol. (a)**

Put $c = 0, b = 1$

$$a + \frac{1}{a} = 1, a^3 = -1$$

$$\frac{a^2}{b+c} + \frac{b^2}{c+a} + \frac{c^2}{a+b}$$

$$= a^2 + \frac{1}{a} = \frac{a^3+1}{a}$$

$$= \frac{-1+1}{a} = \frac{0}{a} = 0$$

10. **Sol. (a)**

$$a'b' = 2 \frac{a^3(b^2-c^2)+b^3(c^2-a^2)+c^3(a^2-b^2)}{a^2(b-c)+b^2(c-a)+c^2(a-b)} = \frac{5}{3} = 2$$

11. **Sol. (d)**

$$9m^2 + n^2 = 40 \text{ and } mn = 4$$

$$\Rightarrow 9m^2 + n^2 + 6mn = 40 + 6mn$$

$$\Rightarrow (3m+n)^2 = 40 + 24 = 64$$

$$\Rightarrow 3m+n = 8$$

12. **Sol. (a)**

$$\frac{a(b-c)^2}{(c-a)(a-b)} = \frac{3}{2} = (1)$$

13. **Sol. (c)**

$$\frac{a^3(b+c)}{(a'-b')(a'-c')} = \frac{3+1}{2} = 2$$

14. **Sol. (b)**

$$a+b = 2c \text{ So, } a-c = c-b$$

According to the question,

$$\frac{a}{a-c} + \frac{c}{b-c} = \frac{a}{c-b} + \frac{c}{b-c}$$

$$= \frac{a}{-(b-c)} + \frac{c}{b-c} = \frac{c-a}{b-c} = \frac{a-c}{c-b} = 1$$

16. **Sol. (d)**

Put $b = 0, a + a = 1$

$$2a = 1 \Rightarrow a = \frac{1}{2}$$

16. **Sol. (b)**

Put $c = 0$,

$$\frac{a^2}{2a^2} + \frac{b^2}{2b^2} + 0 = \frac{1}{2} + \frac{1}{2} = 1$$

17. **Sol. (d)**

$x - y = 2, xy = 24$ (given)

$$(x-y)^2 = (2)^2 \Rightarrow x^2 + y^2 - 2xy = 4$$

$$x^2 + y^2 - 2 \times 24 = 4$$

$$x^2 + y^2 = 4 + 48 = 52$$

18. Sol. (c)

$$x^2 + 4y^2 + 3z^2 + \frac{19}{4} = 2\sqrt{3}(x + y + z)$$

$$\Rightarrow x^2 - 2\sqrt{3}x + 4y^2 - 2\sqrt{3}y + 3z^2 - 2\sqrt{3}z + \frac{19}{4} = 0$$

$$\Rightarrow (x - \sqrt{3})^2 + \left(2y - \frac{\sqrt{3}}{2}\right)^2 + (\sqrt{3}z - 1)^2 = 0$$

$$\Rightarrow (x - \sqrt{3}) = 0, \left(2y - \frac{\sqrt{3}}{2}\right) = 0, (\sqrt{3}z - 1) = 0$$

$$x = \sqrt{3}, y = \frac{\sqrt{3}}{4}, z = \frac{1}{\sqrt{3}}$$

$$(x - 4y + 3z)$$

$$= \sqrt{3} - 4 \times \frac{\sqrt{3}}{4} + 3 \times \frac{1}{\sqrt{3}} = \sqrt{3}$$

19. Sol. (b)

$$x^2 + 9y^2 + 4z^2 = 12(x - 2y + 2z) - 88$$

$$x^2 - 12x + 9y^2 + 24y + 4z^2 - 24z + 88 = 0$$

$$x^2 - 12x + 36 + 9y^2 + 24y + 16 + 4z^2 - 24z$$

$$+ 36 = 0$$

$$(x - 6)^2 + (3y + 4)^2 + (2z - 6)^2 = 0$$

$$x = 6, y = -4/3, z = 3$$

$$(x - 3y + z) = (6 + 4 + 3) = 13$$

20. Sol. (c)

$$\frac{x^4}{(x^2 - y^2)(x^2 - z^2)} + \frac{y^4}{(y^2 - x^2)(y^2 - z^2)} + \frac{z^4}{(z^2 - x^2)(z^2 - y^2)}$$

Because there is three variables and one equation.

So, we can put the value of two variables.

Let, $z = 0$

$$\text{Then, } \frac{x^4}{(x^2 - y^2) \cdot x^2} + \frac{y^4}{(y^2 - x^2) \cdot y^2}$$

$$= \frac{x^2}{x^2 - y^2} + \frac{y^2}{y^2 - x^2} = \frac{x^2 - y^2}{x^2 - y^2} = 1$$

21. Sol. (d)

$$(x - 1)(x - 2)(x - 4) - 90 \text{ From option (d)}$$

If 7 is a factor of the polynomial Then,

$$= (7 - 1)(7 - 2)(7 - 4) - 90$$

$$= 6 \times 5 \times 3 - 90 = 90 - 90 = 0$$

So, $(x - 7)$ is a factor of polyomial.

22. Sol. (c)

$$x^4 + y^4 + x^2y^2 = 117$$

$$x^2 + y^2 - xy = 3(4 + \sqrt{3}) = 12 + 3\sqrt{3} \quad \dots (i)$$

$$x^4 + y^4 + x^2y^2 = (x^2 + y^2 - xy)(x^2 + y^2 + xy)$$

$$117 = 3(4 + \sqrt{3})(x^2 + y^2 + xy)$$

$$(x^2 + y^2 + xy) = \frac{39}{4 + \sqrt{3}} = 3(4 - \sqrt{3})$$

$$= 12 - 3\sqrt{3} \dots (ii)$$

On adding (i) and (ii)

$$x^2 + y^2 = 12$$

23. Sol. (a)

$$k^2 = x(x - 1)(x - 2)(x - 3)$$

$$k^2 = x^4 - 6x^3 + 11x^2 - 6x + 1$$

$$k^2 = (x^2 - 3x + 1)^2$$

Taking square root on both sides.

$$k = x^2 - 3x + 1$$

24. Sol. (b)

$$(x^2 + 5x + 5)^2 - [(x + 1)(x + 4)][(x + 2)(x + 3)]$$

$$= (x^2 + 5x + 5)^2 - [(x^2 + 5x + 4)(x^2 + 5x + 6)]$$

$$\text{Let } x^2 + 5x = p$$

$$= (p + 5)^2 - [(p + 4)(p + 6)]$$

$$= p^2 + 25 + 10p - [p^2 + 10p + 24] = 1$$

25. Sol. (b)

if $p(x) = x^5 + 3x^4 - 2x^3 + 5a - 4$ is divisible by

$$(x - 2)$$

Then, $p(2) = 0$

$$p(2) = (2)^5 + 3(2)^4 - 2(2)^3 + 5a - 4 = 0$$

$$\Rightarrow 32 + 3 \times 16 - 16 + 5a - 4 = 0$$

$$\Rightarrow 64 + 5a - 4 = 0$$

$$\Rightarrow 5a = -60 \Rightarrow a = -12$$

26. Sol. (a)

$$f(x) = x^3 + 4x^2 + px + q$$

Now, $(x - 1)$ and $(x + 2)$ divide

$$f(x). \text{ so, } f(1) = f(-2) = 0$$

$$f(1) = 1^3 + 4 \times 1^2 + p \times 1 + q = 0 \Rightarrow p + q = -5$$

$$f(2) = -8 + 16 - 2p + q = 0 \Rightarrow q - 2p = -8$$

on Solving $p = 1, q = -6$

27. Sol. (d)

Put $a = 1$, then $x = 2, y = 0$

$$\sqrt{x^4 + y^4 - 2x^2y^2} = \sqrt{x^4} = \sqrt{16} = 4$$

28. Sol. (a)

$$\frac{x}{b+c} = \frac{y}{c+a} = \frac{z}{a+b} \text{ (given)}$$

$$\therefore \frac{x}{b+c} = \frac{y}{c+a}$$

$$\Rightarrow \frac{x}{b+c} = \frac{x-y}{(b+c)-(c+a)} = \frac{x-y}{b-a}$$

Similarly

$$\frac{y}{c+a} = \frac{z}{a+b}$$

$$\therefore \frac{y}{c+a} = \frac{y-z}{(c+a)-(a+b)} = \frac{y-z}{c-b} \text{ again}$$

$$\Rightarrow \frac{z}{a+b} = \frac{x}{b+c}$$

$$\Rightarrow \frac{z}{a+b} = \frac{z-x}{(a+b)-(b+c)} = \frac{z-x}{a-c}$$

$$\therefore \frac{x-y}{b-a} = \frac{y-z}{c-b} = \frac{z-x}{a-c}$$

29. Sol. (c)

$$\sqrt[3]{x} + \sqrt[3]{y} + \sqrt[3]{z} = 0 \text{ Then,}$$

$$\Rightarrow (\sqrt[3]{x})^3 + (\sqrt[3]{y})^3 + (\sqrt[3]{z})^3 = 3(\sqrt[3]{xyz})$$

$$\Rightarrow x + y + z = 3(\sqrt[3]{xyz})$$

Take cube on both sides

$$\Rightarrow (x + y + z)^3 = 27(xyz)$$

$$\Rightarrow x^3 + y^3 + z^3 + 3(x+y)(y+z)(z+x) = 27xyz$$

$$\Rightarrow x^3 + y^3 + z^3 - 27xyz = -3(x+y)(y+z)(z+x)$$

$$\Rightarrow \frac{x^3+y^3+z^3-27xyz}{(x+y)(y+z)(z+x)} = -3$$

30. Sol. (c)

$$b+c = ax, a+c = by, a+b = cz$$

$$\Rightarrow a+b+c = a+ax, b+a+c = b+by,$$

$$c+a+b = c+cz$$

$$\Rightarrow \frac{a+b+c}{a} = 1+x, \frac{a+b+c}{b} = 1+y,$$

$$\frac{a+b+c}{c} = 1+z$$

$$\frac{1}{9} \left[\frac{1}{x+1} + \frac{1}{y+1} + \frac{1}{z+1} \right] = \frac{1}{9}$$

31. Sol. (b)

$$(ax+by), \text{ on squaring it, } (ax+by)^2 = a^2x^2 +$$

$$2abxy + b^2y^2$$

$$\text{So, } (ax+by) \text{ is a factor of } a^2x^2 + 2abxy + b^2y^2$$

32. Sol. (a)

$$\frac{x^3-y^3}{x[(x+y)^2-3xy]} \div \frac{y[(x-y)^2+3xy]}{x^3+y^3} \times \frac{(x+y)^2-(x-y)^2}{x^2-y^2}$$

$$\Rightarrow \frac{x^3-y^3}{x[(x+y)^2-3xy]} \times \frac{x^3+y^3}{y[(x-y)^2+3xy]} \times \frac{(x+y)^2-(x-y)^2}{x^2-y^2}$$

$$\Rightarrow \frac{x-y}{x} \times \frac{x+y}{y} \times \frac{4xy}{(x-y)(x+y)} = 4$$

33. Sol. (c)

$$a^2 + b^2 + c^2 + 84 = 4(a-2b+4c)$$

Taking all the terms to the LHS and rearranging it

$$a^2 - 4a + 4 + b^2 + 8b + 16 + c^2 - 16c + 64$$

$$\text{We get, } (a-2)^2 + (b+4)^2 + (c-8)^2 = 0$$

As sum of squares terms is always greater than zero

unless each term is individually equal to 0

$$\text{So } a = 2, b = -4, c = 8$$

$$\sqrt{ab-bc+ca}$$

Putting the above values

$$\sqrt{-8+32+16} = \sqrt{40} = 2\sqrt{10}$$

34. Sol. (d)

$$a+b+c = 4, \frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 3$$

$$1 + \frac{a}{b} + \frac{a}{c} + 1 + \frac{b}{a} + \frac{b}{c} + 1 + \frac{c}{b} + \frac{c}{a} = 12$$

$$\frac{a}{b} + \frac{b}{a} + \frac{c}{a} + \frac{a}{c} + \frac{b}{c} + \frac{c}{b} = 12 - 3 = 9$$

35. Sol. (b)

$$\text{Put } q = 0,$$

$$1 - p^2 = \frac{3}{4} \Rightarrow p^2 = \frac{1}{4} \Rightarrow p = \frac{1}{2}$$

$$\sqrt{2p^2 + 2q^2 + 2pq} + \sqrt{2p^2 + 2q^2 - 2pq}$$

$$= \sqrt{2}p + \sqrt{2}p$$

$$= 2\sqrt{2}p = 2\sqrt{2} \times \frac{1}{2} = \sqrt{2}$$

36. Sol. (a)

$$P = \frac{x^3+y^3}{(x-y)^2+3xy}, Q = \frac{(x+y)^2-3xy}{x^3-y^3} \text{ and } R = \frac{(x+y)^2+(x-y)^2}{x^2-y^2}$$

$$(P \div Q) \times R = \left(\frac{x^3+y^3}{(x-y)^2+3xy} \div \frac{(x+y)^2-3xy}{x^3-y^3} \right) \times \frac{(x+y)^2+(x-y)^2}{x^2-y^2}$$

$$= \frac{x^3+y^3}{x^2+y^2+xy} \times \frac{x^3-y^3}{x^2+y^2-xy} \times \frac{2(x^2+y^2)}{x^2-y^2} = 2(x^2+y^2)$$

37. Sol. (d)

$$\Rightarrow \frac{3x\sqrt{y}+2y\sqrt{x}}{3x\sqrt{y}-2y\sqrt{x}} - \frac{3x\sqrt{y}-2y\sqrt{x}}{3x\sqrt{y}+2y\sqrt{x}} = \sqrt{x}\sqrt{y}$$

$$\Rightarrow \frac{(3x\sqrt{y}+2y\sqrt{x})^2 - (3x\sqrt{y}-2y\sqrt{x})^2}{(3x\sqrt{y}-2y\sqrt{x})(3x\sqrt{y}+2y\sqrt{x})}$$

$$\Rightarrow \frac{4(3x\sqrt{y})(2y\sqrt{x})}{9x^2y-4y^2x} = \sqrt{x}\sqrt{y} \Rightarrow 9x-4y = 24$$

38. Sol. (b)

$$3x^2 - 5x - 8$$

$$\Rightarrow 3x^2 - 8x + 3x - 8 = 0$$

$$\Rightarrow x(3x - 8) + 1(3x - 8) = 0$$

$$\Rightarrow (x + 1)(3x - 8)$$

39. Sol. (a)

$$2x^2 + y^2 + 6x - 2xy + 9 = 0$$

$$\Rightarrow x^2 + 6x + 9 + x^2 + y^2 - 2xy = 0$$

$$\Rightarrow (x + 3)^2 + (x - y)^2 = 0$$

Sum of the squares of two numbers is equal to zero

only if the numbers themselves are zero.

$$\Rightarrow (x + 3) = 0 \text{ and } (x - y) = 0 \Rightarrow x = y = -3$$

$$\text{Now, } 4x^3 - y^3 + x^2y^2 \Rightarrow 3x^3 + x^4 \dots (x = y)$$

$$\Rightarrow x^3(3 + x) \Rightarrow x^3(3 - 3) = 0$$

40. Sol. (d)

$$\text{Given, } \frac{3(x^2+1)-7x}{3x} = 6$$

$$\Rightarrow \frac{3x^2+3-7x}{3x} = 6 \Rightarrow x + \frac{1}{x} = \frac{25}{3}$$

$$\Rightarrow \sqrt{x} + \frac{1}{\sqrt{x}} = \sqrt{\frac{25}{3} + 2}$$

$$\text{If } a^2 + \frac{1}{a^2} = k, \text{ then } a + \frac{1}{a} = \sqrt{k+2} = \sqrt{\frac{31}{3}}$$

41. Sol. (d)

$$a = xy \Rightarrow x = \frac{a}{y}, b = yx \Rightarrow y = \frac{b}{x}$$

$$c = zx \Rightarrow z = \frac{c}{x}$$

$$\text{And, } abc = (xyz)^2$$

$$x^2 + y^2 + z^2 = \left(\frac{a}{y}\right)^2 + \left(\frac{b}{x}\right)^2 + \left(\frac{c}{x}\right)^2$$

$$= \frac{a^2(zx)^2 + b^2(xy)^2 + c^2(yz)^2}{x^2y^2z^2}$$

$$= \frac{a^2(c)^2 + b^2(a^2) + c^2(b^2)}{abc}$$

42. Sol. (b)

As we know the following identity:

$$(x^2 + y^2 - xy)(x^2 + y^2 + xy) = x^4 + x^2y^2 + y^4$$

Now putting the given values:

$$(x^2 + y^2 - xy)(x^2 + y^2 + xy) = \frac{21}{256}$$

$$(x^2 + y^2 - xy)\left(\frac{3}{16}\right) = \frac{21}{256}$$

$$(x^2 + y^2 - xy) = \frac{7}{16} \dots \text{eq (i)}$$

$$\text{And, } (x^2 + y^2 + xy) = \frac{3}{16} \text{ (given)} \dots \text{eq(ii)}$$

Adding eq(i) and eq(ii)

$$2(x^2 + y^2) = \left(\frac{3}{16} + \frac{7}{16}\right) = \frac{5}{8}$$

43. Sol. (c)

$$(x + y)^{\frac{1}{3}} + (z + y)^{\frac{1}{3}} = -(x + z)^{\frac{1}{3}}$$

$$\Rightarrow (x + y)^{\frac{1}{3}} + (z + y)^{\frac{1}{3}} + (x + z)^{\frac{1}{3}} = 0$$

$$\Rightarrow \left[(x + y)^{\frac{1}{3}}\right]^3 + \left[(z + y)^{\frac{1}{3}}\right]^3 + \left[(x + z)^{\frac{1}{3}}\right]^3$$

$$= 3(x + y)^{\frac{1}{3}}(z + y)^{\frac{1}{3}}(x + z)^{\frac{1}{3}}$$

$$\Rightarrow 2(x + y + z) = 3[(x + y)(z + y)]$$

$$(x + z)^{\frac{1}{3}}$$

Cubing both sides,

$$\Rightarrow 8(x + y + z)^3 = 27[(x + y)(z + y)]$$

$$\Rightarrow x^3 + y^3 + z^3 + 3(x + y)(y + z)(z + x) = \frac{27}{8}$$

$$[(x + y)(z + y)(x + z)]$$

$$\Rightarrow x^3 + y^3 + z^3 = \left(\frac{27}{8} - 3\right)[(x + y)(z + y)(x + z)]$$

$$\Rightarrow x^3 + y^3 + z^3 = \frac{3}{8}[(x + y)(z + y)(x + z)]$$

44. Sol. (d)

Since $x^2 + ax + b$ when divided by $x - 1$ or $x + 1$

leaves the same remainder

So on putting $x = 1$ and $x = -1$ we get the same

$$\text{value } 1 + a + b = 1 - a + b$$

$$2a = 0 \Rightarrow a = 0$$

Hence b can take any integer value

45. Sol. (a)

$$3x^3 + 4x^2 - 7 = 0$$

According to the option checking option (a)

$$X=0$$

$$3 \times 0^3 + 4 \times 0^2 - 7 = 0 + 0 - 7 = -7$$

Checking option(b)

$$X=1$$

$$3 \times (1)^3 + 4 \times (1)^2 - 7 = 3 + 4 - 7 = 0$$

Hence, 1 is the zero of polynomial $3x^3 + 4x^2 - 7$

Type-10 (Cyclic Or Symmetricity)

1. If $\frac{a}{2} = \frac{b}{3} = \frac{c}{4} = \frac{2a-3b+5c}{k}$, then find the value of k.

Higher Secondary 2023 (Shift - 3)

- (a) 15 (b) 18
(c) 10 (d) 12

2. If $(ab + bc + ca) = 0$, then what is the value of $\left(\frac{1}{a^2-bc} + \frac{1}{b^2-ac} + \frac{1}{c^2-ab}\right)$?

SSC CHSL 09/06/2022 (Morning)

- (a) 2 (b) 0
(c) 1 (d) $a + b + c$

3. $x = \frac{a-b}{a+b}, y = \frac{b-c}{b+c}, z = \frac{c-a}{c+a}$ then the value of $\frac{(1-x)(1-y)(1-z)}{(1+x)(1+y)(1+z)}$

- (a) 1 (b) -1
(c) 2 (d) ± 1

4. Simplify the expression $\left(\frac{p}{q}\right)^{10} + \left(\frac{q}{p}\right)^{10}$ if $\frac{p}{q} + \frac{q}{p} = 2$.

Graduate Level 03/08/2022 (Shift - 3)

- (a) 2 (b) 0
(c) 1 (d) -1

5. If $x - y + z = 0$ then find the value of $\frac{y^2}{2xz} - \frac{x^2}{2yz} - \frac{z^2}{2xy}$

SSC CGL 12/04/2022 (Evening)

- (a) $\frac{3}{2}$ (b) $\frac{1}{2}$
(c) -6 (d) $-\frac{3}{2}$

6. $\frac{x-a^2}{b+c} + \frac{x-b^2}{c+a} + \frac{x-c^2}{a+b} = 4(a+b+c)$, $x = ?$

- (a) $3a^2$ (b) $4a^2$
(c) $5a^2$ (d) $9a^2$

7. If $\frac{p}{b-c} = \frac{q}{c-a} = \frac{r}{a-b}$, then $p + q + r = ?$

- (a) 0 (b) $a + b + c$

- (c) $(ab + bc + ca)$ (d) $\frac{1}{a} + \frac{1}{b} + \frac{1}{c}$

8. If $x + y + z = 0$, then what is the value of $\frac{x^2}{(yz)} + \frac{y^2}{(xz)} + \frac{z^2}{(xy)}$?

SSC CGL 03/12/2022 (4th Shift)

- (a) 1 (b) 0
(c) 2 (d) 3

9. $xy + yz + zx = 1$, then $\left(\frac{x+y}{1-xy} + \frac{y+z}{1-yz} + \frac{z+x}{1-zx}\right)$?

- (a) 3 (b) $2\sqrt{3}$
(c) $3\sqrt{3}$ (d) 1

10. If $\frac{a}{b} + \frac{b}{a} = -1, a \neq 0, b \neq 0$ then the value of $6(a^3 - b^3)$ is:

SSC CHSL 31/05/2022 (Morning)

- (a) 6 (b) 3
(c) 0 (d) 1

11. if $x^2 = y + z, y^2 = z + x$, and $z^2 = x + y$, then $\frac{1}{1+x} + \frac{1}{1+y} + \frac{1}{1+z} = ?$

- (a) -1 (b) 1
(c) 2 (d) 0

12. $\frac{a}{1-a} + \frac{b}{1-b} + \frac{c}{1-c} = 2017$, then the value of $\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c}$ is

- (a) 2017 (b) 2014
(c) 2020 (d) 1

13. If $\frac{x^2+a^2+2c^2}{b+c} + \frac{x^2+b^2+2a^2}{c+a} + \frac{x^2+c^2+2b^2}{a+b} = 0$ then $x^2 = ?$

- (a) $-(a+b+c)^2$ (b) $-(a^2+b^2+c^2)$
(c) $abc - a^2 - b^2 - c^2$ (d) $ab + bc + ca$

14. $p(q-r)(q+r) + q(r-p)(r+p) + r(p-q)(p+q)$ is equal to

- (a) $(q-p)(r-q)(p-r)$

(b) $(p - q)(q + r)(r + p)$

(c) $(p + q)(r - q)(p - q)$

(d) $(p - q)(p - r)(r - q)$

15. if $a + \frac{1}{b} = b + \frac{1}{c} = c + \frac{1}{a}$ (where $a \neq b \neq c$), then abc is equal to: -

- (a) +1 (b) -1
(c) +1 & -1 (d) None

16. What is the value of the following expression?

$$2^2 \left(\frac{x^a}{x^b}\right)^{(a+b)} \times 3^2 \left(\frac{x^b}{x^c}\right)^{(b+c)} \times 6^{-2} \left(\frac{x^c}{x^a}\right)^{(a+c)}$$

SSC CHSL 08/06/2022 (Afternoon)

- (a) 1 (b) 0
(c) 4 (d) 9

17. If $ab + bc + ca = abc$, then $\frac{b+c}{bc(a-1)} + \frac{a+c}{ac(b-1)} + \frac{a+b}{ab(c-1)} = ?$

- (a) 0 (b) 1
(c) $a + b + c$ (d) $\frac{1}{a} + \frac{1}{b} + \frac{1}{c}$

18. The numerical value of $\frac{(a-b)^2}{(b-c)(c-a)} + \frac{(b-c)^2}{(c-a)(a-b)} + \frac{(c-a)^2}{(a-b)(b-c)}$ is (where $a \neq b \neq c$)

- (a) 0 (b) 1
(c) 2 (d) 3

19. How many terms are there in the following product?

$$(a_1 + a_2 + a_3)(b_1 + b_2 + b_3 + b_4)(c_1 + c_2 + c_3 + c_4 + c_5)$$

[CDS-2021-I]

- (a) 15 (b) 30
(c) 45 (d) 60

20. if $x - \frac{\sqrt{10}}{\sqrt{x}} = 11$, then $x - \sqrt{10x} = ?$

- (a) 1 (b) 0
(c) $\sqrt{10}$ (d) 2

21. $x^2 + y^2 = z + 1$, $y^2 + z^2 = x + 1$, $z^2 + x^2 = y + 1$, find xyz ?

- (a) $1/4$ (b) $-1/8$
(c) -2 (d) $-1/6$

22. $\frac{x+a^2+2c^2}{b+c} + \frac{x+b^2+2a^2}{c+a} + \frac{x+c^2+2b^2}{a+b} = 0$, $x = ?$

- (a) $-3a^2$ (b) $3a^2$
(c) $2a^2$ (d) $5a^2$

23. $a + b + c = abc$, then $\frac{(1-a^2)(1-b^2)}{ab} + \frac{(1-b^2)(1-c^2)}{bc} + \frac{(1-c^2)(1-a^2)}{ca}$

- (a) 3 (b) 4
(c) 5 (d) 2

24. If $\frac{x}{a+b} = \frac{y}{b+c} = \frac{z}{c+a}$, then

- (a) $\frac{x-y}{a-c} = \frac{y-z}{b-a} = \frac{z-x}{c-b}$ (b) $\frac{x}{a-b} = \frac{y}{b-c} = \frac{z}{c-a}$
(c) $\frac{x}{a} = \frac{y}{b} = \frac{z}{c}$ (d) $\frac{x-y}{a} = \frac{y-z}{b} = \frac{z-x}{c}$

25. The value of $\left(1 + \frac{1}{x+1}\right)\left(1 + \frac{1}{x+2}\right)\left(1 + \frac{1}{x+3}\right)\left(1 + \frac{1}{x+4}\right)$ is

- (a) $\frac{x+1}{x+4}$ (b) $\frac{x+4}{x+1}$
(c) $\frac{x+1}{x+5}$ (d) $\frac{x+5}{x+1}$

26. If $\frac{a}{b+c} = \frac{b}{c+a} = \frac{c}{a+b}$, then which one of the following statements is correct?

- (a) Each fraction is equal to 1 or -1,
(b) Each fraction is equal to $\frac{1}{2}$ or 1.
(c) Each fraction is equal to $\frac{1}{2}$ or -1.
(d) Each fraction is equal to $\frac{1}{2}$ only.

27. If $a + b - c = 0$, then what is the value of $\frac{(b-c)^2}{4bc} + \frac{(c-a)^2}{4ca} - \frac{(a+b)^2}{4ab}$?

- (a) $\frac{1}{2}$ (b) $-\frac{3}{4}$
(c) $-\frac{1}{2}$ (d) $\frac{3}{4}$

SSC CHSL 6/8/2021 (Morning)

28. If $a + b + c = 0$, and $\frac{a^2}{2a+b} + \frac{b^2}{2b+c} + \frac{c^2}{2c+a} = 4$, then find $\frac{b^2}{2a+b} + \frac{c^2}{2b+c} + \frac{a^2}{2c+a} = ?$

- (a) 4 (b) 12
(c) 16 (d) 9

29. If $P = \frac{x^4-8x}{x^3-x^2-2x}$, $Q = \frac{x^2+2x+1}{x^2-4x-5}$ and $R = \frac{2x^2+4x+8}{x-5}$ then $(P \times Q) \div R$ is equal to:

SSC CGL 4/03/2020 (Afternoon)

- (a) $\frac{1}{2}$ (b) 1
(c) 2 (d) 4

30. If $x^{2a} = y^{2b} = z^{2c} \neq 0$ and $x^2 = yz$, then the value of $\frac{ab+bc+ca}{bc}$ is:

SSC CGL 3/03/2020 (Morning)

- (a) 3 (b) $3ac$
(c) $3bc$ (d) $3ab$

31. If $a + b + c = 0$, then the value of $\left(\frac{a+b}{c} + \frac{b+c}{a} + \frac{c+a}{b}\right) \left(\frac{a}{b+c} + \frac{b}{c+a} + \frac{c}{a+b}\right)$ is

- (a) 0 (b) 1
(c) 3 (d) 9

32. $(x+y)^{\frac{1}{3}} + (z+y)^{\frac{1}{3}} = -(x+z)^{\frac{1}{3}}$ then $(x^3 + y^3 + z^3)$ can be expressed as:

SSC CHSL 10/7/2019 (Morning)

- (a) $\frac{1}{8}xyz$
(b) $(x+y)(y+z)(z+x)$
(c) $\frac{3}{8}(x+y)(y+z)(z+x)$
(d) $3xyz$

33. If $a = \frac{xy}{x+y}$, $b = \frac{yz}{y+z}$ and $c = \frac{xz}{x+z}$, then x is equal to

- (a) $\frac{2abc}{ab+bc+ca}$ (b) $\frac{2abc}{ab-bc+ca}$
(c) $\frac{2abc}{ac+bc-ab}$ (d) $\frac{2abc}{bc-ac+ab}$

34. If $x = \sqrt[3]{a \sqrt[3]{b \sqrt[3]{a \sqrt[3]{b \dots \dots \infty}}}}$, then the value of x is:

- (a) $\sqrt[5]{ab^3}$ (b) $\sqrt[3]{a^5b}$
(c) $\sqrt[3]{a^3b}$ (d) $\sqrt[5]{a^3b}$

35. If $\frac{a^2-bc}{a^2+bc} + \frac{b^2-ca}{b^2+ca} + \frac{c^2-ab}{c^2+ab} = 1$, then the value of $\frac{a^2}{a^2+bc} + \frac{b^2}{b^2+ca} + \frac{c^2}{c^2+ab}$

- (a) 2 (b) 1
(c) -2 (d) 0

Type-10 (Cyclic Or Symmetricity) ANSWER KEY

1	A	2	B	3	A	4	A	5	A	6	D	7	A
8	D	9	C	10	C	11	B	12	C	13	B	14	D
15	A	16	A	17	B	18	D	19	B	20	A	21	B
22	A	23	B	24	D	25	D	26	C	27	B	28	C
29	A	30	A	31	D	32	C	33	D	34	D	35	A

Type-10 (Cyclic Or Symmetry) Solution

1. Sol. (a)

$$\frac{a}{2} = \frac{b}{3} = \frac{c}{4} = \frac{2a-3b+5c}{k} = n \text{ (let)}$$

$$a = 2n, b = 3n, c = 4n \text{ and } 2a - 3b + 5c = kn - (i)$$

Put value of a, b and c in equation (i),

$$2 \times 2n - 3 \times 3n + 5 \times 4n = kn$$

$$\Rightarrow 4n - 9n + 20n = kn \Rightarrow 15n = kn \Rightarrow k = 15$$

2. Sol. (b)

$$ab + bc + ca = 0 \Rightarrow a(b+c) = -bc$$

$$\text{Similarly, } b(c+a) = -ca, c(a+b) = -ab$$

$$\Rightarrow \frac{1}{a^2-bc} + \frac{1}{b^2-ca} + \frac{1}{c^2-ab}$$

$$\Rightarrow \frac{1}{a^2+a(b+c)} + \frac{1}{b^2+b(c+a)} + \frac{1}{c^2+c(a+b)}$$

$$\Rightarrow \frac{1}{a(a+b+c)} + \frac{1}{b(a+b+c)} + \frac{1}{c(a+b+c)} = \frac{bc+ca+ab}{abc(a+b+c)} = 0$$

3. Sol. (a)

$$a = b = c$$

$$x = 0$$

$$y = 0$$

$$z = 0$$

$$\frac{1}{1} = 1$$

4. Sol. (a)

$$\text{If } \frac{p}{q} + \frac{q}{p} = 2 \Rightarrow p^2 + q^2 = 2pq$$

It is only possible when $p = q$.

$$\text{Then, } \left(\frac{p}{q}\right)^{10} + \left(\frac{q}{p}\right)^{10} = 1 + 1 = 2$$

5. Sol. (a)

$$\text{If } x - y + z = 0 \text{ then}$$

$$\Rightarrow x^3 - y^3 + z^3 = -3xyz$$

$$\Rightarrow -(-x^3 + y^3 - z^3) = -3xyz$$

$$\Rightarrow y^3 - x^3 - z^3 = 3xyz \dots\dots (1)$$

Now,

$$\frac{y^2}{2xz} - \frac{x^2}{2yz} - \frac{z^2}{2xy} = \frac{y^3 - x^3 - z^3}{2xyz}$$

$$= \frac{3xyz}{2xyz} = \frac{3}{2}$$

6. Sol. (d)

$$a = b = c$$

$$\frac{x-a^2}{2a} \times 3 = 4 \times 3a$$

$$x - a^2 = 8a^2$$

$$x = 9a^2$$

$$= 8a(a+b+c)^2 = (3a)^2 = 9a^2$$

7. Sol. (a)

$$\text{Let } \frac{p}{b-c} = \frac{q}{c-a} = \frac{r}{a-b} = k$$

$$p = k(b-c)$$

And

$$r = k(a-b)$$

On adding equation (i), (ii) and (iii)

$$p + q + r = k(b-c + c-a + a-b) = 0$$

8. Sol. (d)

$$x^3 + y^3 + z^3 - 3xyz = (x+y+z)$$

$$(x^2 + y^2 + z^2 - xy - yz - zx)$$

$$\text{When } (x+y+z) = 0$$

$$\text{When } (x+y+z) = 0, \text{ then}$$

$$x^3 + y^3 + z^3 = 3xyz \text{ eq. (1)}$$

$$(x+y+z) = 0 \text{ (given)}$$

$$\frac{x^2}{(yz)} + \frac{y^2}{(xz)} + \frac{z^2}{(xy)} = \frac{x^3+y^3+z^3}{xyz} =$$

$$\frac{3xyz}{xyz} = 3$$

9. Sol. (c)

$$x = y = z$$

$$3x^2 = 1$$

$$x^2 = \frac{1}{3}$$

$$x = \frac{1}{\sqrt{3}}$$

$$\frac{2}{\sqrt{3}} \times 3 = \frac{2\sqrt{3}}{\frac{2}{3}} = 3\sqrt{3}$$

$$\frac{1}{xyz} = \frac{1}{x^3} = 3\sqrt{3}$$

10. Sol. (c)

$$\Rightarrow \frac{a}{b} + \frac{b}{a} = -1$$

$$\Rightarrow \frac{a^2+b^2}{ab} = -1 \Rightarrow a^2 + b^2 = -ab - (1)$$

$$(a-b)^2 = a^2 + b^2 - 2ab$$

Now put the value of eq. (1) in the above formula,

$$\Rightarrow (a-b)^2 = -ab - 2ab = -3ab$$

$$a-b = \sqrt{-3ab}$$

$$6(a^3 - b^3) = 6(a-b)(a^2 + b^2 + ab)$$

$$= 6 \times \sqrt{-3ab}(-ab + ab)$$

$$= 6\sqrt{-3ab} \times 0 = 0$$

11. Sol. (b)

$$2^2 = 2 + 2, 2^2 = 2 + 2, 2^2 = 2 + 2, \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$$

$$= \frac{3}{3} = 1$$

12. Sol. (c)

$$\frac{a}{1-a} + \frac{b}{1-b} + \frac{c}{1-c} = 2017$$

Add 3 on both sides

$$\Rightarrow \frac{a}{1-a} + \frac{b}{1-b} + \frac{c}{1-c} + 3 = 2020$$

$$\Rightarrow \frac{a}{1-a} + 1 + \frac{b}{1-b} + 1 + \frac{c}{1-c} + 1 = 2020$$

$$\Rightarrow \frac{a+1-a}{1-a} + \frac{a+1-b}{1-b} + \frac{c+1-c}{1-c} = 2020$$

$$\Rightarrow \frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c} = 2020$$

13. Sol. (b)

Put $a = b = c$,

$$3. \frac{x^2+3a^2}{2a} = 0$$

$$x^2 = -3a^2$$

14. Sol. (d)

$$\Rightarrow p(q-r)(q+r) + q(r-p)(r+p) + r(p-q)(p+q)$$

$$\Rightarrow pq^2 - pr^2 + qr^2 - qp^2 + rp^2 - rq^2$$

$$\Rightarrow p(q^2 - r^2) + p^2(r - q) + qr(r - q)$$

$$\Rightarrow (q-r)[pq + pr - p^2 - qr]$$

$$\Rightarrow (q-r)[q(p-r) + p(r-p)]$$

$$\Rightarrow (q-r)[q(p-r) - p(p-r)]$$

$$\Rightarrow (q-r)(q-p)(p-r)$$

$$\Rightarrow (r-q)(p-q)(p-r)$$

15. Sol. (a)

$$a + \frac{1}{b} = b + \frac{1}{c} \Rightarrow a - b = \frac{1}{c} - \frac{1}{b} = \frac{b-c}{bc}$$

$$b + \frac{1}{c} = c + \frac{1}{a} \Rightarrow b - c = \frac{1}{a} - \frac{1}{c} = \frac{c-a}{ac}$$

$$a + \frac{1}{b} = c + \frac{1}{a} \Rightarrow c - a = \frac{1}{b} - \frac{1}{a} = \frac{a-b}{ab}$$

$$\therefore (a-b)(b-c)(c-a) = \frac{(b-c)(c-a)(a-b)}{a^2b^2c^2}$$

$$a^2b^2c^2 = 1, abc = \pm 1$$

16. Sol. (a)

$$2^2(x)^{(a-b)(a+b)} \times 3^2(x)^{(b-c)(b+c)} \times 6^{-2}$$

$$(x)^{(c-a)(c+a)}$$

$$= 36 \times (x)^{a^2-b^2+b^2-c^2} \times \frac{1}{36} \times (x)^{c^2-a^2}$$

$$= 1$$

17. Sol. (b)

$$ab + bc + ca = abc$$

Divide eqn by (abc) on both sides

$$\Rightarrow \frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 1$$

$$\Rightarrow ab + ca = abc - bc$$

$$\Rightarrow a(b+c) = bc(a-1)$$

$$\Rightarrow \frac{b+c}{bc(a-1)} = \frac{1}{a}$$

Similarly

$$\frac{a+c}{ac(b-1)} = \frac{1}{b}$$

And

$$\frac{a+b}{ab(c-1)} = \frac{1}{c}$$

On adding equation (i), (ii) and (iii)

$$\frac{b+c}{bc(a-1)} + \frac{a+c}{ac(b-1)} + \frac{a+b}{ab(c-1)} = \frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 1$$

18. Sol. (d)

Let $a-b = p$, $b-c = q$, and $c-a = r$ Then,

$$p + q + r = 0 \Rightarrow p^3 + q^3 + r^3 = 3pqr$$

$$\Rightarrow \frac{p^2}{qr} + \frac{q^2}{pr} + \frac{r^2}{pq} = 3$$

$$\Rightarrow \frac{(a-b)^2}{(b-c)(c-a)} + \frac{(b-c)^2}{(c-a)(a-b)} + \frac{(c-a)^2}{(a-b)(b-c)} = 3$$

19. Sol. (d)

$$(a_1 + a_2 + a_3)(b_1 + b_2 + b_3 + b_4)(c_1 + c_2 + c_3 + c_4 + c_5)$$

Total no. of terms = $3 \times 4 \times 5 = 60$.

20. Sol. (a)

$$\sqrt{x} \left(x - \frac{\sqrt{10}}{\sqrt{x}} \right) = (11)\sqrt{x}$$

$$x\sqrt{x} - \sqrt{10} = 11\sqrt{x}$$

$$x\sqrt{x} - \sqrt{10} = 10\sqrt{x} + \sqrt{x}$$

$$\sqrt{x}(x - 10) = \sqrt{x} + \sqrt{10}$$

$$\sqrt{x}((\sqrt{x})^2 - (\sqrt{10})^2) = \sqrt{x} + \sqrt{10}$$

$$\sqrt{x}(\sqrt{x} - \sqrt{10})(\sqrt{x} + \sqrt{10}) = (\sqrt{x} + \sqrt{10})$$

$$x - \sqrt{10}x = 1$$

21. Sol. (b)

$$x = y = z$$

$$2x^2 = x + 1$$

$$2x^2 - x - 1 = 0$$

$$+ \frac{2}{2}, -\frac{1}{2}$$

$$x = 1, -\frac{1}{2}$$

$$xyz = 1, -\frac{1}{8}$$

22. Sol. (a)

$$a = b = c$$

$$\frac{x+3a^2}{2a} \times 3 = 0$$

$$x + 3a^2 = 0$$

$$x = -3a^2$$

23. Sol. (b)

$$a = b = c$$

$$3a = a^3$$

$$a^2 = 3$$

$$\frac{(1-3)(1-3)}{3} \times 3$$

$$= 4 \text{ Ans}$$

24. Sol. (d)

$$\frac{x}{a+b} = \frac{y}{b+c} = \frac{z}{a+c} \quad \dots (i)$$

$$\frac{x}{a+b} = \frac{y}{b+c}$$

$$\Rightarrow \frac{x}{y} = \frac{a+b}{b+c}$$

$$\Rightarrow \frac{x}{y} - 1 = \frac{a+b}{b+c} - 1$$

$$\Rightarrow \frac{x-y}{y} = \frac{a-c}{b+c}$$

$$\Rightarrow \frac{x-y}{a-c} = \frac{y}{b+c} \quad \dots (ii)$$

Similarly

$$\frac{y-z}{b-a} = \frac{z}{c+a} \quad \dots (iii)$$

And

$$\frac{z-x}{c-b} = \frac{x}{a+b} \quad \dots (iv)$$

From equation (i), (ii), (iii) and (iv) $\frac{x-y}{a-c} = \frac{y-z}{b-a} = \frac{z-x}{c-b}$

25. Sol. (d)

$$\left(1 + \frac{1}{x+1}\right) \left(1 + \frac{1}{x+2}\right) \left(1 + \frac{1}{x+3}\right) \left(1 + \frac{1}{x+4}\right)$$

$$= \left(\frac{x+1+1}{x+1}\right) \left(\frac{x+2+1}{x+2}\right) \left(\frac{x+3+1}{x+3}\right) \left(\frac{x+4+1}{x+4}\right)$$

$$= \left(\frac{x+2}{x+1}\right) \left(\frac{x+3}{x+2}\right) \left(\frac{x+4}{x+3}\right) \left(\frac{x+5}{x+4}\right)$$

$$= \frac{x+5}{x+1}$$

26. Sol. (c)

$$a/(b+c) = b/(c+a) = c/(a+b)$$

Taking reciprocal and adding 1 to each ratio we get;

$$(b+c)/a + 1 = (c+a)/b + 1 = (a+b)/c + 1$$

$$\text{or } (a+b+c)/a = (a+b+c)/b = (a+b+c)/c$$

So this can only be equal when $a = b = c$ or

$$a + b + c = 0$$

When $a = b = c$ we get $a/(b+c) = 1/2$ When $a + b + c = 0$ we get $b + c = -a$

$$\text{So } a/(b+c) = -1$$

So the ratios are $1/2$ or -1

27. Sol. (b)

If $a + b - c = 0$ then

$$b - c = -a, c - a = b, a + b = c$$

$$\Rightarrow \frac{(b-c)^2}{4bc} + \frac{(c-a)^2}{4ca} - \frac{(a+b)^2}{4ab}$$

$$= \frac{(-a)^2}{4bc} + \frac{(b)^2}{4ca} - \frac{(c)^2}{4ab}$$

$$= \frac{a^3+b^3-c^3}{4abc} = \frac{-3abc}{4abc} = \frac{-3}{4}$$

28. Sol. (c)

$$\frac{a^2}{2a+b} + \frac{b^2}{2b+c} + \frac{c^2}{2c+a} = 4$$

$$\frac{4a^2}{2a+b} + \frac{4b^2}{2b+c} + \frac{4c^2}{2c+a} = 16 \quad \dots (i)$$

$$\frac{b^2}{2a+b} + \frac{c^2}{2b+c} + \frac{a^2}{2c+a} = k \text{ (Let)} \quad \dots (ii)$$

$$(1)-(2) \rightarrow \frac{4a^2-b^2}{2a+b} + \frac{4b^2-c^2}{2b+c} + \frac{4c^2-a^2}{2c+a} = 16-k$$

$$\frac{(2a-b)(2a+b)}{2a+b} + \frac{2(b-c)(2b+c)}{2b+c} + \frac{(2c-a)(2c+a)}{2c+a} = 16-k$$

$$2a-b + 2b-c + 2c-a = 16-k$$

$$a + b + c = 16 - k$$

$$k = 16$$

29. Sol. (a)

$$P = \frac{x^4-8x}{x^3-x^2-2x} = \frac{x^3-8}{x^2-x-2}$$

$$= \frac{(x-2)(x^2+2x+4)}{(x+1)(x-2)} = \frac{(x^2+2x+4)}{(x+1)}$$

$$Q = \frac{x^2+2x+1}{x^2-4x-5} = \frac{(x+1)^2}{(x-5)(x+1)} = \frac{(x+1)}{(x-5)}$$

$$\text{and } R = \frac{2x^2+4x+8}{x-5} = \frac{2(x^2+2x+4)}{x-5}$$

$$\text{Then, } (P \times Q) \div R = \frac{(x^2+2x+4)}{(x+1)} \times \frac{(x+1)}{(x-5)}$$

$$\times \frac{x-5}{2(x^2+2x+4)} = \frac{1}{2}$$

30. Sol. (a)

$$\text{Given, } x^{2a} = y^{2b} = z^{2c} \neq 0 \quad \dots (i)$$

$$\text{and } x^2 = yz \quad \dots (ii)$$

Let $x = y = z = m$ (where m is any integer value) put these value in eq (2)

$$x^2 = yz \Rightarrow m^2 = m \times m \quad (\text{condition satisfied})$$

put these value in eq. (1)

$$x^{2a} = y^{2b} = z^{2c} \Rightarrow m^{2a} = m^{2b} = m^{2c} \neq 0$$

$$(3) \dots (m \text{ is an integer value})$$

in equation (3) since base is same power must be same

$$\Rightarrow 2a = 2b = 2c \Rightarrow a = b = c$$

$$\text{let } a = b = c = k \Rightarrow \frac{ab+bc+ca}{bc}$$

$$\Rightarrow \frac{(k \times k) + (k \times k) + (k \times k)}{k \times k} = \frac{3k^2}{k^2} = 3$$

Alternate solution is put the value of the $a = b = c = 1$ and the value of $x = y = z = 2$

31. Sol. (d)

$$a + b + c = 0$$

$$\Rightarrow a + b = -c$$

Similarly

$$b + c = -a$$

And

$$a + c = -b$$

$$\left(\frac{a+b}{c} + \frac{b+c}{a} + \frac{c+a}{b}\right) \left(\frac{a}{b+c} + \frac{b}{c+a} + \frac{c}{a+b}\right)$$

$$= \left(\frac{-c}{c} + \frac{-a}{a} + \frac{-b}{b}\right) \left(\frac{a}{-a} + \frac{b}{-b} + \frac{c}{-c}\right)$$

$$= (-1 - 1 - 1)(-1 - 1 - 1)$$

$$= (-3)(-3) = 9$$

32. Sol. (c)

$$(x+y)^{\frac{1}{3}} + (z+y)^{\frac{1}{3}} = -(x+z)^{\frac{1}{3}}$$

$$\Rightarrow (x+y)^{\frac{1}{3}} + (z+y)^{\frac{1}{3}} + (x+z)^{\frac{1}{3}} = 0$$

$$\Rightarrow \left[(x+y)^{\frac{1}{3}}\right]^3 + \left[(z+y)^{\frac{1}{3}}\right]^3 + \left[(x+z)^{\frac{1}{3}}\right]^3$$

$$= 3(x+y)^{\frac{1}{3}}(z+y)^{\frac{1}{3}}(x+z)^{\frac{1}{3}}$$

$$\Rightarrow 2(x+y+z) = 3[(x+y)(z+y)]$$

$$(x+z)]^{\frac{1}{3}}$$

Cubing both sides,

$$\Rightarrow 8(x+y+z)^3 = 27[(x+y)(z+y)(x+z)]$$

$$\Rightarrow x^3 + y^3 + z^3 + 3(x+y)(y+z)(z+x) = \frac{27}{8}$$

$$[(x+y)(z+y)(x+z)]$$

$$\Rightarrow x^3 + y^3 + z^3 = \left(\frac{27}{8} - 3\right) [(x+y)(z+y)(x+z)]$$

$$\Rightarrow x^3 + y^3 + z^3 = \frac{3}{8} [(x+y)(z+y)(x+z)]$$

33. Sol. (d)

$$a = \frac{xy}{x+y}$$

$$\Rightarrow \frac{1}{a} = \frac{x+y}{xy} = \frac{1}{y} + \frac{1}{x}$$

$$b = \frac{yz}{y+z}$$

$$\Rightarrow \frac{1}{b} = \frac{y+z}{yz} = \frac{1}{z} + \frac{1}{y}$$

$$c = \frac{xz}{x+z}$$

$$\Rightarrow \frac{1}{c} = \frac{x+z}{xz} = \frac{1}{x} + \frac{1}{z}$$

On adding equation (i) and (iii)

$$\Rightarrow \frac{1}{a} + \frac{1}{c} = \frac{1}{y} + \frac{1}{x} + \frac{1}{x} + \frac{1}{z}$$

$$\Rightarrow \frac{1}{a} + \frac{1}{c} = \frac{2}{x} + \frac{1}{y} + \frac{1}{z}$$

$$\Rightarrow \frac{1}{a} + \frac{1}{c} = \frac{2}{x} + \frac{1}{b}$$

$$\Rightarrow \frac{2}{x} = \frac{1}{a} + \frac{1}{c} - \frac{1}{b}$$

$$\Rightarrow \frac{2}{x} = \frac{bc+ab-ac}{abc} \left[\because \frac{1}{z} + \frac{1}{y} = \frac{1}{b} \right]$$

$$\Rightarrow x = \frac{2abc}{bc-ac+ab}$$

34. Sol. (d)

Given

$$x = \sqrt{a^3 \sqrt{b \sqrt{a^3 \sqrt{b \dots \dots \infty}}} \dots \dots \infty} \quad \dots (i)$$

on squaring both side

$$\Rightarrow x^2 = \sqrt{a^3 \sqrt{b \sqrt{a^3 \sqrt{b \dots \dots \infty}}} \dots \dots \infty}$$

On cubing both sides

$$\Rightarrow x^6 = a^3 b \sqrt{a^3 \sqrt{b \sqrt{a^3 \sqrt{b \dots \dots \infty}}} \dots \dots \infty}$$

$$\Rightarrow x^6 = a^3 bx \text{ from equation } \dots (ii)$$

 $\Rightarrow$ On dividing above eq. by x we get

$$\Rightarrow \frac{x^6}{x} = \frac{a^3 bx}{x}$$

$$\Rightarrow x^5 = a^3 b$$

$$\Rightarrow x = \sqrt[5]{a^3 b}$$

35. Sol. (a)

$$\frac{a^2-bc}{a^2+bc} + \frac{b^2-ca}{b^2+ca} + \frac{c^2-ab}{c^2+ab} = 1$$

$$\frac{a^2-bc}{a^2+bc} + 1 + \frac{b^2-ca}{b^2+ca} + 1 + \frac{c^2-ab}{c^2+ab} + 1 = 1 + 3$$

$$\Rightarrow \frac{2a^2}{a^2+bc} + \frac{2b^2}{b^2+ca} + \frac{2c^2}{c^2+ab} = 4$$

$$\frac{a^2}{a^2+bc} + \frac{b^2}{b^2+ca} + \frac{c^2}{c^2+ab} = \frac{4}{2} = 2$$

* * * * *

Type-11 (Maximum and Minimum)

1. For $x > 0$, what is the minimum value of $x + \frac{x+2}{2x}$?

[CDS-2023-I]

- (a) 1
(b) 2
(c) $2\frac{1}{2}$
(d) Cannot be determined

2. Which one of the following fractions will have minimum change in its value if 3 is added to both the numerator and the denominator of all the fractions?

[CDS-2021-I]

- (a) $\frac{2}{3}$ (b) $\frac{3}{4}$
(c) $\frac{4}{5}$ (d) $\frac{5}{6}$

3. If $a + b = 10$, then find maximum value of ab but give a & b are positive real no.

- (a) 20 (b) 30
(c) 25 (d) 40

4. The minimum value of $(x-2)(x-7)$ is

- (a) $\frac{25}{4}$ (b) $-\frac{25}{4}$
(c) $\frac{16}{3}$ (d) $\frac{13}{2}$

5. If $a \cdot b = 16$, find out minimum value of $(a + b)$.

- (a) 15 (b) 0
(c) 8 (d) None

6. If x is a positive real no. then find out the minimum value of $\left(x + \frac{1}{x}\right)$.

- (a) 3 (b) 2
(c) 0 (d) None

7. What is the maximum value of the expression $\frac{1}{x^2+5x+10}$?

[CDS-2019-II]

- (a) $\frac{15}{4}$ (b) $\frac{15}{2}$
(c) 1 (d) $\frac{4}{15}$

8. $(x-7)(y-10)(z-12) = 1000$, find the value of $(x+y+z)$ minimum value.

- (a) 58 (b) 59
(c) 56 (d) 69

9. For positive real numbers a and b , find the minimum value of $(a+b)^2$.

- (a) ab (b) $2ab$
(c) $3ab$ (d) $4ab$

10. $5 - (3a - 2b)^2$ will be maximum, when $\frac{a}{b} = ?$

- (a) $\frac{3}{2}$ (b) $\frac{5}{2}$
(c) $\frac{2}{3}$ (d) None of there

11. A real number x , such that $(x - x^2)$ is maximum. What is x equal to?

[2019-II]

- (a) -1.5 (b) -0.5
(c) 0.5 (d) 1.5

12. If $x > 2$, then minimum value of $x^2 + \frac{1}{x^2-4} - 7$ is

- (a) 1 (b) 2
(c) -1 (d) 3

13. The minimum value of $\frac{1}{3+x-x^2}$ is

- (a) $\frac{4}{13}$ (b) $\frac{13}{4}$
(c) $\frac{2}{13}$ (d) $\frac{13}{2}$

14. If x is real number, then the minimum value of $x^2 - x + 1$ is

(a) $\frac{2}{3}$ (b) $\frac{3}{4}$
(c) $\frac{3}{2}$ (d) $\frac{4}{3}$

15. If $x = 5^{n-1} + 5^{-n-1}$, where n is real, the minimum value of x is,

(a) $5/2$ (b) $2/5$
(c) 10 (d) $1/2$

16. If x, y, z are positive real number find the minimum value of $(x + y + z) \left(\frac{1}{x} + \frac{1}{y} + \frac{1}{z} \right)$

(a) 9 (b) 6
(c) 3 (d) 8

17. If x and y are positive real numbers and $xy = 8$, then the minimum value of $2x + y$ is:-

(a) 9 (b) 17
(c) 10 (d) 8

18. If x and y are real numbers, then the least possible value of $4(x-2)^2 + (y-3)^2 - 2(x-3)^2$ is:

SSC CPO 11/12/19 (Evening)

(a) 3 (b) -4
(c) 1 (d) -8

19. $3a + 2b + 2c = 14$, find maximum value of $a^3 b^2 c^2$

(a) 2^6 (b) 2^7
(c) 2^8 (d) 2^4

20. $\frac{x^2(y+z) + y^2(z+x) + z^2(x+y)}{xyz}$ find minimum value
 $x \neq y \neq z, x, y, z$ are positive real no.

(a) 5 (b) 4
(c) 7 (d) 6

Type-11 ANSWER KEY

1	C	2	D	3	C	4	B	5	C	6	B	7	D
8	B	9	D	10	C	11	C	12	C	13	A	14	B
15	B	16	A	17	D	18	B	19	B	20	D		

Type-11 (Maximum and Minimum) Solution

1. Sol. (c)

$$x + (x+2)/2x = x + 1/2 + 1/x$$

So we have to find the minimum of $x + 1/x$ and add $1/2$ to it

$$\text{As } AM > GM, \text{ So } (x + 1/x)/2 > \sqrt{(x \times 1/x)}$$

$$\text{Or } x + 1/x > 2$$

$$\text{So min of } x + (x+2)/2x = 2 + 1/2 = 5/2$$

2. Sol. (d)

$$\frac{2}{3} = 0.667, \frac{2+3}{3+3} = \frac{5}{6} = 0.833$$

$$\text{Difference} = 0.167$$

$$\frac{3}{4} = 0.74, \frac{3+3}{4+3} = \frac{6}{7} = 0.857$$

$$\text{Difference} = 0.117$$

$$\frac{4}{5} = 0.8, \frac{4+3}{5+3} = \frac{7}{8} = 0.875$$

$$\text{Difference} = 0.075$$

$$\frac{5}{6} = 0.833, \frac{5+3}{6+3} = \frac{8}{9} = 0.889$$

$$\text{Difference} = 0.056$$

Hence, $\frac{5}{6}$ shows minimum change in its value.

3. Sol. (c)

$$\frac{a+b}{2} \geq \sqrt{ab}$$

$$\frac{10}{2} \geq \sqrt{ab}$$

$$5 \geq \sqrt{ab}$$

$$25 \geq ab$$

4. **Sol. (b)**
 $(x-2)(x-7)$
 $x^2 - 9x + 14$
 Here $a > 0$
 So Minimum value = $\frac{4ac-b^2}{4a}$
 Where $a = 1$, $b = -9$ and $c = 14$
 $= \frac{4(1)(14) - (-9)^2}{4(1)} = \frac{-25}{4}$
5. **Sol. (c)**
 $a \cdot b = 16$
 a, b should be +ve
 $4, 4$ for minimum value
 $a + b = 4 + 4 = 8$
 or
 $\frac{a+b}{2} \geq \sqrt{ab}$
 $\frac{a+b}{2} \geq \sqrt{16}$
 $a + b \geq 8$
6. **Sol. (b)**
 variable $-x, \frac{1}{x}$
 $\frac{x+\frac{1}{x}}{2} \geq 2\sqrt{x \cdot \frac{1}{x}}$
 $x + \frac{1}{x} \geq 2$
7. **Sol. (d)**
 $\frac{1}{x^2+5x+10}$ will be maximum
 when $x^2 + 5x + 10$ will be minimum
 Minimum value of $x^2 + 5x + 10$
 $= -\frac{D}{4a}$ { where $D = \text{Discriminant} = -15$ }
 $= \frac{15}{4}$ Maximum value of expression = $\frac{4}{15}$
8. **Sol. (b)**
 $\frac{x-7+y-10+z-12}{3} \geq \sqrt[3]{1000}$
 $\frac{x+y+z-29}{3} \geq 10$
 $x+y+z \geq 59$
9. **Sol. (d)**
 Since a and b are positive real numbers Then,
 $AM \geq GM$

$$\Rightarrow \frac{a+b}{2} \geq \sqrt{ab}$$

$$\Rightarrow a+b \geq 2\sqrt{ab}$$

On squaring both sides

$$\Rightarrow (a+b)^2 \geq 4ab$$

10. **Sol. (C)**
 maximum value of $x^2 < \infty$
 $3a - 2b = 0$
 $3a = 2b$
 $\frac{a}{b} = \frac{2}{3}$
11. **Sol. (c)**
 Let $y = x - x^2$
 Differentiation both, side w.r.t. $x \frac{dy}{dx} = 1 - 2x$
 At max. $\frac{dy}{dx} = 0 \Rightarrow 1 - 2x = 0 \Rightarrow x = \frac{1}{2} = 0.5$

12. **Sol. (c)**
 Since $x > 2$, $x^2 - 4$ will always be a positive number
 Then,
 $AM \geq GM$
 $\Rightarrow (x^2 - 4) + \frac{1}{(x^2 - 4)} \geq 2$
 Subtract 3 on both sides
 $\Rightarrow x^2 - 4 + \frac{1}{x^2 - 4} - 3 \geq 2 - 3$
 $\Rightarrow x^2 + \frac{1}{x^2 - 4} - 7 \geq -1$

13. **Sol. (a)**
 Let $p = \frac{1}{3-x-x^2}$
 p will be minimum when $(3-x-x^2)$ will be maximum
 Here $a < 0$
 Maximum value = $\frac{4ac-b^2}{4a}$
 Where $a = -1$, $b = -1$ and $c = 3$
 $= \frac{4(-1)(3) - (-1)^2}{4(-1)} = \frac{-12-1}{-4} = \frac{13}{4}$
 So Minimum value of $p = \frac{1}{\frac{13}{4}} = \frac{4}{13}$

14. **Sol. (b)**
 $x^2 - x + 1$ Here $a > 0$

$$\text{so Minimum value} = \frac{4ac-b^2}{4a}$$

Where $a = 1$, $b = -1$ and $c = 1$

$$= \frac{4(1)(1) - (-1)^2}{4(1)} = \frac{3}{4}$$

15. Sol. (b)

On Putting real value of $n = 0$, we will get minimum value of x ,

$$\Rightarrow x = 5^{0-1} + 5^{-0-1}$$

$$\Rightarrow x = 5^{-1} + 5^{-1}$$

$$\Rightarrow x = \frac{1}{5} + \frac{1}{5}$$

$$x = \frac{2}{5}$$

16. Sol. (a)

$$1 + \frac{x}{y} + \frac{x}{z} + \frac{y}{x} + 1 + \frac{y}{z} + \frac{z}{x} + \frac{z}{y} + 1$$

$$3 + \frac{x}{y} + \frac{y}{x} + \frac{y}{z} + \frac{z}{y} + \frac{z}{x} + \frac{x}{z} + \frac{x}{y}$$

$$3 + 6 = 9$$

17. Sol. (d)

$xy = 8$ Given

So, $(x, y) = (1, 8)$

We have to Questions the options and check them

$$(8, 1)$$

$$(2, 4)$$

$$(4, 2)$$

$$2x + y = 2 \times 1 + 8 = 10$$

$$2 \times 8 + 1 = 11$$

$$2 \times 2 + 4 = 8 \text{ minimum}$$

$$2 \times 4 + 2 = 10$$

Hence in this question we have all the options. So, take all positive factor otherwise we should have to take -ve values also.

$$(x, y) = (1, 8)$$

$$(8, 1)$$

$$(2, 4)$$

$$(4, 2)$$

$$(-1, -8)$$

$$(-8, -1)$$

$$(-2, -4)$$

$$(-4, -2)$$

18. Sol. (b)

$$4(x-2)^2 + (y-3)^2 - 2(x-3)^2 \dots (i)$$

In order to get least value of $(y-3)^2$, we need to put

$$y = 3$$

$$\text{Now, } 4(x-2)^2 - 2(x-3)^2$$

After differentiation we get,

$$8(x-2) - 4(x-3) = 0$$

$$8x - 16 - 4x + 12 = 0 \Rightarrow x = 1$$

Now putting $x = 1$ and $y = 3$ in eq (1) $= 4(1) + 0 -$

$$2 \times 4 = -4$$

19. Sol. (b)

$$\frac{3a + 2b + 2c}{7} \geq \sqrt[7]{a^3 b^2 c^2}$$

$$2 \geq \sqrt[7]{a^3 b^2 c^2} (\because \text{given})$$

$$2^7 \geq a^3 b^2 c^2$$

20. Sol. (d)

$$\frac{x^2 y + x^2 z + y^2 z + y^2 x + z^2 x + z^2 y}{xyz}$$

$$\frac{x}{z} + \frac{x}{y} + \frac{y}{x} + \frac{y}{z} + \frac{z}{y} + \frac{z}{x} = 6$$

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Type-1 (Basic & Ratio MCQ)

1. $\sqrt{\frac{1+\sin A}{1-\sin A}} = \underline{\hspace{2cm}}$

[SSC CGL 05/12/2023, (Shift-04)]

- (a) cosecA – cotA (b) secA – tanA
(c) secA + tanA (d) sec A

2. If $\sin A + \operatorname{cosec} A = 3$, then find the value of $\frac{\sin^4 A + 1}{\sin^2 A}$?

[SSC CGL 05/12/2022, (Shift-04)]

- (a) 1 (b) 0 (c) 7 (d) 3

3. If $\sin x = \frac{3}{5}$, $0 \leq x \leq 90^\circ$, then the value of $\cot x \sec x$ is

[SSC CHSL (10 + 2) Tier-I

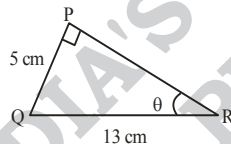
Exam 19/03/2020(Shift-I)]

- (a) $\frac{3}{5}$ (b) $\frac{5}{3}$ (c) $\frac{4}{5}$ (d) $\frac{6}{5}$

4. In the right triangle shown in the figure, what is the value of cosec θ ?

[SSC CGL (CBE) Tier-I

Exam 09/03/2020 (Shift-I)]



- (a) $\frac{13}{5}$ (b) $\frac{15}{3}$ (c) $\frac{5}{13}$ (d) $\frac{5}{11}$

5. If $\cot B = \frac{12}{5}$, what is the value of sec B ?

[SSC CGL Tier-I (CBE)

Exam 12/04/2022 (Shift-I)]

- (a) $\frac{3}{12}$ (b) $\frac{13}{12}$ (c) $\frac{13}{5}$ (d) $\frac{12}{13}$

6. $5 \tan \theta = 4$, then the value of $\left(\frac{5 \sin \theta - 3 \cos \theta}{5 \sin \theta + 3 \cos \theta} \right)$ is

[SSC CGL Tier-I 2021]

- (a) $\frac{1}{7}$ (b) $\frac{2}{7}$ (c) $\frac{5}{7}$ (d) $\frac{2}{5}$

7. If $\sec x - \cos x = 4$, then what will be the value of $\frac{(1+\cos^2 x)}{\cos x}$?

- (a) $2\sqrt{5}$ (b) $3\sqrt{5}$ (c) $3\sqrt{6}$ (d) None

[SSC CGL 08/12/2022 (Shift-03)]

8. If θ lies in the first quadrant and $\cot \theta = \frac{63}{16}$, then where the value of $(\sin \theta + \cos \theta)$?

[CDS 2020]

- (a) 1 (b) $\frac{69}{65}$ (c) $\frac{79}{65}$ (d) 2

9. A rectangle is 48 cm long and 14 cm wide. If the diagonal makes an angle θ with the longer side, then what is $(\sec \theta + \operatorname{cosec} \theta)$ equal to ?

[CDS 2020]

- (a) $\frac{775}{168}$ (b) $\frac{725}{168}$ (c) $\frac{375}{84}$ (d) $\frac{325}{84}$

10. Let ABC be a triangle right angled at C, then what is $\tan A + \tan B$ equal to ?

[CDS 2021]

- (a) $\frac{a}{bc}$ (b) $\frac{a^2}{bc}$ (c) $\frac{b^2}{ca}$ (d) $\frac{c^2}{ab}$

11. If $\sec \theta + \cos \theta = \frac{5}{2}$, where $0 \leq \theta \leq 90^\circ$, then what is the value of $\sin^2 \theta$?

[CDS 2021]

- (a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) $\frac{3}{4}$ (d) 1

12. If $\cos \theta = \frac{12}{13}$, $\frac{\sin \theta(1-\tan \theta)}{\tan \theta(1+\operatorname{cosec} \theta)} = ?$

[SSC CGL Mains 03/02/2022]

- (a) $\frac{25}{78}$ (b) $\frac{35}{234}$ (c) $\frac{35}{108}$ (d) $\frac{25}{156}$

13. If $\operatorname{cosec} \theta = 1.25$, then $\frac{4 \tan \theta - 5 \cos \theta + 1}{\sec \theta + 4 \cot \theta - 1} = ?$

[CDS 2021]

- (a) 2 (b) $\frac{10}{11}$ (c) $\frac{9}{10}$ (d) $\frac{1}{2}$

14. If $\triangle ABC$ is right angled at C, then what is $\cos(A+B) + \sin(A+B)$ equal to ?

- (a) 0 (b) $\frac{1}{2}$ (c) 1 (d) 2

15. In a right-angled triangle PQR right-angled at Q, the length of the side PR is 17 units, length of the base QR is 8 units, and length of the side PQ is 15 units. If $\angle RPQ = \alpha$, then $\sin \alpha + \cos \alpha$ is:

[SSC CGL 01/12/2022 (1st Shift)]

- (a) $\frac{18}{17}$ (b) $\frac{23}{17}$ (c) $\frac{21}{17}$ (d) $\frac{15}{17}$
16. If $\sin \theta - \cos \theta = \frac{7}{17}$, then find the value of $\sin \theta + \cos \theta$

- (a) $\frac{23}{17}$ (b) $\frac{44}{17}$ (c) $\frac{46}{31}$ (d) None

[SSC CHSL 2020 CGL 2021]

17. If $\cos \theta + \sin \theta = \sqrt{2} \cos \theta$, find the value of $(\cos \theta - \sin \theta)$.

[SSC CPO 10/11/2022 (Afternoon)]

- (a) $\sqrt{2} \sin \theta$ (b) $\sqrt{2} \cos \theta$
(c) $\frac{1}{\sqrt{2}} \sin \theta$ (d) $\frac{1}{2} \cos \theta$

18. If $\cos 48^\circ = \frac{m}{n}$, then $\sec 48^\circ - \cot 42^\circ$ is equal to:

[SSC CPO 10/11/2022 (Morning)]

- (a) $\frac{m - \sqrt{n^2 - m^2}}{m}$ (b) $\frac{m - \sqrt{n^2 - m^2}}{n}$
(c) $\frac{n - \sqrt{n^2 - m^2}}{n}$ (d) $\frac{n - \sqrt{n^2 - m^2}}{m}$

19. In a right triangle for an acute angle x, find $\sin x$. It is given that $\tan x = 5$.

[SSC CPO 09/11/2022 (Afternoon)]

- (a) $\frac{1}{3}$ (b) $\frac{5}{\sqrt{26}}$ (c) $\frac{2}{5}$ (d) $\frac{5}{\sqrt{28}}$

20. If $\sec A = \frac{17}{8}$, given that $A < 90^\circ$ what is the value of the following? $\frac{34 \sin A + 15 \cot A}{68 \cos A - 16 \tan A}$

[SSC CGL 11/04/2022]

- (a) 23 (b) 19 (c) 30 (d) 38

21. If $\sin A = \frac{5}{13}$ and $7 \cot B = 24$, then the value of $(\sec A \cos B)(\operatorname{cosec} B \tan A)$ is:

- (a) $\frac{13}{14}$ (b) $\frac{65}{42}$ (c) $\frac{15}{13}$ (d) $\frac{13}{7}$

22. In ΔPQR , if $PQ = 13$ cm and $PR = 12$ cm, then the value of $\sin \theta + \tan \theta = ?$

[SSC CHSL 16/10/2020 (Evening)]

- (a) $\frac{213}{5}$ (b) $\frac{218}{5}$ (c) $\frac{216}{13}$ (d) $\frac{216}{65}$

23. If $2 \cot \theta = 3$, then $\frac{\sqrt{13} \cos \theta - 3 \tan \theta}{3 \tan \theta + \sqrt{13} \sin \theta}$ is:

- (a) $\frac{3}{4}$ (b) $\frac{1}{4}$ (c) $\frac{2}{3}$ (d) $\frac{1}{5}$

24. If θ be acute angle and $\cos \theta = \frac{15}{17}$, then the value of $\cot(90^\circ - \theta)$ is

- (a) $\frac{2\sqrt{8}}{15}$ (b) $\frac{8}{15}$ (c) $\frac{\sqrt{2}}{17}$ (d) $\frac{8\sqrt{2}}{17}$

25. If ABC is a right angled triangle at C and having u units, v units and w units as the length of its sides opposite to be vertices A, B and C respectively, then what is $\tan A + \tan B$ equal to?

- (a) $\frac{u^2}{vw}$ (b) 1 (c) $u + v$ (d) $\frac{w^2}{uv}$

26. $\frac{(1 + \cos \theta)(\operatorname{cosec} \theta - \cot \theta) \sec \theta}{\sin \theta (1 - \sin \theta)(\sec \theta + \tan \theta)} = ?$

[SSC CHSL (10 + 2) Tier-I]

Exam 19/04/2022 (Afternoon)]

- (a) $\sec^2 \theta$ (b) $\sin^2 \theta$
(c) $\cos^2 \theta$ (d) $\operatorname{cosec}^2 \theta$

27. If $\cos \theta = \frac{5}{13}$, then the value of $\tan^2 \theta + \sec^2 \theta$ is equal to :

[SSC CGL Tier II 11/18/2020]

- (a) $\frac{303}{25}$ (b) $\frac{313}{25}$ (c) $\frac{233}{25}$ (d) $\frac{323}{25}$

28. What is $\frac{\sin \theta - \cos \theta + 1}{\sin \theta + \cos \theta - 1} - \frac{\sin \theta + 1}{\cos \theta}$ equal to?

[CDS 2020-I]

- (a) 0 (b) 1
(c) $2 \sin \theta$ (d) $2 \cos \theta$

29. In a right angle Δxyz , side $x < y < z$, if $2x + 7z = 9y$, $x = 8$, then $\sec y - \sec x = ?$

[SSC CHSL 19/03/2020 (Afternoon)]

- (a) $\frac{105}{108}$ (b) $\frac{121}{128}$ (c) $\frac{119}{120}$ (d) $\frac{119}{120}$

30. ABC is a right triangle with right angle at A. If the value of $\tan B = \frac{1}{\sqrt{3}}$, then for any real k the length of the hypotenuse is of the form.

- (a) $3k$ (b) $2k$ (c) $5k$ (d) $9k$

31. If $\cot x = \frac{a}{b}$, then find the value of $2(\operatorname{acos} 2x + \operatorname{bsin} 2x)$?

- (a) 0 (b) a^2 (c) a (d) $2a$

32. If α is an acute angle and $\sin \alpha = \sqrt{\frac{x-1}{2x}}$, then what is $\tan \alpha$ equal to?

- (a) $\sqrt{\frac{x-1}{x+1}}$ (b) $\sqrt{\frac{x+1}{x-1}}$
(c) $\sqrt{x^2-1}$ (d) $\sqrt{x^2+1}$

33. ABC is a right angle triangle and right angle at B. If $\sin 21^\circ = \frac{x}{y}$ then find the value of $\sec 21^\circ - \sin 69^\circ$.

- (a) $\frac{x^2}{y\sqrt{y^2-x^2}}$ (b) $\frac{x^2}{y\sqrt{y^2+x^2}}$
(c) $\frac{x^2}{y\sqrt{x^2-y^2}}$ (d) $\frac{y^2}{x\sqrt{y^2-x^2}}$

34. In $\triangle PQR$, $\angle Q = 90^\circ$. If $\cot R = \frac{1}{3}$, then what is the value of $\frac{\sec P(\cos R + \sin P)}{\operatorname{cosec} R(\sin R - \operatorname{cosec} P)}$?

[SSC CGL Tier-II Exam, 15/11/2020]

- (a) $\frac{2}{3}$ (b) $-\frac{2}{3}$ (c) $-\frac{2}{7}$ (d) $\frac{2}{7}$

35. If $\sin \theta = \frac{m^2-n^2}{m^2+n^2}$, then what is the value of $\tan \theta$?

- (a) $\frac{m^2+n^2}{m^2-n^2}$ (b) $\frac{2mn}{m^2+n^2}$
(c) $\frac{m^2-n^2}{2mn}$ (d) $\frac{m^2+n^2}{2mn}$

36. If $\sqrt{3} \tan \theta = 3 \sin \theta$, then what is the value of $(\sin^2 \theta - \cos^2 \theta)$?

[SSC CGL Tier-II (CBE) Exam 2022]

- (a) $\frac{1}{5}$ (b) $\frac{1}{2}$ (c) $-\frac{1}{2}$ (d) $\frac{1}{3}$

37. If $\sin \theta = \frac{9}{41}$, $0^\circ < \theta < 90^\circ$, then what is the value of $\cot \theta$?

[SSC CGL Tier-II (CBE) Exam 8/8/2022]

- (a) $\frac{39}{9}$ (b) $\frac{47}{8}$ (c) $\frac{35}{8}$ (d) $\frac{40}{9}$

38. In a right angled triangle ABC, $\angle B$ is the right angle and $AC = 2\sqrt{5}$ cm. If $AB - BC = 2$ cm then the value of $(\cos^2 A - \cos^2 C)$ is

- (a) $\frac{2}{5}$ (b) $\frac{3}{5}$ (c) $\frac{1}{2}$ (d) $\frac{3}{10}$

39. If $0 < A, B < 45^\circ$. $\cos(A+B) = \frac{24}{25}$ and $\sin(A-B) = \frac{15}{17}$ then $\tan 2A$ is:

- (a) $\frac{416}{87}$ (b) 0 (c) 1 (d) $\frac{213}{4}$

40. If $5 \sin \theta - 4 \cos \theta = 0$, $0^\circ < \theta < 90^\circ$, then the value of $\frac{5 \sin \theta + 2 \cos \theta}{5 \sin \theta + 3 \cos \theta}$ is:

[SSC CHSL Tier-I (CBE)

Exam 13/04/2022 (Shif-I)]

- (a) $\frac{4}{7}$ (b) $\frac{6}{7}$ (c) $\frac{2}{7}$ (d) $\frac{3}{7}$

41. In $\triangle ABC$, right angled at B, if $\tan A = \frac{1}{2}$, then the value of $\frac{\sin A(\cos C + \cos A)}{\cos C(\sin C - \sin A)}$ is:

[SSC CGL Tier-II Exam 16/11/2020]

- (a) 2 (b) 1 (c) 3 (d) $2\sqrt{5}$

42. If $\sec \theta = \frac{a}{b}$, $b \neq 0$, then $\frac{1 - \tan^2 \theta}{2 - \sin^2 \theta} = ?$

[SSC CGL Tier-II Exam, 15/11/2020]

- (a) $\frac{b^2(2b^2-a^2)}{a^2(a^2+b^2)}$ (b) $\frac{a^2(2b^2-a^2)}{b^2(a^2+b^2)}$
(c) $\frac{a^2(2b^2+a^2)}{b^2(a^2+b^2)}$ (d) $\frac{a^2(2b^2+a^2)}{b^2(a^2-b^2)}$

43. In $\triangle PQR$, $\angle Q = 90^\circ$. If $\cot R = \frac{1}{3}$, then what is the value of $\frac{\sec P(\cos R + \sin P)}{\operatorname{cosec} R(\sin R - \operatorname{cosec} P)}$?

[SSC CGL Tier-II Exam, 15/11/2020]

- (a) $\frac{2}{3}$ (b) $-\frac{2}{3}$ (c) $-\frac{2}{7}$ (d) $\frac{2}{7}$

44. $\frac{\sec A(\sec A + \tan A)(1 - \sin A)}{(\operatorname{cosec}^2 A - 1)\sin^2 A}$ is equal to:

[SSC CGL Tier-II Exam, 16/11/2020]

- (a) $\cot A$ (b) $\cos A$
(c) $\sec^2 A$ (d) $\cos^2 A$

45. If $\operatorname{cosec} \theta = b/a$, then $\frac{\sqrt{3}\cot \theta + 1}{\tan \theta + \sqrt{3}}$ is equal to:

[SSC CGL Tier-II Exam, 16/11/2020]

- (a) $\frac{\sqrt{b^2-a^2}}{b}$ (b) $\frac{\sqrt{b^2-a^2}}{a}$
(c) $\frac{\sqrt{a^2+b^2}}{a}$ (d) $\frac{\sqrt{a^2+b^2}}{b}$

Type-1 ANSWER KEY													
1	C	2	C	3	B	4	A	5	B	6	A	7	A
8	C	9	A	10	D	11	C	12	B	13	B	14	C
15	B	16	A	17	A	18	D	19	B	20	B	21	B
22	D	23	B	24	B	25	D	26	A	27	B	28	A
29	C	30	B	31	D	32	A	33	A	34	C	35	C
36	D	37	D	38	B	39	A	40	B	41	C	42	B
43	C	44	C	45	B								

Type-1 (Basic & Ratio) Solution

1. Sol. (c)

$$\frac{\sqrt{1+\sin A}}{\sqrt{1-\sin A}}$$

Rationalizing above

$$\frac{\sqrt{1+\sin A}}{\sqrt{1-\sin A}} \times \frac{\sqrt{1+\sin A}}{\sqrt{1+\sin A}} = \frac{\sqrt{(1+\sin A)^2}}{\sqrt{(1-\sin^2 A)}}$$

$$\frac{1+\sin A}{\cos A} = \frac{1}{\cos A} + \frac{\sin A}{\cos A} = \sec A + \tan A$$

2. Sol. (c)

$$\sin A + \operatorname{cosec} A = 3$$

$$\sin A + \frac{1}{\sin A} = 3$$

Squaring both sides

$$\sin^2 A + \frac{1}{\sin^2 A} + 2 = 9$$

$$\frac{\sin^4 A + 1}{\sin^2 A} = 9 - 2 = 7$$

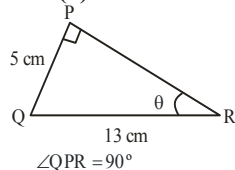
3. Sol. (b)

$$\sin x = \frac{3}{5}$$

$$\therefore \cot x \cdot \sec x = \frac{\cos x}{\sin x} \times \frac{1}{\cos x}$$

$$= \frac{1}{\sin x} = \frac{5}{3}$$

4. Sol. (a)



$$\Delta QPR = 90^\circ$$

$$\therefore \operatorname{cosec} \theta = \frac{QR}{PQ} = \frac{13}{5}$$

5. Sol. (b)

$$\cot B = \frac{12}{5}$$

$$\therefore \tan B = \frac{1}{\cot B} = \frac{5}{12}$$

$$\therefore \sec B = \sqrt{1 + \tan^2 B}$$

$$\sqrt{1 + \left(\frac{5}{12}\right)^2} = \sqrt{1 + \frac{25}{144}}$$

$$\sqrt{\frac{144+25}{144}} = \sqrt{\frac{169}{144}}$$

$$= \frac{13}{12}$$

6. Sol. (a)

Taking $\cos \theta$ out side in numerator and in denominator and making $\tan \theta$ hence eq. will be $\left(\frac{5\tan\theta-3}{5\tan\theta+3}\right)$ as it is given that $5\tan\theta = 4$ after putting

values and solving we will get the equation reduced to $1/7$

7. Sol. (a)

Given,

$$\sec x - \cos x = 4$$

$$\frac{1}{\cos x} - \cos x = 4$$

$$= \cos x - \frac{1}{\cos x} = -4$$

Squaring both side

$$\cos^2 x + \frac{1}{\cos^2 x} = 18$$

$$\text{Now, } \cos x + \frac{1}{\cos x} = \sqrt{18 + 2} = \sqrt{20}$$

$$\frac{\cos^2 x + 1}{\cos x} = 2\sqrt{5}$$

8. Sol. (c)

$$\text{As } \cot \theta = \frac{63}{16}$$

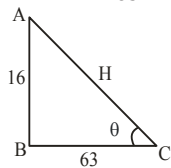
From ΔABC

$$B = 63, P = 16$$

$$\therefore H = \sqrt{63^2 + 16^2} = 65$$

Now, $\sin \theta + \cos \theta$

$$= \frac{P+B}{H} = \frac{63+16}{65} = \frac{79}{65}$$



9. Sol. (a)

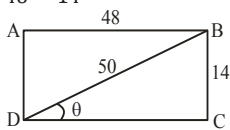
$$\text{Diagonal BD} = \sqrt{(AB)^2 + (AD)^2}$$

$$= \sqrt{(48)^2 + (14)^2}$$

$$= \sqrt{2500} = 50$$

Now $\sec \theta + \operatorname{cosec} \theta$

$$\frac{50}{48} + \frac{50}{14}$$

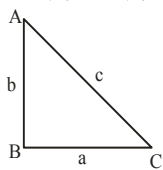


$$= \frac{50}{2} \left[\frac{24+7}{24 \times 7} \right] = \frac{775}{168}$$

10. Sol. (d)

$$\text{An right angle triangle, } (AC)^2 + (BC)^2 = (AB)^2$$

$$\Rightarrow (b)^2 + (a)^2 = c^2$$



$$\begin{aligned} \text{Now, } \tan A + \tan B &= \frac{a}{b} + \frac{b}{a} = \frac{a^2 + b^2}{ab} \\ &= \frac{c^2}{ab} \end{aligned}$$

11. Sol. (c)

$$\sec \theta + \cos \theta = \frac{5}{2} \Rightarrow \frac{1 + \cos^2 \theta}{\cos \theta} = \frac{5}{2}$$

$$\Rightarrow 2\cos^2 \theta - 5\cos \theta + 2 = 0$$

$$(2\cos \theta - 1)(\cos \theta - 2) = 0$$

$$\therefore \text{As, } \cos \theta \neq 2, \therefore \cos \theta = \frac{1}{2}$$

$$\sin^2 = 1 - \cos^2 \theta = 1 - \left(\frac{1}{2}\right)^2 = \frac{3}{4}$$

12. Sol. (b)

$$\cos \theta = \frac{12}{13} = \frac{B}{H} \Rightarrow P = \sqrt{H^2 + B^2}$$

$$= \sqrt{13^2 - 12^2} = 5$$

$$\sin \theta = \frac{P}{H} = \frac{5}{13} \Rightarrow \tan \theta = \frac{P}{B} = \frac{5}{12} \Rightarrow \operatorname{cosec} \theta = \frac{13}{5}$$

$$\frac{(\sin \theta (1 - \tan \theta))}{\tan \theta (1 + \operatorname{cosec} \theta)} = \frac{5/13(1 - 5/12)}{5/12(1 + 12/5)} = \frac{35}{234}$$

13. Sol. (b)

$$\operatorname{Cosec} \theta = \frac{H}{P} = \frac{125}{100} = \frac{5}{4}$$

$$B = 3 \frac{4 \times \frac{4}{3} - 5 \times \frac{3}{5} + 1}{\frac{5}{3} + 4 \times \frac{3}{4} - 1}$$

$$= \frac{10}{11}$$

14. Sol. (c)

In ΔABC , if $\angle C$ is 90° , then $\angle A + \angle B$

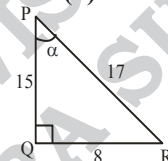
$$= 180^\circ - 90^\circ = 90^\circ$$

Now,

$$\cos(A+B) + \sin(A+B)$$

$$= 0 + 1 = 1$$

15. Sol. (b)



$$\sin \alpha + \cos \alpha = \frac{8}{17} + \frac{15}{17} = \frac{23}{17}$$

16. Sol. (a)

$$\sin \theta - \cos \theta = \frac{7}{17}$$

$$\sin \theta + \cos \theta = \sqrt{a^2 + b^2 - m^2}$$

$$= \sqrt{1 + 1 - \frac{49}{289}} \Rightarrow \sqrt{\frac{523}{289}} = \frac{23}{17}$$

Or

Short trick

Use tripot, $H = 17$, $B = 8$, $P = 15$

Put in $\sin \theta + \cos \theta$

$$\frac{P}{H} + \frac{B}{H} = \frac{23}{17}$$

17. Sol. (a)

$$\cos \theta + \sin \theta = \sqrt{2} \cos \theta$$

$$\Rightarrow \sin \theta = \sqrt{2} \cos \theta - \cos \theta$$

$$\Rightarrow \sin \theta = \cos \theta (\sqrt{2} - 1)$$

$$\Rightarrow \sin \theta \times \frac{1}{\sqrt{2} - 1} = \cos \theta$$

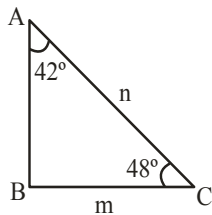
$$\Rightarrow (\sqrt{2} + 1) \sin \theta = \cos \theta$$

Subtracting $\sin \theta$ from it

$$\Rightarrow \sin \theta (\sqrt{2} + 1 - 1) = \cos \theta - \sin \theta$$

$$\Rightarrow \sqrt{2} \sin \theta = \cos \theta - \sin \theta$$

18. Sol. (d)

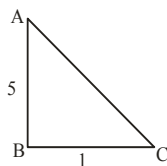


$$\sec 48^\circ = \frac{n}{m} \text{ and } \cot 42^\circ = \frac{\sqrt{n^2 - m^2}}{m}$$

$$\text{So, } \sec 48^\circ - \cot 42^\circ = \frac{n}{m} - \frac{\sqrt{n^2 - m^2}}{m}$$

$$= \frac{n - \sqrt{n^2 - m^2}}{m}$$

19. Sol. (b)



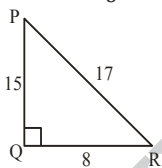
In triangle, ABC,

$$AC = \sqrt{5^2 + 1^2} = \sqrt{26} \text{ (Pythagoras theorem)}$$

$$\sin x = \frac{P}{H} = \frac{5}{\sqrt{26}}$$

20. Sol. (b)

$$\sec A = \frac{17}{8}$$



$$BC = \sqrt{17^2 - 8^2} = \sqrt{289 - 64}$$

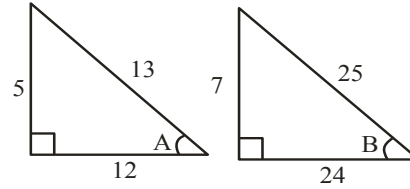
$$= \sqrt{225} = 15$$

$$\frac{34 \sin A + 15 \cot A}{68 \cos A - 16 \tan A} = \frac{34 \left(\frac{15}{17} \right) + 15 \left(\frac{8}{15} \right)}{68 \left(\frac{8}{17} \right) - 16 \left(\frac{15}{8} \right)}$$

$$= \frac{30 + 8}{32 - 30} = \frac{38}{2} = 19$$

21. Sol. (b)

According to the question,

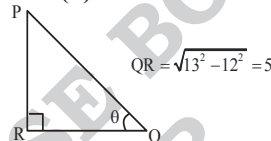


$$\cos A = \frac{12}{13} \text{ and } \cos B = \frac{24}{25}$$

So, $(\sec A \cos B)(\operatorname{cosec} B \tan A)$

$$= \left(\frac{13}{12} \times \frac{24}{25} \right) \left(\frac{25}{7} \times \frac{5}{12} \right) = \frac{65}{42}$$

22. Sol. (d)

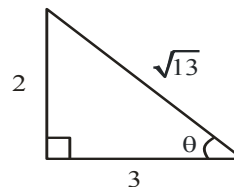


$$\sin \theta + \tan \theta = \frac{12}{13} + \frac{12}{5}$$

$$= \frac{60 + 156}{65} = \frac{216}{65}$$

23. Sol. (b)

$$2 \cot \theta = 3 \text{ (given)} \Rightarrow \cot \theta = \frac{3}{2}$$



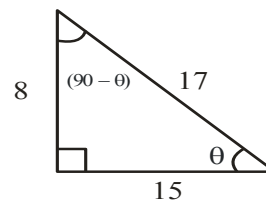
$$\frac{\sqrt{13} \cos \theta - 3 \tan \theta}{3 \tan \theta + \sqrt{13} \sin \theta}$$

$$\Rightarrow \frac{\sqrt{13} \times \left(\frac{3}{\sqrt{13}} \right) - 3 \times \left(\frac{2}{3} \right)}{3 \times \left(\frac{2}{3} \right) + \sqrt{13} \times \left(\frac{2}{\sqrt{13}} \right)}$$

$$\Rightarrow \frac{3 - 2}{2 + 2} = \frac{1}{4}$$

24. Sol. (b)

$$\cos \theta = \frac{15 \rightarrow \text{Base}}{17 \rightarrow \text{Hypo.}}$$



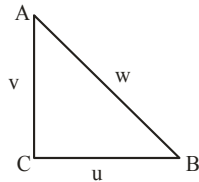
Perpendicular = 8

$$= \cot (90^\circ - \theta) = \tan \theta$$

$$= \frac{8}{15} \left[\therefore \tan \theta = \frac{P}{B} \right]$$

25. Sol. (d)

In $\triangle ABC$



$$\tan A = \frac{BC}{AC} = \frac{u}{v}$$

$$\text{and } \tan B = \frac{v}{u}$$

$$\text{Also, } u^2 + v^2 = w^2 \quad \dots(i)$$

(by Pythagoras theorem)

$$\begin{aligned} \therefore \tan A + \tan B &= \frac{u}{v} + \frac{v}{u} = \frac{u^2 + v^2}{uv} \\ &= \frac{w^2}{uv} \quad [\text{from Eq. (i)}] \end{aligned}$$

26. Sol. (a)

Expression

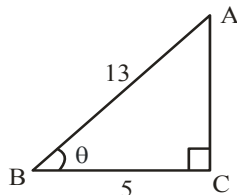
$$\begin{aligned} &= \frac{(1+\cos \theta) \left(\frac{1}{\sin \theta} - \frac{\cos \theta}{\sin \theta} \right) \times \frac{1}{\cos \theta}}{\sin \theta (1-\sin \theta) \left(\frac{1}{\cos \theta} + \frac{\sin \theta}{\cos \theta} \right)} \\ &= \frac{(1+\cos \theta) \left(\frac{1-\cos \theta}{\sin \theta} \right) \times \frac{1}{\cos \theta}}{\sin \theta (1-\sin \theta) \left(\frac{1+\sin \theta}{\cos \theta} \right)} \\ &= \frac{(1-\cos^2 \theta) \times \frac{1}{\sin \theta \cos \theta}}{\sin \theta (1-\sin^2 \theta) \times \frac{1}{\cos \theta}} \\ &= \frac{\sin^2 \theta \times \frac{1}{\sin \theta \cos \theta}}{\sin^2 \theta \cos^2 \theta \times \frac{1}{\cos \theta}} \\ &= \frac{1}{\cos^2 \theta} = \sec^2 \theta \end{aligned}$$

27. Sol. (b)

$$\text{Here, } \cos \theta = \frac{5}{13}$$

Using Pythagoras theorem in triangle ABC.

We get



$$AB^2 = AC^2 + BC^2$$

$$13^2 = 5^2 + AC^2$$

$$AC^2 = 169 - 25$$

$$AC^2 = 144$$

$$AC = \sqrt{144}$$

$$= AC = 12$$

Now,

$$\tan^2 \theta + \sec^2 \theta = \frac{AC^2}{BC^2} + \frac{AB^2}{BC^2}$$

$$= \frac{AC^2 + AB^2}{BC^2}$$

$$= \frac{12^2 + 13^2}{5^2}$$

$$= \frac{144 + 169}{25}$$

$$\Rightarrow \tan^2 \theta + \sec^2 \theta = \frac{313}{25}$$

28. Sol. (a)

$$\frac{\sin \theta - \cos \theta + 1 \sin \theta + 1}{\sin \theta + \cos \theta - 1 \cos \theta}$$

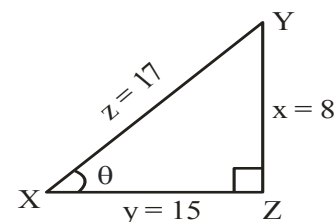
$$= \frac{(\sin \theta - \cos \theta + 1)(\cos \theta) - (\sin \theta + 1)(\sin \theta + \cos \theta - 1)}{(\sin \theta + \cos \theta - 1)(\cos \theta)}$$

$$\sin \theta \cdot \cos \theta - \cos^2 \theta + \cos \theta - \sin^2 \theta$$

$$= \frac{-\sin \theta - \sin \theta \cos \theta - \cos \theta + \sin \theta + 1}{(\sin \theta + \cos \theta - 1)(\cos \theta)} = 0$$

$$\frac{0}{(\sin \theta + \cos \theta - 1)(\cos \theta)} = 0$$

29. Sol. (c)



$$2x + 7z = 9y$$

$$2x + 7z = 7y + 2y$$

$$7(z - y) = 2(y - x)$$

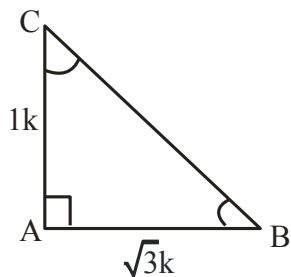
$$\frac{(z - y)}{y - x} = \frac{2}{7}$$

$$8, 15, 17 \rightarrow \text{triplet}$$

$$\sec y - \sec x \Rightarrow \frac{17}{3} - \frac{17}{15} = \frac{17 \times 7}{15 \times 8} = \frac{119}{120}$$

30. Sol. (b)

Given,



$$\tan B = \frac{k}{\sqrt{3}k}$$

In $\triangle ABC$,

$$AB^2 + AC^2 = BC^2$$

(by Pythagoras theorem)

$$\Rightarrow (\sqrt{3}k)^2 + (1k)^2 = BC^2$$

$$\Rightarrow BC^2 = 4k^2 \Rightarrow BC = 2k$$

31. Sol. (d)

$$\cot x = \frac{a}{b} = \frac{\text{base}}{\text{perpendicular}}$$

$$\Rightarrow \text{hypotenuse} = \sqrt{a^2 + b^2} \Rightarrow \sin x = \frac{b}{\sqrt{a^2 + b^2}}$$

$$\cos x = \frac{a}{\sqrt{a^2 + b^2}}$$

$$\therefore 2(a \cos 2x + b \sin 2x)$$

$$= 2(a(1 - 2\sin^2 x) + b(2\cos x \sin x))$$

$$= 2 \left[a \left[\frac{1 - 2b^2}{a^2 + b^2} \right] + b \left[2 \frac{ab}{a^2 + b^2} \right] \right]$$

$$= 2a \left[\frac{a^2 + b^2 - 2b^2}{a^2 + b^2} \right] + 4b \frac{(ab)}{a^2 + b^2}$$

$$= 2a \left[\frac{a^2 - b^2 - 2b^2}{a^2 + b^2} \right] = 2a$$

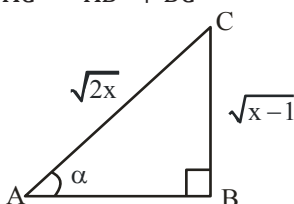
32. Sol. (a)

Given,

$$\sin \alpha = \frac{\sqrt{x-1}}{2x}$$

In $\triangle ABC$, using Pythagoras theorem,

$$AC^2 = AB^2 + BC^2$$

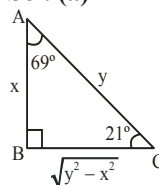


$$\Rightarrow 2x = AB^2 + (x+1)$$

$$\Rightarrow AB^2 = x+1 \Rightarrow AB = \sqrt{x+1}$$

$$\therefore \tan \alpha = \frac{BC}{AB} = \frac{\sqrt{x-1}}{\sqrt{x+1}} = \sqrt{\frac{x-1}{x+1}}$$

33. Sol. (a)



$$\text{In } \triangle ABC, \sin 21^\circ = \frac{x}{y}$$

$$AB = x$$

$$AC = y$$

$$BC = \sqrt{y^2 - x^2}$$

$$\Rightarrow \sec 21^\circ - \sin 69^\circ$$

$$\Rightarrow \frac{AC}{BC} - \frac{BC}{AC}$$

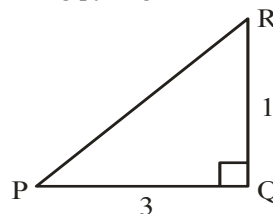
$$\Rightarrow \frac{(AC)^2 - (BC)^2}{(BC)(AC)} = \frac{y^2 - (y^2 - x^2)}{y\sqrt{y^2 - x^2}}$$

$$\Rightarrow \frac{y^2 - y^2 + x^2}{y\sqrt{y^2 - x^2}} = \frac{x^2}{y\sqrt{y^2 - x^2}}$$

34. Sol. (c)

$$\text{Here, } \cot R = \frac{1}{3}$$

Using pythagoras theorem,



$$PR^2 = PQ^2 + QR^2$$

$$PR^2 = 3^2 + 1^2$$

$$PR = \sqrt{10}$$

The expression

$$= \frac{\sec P(\cos R + \sin P)}{\operatorname{cosec} R(\sin R - \operatorname{cosec} P)}$$

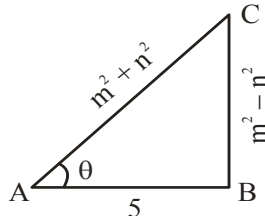
$$= \frac{\sqrt{10}}{3} \left(\frac{1}{\sqrt{10}} + \frac{1}{\sqrt{10}} \right)$$

$$= \frac{\sqrt{10}}{3} \left(\frac{3}{\sqrt{10}} - \frac{\sqrt{10}}{1} \right)$$

$$= \frac{\frac{\sqrt{10}}{3} \times \frac{2}{\sqrt{10}}}{\frac{\sqrt{10}}{3} \times \frac{-7}{\sqrt{10}}} = \frac{\frac{2}{3}}{\frac{-7}{3}} = -\frac{2}{7}$$

35. Sol. (c)

Given, $\sin \theta = \frac{m^2 - n^2}{m^2 + n^2}$



In $\triangle ABC$,

$$\begin{aligned} AB &= \sqrt{(AC)^2 - (BC)^2} \\ &= \sqrt{m^4 + n^4 + 2m^2n^2 - (m^4 + n^4 - 2m^2n^2)} \\ &= \sqrt{4m^2n^2} = 2mn \\ \therefore \tan \theta &= \frac{m^2 - n^2}{2mn} \end{aligned}$$

36. Sol. (d)

$$\therefore \sqrt{3} \tan \theta = 3 \sin \theta$$

$$\Rightarrow \frac{\tan \theta}{\sin \theta} = \frac{3}{\sqrt{3}}$$

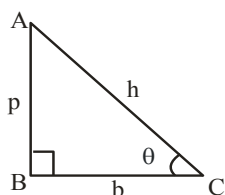
$$\Rightarrow \frac{\sin \theta}{\cos \theta} \times \frac{1}{\sin \theta} = \sqrt{3}$$

$$\Rightarrow \frac{1}{\cos \theta} = \sqrt{3} \Rightarrow \cos \theta = \frac{1}{\sqrt{3}} = \frac{b}{h}$$

$$\begin{aligned} \therefore p &= \sqrt{h^2 - b^2} = \sqrt{(\sqrt{3})^2 - (1)^2} \\ &= \sqrt{3 - 1} = \sqrt{2} \end{aligned}$$

$$\begin{aligned} \sin^2 \theta - \cos^2 \theta &= \left(\frac{p}{h}\right)^2 - \left(\frac{b}{h}\right)^2 \\ &= \left(\frac{\sqrt{2}}{\sqrt{3}}\right)^2 - \left(\frac{1}{\sqrt{3}}\right)^2 \\ &= \frac{2}{3} - \frac{1}{3} = \frac{1}{3} \end{aligned}$$

37. Sol. (d)



$$\begin{aligned} \sin \theta &= \frac{p}{h} \\ b &= \sqrt{h^2 - p^2} \\ &= \sqrt{(41)^2 - (9)^2} \\ &= \sqrt{(41 + 9)(41 - 9)} \end{aligned}$$

$$= \sqrt{50 \times 32} = 40$$

$$\cos \theta = \frac{b}{p} = \frac{40}{9}$$

OR

$$\sin \theta = \frac{9}{41}$$

$$\Rightarrow \operatorname{cosec} \theta = \frac{1}{\sin \theta} = \frac{41}{9}$$

$$\therefore \cot \theta = \sqrt{\operatorname{cosec}^2 \theta - 1}$$

$$= \sqrt{\left(\frac{41}{9}\right)^2 - 1}$$

$$= \sqrt{\frac{1681}{81} - 1} = \sqrt{\frac{1681 - 81}{81}}$$

$$= \sqrt{\frac{1600}{81}} = \frac{40}{9} \text{ because } 0^\circ < \theta$$

38. Sol. (b)

By Pythagoras theorem,

$$x^2 + (x - 2)^2 = 20$$

$$x^2 + x^2 + 4x + 4 = 20$$

$$2x^2 + 4x + 4 = 20$$

$$x^2 + 2x + 2 = 10$$

Solving the quadratic equation we get

$$x = 4 \text{ and } x = -2$$

Since x cannot be negative $x = 4$.

$$AC = 2\sqrt{5}$$

$$\cos A = \frac{x}{2\sqrt{5}}$$

$$\cos^2 A = \frac{x^2}{20} = \frac{16}{20} = \frac{4}{5}$$

$$\cos C = \cos(90 - A) = \sin A = \frac{x-2}{2\sqrt{5}}$$

$$\sin^2 A = \frac{(x-2)^2}{20} = \frac{4}{20} = \frac{1}{5}$$

$$(\cos^2 A - \cos^2 C) = \cos^2 A -$$

$$\sin^2 A = \frac{4}{5} - \frac{1}{5} = \frac{3}{5}$$

Hence Option B is the correct answer.

39. Sol. (a)

$$\cos [A + B] = \frac{24}{25}$$

$$\therefore \sin(A + B) = \sqrt{1 - \left(\frac{24}{25}\right)^2}$$

$$= \sqrt{1 - \frac{576}{625}}$$

$$= \sqrt{\frac{625-576}{625}} = \sqrt{\frac{49}{625}} = \frac{7}{25}$$

$$\therefore \tan(A+B)$$

$$= \frac{\sin(A+B)}{\cos(A+B)} = \frac{7}{24}$$

$$\text{Again } \sin(A-B) = \frac{15}{17}$$

$$\therefore \cos(A-B) = \sqrt{1 - \left(\frac{15}{17}\right)^2}$$

$$= \sqrt{1 - \frac{225}{289}}$$

$$= \sqrt{\frac{289-225}{289}} = \sqrt{\frac{64}{289}} = \frac{8}{17}$$

$$\therefore \tan(A-B)$$

$$= \frac{\sin(A-B)}{\cos(A-B)} = \frac{15}{8}$$

$$\therefore \tan 2A = \tan[(A+B) + (A-B)]$$

$$= \frac{\tan(A+B) + \tan(A-B)}{1 - \tan(A+B)\tan(A-B)}$$

$$= \frac{\frac{7}{24} + \frac{15}{8}}{1 - \frac{7}{24} \times \frac{15}{8}} = \frac{416}{87}$$

40. Sol. (b)

$$5\sin\theta - 4\cos\theta = 0$$

$$\Rightarrow 5\sin\theta = 4\cos\theta$$

$$\Rightarrow \frac{\sin\theta}{\cos\theta} = \frac{4}{5}$$

$$\Rightarrow \tan\theta = \frac{4}{5}$$

$$\therefore \text{Expression} = \frac{5\sin\theta + 2\cos\theta}{5\sin\theta + 3\cos\theta}$$

$$= \frac{5\frac{\sin\theta}{\cos\theta} + 2\frac{\cos\theta}{\cos\theta}}{5\frac{\sin\theta}{\cos\theta} + 3\frac{\cos\theta}{\cos\theta}}$$

[Dividing N⁵ and D^r by cos θ]

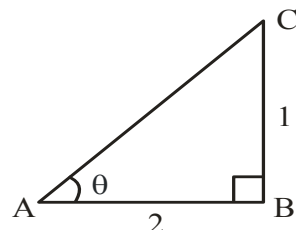
$$= \frac{5\tan\theta + 2}{5\tan\theta + 3} = \frac{5 \times \frac{4}{5} + 2}{5 \times \frac{4}{5} + 3} = \frac{6}{7}$$

41. Sol. (c)

Here, it is given

$$\angle B = 90^\circ \text{ and } \tan A = \frac{1}{2}$$

Using Pythagoras theorem



$$AC^2 = AB^2 + BC^2$$

$$AC = \sqrt{2^2 + 1^2}$$

$$AC = \sqrt{5}$$

The expression

$$= \frac{\sin A(\cos C + \cos A)}{\cos C(\sin C - \sin A)}$$

$$= \frac{\frac{1}{\sqrt{5}} \left(\frac{1}{\sqrt{5}} + \frac{2}{\sqrt{5}} \right)}{\frac{1}{\sqrt{5}} \left(\frac{2}{\sqrt{5}} - \frac{1}{\sqrt{5}} \right)} = \frac{\frac{3}{5}}{\frac{1}{5}} = 3$$

42. Sol. (2)

$$\text{Here, } \sec\theta = \frac{a}{b}$$

$$\Rightarrow \cos\theta = \frac{b}{a}$$

$$\text{The expression} = \frac{1 - \tan^2\theta}{2 - \sin^2\theta}$$

$$= \frac{1 - (\sec^2\theta - 1)}{2 - (1 - \cos^2\theta)} = \frac{2 - \sec^2\theta}{1 + \cos^2\theta}$$

$$= \frac{\left[2 - \frac{a^2}{b^2} \right]}{\left[1 + \left(\frac{b}{a} \right)^2 \right]}$$

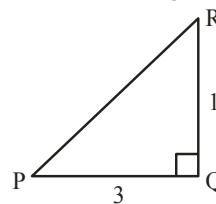
$$\frac{(2b^2 - a^2)}{b^2}$$

$$1 + \frac{b^2}{a^2}$$

$$= \frac{a^2(2b^2 - a^2)}{b^2(a^2 + b^2)}$$

43. Sol. (c)

$$\text{Here, } \cot R = \frac{1}{3}$$



$$PR^2 = PQ^2 + QR^2$$

$$PR^2 = 3^2 + 1^2$$

$$PR = \sqrt{10}$$

The expression

$$\begin{aligned}
 &= \frac{\sec P(\cos R + \sin P)}{\operatorname{cosec} R(\sin R - \cos P)} \\
 &= \frac{\frac{\sqrt{10}}{3} \left(\frac{1}{\sqrt{10}} + \frac{1}{\sqrt{10}} \right)}{\frac{\sqrt{10}}{3}} \left(\frac{3}{\sqrt{10}} - \frac{\sqrt{10}}{1} \right) \\
 &= \frac{\frac{\sqrt{10}}{3} \times \frac{2}{\sqrt{10}}}{\frac{\sqrt{10}}{3} \times \frac{-7}{\sqrt{10}}} = \frac{\frac{2}{3}}{\frac{-7}{3}} = -\frac{2}{7}
 \end{aligned}$$

44. Sol. (c)

$$\begin{aligned}
 &\frac{\sec A(\sec A + \tan A)(1 - \sin A)}{(\operatorname{cosec}^2 A - 1)\sin^2 A} \\
 &= \frac{\sec A \left(\frac{1}{\cos A} + \frac{\sin A}{\cos A} \right) (1 - \sin A)}{\left(\frac{1}{\sin^2 A} - 1 \right) \sin^2 A} \\
 &= \frac{\sec A \left(\frac{1 + \sin A}{\cos A} \right) \frac{(1 - \sin A)}{1}}{\frac{(1 - \sin^2 A)}{\sin^2 A} \sin^2 A} \\
 &= \frac{1}{\cos A} \frac{(1 - \sin^2 A)}{\cos A} \\
 &= \frac{1}{\cos^2 A} = \sec^2 A
 \end{aligned}$$

45. Sol. (b)

Here $\operatorname{cosec} \theta = \frac{b}{a}$

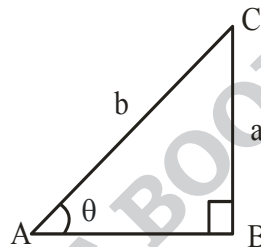
$$\Rightarrow \sin \theta = \frac{a}{b}$$

Using Pythagoras theorem we get

$$AC^2 = AB^2 + BC^2$$

$$AB^2 = a^2 + AB^2$$

$$\Rightarrow AB = \sqrt{b^2 - a^2}$$



Now

The expression

$$\begin{aligned}
 &= \frac{\sqrt{3} \cot \theta + 1}{\tan \theta + \sqrt{3}} \\
 &= \frac{\frac{\sqrt{3}}{\tan \theta} + 1}{\tan \theta + \sqrt{3}} \\
 &= \frac{\sqrt{3} + \tan \theta}{\tan \theta (\tan \theta + \sqrt{3})} \\
 &= \frac{1}{\tan \theta} = \cot \theta = \frac{AB}{AC} \\
 &= \frac{\sqrt{b^2 - a^2}}{a}
 \end{aligned}$$

Type-2 (Table MCQ)

1. What is the value of $3\sin^2 30^\circ + \frac{3}{5}\cos^2 60^\circ - 2\sec^2 45^\circ$?

[SSC CGL Tier II 2023]

- (a) $\frac{-5}{2}$ (b) $\frac{-5}{8}$ (c) $\frac{-31}{10}$ (d) $\frac{-25}{17}$

2. The value of $(\sin^4 45^\circ + \cos^4 60^\circ) + (\tan^4 45^\circ + \cot^4 45^\circ)$ is:

[SSC CPO 09/11/2022 (Afternoon)]

- (a) $\frac{37}{16}$ (b) $\frac{33}{16}$ (c) $\frac{35}{16}$ (d) $\frac{39}{16}$

3. The value of $\cos 0^\circ \cos 30^\circ \cos 45^\circ \cos 60^\circ \cos 90^\circ$ is:

[SSC CGL 05/03/2020 (Evening)]

- (a) 5 (b) $\frac{\sqrt{6}}{8}$ (c) 3 (d) 0

4. The numerical value of $\frac{\cos^2 45^\circ}{\sin^2 60^\circ} + \frac{\cos^2 60^\circ}{\sin^2 45^\circ} - \frac{\tan^2 30^\circ}{\cot^2 45^\circ} - \frac{\sin^2 30^\circ}{\cot^2 30^\circ}$ is

- (a) $1\frac{1}{4}$ (b) $\frac{3}{4}$ (c) $\frac{1}{4}$ (d) $\frac{1}{2}$

5. What is the value of $3\sin^2 30^\circ + \frac{3}{5}\cos^2 60^\circ - 2\sec^2 45^\circ$?

[SSC CGL Tier-II (CBE) Exam. 08/08/2022]

- (a) $\frac{-5}{2}$ (b) $\frac{-5}{8}$ (c) $\frac{-31}{10}$ (d) $\frac{-25}{17}$

6. If $0 < \theta < \frac{\pi}{2}$, $0 < \phi < \frac{\pi}{2}$ and $\cos \theta < \cos \phi$, then which of the following is correct

[CDS 2021]

- (a) $\theta < \phi$ (b) $\theta > \phi$
(c) $\theta + \phi = 90^\circ$ (d) None

7. If for some lying between 0° and 90° , $\tan \theta = 1$, then what is the value of $\sin^2 \theta - 2\sin \theta \cos \theta$

[2021-II]

- (a) -1 (b) 0 (c) $\frac{1}{2}$ (d) $-\frac{1}{2}$

8. The value of $\frac{\cos^2 60^\circ + 4\sec^2 30^\circ - \tan^2 45^\circ}{\sin^2 30^\circ + \cos^2 30^\circ}$ is

- (a) $\frac{64}{\sqrt{3}}$ (b) $\frac{55}{12}$ (c) $\frac{67}{12}$ (d) $\frac{67}{10}$

9. Find the value of $\frac{3}{4}\cot^2 30^\circ + \cos^2 30^\circ - 3\operatorname{cosec}^2 60^\circ + \tan^2 60^\circ$

[SSC CGL 17/08/2021 (Morning)]

- (a) -4 (b) 10 (c) 2 (d) $\frac{\sqrt{3}}{4}$

10. The value of $\sin 60^\circ \cos 30^\circ - \cos 60^\circ \sin 30^\circ$ is:

[SSC CHSL 19/10/2020 (Afternoon)]

- (a) $\frac{1}{2}$ (b) $\frac{1}{\sqrt{2}}$ (c) 1 (d) $\frac{\sqrt{3}}{2}$

11. $16\cos^3 \frac{\pi}{6} - 12\cos \frac{\pi}{6} =$

[SSC CGL 01/12/2022 (4th Shift)]

- (a) 0 (b) 2 (c) 1 (d) -1

12. If $\operatorname{cosec}^2 x - 2 = 0$, then the value of x ($0 < x < 90^\circ$) is :

[SSC CHSL (10+2) Tier-I]

Exam, 19.10.2020 (Shift-II)]

- (a) 15° (b) 45° (c) 30° (d) 60°

13. If $\cos 1^\circ = p$ and $\cos 89^\circ = q$, then which one of the following is correct?

- (a) p is close to 0 and q is close to 1
(b) $p < q$
(c) $p = q$
(d) p is close to 1 and q is close to 0

14. Evaluate the following expression: $3\tan^2 45^\circ + 2\cos 60^\circ - 2\sin 30^\circ$

[SSC CHSL 26/05/2022 (Evening)]

- (a) 3 (b) 4 (c) 0 (d) 2

15. Which one of the following is correct

- (a) $\sin 35^\circ > \cos 55^\circ$ (b) $\cos 61^\circ > \frac{1}{2}$

(c) $\sin 32^\circ > \frac{1}{2}$ (d) $\tan 44^\circ > 1$

16. Evaluate the following expression.

$$\frac{\tan^2 60^\circ + \operatorname{cosec} 30^\circ \sin 90^\circ + 3 \sec^2 30^\circ}{4 \sin^2 45^\circ + \sec^2 60^\circ - \cot^2 30^\circ - 5 \cos^2 90^\circ}$$

[SSC CHSL 06/08/2021 (Morning)]

(a) $\frac{7}{3}$ (b) 3 (c) $\frac{19}{17}$ (d) -12

17. If $\frac{x - x \tan^2 30^\circ}{1 + \tan^2 30^\circ} = \sin^2 30^\circ + 4 \cot^2 45^\circ - \sec^2 60^\circ$
Then value of x is:

(a) $\frac{1}{4}$ (b) $\frac{1}{\sqrt{3}}$ (c) $\frac{1}{2}$ (d) $\frac{1}{5}$

18. What number should be subtracted from $4(\sin^4 60^\circ + \cos^4 30^\circ) - (\tan^2 45^\circ - \cot^2 30^\circ) + \cos^2 45^\circ - \operatorname{cosec}^2 45^\circ + \sec^2 60^\circ$ to get 2?

[SSC CHSL 13/04/2021 (Evening)]

(a) 5 (b) 4 (c) 7 (d) 3

19. If $\alpha + \beta = 90^\circ$ and $\alpha = 2\beta$, then the value of $3 \cos^2 \alpha - 2 \sin^2 \beta$ is equal to:

[SSC CGL Tier II 18/11/2020]

(a) $\frac{1}{4}$ (b) $\frac{3}{2}$ (c) $\frac{4}{3}$ (d) $\frac{3}{4}$

20. If $\frac{x - x \operatorname{cosec}^2 30^\circ}{1 + \operatorname{cosec}^2 30^\circ} = \cos^2 60^\circ + 4 \cot^2 45^\circ - \sec^2 60^\circ$,
then the value of x is

[SSC CHSL 25/05/2022 (Morning)]

(a) $\frac{5}{12}$ (b) $-\frac{5}{12}$ (c) $\frac{1}{5}$ (d) $-\frac{1}{12}$

21. The value of $\frac{\sin 30^\circ \cos 60^\circ + \cos 45^\circ \sin 45^\circ}{\tan 60^\circ \cot 30^\circ}$ is:

[SSC CHSL 19/03/2020 (Morning)]

(a) $\frac{1}{\sqrt{3}}$ (b) $\sqrt{3}$ (c) 2 (d) $1/4$

22. Find the value of $\frac{\cos 30^\circ - \sin 30^\circ}{\sin 60^\circ + \cos 60^\circ}$

[SSC CHSL 17/03/2020 (Morning)]

(a) $2 + \sqrt{3}$ (b) $2 - \sqrt{3}$
(c) $1 + \sqrt{3}$ (d) $1 - \sqrt{3}$

23. The value of $\frac{\sec^2 60^\circ \cos^2 45^\circ + \operatorname{cosec}^2 30^\circ}{\cot 30^\circ \sec^2 45^\circ - \operatorname{cosec}^2 30^\circ \tan 45^\circ}$ is:

[SSC CGL 24/08/2021 (Afternoon)]

(a) $3(2 - \sqrt{3})$ (b) $-3(2 - \sqrt{3})$
(c) $3(2 + \sqrt{3})$ (d) $-3(2 + \sqrt{3})$

24. The value of

$$\frac{\tan^2 30^\circ + \sin^2 90^\circ + \cot^2 60^\circ + \sin^2 30^\circ \cdot \cos^2 45^\circ}{\sin 60^\circ \cdot \cos 30^\circ - \cos 60^\circ \cdot \sin 30^\circ}$$
 is:

[SSC CGL 16/08/2021 (Evening)]

(a) $\frac{25}{12}$ (b) $\frac{43}{12}$ (c) $\frac{37}{12}$ (d) $\frac{47}{12}$

25. The value of $\frac{\operatorname{cosec}^2 30^\circ \sin^2 45^\circ + \sec^2 60^\circ}{\tan 60^\circ \operatorname{cosec}^2 45^\circ - \sec^2 60^\circ \tan 45^\circ}$ is:

[SSC CGL Tier-II Exam, 15.11.2020]

(a) $-2\sqrt{3} - 2$ (b) $-3(2 + \sqrt{3})$
(c) $3(2 + \sqrt{3})$ (d) $2(\sqrt{3} - 2)$

26. What is the value of the expression $\cos^2 \frac{\pi}{8} + 4 \cos^2 \frac{\pi}{4} - \sec \frac{\pi}{3} + 5 \tan^2 \frac{\pi}{3} + \sin^2 \frac{\pi}{8}$?

(a) 8 (b) 10 (c) 16 (d) 18

27. If $A = 30^\circ$, $B = 60^\circ$ and $C = 135^\circ$, then what is the value of $\sin^3 A + \cos^3 B + \tan^3 C - 3 \sin A \cos B \tan C$?

(a) 0 (b) 1 (c) 8 (d) 9

28. The value of $\frac{2 \sin^2 30^\circ \cdot \tan 60^\circ - 3 \cos^2 60^\circ \cdot \sec^2 30^\circ}{4 \cot^2 45^\circ - \sec^2 60^\circ + \sin^2 60^\circ + \cos^2 90^\circ}$

[SSC CGL 13/08/2021 (Afternoon)]

(a) $\frac{2(\sqrt{3}+2)}{3}$ (b) $\frac{1}{3}(\sqrt{3} - 2)$
(c) $\frac{2(\sqrt{3}-2)}{3}$ (d) $\frac{1}{3}(\sqrt{3} + 2)$

29. What is the value of $5 \sin^2 60^\circ + 7 \sin^2 45^\circ + 8 \cos^2 45^\circ$?

[SSC CGL Tier II 08/08/2022]

(a) 10 (b) $\frac{57}{4}$ (c) 25 (d) $\frac{45}{4}$

30. The value of $\frac{\tan 30^\circ \operatorname{cosec} 60^\circ + \tan 60^\circ \sec 30^\circ}{\sin^2 30^\circ + 4 \cot^2 45^\circ - \sec^2 60^\circ}$ is :

[SSC CGL (CBE) Tier-I

Exam, 04.03.2020 (Shift-I)]

- (a) $\frac{2}{3}$ (b) $\frac{32}{99}$ (c) $\frac{8}{3}$ (d) $\frac{32}{3}$
31. If $a = 45^\circ$ and $b = 15^\circ$, what is the value of $\frac{\cos(a-b) - \cos(a+b)}{\cos(a-b) + \cos(a+b)}$?

[SSC CGL 13/12/2022 (2nd Shift)]

- (a) $2 - 2\sqrt{2}$ (b) $3 - \sqrt{6}$
(c) $3 - \sqrt{2}$ (d) $2 - \sqrt{3}$
32. Find the value of $\frac{\tan^3 45^\circ + 4\cos^3 60^\circ}{2\operatorname{cosec}^2 45^\circ - 3\sec^2 30^\circ + \sin 30^\circ}$

[SSC CGL 13/04/2022 (Morning)]

- (a) $\frac{3}{4}$ (b) $1 + \sqrt{2}$
(c) $\frac{4}{3}$ (d) 3
33. If $2x^2 \cos 60^\circ - 4\cot^2 45^\circ - 2\tan 60^\circ = 0$, then what is the value of x ?
- (a) 2 (b) 3
(c) $\sqrt{3} - 1$ (d) $\sqrt{3} + 1$

34. Evaluate the following expression.

$$\frac{\tan^2 60^\circ + \operatorname{cosec} 30^\circ \sin 90^\circ + 3\sec^2 30^\circ}{4\sin^2 45^\circ + \sec^2 60^\circ - \cot^2 30^\circ - 5\cos^2 90^\circ}$$

[SSC CHSL 06/08/2021 (Shift-01)]

- (a) $\frac{7}{3}$ (b) 3 (c) $\frac{19}{17}$ (d) -12
35. Find the value of $\frac{8\sin 30^\circ \cdot \sin^2 60^\circ - 4\sin 90^\circ - \sec^2 45^\circ}{\tan^2 45^\circ - \cot^2 30^\circ}$.

[SSC CGL 13/08/2021 (Afternoon)]

- (a) $\frac{3}{2}$ (b) $\frac{3}{4}$ (c) $-\frac{1}{2}$ (d) $\frac{5}{2}$

36. If $\frac{k - k\cot^2 30^\circ}{1 + \cot^2 30^\circ} = \sin^2 60^\circ + 4\tan^2 45^\circ - \operatorname{cosec}^2 60^\circ$, then the value of k (correct to two decimal places) is :

[SSC CGL 03/12/2022 (Shift- 03)]

- (a) 5.55 (b) -6.83 (c) -5.58 (d) 6.83

37. If $A = 60^\circ$, what is the value of:

$$\frac{[8\cos A + 7\sec A - \tan^2 A]}{10\sin \frac{A}{2}}?$$

[SSC CGL 18/04/2022 (Morning)]

- (a) 5 (b) 3 (c) 15 (d) 10

38. The value of $152(\sin 30^\circ + 2\cos^2 45^\circ + 3\sin 30^\circ + 4\cos^2 45^\circ + \dots + 17\sin 30^\circ + 18\cos^2 45^\circ)$ is

- (a) an integer but not perfect square
(b) a rational number but not an integer
(c) a perfect square of an integer
(d) irrational

39. If $A + B + C = 180^\circ$, then $\tan^2 \frac{A}{2} + \tan^2 \frac{B}{2} + \tan^2 \frac{C}{2} = ?$

- (a) 1 (b) 3 (c) 2 (d) 0

40. The value of $\frac{5\cos^2 60^\circ + 4\sec^2 30^\circ - \tan^2 45^\circ}{\tan^2 60^\circ - \sin^2 30^\circ - \cos^2 45^\circ}$ is :

[SSC CGL Tier-II Exam, 16/11/2020]

- (a) $\frac{67}{27}$ (b) $\frac{22}{9}$ (c) $\frac{67}{24}$ (d) $\frac{19}{9}$

Type-2 ANSWER KEY

1	C	2	A	3	D	4	B	5	C	6	B	7	D	8	B
9	C	10	A	11	A	12	B	13	D	14	A	15	C	16	B
17	C	18	C	19	A	20	B	21	D	22	B	23	D	24	B
25	B	26	C	27	A	28	C	29	D	30	D	31	D	32	D
33	D	34	B	35	A	36	B	37	B	38	C	39	A	40	A

Type-2 (Table Solution)

1. Sol. (c)

$$3\sin^2 30^\circ + \frac{3}{5}\cos^2 60^\circ = 2\sin^2 45^\circ$$

$$= 3 \times \frac{1}{4} + \frac{3}{5} \times \frac{1}{4} - 2(2)$$

$$= \frac{3}{4} + \frac{3}{20} - 4 \Rightarrow \frac{18}{20} - 4$$

$$= \frac{-62}{20} = \frac{-31}{10}$$

2. Sol. (a)

$$(\sin^4 45^\circ + \cos^4 60^\circ) + (\tan^4 45^\circ + \cot^4 45^\circ)$$

$$= \left(\frac{1}{\sqrt{2}}\right)^4 + \left(\frac{1}{2}\right)^4 + 1 + 1$$

$$= \frac{1}{4} + \frac{1}{16} + 2 = \frac{37}{16}$$

3. Sol. (d)

$$\cos 0^\circ \cos 30^\circ \cos 45^\circ \cos 60^\circ \cos 90^\circ = 0$$

$$[\cos 90^\circ = 0]$$

4. Sol. (b)

$$\frac{\cos^2 45^\circ}{\sin^2 60^\circ} + \frac{\cos^2 60^\circ}{\sin^2 45^\circ} - \frac{\tan^2 30^\circ}{\cot^2 45^\circ} \cdot \frac{\sin^2 30^\circ}{\cot^2 30^\circ}$$

$$\frac{1}{\frac{3}{4}} + \frac{1}{\frac{1}{4}} - \frac{1}{1} - \frac{1}{3}$$

$$\Rightarrow \frac{3}{4}$$

5. Sol. (c)

$$\text{Expression} = 3\sin^2 30^\circ +$$

$$\frac{3}{5}\cos^2 60^\circ - 2\sec^2 45^\circ$$

$$= 3 \times \left(\frac{1}{2}\right)^2 + \frac{3}{5} \times \left(\frac{1}{2}\right)^2 - 2 \times (\sqrt{2})^2$$

$$= \frac{3}{4} + \frac{3}{20} - 4$$

$$= \frac{15+3-80}{20} = \frac{-60}{20} = \frac{-31}{10}$$

6. Sol. (b)

7. Sol. (d)

$$\tan \theta = 1 \Rightarrow \theta = 45^\circ$$

$$\Rightarrow \sin^2 45^\circ - 2\sin 45^\circ \cos 45^\circ$$

$$\Rightarrow \frac{1}{2} - 1 = \frac{-1}{2}$$

8. Sol. (b)

$$\frac{\cos^2 60^\circ + 4\sec^2 30^\circ - \tan^2 45^\circ}{\sin^2 30^\circ + \cos^2 30^\circ}$$

$$= \frac{\left(\frac{1}{2}\right)^2 + 4\left(\frac{2}{\sqrt{3}}\right)^2 - 1^2}{1}$$

$$(\because \sin^2 A + \cos^2 A = 1)$$

$$= \frac{1}{4} + \frac{4 \times 4}{3} - 1 = \frac{1}{4} + \frac{16}{3} - 1$$

$$= \frac{3+64-12}{12} = \frac{55}{12}$$

9. Sol. (c)

$$\frac{3}{4}\cot^2 30^\circ + \cos^2 30^\circ.$$

$$\operatorname{cosec}^2 60^\circ + \tan^2 60^\circ$$

$$\Rightarrow \frac{3}{4} \times 3 + \frac{3}{4} - 3 \times \frac{4}{3} + 3 \Rightarrow 2$$

10. Sol. (a)

$$\sin 60^\circ \cos 30^\circ - \cos 60^\circ \sin 30^\circ$$

$$\Rightarrow \frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{2} - \frac{1}{2} \times \frac{1}{2}$$

$$\Rightarrow \frac{3}{4} - \frac{1}{4} = \frac{1}{2}$$

11. Sol. (a)

$$16\cos^3 \frac{\pi}{6} - 12\cos \frac{\pi}{6}$$

$$= 16\cos^3 30^\circ - 12\cos 30^\circ$$

$$= 16\left(\frac{\sqrt{3}}{2}\right)^3 - 12 \times \frac{\sqrt{3}}{2}$$

$$= 16\left(\frac{3\sqrt{3}}{8}\right) - 6\sqrt{3} \Rightarrow 0$$

12. Sol. (b)

$$\operatorname{cosec}^2 x - 2 = 0$$

$$\Rightarrow \operatorname{cosec}^2 x = 2$$

$$\Rightarrow \operatorname{cosec} x = \sqrt{2} \text{ because}$$

$$0 < x < 90^\circ$$

$$\Rightarrow \operatorname{cosec} x$$

$$= \sqrt{2} = \operatorname{cosec} 45^\circ$$

$$\Rightarrow x = 45^\circ$$

13. Sol. (d)

We know that, the value of $\cos \theta$ is decreasing from 0° to 90° .

$$\therefore \cos 1^\circ > \cos 89^\circ$$

$$\Rightarrow p > q$$

Also, $\cos 1^\circ$ is close to 1 and $\cos 89^\circ$ is close to 0.

Hence, option (d) is correct.

14. Sol. (a)

$$3\tan^2 45^\circ + 2\cos 60^\circ - 2\sin 30^\circ$$

$$\Rightarrow 3 \times 1 + 2 \times \frac{1}{2} - 2 \times \frac{1}{2} = 3 + 1 - 1 = 3$$

15. Sol. (c)

We know that, $\sin \theta$ is increasing in 0° to 90° .

$$\therefore \sin 30^\circ = \frac{1}{2}$$

$$\therefore \sin 32^\circ > \frac{1}{2}$$

16. Sol. (b)

$$\frac{\tan^2 60^\circ + \operatorname{cosec} 30^\circ \sin 90^\circ + 3\sec^2 30^\circ}{4\sin^2 45^\circ + \sec^2 60^\circ - \cot^2 30^\circ - 5\cos^2 90^\circ}$$

$$\frac{(\sqrt{3})^2 + (2)(1) + 3 \times \frac{4}{3}}{4 \times \frac{1}{2} + 4 - (\sqrt{3})^2 - 0} = \frac{3+2+4}{3}$$

$$= 3$$

17. Sol. (c)

$$\frac{x - x\tan^2 30^\circ}{1 + \tan^2 30^\circ}$$

$$= \sin^2 30^\circ + 4\cot^2 45^\circ - \sec^2 60^\circ$$

$$\frac{x(1 - \tan^2 30^\circ)}{1 + \tan^2 30^\circ} = \left(\frac{1}{2}\right)^2 + 4 \times 1 - (2)^2$$

$$\frac{x \left[1 - \left(\frac{1}{\sqrt{3}} \right)^2 \right]}{1 + \left(\frac{1}{\sqrt{3}} \right)^2} = \frac{1}{4} + 4 - 4$$

$$\frac{x \left[1 - \frac{1}{3} \right]}{1 + \frac{1}{3}} = \frac{1}{4}$$

$$x \times \frac{2}{3} = \frac{1}{4} \times \frac{4}{3}$$

$$x = \frac{1}{3} \times \frac{3}{2} = \frac{1}{2}$$

18. Sol. (c)

$$4(\sin^4 60^\circ + \cos^4 30^\circ)$$

$$(\tan^2 45^\circ - \cot^2 30^\circ)$$

$$+\cos^2 45^\circ - \operatorname{cosec}^2 45^\circ + \sec^2 60^\circ$$

$$= 4 \left(2 \times \frac{9}{16} \right) - (1 - 3) + \frac{1}{2} - 2 + 4 = 9$$

19. Sol. (a)

$$\alpha + \beta = 90^\circ \text{ and } \alpha = 2\beta$$

$$\alpha = 60^\circ \text{ and } \beta = 30^\circ$$

$$\Rightarrow 3\cos^2 \alpha - 2\sin^2 \beta$$

$$= 3 \times \frac{1}{4} - 2 \times \frac{1}{4} \Rightarrow \frac{3}{4} - \frac{2}{4} = \frac{1}{4}$$

20. Sol. (b)

$$\frac{x(1 - \operatorname{cosec}^2 30^\circ)}{1 + \operatorname{cosec}^2 30^\circ} = \left(\frac{1}{2}\right)^2 + (1 \times 4) - 2^2$$

$$\frac{x(1-4)}{1+4} = \frac{1}{4} + 4 - 4$$

$$x \times \frac{-3}{5} = \frac{1}{4} \Rightarrow x = \frac{1}{4} \times \frac{5}{-3} = -\frac{5}{12}$$

21. Sol. (d)

$$\frac{\sin 30^\circ \cos 60^\circ + \cos 45^\circ \sin 45^\circ}{\tan 60^\circ \cot 30^\circ}$$

$$\frac{\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) + \left(\frac{1}{\sqrt{2}}\right)\left(\frac{1}{\sqrt{2}}\right)}{(\sqrt{3})(\sqrt{3})}$$

$$= \frac{\frac{1}{4} + \frac{1}{2}}{(\sqrt{3})(\sqrt{3})}$$

$$= \frac{\frac{1}{4} + \frac{1}{2}}{3} \Rightarrow \frac{\frac{3}{4}}{3} = \frac{1}{4}$$

22. Sol. (b) $\frac{\cos 30^\circ - \sin 30^\circ}{\sin 60^\circ + \cos 60^\circ}$

$$\Rightarrow \frac{\frac{\sqrt{3}}{2} - \frac{1}{2}}{\frac{\sqrt{3}}{2} + \frac{1}{2}}$$

$$= \frac{\frac{\sqrt{3}-1}{2}}{\frac{\sqrt{3}+1}{2}}$$

$$= \frac{\sqrt{3}-1}{\sqrt{3}+1} = \frac{\sqrt{3}-1}{\sqrt{3}+1} \times \frac{\sqrt{3}-1}{\sqrt{3}-1}$$

$$= \frac{(\sqrt{3}-1)^2}{3-1} = \frac{3+1-2\sqrt{3}}{2}$$

$$= \frac{4-2\sqrt{3}}{2} = 2-\sqrt{3}$$

23. Sol. (d)

$$\frac{\sec^2 60^\circ \cos^2 45^\circ + \operatorname{cosec}^2 30^\circ}{\cot 30^\circ \sec^2 45^\circ - \operatorname{cosec}^2 30^\circ \sin^2 15^\circ}$$

$$\Rightarrow \frac{(2)^2 \left(\frac{1}{\sqrt{2}}\right)^2 + (2)^2}{\sqrt{3}(\sqrt{2})^2 - (2)^2} \Rightarrow \frac{4 \times \frac{1}{2} + 4}{2\sqrt{3}-4}$$

$$= -3(2+\sqrt{3})$$

24. Sol. (b)

$$\frac{\tan^2 30^\circ + \sin^2 90^\circ + \cot^2 60^\circ + \sin^2 30^\circ \times \cos^2 45^\circ}{\sin 60^\circ \cdot \cos 30^\circ - \cos 60^\circ \cdot \sin 30^\circ}$$

$$\Rightarrow \frac{\frac{1}{3} + 1 + \frac{1}{3} + \frac{1}{4} \times \frac{1}{2}}{\frac{\sqrt{3}}{2} \cdot \frac{\sqrt{3}}{2} - \frac{1}{2} \times \frac{1}{2}}$$

$$\Rightarrow \frac{\frac{2}{3} + 1 + \frac{1}{4}}{\frac{3}{4} - \frac{1}{4}} \Rightarrow \frac{\frac{24+16+3}{4}}{\frac{3-1}{4}}$$

$$\Rightarrow \frac{43}{2} = \frac{43}{12}$$

25. Sol. (b)

$$\frac{\operatorname{cosec}^2 30^\circ \cdot \sin^2 45^\circ + \sec^2 60^\circ}{\tan 60^\circ \cdot \operatorname{cosec}^2 45^\circ - \sec^2 60^\circ \tan 45^\circ}$$

$$= \frac{2^2 \times \left(\frac{1}{\sqrt{2}}\right)^2 + 2^2}{\sqrt{3} \cdot \sqrt{2}^2 - 2^2 \cdot 1}$$

$$= \frac{4}{2} + 4$$

$$= \frac{6}{2(\sqrt{3}-2)}$$

$$= \frac{2+4}{2(\sqrt{3}-2)}$$

$$= \frac{3}{\sqrt{3}-2} \times \frac{\sqrt{3}+2}{\sqrt{3}+2}$$

$$= \frac{3(\sqrt{3}+2)}{\sqrt{3}^2 - 2^2}$$

$$= \frac{3(\sqrt{3}+2)}{3-4}$$

$$= \frac{3(\sqrt{3}+2)}{1}$$

$$= -3(\sqrt{3}+2)$$

26. Sol. (c)

$$\left(\cos^2 \frac{\pi}{8} + \sin^2 \frac{\pi}{8}\right) + 4\cos \frac{\pi}{4} - \sec \frac{\pi}{3} + 5\tan^2 \frac{\pi}{3}$$

$$= 1 + 4\left(\frac{1}{\sqrt{2}}\right)^2 - 2 + 5(\sqrt{3})^2$$

$$(\because \sin^2 \theta + \cos^2 \theta = 1)$$

$$= 1 + 2 - 2 + 15 = 16$$

27. Sol. (a)

Given: A = 30°, B = 60° and C = 135°

To find: sin³ A + cos³ B + tan³ C -

$$3\sin A \cos B \tan C$$

$$= [\sin(30^\circ)]^3 + [\cos(60^\circ)]^3 +$$

$$[\tan(135^\circ)]^3 -$$

$$3[\sin(30^\circ)][\cos(60^\circ)][\tan(90^\circ)]$$

$$= \left(\frac{1}{2}\right)^3 + \left(\frac{1}{2}\right)^3 + (-1)^3 - 3\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)(-1)$$

$$= \frac{1}{8} + \frac{1}{8} - 1 + \frac{3}{4}$$

$$= \frac{1}{4} - \frac{1}{4} = 0$$

$$\Rightarrow \text{Ans} - (A)$$

28. Sol. (c)

$$\frac{2\sin^2 30^\circ \cdot \tan 60^\circ - 3\cos^2 60^\circ \cdot \sec^2 30^\circ}{4\cot^2 45^\circ - \sec^2 60^\circ + \sin^2 60^\circ + \cos^2 90^\circ}$$

$$\Rightarrow \frac{2 \times \frac{1}{4} \times \sqrt{3} - 3 \times \frac{1}{4} \times \frac{4}{3}}{4 - 4 + \frac{3}{4}}$$

$$\Rightarrow \frac{\frac{\sqrt{3}}{2} - 1}{\frac{3}{4}} \Rightarrow \frac{2(\sqrt{3}-2)}{3}$$

29. Sol. (d)

$$5\sin^2 60^\circ + 7\sin^2 45^\circ + 8\cos^2 45^\circ$$

$$= 5 \times \left(\frac{\sqrt{3}}{2}\right)^2 + 7 \times \left(\frac{1}{\sqrt{2}}\right)^2 + 8 \times \left(\frac{1}{\sqrt{2}}\right)^2$$

$$= 5 \times \frac{3}{4} + 7 \times \frac{1}{2} + 8 \times \frac{1}{2}$$

$$= \frac{15}{4} + \frac{7}{2} + 4$$

$$= \frac{15+14+16}{4} = \frac{45}{4}$$

30. Sol. (d)

$$= \frac{\tan 30^\circ \cdot \operatorname{cosec} 60^\circ + \tan 60^\circ \cdot \sec 30^\circ}{\sin^2 30^\circ + 4 \cot^2 45^\circ - \sec^2 60^\circ}$$

$$= \frac{\frac{1}{\sqrt{3}} \times \frac{2}{\sqrt{3}} + \sqrt{3} \cdot \frac{2}{\sqrt{3}}}{\left(\frac{1}{2}\right)^2 + 4 \times 1 - (2)^2}$$

$$= \frac{\frac{2}{3} + 2}{\frac{1}{4} + 4 - 4} = \frac{\frac{2+6}{3}}{\frac{1}{4}} = \frac{8}{3} \times 4 = \frac{32}{3}$$

31. Sol. (d)

Putting $a = 45^\circ$ and $b = 15^\circ$, we have :

$$\frac{\cos 30^\circ - \cos 60^\circ}{\cos 30^\circ + \cos 60^\circ} = \frac{\frac{\sqrt{3}}{2} - \frac{1}{2}}{\frac{\sqrt{3}}{2} + \frac{1}{2}} = \frac{\sqrt{3} - 1}{\sqrt{3} + 1}$$

$$= \frac{(\sqrt{3} - 1)(\sqrt{3} - 1)}{(\sqrt{3} + 1)(\sqrt{3} - 1)} = \frac{3 + 1 - 2\sqrt{3}}{2}$$

$$= \frac{4 - 2\sqrt{3}}{2} = 2 - \sqrt{3}$$

32. Sol. (d)

$$\frac{\tan^3 45^\circ + 4 \cos^3 60^\circ}{2 \operatorname{cosec}^2 45^\circ - 3 \sec^2 30^\circ + \sin 30^\circ}$$

$$= \frac{(1)^3 + 4 \left(\frac{1}{2}\right)^3}{2(\sqrt{2})^2 - 3 \left(\frac{2}{\sqrt{3}}\right)^2 + \frac{1}{2}}$$

$$= \frac{1 + \frac{1}{2}}{4 - 4 + \frac{1}{2}} = \frac{\frac{3}{2}}{\frac{1}{2}} = 3$$

33. Sol (d)

Given, $2x^2 \cos 60^\circ - 4 \cot^2 45^\circ - 2 \tan 60^\circ = 0$

$$\Rightarrow 2x^2 \times \frac{1}{2} - 4(1)^2 - 2 \times \sqrt{3} = 0$$

$$\Rightarrow x^2 - 4 - 2\sqrt{3} = 0$$

$$\Rightarrow x^2 = 4 + 2\sqrt{3}$$

$$\Rightarrow x^2 = 3 + 1 + 2\sqrt{3}$$

$$\Rightarrow x^2 = (\sqrt{3})^2 + (1)^2 + 2\sqrt{3} \cdot 1$$

$$\Rightarrow x^2 = (\sqrt{3} + 1)^2$$

$$\Rightarrow x = (\sqrt{3} + 1)$$

34. Sol (b)

$$\frac{\tan^2 60^\circ + \operatorname{cosec} 30^\circ \sin 90^\circ + 3 \sec^2 30^\circ}{4 \sin^2 45^\circ + \sec^2 60^\circ - \cot^2 30^\circ - 5 \cos^2 90^\circ}$$

$$= \frac{3 + 2 + (3 \times 4/3)}{(4 \times \frac{1}{2}) + 4 - 3 - 0} = \frac{9}{3} = 3$$

35. Sol. (a)

$$\Rightarrow \frac{8 \sin 30^\circ \cdot \sin^2 60^\circ - 4 \sin 90^\circ - \sec^2 45^\circ}{\tan^2 45^\circ - \cot^2 30^\circ}$$

$$\Rightarrow \frac{8 \times \frac{1}{2} \times \frac{3}{4} - 4 - 2}{1 - 3} \Rightarrow \frac{3 - 4 - 2}{-2}$$

$$\Rightarrow \frac{-3}{-2} = \frac{3}{2}$$

36. Sol. (b)

Given

$$\frac{k - k \cot^2 30^\circ}{1 + \cot^2 30^\circ} = \sin^2 60^\circ + 4 \tan^2 45^\circ - \operatorname{cosec}^2 60^\circ$$

$$= \left(\frac{\sqrt{3}}{2}\right)^2 + 4 \times 1 - \left(\frac{2}{\sqrt{3}}\right)^2$$

$$= \frac{3}{4} + 4 - \frac{4}{3} = \frac{41}{12}$$

$$\text{L.H.S} = \frac{k(1 - \cot^2 30^\circ)}{1 + \cot^2 30^\circ} = \frac{k(1 - 3)}{1 + 3} = \frac{-k}{2}$$

$$\text{Hence, } \frac{-k}{2} = \frac{41}{12} \Rightarrow k = -\frac{41}{6} = -6.83$$

37. Sol. (b)

$$= \frac{[8 \cos A + 7 \sec A - \tan^2 A]}{10 \sin \frac{A}{2}}$$

$$= \frac{[8 \cos 60^\circ + 7 \sec 60^\circ - \tan^2 60^\circ]}{10 \sin \frac{60^\circ}{2}}$$

$$= \frac{\left[8 \times \frac{1}{2} + 7 \times 2 - (\sqrt{3})^2 \right]}{10 \times \frac{1}{2}}$$

$$= \frac{[4 + 14 - 3]}{5} = \frac{15}{5} = 3$$

38. Sol. (c)

$$152(\sin 30^\circ + 2\cos^2 45^\circ + 3\sin 30^\circ \dots \dots +$$

$$17\sin 30^\circ + 18\cos^2 45^\circ) \Rightarrow 152$$

$$\left(\frac{1}{2} + 2\left(\frac{1}{\sqrt{2}}\right)^2 + 3 \times \frac{1}{2} \dots 17 \times \frac{1}{2} + 18\left(\frac{1}{\sqrt{2}}\right)^2 \right)$$

$$\Rightarrow 152 \left[\frac{1}{2} + 1 + 1\frac{1}{2} + \dots \dots \dots + 8\frac{1}{2} + 9 \right]$$

$\Rightarrow$ This is in A.P. where

$$a = \frac{1}{2}, d = \frac{1}{2}, n = 18$$

$$\Rightarrow S_{152} = 152 \left[\frac{18}{2} \left(2 \times \frac{1}{2} + (18 - 1) \frac{1}{2} \right) \right]$$

$$\Rightarrow 152 \left[\frac{18}{2} \left(1 + \frac{17}{2} \right) \right]$$

$$\Rightarrow 152 \times 9 \times \frac{19}{2} \Rightarrow 12996 \Rightarrow \sqrt{12996} = 114$$

39. Sol (a)

Answer is independent of A, B, C and

$$A + B + C = 180^\circ \text{ So put, } A = B = C = 60^\circ$$

$$\tan^2 \frac{A}{2} + \tan^2 \frac{B}{2} + \tan^2 \frac{C}{2} = \tan^2 30^\circ + \tan^2 30^\circ +$$

$$\tan^2 30^\circ = \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = 1$$

40. Sol (a)

The expression

$$= \frac{5\cos^2 60^\circ + 4\sec^2 30^\circ - \tan^2 45^\circ}{\tan^2 60^\circ - \sin^2 30^\circ - \cos^2 45^\circ} = \frac{5\left(\frac{1}{2}\right)^2 + 4\left(\frac{2}{\sqrt{3}}\right)^2 - 1^2}{\sqrt{3}^2 - \left(\frac{1}{2}\right)^2 - \left(\frac{1}{\sqrt{2}}\right)^2}$$

$$= \frac{\frac{5}{4} + \frac{16}{3} - 1}{3 - \frac{1}{4} - \frac{1}{2}}$$

$$= \frac{\frac{15 + 64 - 12}{12}}{\frac{12 - 1 - 2}{4}} = \frac{67}{27}$$

* * * * *

Type-3 (Quadrant MCQ)

1. Find θ , if $\cos \theta = -\frac{\sqrt{3}}{2}$
[SSC CHSL 2023 (Afternoon)]

(a) $\frac{3\pi}{2}$ (b) $\frac{5\pi}{6}$ (c) $\frac{2\pi}{3}$ (d) $\frac{4\pi}{3}$

2. The value of $\cot(-315^\circ)$ is:
[Higher Secondary 04/08/2022 (Shift - 3)]

(a) $-\sqrt{3}$ (b) $\sqrt{3}$ (c) 1 (d) -1

3. If $A = 60^\circ$, then what is the value of $(4\cos^3 A - 3\cos A)$?
[SSC CHSL 16/04/2021 (Morning)]

(a) -1 (b) $-\frac{\sqrt{3}}{2}$ (c) $\frac{\sqrt{3}}{2}$ (d) 1

4. If A is an acute angle, the simplified form of
$$\frac{\cos(\pi-A) \cdot \cot\left(\frac{\pi}{2}+A\right) \cos(-A)}{\tan(\pi+A) \tan\left(\frac{3\pi}{2}+A\right) \sin(2\pi-A)}$$

[SSC CGL 13/12/2022 (4th Shift)]

(a) $\cos^2 A$ (b) $\sin A$ (c) $\sin^2 A$ (d) $\cos A$

5. If $\cos \theta + \sec \theta - 2 = 0$, where $0 < \theta < \frac{\pi}{2}$, then what is the value of $\cos^4 \theta + \sec^4 \theta - 2$?

[CDS 2022-I]

(a) -2 (b) -1 (c) 0 (d) 2

6. If α, β and γ are acute angles such that $\sin \alpha = \frac{\sqrt{3}}{2}$, $\cos \beta = \frac{\sqrt{3}}{2}$ and $\tan \gamma = 1$, then what is $\alpha + \beta + \gamma$ equal to?

(a) 105° (b) 120° (c) 135° (d) 150°

7. Simplify $\frac{1}{\cos x} \sqrt{\frac{\cos(\pi+x) \cos(-x)}{\sin(\pi-x) \cos\left(\frac{\pi}{2}+x\right)}}$.

[Graduate Level 04/08/2022 (Shift - 2)]

(a) $\sec x$ (b) $\tan x$
(c) $\operatorname{cosec} x$ (d) $\cot x$

8. Find the value of $\cos 225^\circ$

[SSC CHSL 17/03/2020 (afternoon)]

(a) -0.7071 (b) -0.866
(c) 0.7071 (d) 0.866

9. Find $\cos\left(-\frac{7\pi}{2}\right)$.
[SSC CPO 10/71/2022 (Evening)]

(a) $\frac{1}{2}$ (b) 1 (c) -7 (d) 0

10. $\tan(\pi + \theta) = ?$
[SSC CHSL 08/06/2022 (Morning)]

(a) $\sec \theta$ (b) $\operatorname{cosec} \theta$
(c) $\cot$ (d) $\tan$

11. The value of $\sin^2 \frac{2\pi}{3} + \cos^2 \frac{5\pi}{6} - \tan^2 \frac{3\pi}{4}$ is :

[Graduate Level 03/08/2022 (Shift-3)]

(a) 2 (b) $\frac{1}{2}$ (c) $\frac{1}{4}$ (d) 4

12. $\cos^3 60^\circ - \cos^3 240^\circ - \cos^3 360^\circ =$

[SSC CGL 09/12/2022 (1st Shift)]

(a) $-\frac{3}{4}$ (b) $-\frac{7}{5}$ (c) $-\frac{3}{5}$ (d) $-\frac{9}{7}$

13. What is the value of $\cos\left(-\frac{11\pi}{3}\right)$

[SSC CGL 06/12/2022 2nd Shift]

(a) 1 (b) $\frac{\sqrt{3}}{2}$ (c) $\frac{1}{2}$ (d) 0

14. Find the value of $\sin(-390^\circ) \cos(330^\circ) + \operatorname{cosec}(300^\circ) \sec(240^\circ)$

(a) 1 (b) $\frac{19}{4\sqrt{3}}$ (c) $\frac{13}{4\sqrt{3}}$ (d) $\frac{13}{2\sqrt{3}}$

15. What is the value of $\tan 240^\circ$?

[SSC CGL 01/12/2022 (3rd Shift)]

(a) $\sqrt{2}$ (b) $(-\sqrt{3})$ (c) $\sqrt{3}$ (d) 3

16. The value of following is $\cos 24^\circ + \cos 55^\circ + \cos 125^\circ + \cos 204^\circ + \cos 300^\circ$

(a) $-\frac{1}{2}$ (b) $\frac{1}{2}$ (c) 2 (d) 1

17. Find the value of $\operatorname{cosec}(60^\circ + A) - \sec(30^\circ - A) + \frac{\operatorname{cosec} 49^\circ}{\sec 41^\circ}$

SSC CGL 23/08/2021 (Evening)

(a) 2 (b) -1 (c) 0 (d) 1

18. If $x = \sin 130^\circ \cos 80^\circ$, $y = \sin 80^\circ \cos 130^\circ$, and $z = 1 + xy$, then which of the following is true?

[DP Head Constable 18/10/2022 (Shift - 03)]

- (a) $x > 0, y < 0$ and $0 < z < 1$
 (b) $x > 0, y > 0$ and $z > 0$
 (c) $x < 0, y < 0$ and $0 < z < 1$
 (d) $x > 0, y < 0$ and $z > 1$

19. If A, B and C be the angles of triangle, then out of the following which one is the incorrect relation?

- (a) $\cos \frac{A+B}{2} = \sin \frac{C}{2}$ (b) $\tan \frac{A+B}{2} = \cot \frac{C}{2}$
 (c) $\cot \frac{A+B}{2} = \tan \frac{C}{2}$ (d) $\sin \frac{A+B}{2} = \cos \frac{C}{2}$

20. $\sin^4 \frac{\pi}{8} + \sin^4 \frac{3\pi}{8} + \sin^4 \frac{5\pi}{8} + \sin^4 \frac{7\pi}{8} = ?$

(a) $\frac{3}{2}$ (b) 1 (c) $\frac{1}{2}$ (d) 0

21. The value of $\sin^2 \frac{2\pi}{3} + \cos^2 \frac{5\pi}{6} - \tan^2 \frac{3\pi}{4}$ is:

[SSC Phase : 03/08/2022 (Shift- 02)]

(a) $\frac{1}{2}$ (b) $\frac{1}{4}$ (c) 4 (d) 2

22. What is the value of $(4/3)\cot^2(\pi/6) + 3\cos^2(150^\circ) - 4\operatorname{cosec}^2 45^\circ + 8\sin(\pi/2)$?

(a) $\frac{25}{4}$ (b) 1 (c) $-\frac{7}{2}$ (d) $\frac{13}{2}$

23. The value of the expression $\cos^2 45^\circ + \cos^2 135^\circ + \cos^2 225^\circ + \cos^2 315^\circ$ is:

[SSC CPO 10/11/2022 (Morning)]

(a) 2 (b) $\frac{1}{2}$ (c) $\frac{3}{2}$ (d) 1

24. If $\sec 2\theta = \operatorname{cosec}(\theta - 36^\circ)$, where 2θ is an acute angle, find the value of θ .

[SSC CGL 05/12/2022 (Shift- 01)]

(a) 32° (b) 46° (c) 20° (d) 42°

25. Find the value of $\cot\left(\frac{-5\pi}{4}\right) \cdot \cos\left(\frac{-4\pi}{3}\right) + \sin\left(\frac{13\pi}{4}\right) \cdot \sec\left(\frac{15\pi}{4}\right)$

(a) 0 (b) $-\frac{1}{2}$ (c) $\frac{3}{2}$ (d) 1

26. The value of $\sin 135^\circ + \cos 270^\circ$ is

[Higher Secondary 03/08/2022 (Shift - 4)]

(a) $\frac{1}{\sqrt{3}}$ (b) $\frac{1}{\sqrt{2}}$ (c) $-\frac{1}{\sqrt{2}}$ (d) $-\frac{1}{\sqrt{3}}$

27. If $\tan 3\theta \cdot \tan 7\theta = 1$, where 7θ is an acute angle, then find the value of $\cot 15\theta$.

[SSC CGL 12/12/2022 (3rd Shift)]

(a) 1 (b) -1 (c) $-\sqrt{3}$ (d) $\sqrt{3}$

28. $\tan \frac{11\pi}{3} - 2\sin \frac{4\pi}{6} - \frac{3}{4}\operatorname{cosec}^2 \frac{\pi}{4} + 4\cos^2 \frac{17\pi}{6} = ?$

(a) $3 - \frac{4\sqrt{3}}{2}$ (b) $3 + \frac{4\sqrt{3}}{2}$
 (c) $1 + \frac{\sqrt{3}}{2}$ (d) $\sqrt{3} - \frac{1}{4}$

29. If A lies between 45° and 540° , and $\sin A = 0.5$, what is the value of $\frac{A}{3}$ in degree?

[SSC CHSL 15/04/2021 (Morning)]

(a) 170° (b) 175° (c) 165° (d) 160°

30. Find the value of $\frac{\cos\left(\frac{83\pi}{18}\right)\sec\left(\frac{-\pi}{9}\right)\tan\left(\frac{11\pi}{18}\right)}{\sec\left(\frac{65\pi}{18}\right)\sin\left(\frac{46\pi}{9}\right)\cot\left(\frac{7\pi}{18}\right)}$

(a) 1 (b) -1 (c) $\frac{1}{8}$ (d) $\frac{1}{4}$

31. Find the value of $\sin^4 \frac{\pi}{8} + \sin^4 \frac{3\pi}{8} + \sin^4 \frac{5\pi}{8} + \sin^4 \frac{7\pi}{8}$

(a) $-\frac{3}{2}$ (b) $\frac{3}{2}$ (c) $\frac{1}{2}$ (d) 0

32. If $\frac{\sin^2 \theta}{\cos^2 \theta - 3\cos \theta + 2} = 1$ lies in the first quadrant, then the value of $\frac{\tan^2 \frac{\theta}{2} + \sin^2 \frac{\theta}{2}}{\tan \theta + \sin \theta}$ is :

[(SSC CGL Tier-II (CBE) Exam. 03.02.2022)]

(a) $\frac{2\sqrt{3}}{27}$ (b) $\frac{5\sqrt{3}}{27}$ (c) $\frac{2\sqrt{3}}{9}$ (d) $\frac{7\sqrt{3}}{54}$

Type-3 ANSWER KEY

1	B	2	C	3	A	4	D	5	C	6	C	7	C	8	A
9	D	10	D	11	B	12	A	13	C	14	C	15	C	16	B
17	D	18	A	19	B	20	A	21	A	22	A	23	A	24	D
25	B	26	B	27	B	28	B	29	A	30	B	31	B	32	D

Type-3 (Quadrant) Solution

1. Sol. (b)

$$\cos \theta = -\frac{\sqrt{3}}{2} = -\cos \frac{\pi}{6}$$

$$\cos \theta = \cos \left(\pi - \frac{\pi}{6} \right) = \cos \frac{5\pi}{6} \Rightarrow \theta = \frac{5\pi}{6}$$

2. Sol. (c)

$$\cot(-315^\circ) = -\cot 315^\circ$$

$$= -\cot(360^\circ - 45^\circ) = \cot 45^\circ = 1$$

3. Sol. (a)

$$(4\cos^3 60^\circ - 3\cos 60^\circ)$$

$$= 4 \times \frac{1}{8} - 3 \times \frac{1}{2} = 0.5 - 1.5 = -1$$

4. Sol. (d)

$$\frac{\cos(\pi-A) \cdot \cot\left(\frac{\pi}{2}+A\right) \cos(-A)}{\tan(\pi+A) \tan\left(\frac{3\pi}{2}+A\right) \sin(2\pi-A)}$$

$$= \frac{-\cos A \cdot (-\tan A) \cos A}{\tan A \cdot (-\cot A) \cdot (-\sin A)} = \frac{\cos^2 A}{\sin A \cot A}$$

$$= \cos A$$

5. Sol. (c)

$$\cos \theta + \sec \theta - 2 = 0 \Rightarrow \cos \theta + \frac{1}{\cos \theta} - 2 = 0$$

$$\Rightarrow \cos^2 \theta - 2\cos \theta + 1 = 0$$

$$(\cos \theta - 1)^2 = 0$$

$$\cos \theta = 1 = \cos(0) \Rightarrow \theta = 0$$

$$\text{Now, } \cos^4 \theta + \sec^4 \theta - 2$$

$$(1)^4 + (1)^4 - 2 = 0$$

6. Sol. (c)

$$\sin \alpha = \frac{\sqrt{3}}{2}$$

$$\Rightarrow \alpha = 60^\circ \left(\because \sin 60^\circ = \frac{\sqrt{3}}{2} \right)$$

Now

$$\cos \beta = \frac{\sqrt{3}}{2}$$

$$\Rightarrow \beta = 30^\circ \left(\because \sin 30^\circ = \frac{\sqrt{3}}{2} \right)$$

$$\text{and } \tan \gamma = 1$$

$$\Rightarrow \gamma = 45^\circ \left(\because \tan 45^\circ = 1 \right)$$

$$\therefore \alpha + \beta + \gamma = 60^\circ + 30^\circ + 45^\circ = 135^\circ$$

7. Sol. (c)

$$\frac{1}{\cos x} \sqrt{\frac{\cos(\pi+x)\cos(-x)}{\sin(\pi-x)\cos\left(\frac{\pi}{2}+x\right)}}$$

$$= \frac{1}{\cos x} \sqrt{\frac{-\cos x \cos x}{\sin x (-\sin x)}}$$

$$= \frac{1}{\cos x} \times \frac{\cos x}{\sin x} = \frac{1}{\sin x} = \operatorname{cosec} x$$

8. Sol. (a)

$$\cos 225^\circ = \cos(180^\circ + 45^\circ)$$

$$= -\cos 45^\circ = -\frac{1}{\sqrt{2}} = -\frac{1}{1.414} = -0.7071$$

9. Sol. (d)

$$\cos\left(-\frac{7\pi}{2}\right) = \cos \frac{7\pi}{2} = \cos\left(3\pi + \frac{\pi}{2}\right)$$

$$= -\cos \frac{\pi}{2} = 0$$

10. Sol. (d)

$$\tan(\pi + \theta) = \tan \theta$$

11. Sol. (b)

$$\sin^2 \frac{2\pi}{3} + \cos^2 \frac{5\pi}{6} - \tan^2 \frac{3\pi}{4}$$

$$\begin{aligned}
 &= \sin^2 120^\circ + \cos^2 150^\circ - \tan^2 135^\circ \\
 &= \left(\frac{\sqrt{3}}{2}\right)^2 + \left(\frac{-\sqrt{3}}{2}\right)^2 - 1 \\
 &= \frac{3}{4} + \frac{3}{4} - 1 = \frac{6}{4} - 1 = \frac{1}{2}
 \end{aligned}$$

12. Sol. (a)

$$\begin{aligned}
 &\cos^3 60^\circ - \cos^3 240^\circ - \cos^3 360^\circ \\
 &= \cos^3 60^\circ - \cos^3(180^\circ + 60^\circ) - 1 \\
 &= \cos^3 60^\circ + \cos^3 60^\circ - 1 \\
 &= \left(\frac{1}{2}\right)^3 \times 2 - 1 = \frac{1}{4} - 1 = \frac{-3}{4}
 \end{aligned}$$

13. Sol. (c) Concepts:-

$$(i) \cos(-\theta) = \cos \theta$$

$$(ii) \cos(2n\pi - \theta) = \cos \theta$$

Now,

$$\begin{aligned}
 \cos\left(\frac{-11\pi}{3}\right) &= \cos\left(\frac{11\pi}{3}\right) \\
 &= \cos\left(4\pi - \frac{\pi}{3}\right) = \cos\left(\frac{\pi}{3}\right) = \frac{1}{2}
 \end{aligned}$$

14. Sol. (c)

$$\begin{aligned}
 &\sin(-390^\circ)\cos(330^\circ) + \operatorname{cosec}(300^\circ)\sec(240^\circ) \\
 &= -\sin(360^\circ + 30^\circ)\cos(270^\circ + 60^\circ) \\
 &\quad + \operatorname{cosec}(270^\circ + 30^\circ)\sec(180^\circ + 60^\circ) \\
 &\quad (\because \sin(-\theta) = -\sin \theta) \\
 &= -\sin(30^\circ)\sin(60^\circ) + (-\sec 30^\circ)(-\sec 60^\circ) \\
 &= \left(-\frac{1}{2}\right)\left(\frac{\sqrt{3}}{2}\right) + \left(\frac{2}{\sqrt{3}}\right)\left(\frac{2}{1}\right) \\
 &= -\frac{\sqrt{3}}{4} + \frac{4}{\sqrt{3}} = \frac{16-3}{4\sqrt{3}} = \frac{13}{4\sqrt{3}}
 \end{aligned}$$

15. Sol. (c)

In third quadrant value of $\tan \theta$ and $\cot \theta$ is +ve.

$$\begin{aligned}
 \tan 240^\circ &= \tan(180^\circ + 60^\circ) \\
 &= \tan 60^\circ = \sqrt{3}
 \end{aligned}$$

16. Sol. (b)

$$\begin{aligned}
 &\text{The Value of } \cos 24^\circ + \cos 55^\circ + \cos 125^\circ + \\
 &\cos 204^\circ + \cos 300^\circ
 \end{aligned}$$

$$\text{We know that, } \cos(180^\circ \pm \theta) = -\cos \theta$$

$$\begin{aligned}
 &\Rightarrow \cos 24^\circ + \cos 55^\circ + \cos(180^\circ - 55^\circ) + \\
 &\cos(180^\circ + 24^\circ) + \cos(360^\circ - 60^\circ) \\
 &\Rightarrow \cos 24^\circ + \cos 55^\circ - \cos 55^\circ - \cos 24^\circ + \cos 60^\circ \\
 &= \cos 60^\circ = \frac{1}{2}
 \end{aligned}$$

17. Sol. (d)

$$\begin{aligned}
 &\operatorname{cosec}(60^\circ + A) - \sec(30^\circ - A) + \frac{\operatorname{cosec} 49^\circ}{\sec 41^\circ} \\
 &= \operatorname{cosec}(60^\circ + A) - \sec\{90^\circ - (60^\circ + A)\} + \\
 &\quad \frac{\operatorname{cosec} 49^\circ}{\sec(90^\circ - 49^\circ)} \\
 &= \operatorname{cosec}(60^\circ + A) - \operatorname{cosec}(60^\circ + A) + \\
 &\quad \frac{\operatorname{cosec} 49^\circ}{\operatorname{cosec} 49^\circ} = 0 + 1 = 1
 \end{aligned}$$

18. Sol. (a)

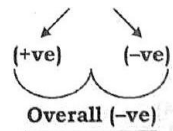
$$x = \sin 130^\circ \cos 80^\circ \Rightarrow x > 0$$

$$y = \sin 80^\circ \cos 130^\circ \Rightarrow y < 0$$

& xy lies between -180° since more value of $\sin$ & $\cos$ both is 1 :

So, product of both can never exceed 1 .

$$\Rightarrow \text{Now, } Z = 1 + (x)(y) \Rightarrow 0 < Z < 1$$



$\Rightarrow$ Option (a) is correct.

19. Sol. (b)

$$A + B + C = 180$$

$$A + B = 180 - C$$

$$\frac{A+B}{2} = 90 - \frac{C}{2}$$

$$\tan\left(\frac{A+B}{2}\right) = \tan\left(90 - \frac{C}{2}\right) = \cot \frac{C}{2}$$

20. Sol. (a)

$$\begin{aligned}
 &\sin^4 \frac{\pi}{8} + \sin^4 \frac{3\pi}{8} + \sin^4 \frac{5\pi}{8} + \sin^4 \frac{7\pi}{8} \\
 &= \sin^4 \frac{\pi}{8} + \sin^4 \frac{3\pi}{8} + \sin^4 \left(\pi - \frac{3\pi}{8}\right)
 \end{aligned}$$

$$\begin{aligned}
 & +\sin^4\left(\pi^5 - \frac{\pi}{8}\right) \\
 & = 2\left(\sin^4\frac{\pi}{8} + \sin^4\frac{3\pi}{8}\right) \\
 & = 2\left(\sin^4\frac{\pi}{8} + \sin^4\left(\frac{\pi}{2} - \frac{\pi}{8}\right)\right) \\
 & = 2\left(\sin^4\frac{\pi}{8} + \cos^4\frac{\pi}{8}\right) \\
 & \left(\because \sin\frac{3\pi}{8} = \sin\left(\frac{\pi}{2} - \frac{\pi}{8}\right) = \cos\frac{\pi}{8}\right) \\
 & = 2\left(\left(\sin^2\frac{\pi}{8} + \cos^2\frac{\pi}{8}\right)^2 - 2\sin^2\frac{\pi}{8} \cdot \cos^2\frac{\pi}{8}\right) \\
 & = 2\left(1 - \frac{1}{2}\left(\sin\frac{\pi}{4}\right)^2\right) = 2\left(1 - \frac{1}{4}\right) = \frac{3}{2}
 \end{aligned}$$

21. Sol. (a)

$$\begin{aligned}
 & \sin^2\frac{2\pi}{3} + \cos^2\frac{5\pi}{6} - \tan^2\frac{3\pi}{4} \\
 & \sin^2\frac{2\pi}{3} = \sin^2\left(\pi - \frac{\pi}{3}\right) = \sin^2\frac{\pi}{3} \\
 & \cos^2\frac{5\pi}{6} = \cos^2\left(\pi - \frac{\pi}{6}\right) = \cos^2\frac{\pi}{6} \\
 & \tan^2\frac{3\pi}{4} = \tan^2\left(\pi - \frac{\pi}{4}\right) = \tan^2\frac{\pi}{4} \\
 & \Rightarrow \sin^2\frac{\pi}{3} + \cos^2\frac{\pi}{6} - \tan^2\frac{\pi}{4} \\
 & = \frac{3}{4} + \frac{3}{4} - 1 = \frac{1}{2}
 \end{aligned}$$

22. Sol. (a)

$$\begin{aligned}
 & \frac{4}{3}\cot^2\left(\frac{\pi}{6}\right) + 3\cos^2 150^\circ - 4\operatorname{cosec}^2 45^\circ + 8\sin^2\frac{\pi}{2} \\
 & = \frac{4}{3}\cot^2(30^\circ) + 3\cos^2(90^\circ + 60^\circ) \\
 & 4\operatorname{cosec}^2 45^\circ + 8\sin^2\frac{\pi}{2} \\
 & = \frac{4}{3} \times 3 + 3 \times \frac{3}{4} - 4 \times 2 + 8 \times 1 \\
 & = 4 + \frac{9}{4} - 8 + 8 = \frac{25}{4}
 \end{aligned}$$

23. Sol. (a)

$$\begin{aligned}
 & \cos^2 45^\circ + \cos^2 135^\circ + \\
 & \cos^2 225^\circ + \cos^2 315^\circ \\
 & = \left(\frac{1}{\sqrt{2}}\right)^2 + \cos^2(90^\circ + 45^\circ) + \cos^2(270^\circ - \\
 & 45^\circ) + \cos^2(360^\circ - 45^\circ)
 \end{aligned}$$

$$\begin{aligned}
 & = \left(\frac{1}{\sqrt{2}}\right)^2 + \left(-\frac{1}{\sqrt{2}}\right)^2 + \left(-\frac{1}{\sqrt{2}}\right)^2 + \left(\frac{1}{\sqrt{2}}\right)^2 \\
 & = \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 2
 \end{aligned}$$

24. Sol. (d)

sec 2θ = cosec(θ - 36°), where 2θ is acute

angle we know that,

$$\sec 2\theta = \operatorname{cosec}(90^\circ - 2\theta)$$

$$\Rightarrow \operatorname{cosec}(90^\circ - 2\theta) = \operatorname{cosec}(\theta - 36^\circ)$$

$$\Rightarrow 90^\circ - 2\theta = \theta - 36^\circ$$

$$\Rightarrow 126^\circ = 3\theta$$

$$\Rightarrow \theta = 42^\circ$$

25. Sol. (b)

$$\begin{aligned}
 & \cot\left(\frac{-5\pi}{4}\right)\cos\left(\frac{-4\pi}{3}\right) + \sin\left(\frac{13\pi}{4}\right)\sec\left(\frac{15\pi}{4}\right) \\
 & = \left[-\cot\left(\pi + \frac{\pi}{4}\right)\right]\left[\cos\left(\pi + \frac{\pi}{3}\right)\right] + \sin\left(3\pi + \frac{\pi}{4}\right) \\
 & \sec\left(\frac{7\pi}{2} + \frac{\pi}{4}\right) \left(\because \cot(-\theta) = -\cot\theta, \cos(-\theta) = \cos\theta\right) \\
 & = \left[-\cot\left(\frac{\pi}{4}\right)\right]\left[-\cos\left(\frac{\pi}{3}\right)\right] + \left[-\sin\left(\frac{\pi}{4}\right)\right]\left[\operatorname{cosec}\left(\frac{\pi}{4}\right)\right] \\
 & = (-1)\left(-\frac{1}{2}\right) + \left(-\frac{1}{\sqrt{2}}\right)(\sqrt{2}) \\
 & = \frac{1}{2} - 1 = -\frac{1}{2}
 \end{aligned}$$

26. Sol. (b)

$$\begin{aligned}
 & \sin 135^\circ + \cos 270^\circ \\
 & = \sin(90^\circ + 45^\circ) + \cos(180^\circ + 90^\circ) \\
 & = \cos 45^\circ - \cos 90^\circ = \frac{1}{\sqrt{2}} - 0 = \frac{1}{\sqrt{2}}
 \end{aligned}$$

27. Sol. (b)

$$\tan 3\theta \cdot \tan 7\theta = 1$$

$$\tan 3\theta = \frac{1}{\tan 7\theta} = \cot 7\theta$$

$$\tan 3\theta = \tan(90^\circ - 7\theta)$$

$$3\theta = 90^\circ - 7\theta \Rightarrow 10\theta = 90^\circ$$

$$\Rightarrow \theta = \frac{90}{10} = 9^\circ$$

$$\text{So, } \cot 15\theta = \cot 135^\circ = -1$$

28. Sol. (b)

$$\begin{aligned} \tan\left(4\pi - \frac{\pi}{3}\right) - 2\sin\frac{2\pi}{3} - \frac{3}{4}\operatorname{cosec}^2\frac{\pi}{4} + 4\cos^2\frac{5\pi}{6} \\ = -\sqrt{3} - 2 \times \frac{\sqrt{3}}{2} - \frac{3}{2} + 4 \times \frac{3}{4} \\ = \frac{3}{2} - 2\sqrt{3} = \frac{3-4\sqrt{3}}{2} \end{aligned}$$

29. Sol. (a)

Given $A = 0.5$ (A lies b/w 45° and 540°)

$$\sin A = \frac{1}{2}$$

Check $A = 510$

$$\sin 510 \Rightarrow \sin(960 + 90^\circ + 60^\circ)$$

$$\cos 60 \quad (\because \text{In II}^{\text{nd}} \text{ quadrant sin is +ve}) \Rightarrow \frac{1}{2}$$

$$A = 510 \Rightarrow \frac{A}{3} = \frac{810}{3} = 170^\circ$$

30. Sol. (b)

$$\begin{aligned} \frac{\cos\left(\frac{83\pi}{18}\right) \sec\left(-\frac{\pi}{9}\right) \tan\left(\frac{11\pi}{18}\right)}{\sec\left(\frac{65\pi}{18}\right) \sin\left(\frac{46\pi}{9}\right) \cot\left(\frac{7\pi}{18}\right)} \\ = \frac{\cos\left(\frac{9\pi}{2} + \frac{\pi}{9}\right) \sec\left(-\frac{\pi}{9}\right) \tan\left(\frac{\pi}{2} + \frac{\pi}{9}\right)}{\sec\left(\frac{7\pi}{2} + \frac{\pi}{9}\right) \sin\left(5\pi + \frac{\pi}{9}\right) \cot\left(\frac{\pi}{2} - \frac{\pi}{9}\right)} \\ = \frac{\left[-\sin\left(\frac{\pi}{9}\right)\right] \sec\left(\frac{\pi}{9}\right) \left[-\tan\left(\frac{\pi}{9}\right)\right]}{\sec\left(\frac{\pi}{9}\right) \left[-\sin\left(\frac{\pi}{9}\right)\right] \tan\left(\frac{\pi}{9}\right)} = -1 \end{aligned}$$

31. Sol. (b)

$$\text{Given} = \sin^4\frac{\pi}{8} + \sin^4\frac{3\pi}{8} + \sin^4\frac{5\pi}{8}$$

$$\begin{aligned} \left(\pi - \frac{3\pi}{8}\right) + \sin^4\left(\pi - \frac{\pi}{8}\right) \\ \left(\because \frac{5\pi}{8} = \pi - \frac{3\pi}{8}, \frac{7\pi}{8} = \pi - \frac{\pi}{8}\right) \\ = \sin^4\frac{\pi}{8} + \sin^4\frac{3\pi}{8} + \sin^4\frac{3\pi}{8} + \sin^4\frac{\pi}{8} \\ (\because \sin(\pi - \theta) = \sin \theta) \\ = 2\left\{\left(\sin^2\frac{\pi}{8}\right)^2 + \left(\sin^2\frac{3\pi}{8}\right)^2\right\} \end{aligned}$$

$$2\left\{\left(\frac{1 - \cos\frac{\pi}{4}}{2}\right)^2 + \left(\frac{1 - \cos\frac{3\pi}{4}}{2}\right)^2\right\}$$

$$\left(\because \sin^2\frac{\theta}{2} = \frac{1 - \cos \theta}{2}\right)$$

$$= \frac{2}{2^2} \left[\left(1 - \frac{1}{\sqrt{2}}\right)^2 + \left(1 + \frac{1}{\sqrt{2}}\right)^2 \right]$$

$$= \frac{1}{2} \left\{ 2 \left(1 + \frac{1}{2}\right) \right\} = 1 + \frac{1}{2} = \frac{3}{2}$$

$$(\because (a+b)^2 + (a-b)^2 = 2(a^2 + b^2))$$

32. Sol. (d)

$$\begin{aligned} \frac{\sin^2 \theta}{\cos^2 \theta - 3\cos \theta + 2} &= 1 \\ \Rightarrow \frac{1 - \cos^2 \theta}{\cos^2 \theta - \cos \theta - 2\cos \theta + 2} &= 1 \\ \Rightarrow \frac{(1 + \cos \theta)(1 - \cos \theta)}{\cos \theta(\cos \theta - 1) - 2(\cos \theta - 1)} &= 1 \\ \Rightarrow \frac{(1 + \cos \theta)(1 - \cos \theta)}{(\cos \theta - 1)(\cos \theta - 2)} &= 1 \end{aligned}$$

$$\Rightarrow \frac{1 + \cos \theta}{2 - \cos \theta} = 1$$

$$\Rightarrow 1 + \cos \theta = 2 - \cos \theta$$

$$\Rightarrow 2\cos \theta = 2 - 1 = 1$$

$$\Rightarrow \cos \theta = \frac{1}{2} = \cos 60^\circ$$

$$\Rightarrow \theta = 60^\circ$$

 $\therefore$ Expression

$$\begin{aligned} &= \frac{\tan^2\frac{\theta}{2} + \sin^2\frac{\theta}{2}}{\tan \theta + \sin \theta} \\ &= \frac{\tan^2 30^\circ + \sin^2 30^\circ}{\tan 60^\circ + \sin 60^\circ} \\ &= \frac{\left(\frac{1}{\sqrt{3}}\right)^2 + \left(\frac{1}{2}\right)^2}{\sqrt{3} + \frac{\sqrt{3}}{2}} \\ &= \frac{\frac{1}{3} + \frac{1}{4}}{\frac{2\sqrt{3} + \sqrt{3}}{2}} = \frac{\frac{4+3}{12}}{\frac{3\sqrt{3}}{2}} \\ &= \frac{7}{12} \times \frac{2}{3\sqrt{3}} = \frac{7}{18\sqrt{3}} \\ &= \frac{7\sqrt{3}}{18\sqrt{3} \times \sqrt{3}} = \frac{7\sqrt{3}}{54} \end{aligned}$$

Type-4 (Complementary Function)

1. What is the value of $\frac{\cos 37^\circ}{\sin 53^\circ}$?

SSC CGL 2023

(a) $\frac{1}{2}$ (b) $\frac{1}{\sqrt{2}}$ (c) 0 (d) 1
2. What is the value of $\frac{\sin 19^\circ}{\cos 71^\circ} + \frac{\cos 73^\circ}{\sin 17^\circ}$?

(CDS [2019-II])

(a) 0 (b) 1 (c) 2 (d) 4
3. $\cos^2 35^\circ + \cos 55^\circ \cdot \sin 35^\circ + \frac{\tan 34^\circ}{\cot 56^\circ} = \dots\dots$

[SSC CGL 05/12/2022 2nd Shift]

(a) 2 (b) 3 (c) 4 (d) 1
4. What is the value of $\frac{3\sin 58^\circ}{\cos 32^\circ} + \frac{3\sin 42^\circ}{\cos 48^\circ}$?

[SSC CGL 13/12/2022 (4th Shift)]

(1) 6 (2) 9 (3) 7 (4) 8
5. What is the value of $\sin 28^\circ \sin 35^\circ \sin 45^\circ \sec 62^\circ \sec 55^\circ$?

SSC CGL 09/12/2022 (Shift- 01)

(a) 2 (b) $\frac{1}{\sqrt{2}}$ (c) $\sqrt{2}$ (d) $\frac{1}{2}$
6. Evaluate the expression $\frac{\sin^2 63^\circ + \sin^2 27^\circ}{\cos^2 17^\circ + \cos^2 73^\circ}$

SSC CGL 08/12/2022

(a) 0 (b) 3 (c) 1 (d) 2
7. Find the value of $\tan 27^\circ \tan 34^\circ + \tan 34^\circ \tan 29^\circ + \tan 29^\circ \tan 27^\circ$.

SSC CGL 12/12/2022 (1st Shift)

(a) 0 (b) -1 (c) $\sqrt{3}$ (d) 1
8. The value of $\cot 15^\circ \cot 25^\circ \cot 45^\circ \cot 75^\circ \cot 65^\circ$ is:

SSC CGL 02/12/2022 (Shift- 03)

(a) 1 (b) $\sqrt{3}$ (c) 2 (d) $\sqrt{2}$
9. Find the value of $\cot 25^\circ, \cot 35^\circ, \cot 45^\circ, \cot 55^\circ \cot 65^\circ$.

SSC CGL 13/08/2022 (Sti)

(a) $\sqrt{3}$ (b) 1 (c) 7 (d) 5
10. The value of $\tan^2 48^\circ - \operatorname{cosec}^2 42^\circ + \operatorname{cosec}(67^\circ + \theta) - \sec(23^\circ - \theta)$ is:

SSC CPO 13/12/2019 (Morning)

(a) -1 (b) 0 (c) 1 (d) -2
11. What is the value of the following?

[2022-I]

$$\frac{2\sin 68^\circ}{\cos 22^\circ} - \frac{2\cot 15^\circ}{5\tan 75^\circ} - \frac{3\tan 20^\circ \tan 40^\circ \tan 45^\circ \tan 50^\circ \tan 70^\circ}{5}$$

(a) -1 (b) 0 (c) 1 (d) 5
12. What is the value of $\frac{\cos 50^\circ}{\sin 40^\circ} + \frac{3\operatorname{cosec} 80^\circ}{\sec 10^\circ} - 2\cos 50^\circ \cdot \operatorname{cosec} 40^\circ$?

SSC CGL Tier II 08/08/2022

(a) 3 (b) 2 (c) 5 (d) 4
13. What will be the value of-

$$\frac{\sin 30^\circ \sin 40^\circ \sin 50^\circ \sin 60^\circ}{\cos 30^\circ \cos 40^\circ \cos 50^\circ \cos 60^\circ}$$
?

SSC CGL 01/12/2022

(a) $\frac{1}{\sqrt{2}}$ (b) $\sqrt{3}$ (c) 1 (d) $\frac{1}{\sqrt{3}}$
14. The value of $\cot 18^\circ (\cot 72^\circ \cos^2 22^\circ + \frac{1}{\tan 72^\circ \sec^2 68^\circ})$ is

(a) 1 (b) $\sqrt{2}$ (c) 3 (d) $\frac{1}{\sqrt{3}}$
15. Simplify the following-
 $\cot 13^\circ \cot 27^\circ \cot 45^\circ \cot 63^\circ \cot 77^\circ = ?$

SSC CGL 06/12/2022 (3rd Shift)

(a) 1 (b) $\sqrt{3}$ (c) 2 (d) $\sqrt{2}$
16. If $4(\operatorname{cosec}^2 57^\circ - \tan^2 33^\circ) - \cos 90^\circ + y \times \tan^2 66^\circ \times \tan^2 24^\circ = \frac{y}{2}$ then the value of y is:

SSC CPO 25/11/2020 (Morning)

(a) 4 (b) 8 (c) -4 (d) -8
17. value of $\frac{\sin^2 52^\circ + 2 + \sin^2 38^\circ}{4\cos^2 43^\circ - 5 + 4\cos^2 47^\circ}$ is

SSC CPO 24/11/2020 (Evening)

(a) 3 (b) $\frac{1}{3}$ (c) -3 (d) $-\frac{1}{3}$
18. The value of $\frac{3\cos^2 27^\circ - 5 + 3\cos^2 63^\circ}{\tan^2 32^\circ + 4 - \operatorname{cosec}^2 58^\circ} + \sin 35^\circ \cos 55^\circ + \cos 35^\circ \sin 55^\circ$ is:

SSC CHSL 19/04/2021

(a) $-\frac{1}{4}$ (b) $-\frac{1}{3}$ (c) $\frac{1}{3}$ (d) $1\frac{2}{3}$

19. The value of $\frac{5\cos^2 62^\circ + 5\cos^2 28^\circ - 21}{7\sin^2 35^\circ + 7\sin^2 55^\circ + 1}$ is :
SSC CGL 20/04/2022
(a) 2 (b) -2 (c) 3 (d) -3

20. The value of $\frac{(\cos 9^\circ + \sin 81^\circ)(\sec 9^\circ + \operatorname{cosec} 81^\circ)}{\sin 56^\circ \sec 34^\circ + \cos 25^\circ \operatorname{cosec} 65^\circ}$ is:
SSC CHSL 02/07/2019
(a) $\frac{1}{2}$ (b) 4 (c) 2 (d) 1

21. The value of $\frac{\sin^2 52^\circ + 2 + \sin^2 38^\circ}{4\cos^2 43^\circ - 5 + 4\cos^2 47^\circ}$ is:
(a) 3 (b) -2 (c) -4 (d) -3

22. The value of $\frac{3(\operatorname{cosec}^2 26^\circ - \tan^2 64^\circ) + (\cot^2 42^\circ - \sec^2 48^\circ)}{\cot(22^\circ - \theta) - \operatorname{cosec}^2(62^\circ + \theta) - \tan(\theta + 68^\circ) + \tan^2(28^\circ - \theta)}$
SSC CGL Tier II 03/02/2022
(a) 3 (b) 4 (c) -1 (d) -2

23. The value of $\frac{2\sin^2 38^\circ \sec^2 52^\circ + \cos 64^\circ \sin 26^\circ + \sin^2 64^\circ}{\tan^2 23^\circ + \cot^2 23^\circ - \sec^2 67^\circ - \operatorname{cosec}^2 67^\circ}$
SSC CGL Tier II 15/11/2020
(a) -2 (b) $\frac{3}{2}$ (c) 2 (d) $-\frac{3}{2}$

24. Evaluate the following expression $\frac{3(\cot^2 46^\circ - \sec^2 44^\circ)}{2(\sin^2 28^\circ + \sin^2 62^\circ)} + \frac{2\cos^2 60^\circ \tan^2 33^\circ \tan^2 57^\circ}{\sec^2(90^\circ - \theta) - \cot^2 \theta}$
SSC CHSL 10/08/2021
(a) -1 (b) 1 (c) -2 (d) 2

25. The value of $\left[\frac{\sin^2 27^\circ + \sin^2 63^\circ}{\cos^2 24^\circ + \cos^2 66^\circ} - \sin^2 69^\circ - \cos 69^\circ \sin 21^\circ \right]$ is:
SSC CHSL 11/08/2021
(a) 3 (b) 2 (c) 0 (d) 1

26. The value of $\frac{\tan 50^\circ + \sec 50^\circ}{\cot 40^\circ + \operatorname{cosec} 40^\circ} + \cos^2 65^\circ + \sin 65^\circ \cos 25^\circ + \tan 30^\circ$ is:
SSC CHSL 05/08/2021
(a) $\frac{\sqrt{3}(\sqrt{3}+1)}{3}$ (b) $2 + \sqrt{3}$
(c) $\frac{6+\sqrt{3}}{3}$ (d) $1 + \sqrt{3}$

27. The value of $(\sin 37^\circ \cdot \cos 53^\circ + \cos 37^\circ \cdot \sin 53^\circ) - \frac{4\cos^2 37^\circ - 7 + 4\cos^2 53^\circ}{\tan^2 47^\circ + 4 - \operatorname{cosec}^2 43^\circ}$ is:
SSC CGL 18/08/2021

- (a) 1 (b) -2 (c) 0 (d) 2
28. The value of $\frac{\cos 8^\circ \cos 24^\circ \cos 60^\circ \cos 66^\circ \cos 82^\circ}{\sin 8^\circ \sin 24^\circ \sin 60^\circ \sin 66^\circ \sin 82^\circ}$ is

- SSC CHSL 09/08/2021
(a) 1 (b) $\frac{1}{\sqrt{2}}$ (c) $\frac{1}{\sqrt{3}}$ (d) 0

29. The value of $\frac{(\cos 9^\circ + \sin 81^\circ)(\sec 9^\circ + \operatorname{cosec} 81^\circ)}{\operatorname{cosec}^2 71^\circ + \cos^2 15^\circ - \tan^2 19^\circ + \cos^2 75^\circ}$
SSC CGL Tier II 03/02/2022
(a) 1 (b) 4 (c) -3 (d) 2

30. The value of $\tan(63^\circ - \theta) - \cot(27^\circ + \theta) + \frac{\operatorname{cosec}^2 70^\circ - \tan^2 20^\circ}{\sec^2 37^\circ - \cot^2 53^\circ}$ is:
SSC CHSL 19/10/2020 (Morning)
(a) -2 (b) 3 (c) 0 (d) 1

31. The value of $\sin 23^\circ \cos 67^\circ + \sec 52^\circ \sin 38^\circ + \frac{\cos 23^\circ \sin 67^\circ + \operatorname{cosec} 52^\circ \cos 38^\circ}{\operatorname{cosec}^2 20^\circ - \tan^2 70^\circ}$ is:
SSC CGL Tier-I Exam 11/04/2022 (Shift I)
(a) 3 (b) 4 (c) 2 (d) 0

32. The value of $\left(\frac{\sin 23^\circ \cos 67^\circ + \sec 52^\circ \sin 38^\circ}{\operatorname{cosec}^2 20^\circ - \tan^2 70^\circ} \right) + \left(\frac{\cos 23^\circ \sin 67^\circ + \operatorname{cosec} 52^\circ \cos 38^\circ}{\operatorname{cosec}^2 20^\circ - \tan^2 70^\circ} \right)$ is:
SSC CGL 11/04/2022
(a) 3 (b) 4 (c) 2 (d) 0

33. The value of $\frac{\tan(45^\circ - \alpha)}{\cot(45^\circ + \alpha)} - \frac{(\cos 19^\circ + \sin 71^\circ)(\sec 19^\circ + \operatorname{cosec} 71^\circ)}{\tan 12^\circ \cdot \tan 24^\circ \cdot \tan 66^\circ \cdot \tan 78^\circ}$
SSC CGL 13/08/2021
(a) -3 (b) 0 (c) -2 (d) 2

34. If $\operatorname{cosec} 31^\circ = x$, then $\sin^2 59^\circ + \frac{1}{\operatorname{cosec}^2 31^\circ} + \tan^2 59^\circ - \frac{1}{\sin^2 59^\circ \cdot \operatorname{cosec}^2 59^\circ}$ is equal to
SSC CHSL 02/07/2019
(a) $x + 1$ (b) $x^2 - 1$
(c) $x - 1$ (d) $x^2 + 1$

35. The value of $\frac{4\tan^2 30^\circ + \sin^2 30^\circ \cos^2 45^\circ + \sec^2 48^\circ - \cot^2 42^\circ}{\cos 37^\circ \sin 53^\circ + \sin 37^\circ \cos 53^\circ + \tan 18^\circ \tan 72^\circ}$
SSC CGL Tier II 29/01/2022
(a) $\frac{59}{48}$ (b) $\frac{35}{24}$ (c) $\frac{49}{24}$ (d) $\frac{35}{48}$

Type-4 ANSWER KEY															
1	D	2	C	3	A	4	A	5	B	6	C	7	D	8	A
9	B	10	A	11	C	12	B	13	C	14	A	15	A	16	D
17	C	18	C	19	B	20	C	21	D	22	D	23	D	24	A
25	C	26	C	27	D	28	C	29	D	30	D	31	A	32	A
33	A	34	B	35	A										

Type-4 (Complementary Function)

1. Sol. (d)

$$\frac{\cos 37^\circ}{\sin 53^\circ}$$

We know, $\cos(90^\circ - \theta) = \sin \theta$

$$\Rightarrow \frac{\cos(90^\circ - 53^\circ)}{\sin 53^\circ} = \frac{\sin 53^\circ}{\sin 53^\circ} = 1$$

2. Sol. (c)

$$\frac{\sin 19^\circ}{\cos 71^\circ} + \frac{\cos 73^\circ}{\sin 17^\circ}$$

$$= \frac{\sin 19^\circ}{\cos(90^\circ - 19^\circ)} + \frac{\cos 73^\circ}{\sin(90^\circ - 73^\circ)}$$

$$= \frac{\sin 19^\circ}{\sin 19^\circ} + \frac{\cos 73^\circ}{\cos 73^\circ} = 1 + 1 = 2$$

3. Sol. (a)

If $A + B = 90^\circ$, then $\tan A = \cot B$

and $\sin A = \cos B$

$$\Rightarrow \cos^2 35^\circ + \cos 55^\circ \cdot \sin 35^\circ + \frac{\tan 34^\circ}{\cot 56^\circ}$$

$$= \cos^2 35^\circ + \sin^2 35^\circ + 1 \Rightarrow 1 + 1 = 2$$

4. Sol. (a)

$$\frac{3\sin 58^\circ}{\cos 32^\circ} + \frac{3\sin 42^\circ}{\cos 48^\circ}$$

$3 + 3$ (By complimentary functions)

$$= 6$$

5. Sol. (b)

$$\sin 28^\circ \sin 35^\circ \sin 45^\circ \sec 62^\circ \sec 55^\circ$$

we know, $\sin(90^\circ - \theta) = \cos \theta$

$$\sin 45^\circ = \frac{1}{\sqrt{2}}$$

$$\cos \theta \times \sec \theta = 1$$

$$\Rightarrow \sin(90^\circ - 62^\circ) \sin(90^\circ - 55^\circ)$$

$$\sin 45^\circ \sec 62^\circ \sec 55^\circ$$

$$\Rightarrow \cos 62^\circ \cos 55^\circ \sin 45^\circ \sec 62^\circ \sec 55^\circ$$

$$\Rightarrow 1.1 \cdot \frac{1}{\sqrt{2}} = \frac{1}{\sqrt{2}}$$

6. Sol. (c)

$$\frac{\sin^2 63^\circ + \sin^2 27^\circ}{\cos^2 17^\circ + \cos^2 73^\circ}$$

$$= \frac{\sin^2(90^\circ - 27^\circ) + \sin^2 27^\circ}{\cos^2(90^\circ - 73^\circ) + \cos^2 73^\circ}$$

$$= \frac{\cos^2 27^\circ + \sin^2 27^\circ}{\sin^2 73^\circ + \cos^2 73^\circ} = 1$$

7. Sol. (d)

Concept used : $\tan A \times \tan B + \tan B \times \tan C + \tan C \times \tan A = 1$, if $A + B + C = 90^\circ$

Now, we have : $27^\circ + 34^\circ + 29^\circ = 90^\circ \Rightarrow$

$$\tan 27^\circ \tan 34^\circ + \tan 34^\circ \tan 29^\circ + \tan 29^\circ \tan 27^\circ = 1$$

8. Sol. (a)

$$\cot 15^\circ \cot 25^\circ \cot 45^\circ \cot 75^\circ \cot 65^\circ$$

We know that $\cot(90^\circ - \theta) = \tan \theta$ and $\tan \theta$

$$= \frac{1}{\cot \theta} \text{ and } \cot 45^\circ = 1$$

$$\Rightarrow \cot(90^\circ - 75^\circ) \cot 25^\circ \cot 45^\circ \cot 75^\circ \cot(90^\circ - 25^\circ)$$

$$\Rightarrow \tan 75^\circ \cot 75^\circ \cot 25^\circ \tan 25^\circ \cot 45^\circ$$

$$\Rightarrow 1.1.1 = 1$$

9. Sol. (b)

$$\cot 25^\circ \cot 35^\circ \cot 45^\circ \cot 55^\circ \cot 65^\circ$$

We know that, $\cot(90^\circ - \theta)$

$$= \tan \theta; \cot \theta \times \tan \theta = 1; \cot 45^\circ = 1$$

$$\Rightarrow \cot(90^\circ - 65^\circ) \cot(90^\circ - 55^\circ) \cot 45^\circ \cot 55^\circ$$

$$\Rightarrow \tan 65^\circ \cot 65^\circ \tan 55^\circ \cot 55^\circ \cot 45^\circ \cot 65^\circ$$

$$\Rightarrow 1 \times 1 \times 1 = 1$$

10. Sol. (a)

$$\begin{aligned} & \tan^2 48^\circ - \operatorname{cosec}^2 42^\circ + \operatorname{cosec}(67^\circ + \theta) - \sec(23^\circ - \theta) \\ &= \tan^2 48^\circ - \sec^2 48^\circ + \sec(23^\circ - \theta) \\ & - \sec(23^\circ - \theta) \\ &= -1 - 0 = -1 \end{aligned}$$

11. Sol. (c)

$$\begin{aligned} & \frac{2 \cdot \sin 68^\circ}{\cos 22^\circ} - \frac{2 \cdot \cot 15^\circ}{5 \cdot \tan 75^\circ} \\ & - \frac{3 \cdot \tan 20^\circ \cdot \tan 40^\circ \cdot \tan 45^\circ \cdot \tan 50^\circ \cdot \tan 70^\circ}{5} \\ & \Rightarrow \frac{2 \cdot \sin 68^\circ}{\sin 68^\circ} - \frac{2 \cot 15^\circ}{5 \cot 15^\circ} - \frac{3 \cdot \tan 20^\circ \cdot \tan 40^\circ \cdot 1 \cdot \cot 40^\circ \cdot \cot 20^\circ}{5} \\ &= 2 - \frac{2}{5} - \frac{3}{5} = 2 - 1 = 1 \end{aligned}$$

12. Sol. (b)

$$\begin{aligned} & \frac{\cos 50^\circ}{\sin 40^\circ} + \frac{3 \operatorname{cosec} 80^\circ}{\sec 10^\circ} - \\ & 2 \cos 50^\circ \cdot \operatorname{cosec} 40^\circ \\ &= \frac{\sin 40^\circ}{\sin 40^\circ} + \frac{3 \sec 10^\circ}{\sec 10^\circ} - 2 \sin 40^\circ \cdot \operatorname{cosec} 40^\circ \\ &= 1 + 3 - 2 \left(\sin 40^\circ \times \frac{1}{\sin 40^\circ} \right) \\ &= 1 + 3 - 2(1) \Rightarrow 4 - 2 = 2 \end{aligned}$$

13. Sol. (c)

$$\begin{aligned} & \frac{\sin 30^\circ \sin 40^\circ \sin 50^\circ \sin 60^\circ}{\cos 30^\circ \cos 40^\circ \cos 50^\circ \cos 60^\circ} \\ &= \frac{\cos 60^\circ \cos 50^\circ \cos 40^\circ \cos 30^\circ}{\cos 30^\circ \cos 40^\circ \cos 50^\circ \cos 60^\circ} = 1 \end{aligned}$$

14. Sol. (a)

$$\begin{aligned} & \cot 18^\circ \left[\cot 72^\circ \cos^2 22^\circ + \frac{1}{\tan 72^\circ \cdot \sec^2 68^\circ} \right] \\ &= \cot 18^\circ \cot 72^\circ \cos^2 22^\circ + \frac{\cot 18^\circ}{\tan 72^\circ \cdot \sec^2 68^\circ} \\ &= \cos^2 22^\circ + \cos^2 68^\circ \\ &= \sin^2 68^\circ + \cos^2 68^\circ \\ &= 1 \end{aligned}$$

15. Sol. (a)

Concepts:-

If $A + B = 90^\circ$ then $\cot A \cdot \cot B = 1$

$$\begin{aligned} & \cot 13^\circ \cdot \cot 27^\circ \cdot \cot 45^\circ \cdot \cot 63^\circ \cdot \cot 77^\circ \\ & \cot 13^\circ \cdot \cot 77^\circ \cdot \cot 45^\circ \cdot \cot 63^\circ \cdot \cot 27^\circ \\ &= 1 \times 1 \times 1 = 1 \end{aligned}$$

16. Sol. (d)

$$4(\operatorname{cosec}^2 57^\circ - \tan^2 33^\circ) - \cos 90^\circ + yx$$

$$\tan^2 66^\circ \times \tan^2 24^\circ = \frac{y}{2}$$

We know $\operatorname{cosec}^2 \theta = 1 + \cot^2 \theta$ And $\tan A \tan B = 1$ if $(A + B = 90^\circ)$

$$\text{So, } 4(1 + \cot^2 57^\circ - \cot^2 57^\circ) - \cos 90^\circ +$$

$$y \times 1 = \frac{y}{2} \Rightarrow 4 + y = \frac{y}{2}$$

$$\Rightarrow \frac{y}{2} = -4 \Rightarrow y = -8$$

17. Sol. (c)

$$\begin{aligned} & \frac{\sin^2 52^\circ + 2 + \sin^2 38^\circ}{4 \cos^2 43^\circ - 5 + 4 \cos^2 47^\circ} \\ & \frac{\sin^2 52^\circ + 2 + \cos^2 52^\circ}{4 \cos^2 43^\circ - 5 + 4 \sin^2 43^\circ} \\ & \frac{1 + 2}{4 \cos^2 43^\circ + 4 \sin^2 43^\circ - 5} = \frac{3}{-1} = -3 \end{aligned}$$

18. Sol. (c)

$$\begin{aligned} & \frac{3 \cos^2 27^\circ - 5 + 3 \cos^2 63^\circ}{\tan^2 32^\circ + 4 - \operatorname{cosec}^2 58^\circ} \\ & + \sin 35^\circ \cos 55^\circ + \cos 35^\circ \sin 55^\circ \end{aligned}$$

We know that $\sin A = \cos B$, if

$$A + B = 90^\circ$$

$$\begin{aligned} \text{So, } & \frac{3 \cos^2 27^\circ - 5 + 3 \sin^2 27^\circ}{\cot^2 58^\circ + 4 - \operatorname{cosec}^2 58^\circ} \\ & + \sin 35^\circ \sin 35^\circ + \cos 35^\circ \cos 35^\circ \\ &= \frac{3 - 5}{-1 + 4} + 1 = \frac{1}{3} \end{aligned}$$

19. Sol. (b)

$$\begin{aligned} & \frac{5 \cos^2 62^\circ + 5 \cos^2 28^\circ - 21}{7 \sin^2 35^\circ + 7 \sin^2 55^\circ + 1} \\ & \Rightarrow \frac{5 \cos^2 62^\circ + 5 \sin^2 (90^\circ - 28^\circ) - 21}{7 \sin^2 35^\circ + 7 \cos^2 (90^\circ - 55^\circ) + 1} \\ & \Rightarrow \frac{5(\cos^2 62^\circ + \sin^2 62^\circ) - 21}{7(\sin^2 35^\circ + \cos^2 35^\circ) + 1} \\ & \Rightarrow \frac{5(1) - 21}{7(1) + 1} \Rightarrow \frac{-16}{8} = -2 \end{aligned}$$

20. Sol. (c)

$$\begin{aligned} & \frac{(\cos 9^\circ + \sin 81^\circ)(\sec 9^\circ + \operatorname{cosec} 81^\circ)}{\sin 56^\circ \cdot \sec 34^\circ + \cos 25^\circ \cdot \operatorname{cosec} 65^\circ} \\ & \frac{[\cos(90^\circ - 81^\circ) + \sin 81^\circ][(\sec(90^\circ - 81^\circ) + \operatorname{cosec} 81^\circ)]}{\sin 56^\circ \cdot \sec(90^\circ - 56^\circ) + \cos(90^\circ - 65^\circ) \cdot \operatorname{cosec} 65^\circ} \\ & \Rightarrow \frac{(2 \sin 81^\circ)(2 \operatorname{cosec} 81^\circ)}{\sin 56^\circ \cdot \operatorname{cosec} 56^\circ + \sin 65^\circ \cdot \operatorname{cosec} 65^\circ} \end{aligned}$$

$$\Rightarrow \frac{4 \times 1}{1+1} = 2$$

21. Sol. (d)

$$\frac{\sin^2 52^\circ + 2 + \sin^2 38^\circ}{4\cos^2 43^\circ - 5 + 4\cos^2 47^\circ} \dots (i)$$

We know that, $\sin^2 \theta + \cos^2 \theta = 1$

Equation (i) become

$$\frac{\sin^2 52^\circ + 2 + 1 - \cos^2 38^\circ}{4\cos^2 43^\circ - 5 + 4(1 - \sin^2 47^\circ)} \dots (ii)$$

We know that, $\sin(90^\circ - \theta) = \cos \theta$

$$\cos(90^\circ - \theta) = \sin \theta$$

$\therefore$ Equation (2) becomes:

$$= \frac{\sin^2 52^\circ + 2 + 1 - \cos^2(90^\circ - 52^\circ)}{4\cos^2 43^\circ - 5 + 4 - 4\sin^2(90^\circ - 43^\circ)}$$

$$= \frac{\sin^2 52^\circ + 3 - \sin^2 52^\circ}{4\cos^2 43^\circ - 1 - 4\cos^2 43^\circ} = -3$$

22. Sol. (d)

$$\begin{aligned} & \frac{3(\operatorname{cosec}^2 26^\circ - \tan^2 64^\circ) + (\cot^2 42^\circ - \sec^2 48^\circ)}{\cot(22^\circ - \theta) - \operatorname{cosec}^2(62^\circ + \theta) - \tan(\theta + 68^\circ) + \tan^2(28^\circ - \theta)} \\ & \frac{3(\sec^2 64^\circ - \tan^2 64^\circ) + (\tan^2 48^\circ - \sec^2 48^\circ)}{\tan(\theta + 68^\circ) - \sec^2(28^\circ - \theta) - \tan(\theta + 68^\circ) + \tan^2(28^\circ - \theta)} \\ & = \frac{3(1) + (-1)}{-\sec^2(28^\circ - \theta) + \tan^2(28^\circ - \theta)} \\ & = \frac{2}{-[\sec^2(28^\circ - \theta) - \tan^2(28^\circ - \theta)]} = -2 \end{aligned}$$

23. Sol. (d)

$$\begin{aligned} & \frac{2\sin^2 38^\circ \sec^2 52^\circ + \cos 64^\circ \sin 26^\circ + \sin^2 64^\circ}{\tan^2 23^\circ + \cot^2 23^\circ - \sec^2 67^\circ - \operatorname{cosec}^2 67^\circ} \\ & \frac{2\sin^2 38^\circ \frac{1}{\sin^2 38^\circ} + \cos 64^\circ \cos 64^\circ + \sin^2 64^\circ}{\tan^2 23^\circ + \cot^2 23^\circ - \operatorname{cosec}^2 23^\circ - \operatorname{cosec}^2 23^\circ} \\ & \Rightarrow \frac{2 + \cos^2 64^\circ + \sin^2 64^\circ}{-2} \Rightarrow \frac{2+1}{-2} = -\frac{3}{2} \end{aligned}$$

24. Sol. (a)

$$\begin{aligned} & \frac{3(\cot^2 46^\circ - \sec^2 44^\circ)}{2(\sin^2 28^\circ + \sin^2 62^\circ)} + \frac{2\cos^2 60^\circ \tan^2 33^\circ \tan^2 57^\circ}{\sec^2(90^\circ - \theta) - \cot^2 \theta} \\ & \Rightarrow \frac{3(\tan^2 44^\circ - \sec^2 44^\circ)}{2(\sin^2 28^\circ + \cos^2 28^\circ)} + \frac{2\cos^2 60^\circ \tan^2 33^\circ \cot^2 33^\circ}{\operatorname{cosec}^2 \theta - \cot^2 \theta} \Rightarrow \frac{-3}{2} + \frac{1}{2} = -1 \end{aligned}$$

25. Sol. (c)

$$\begin{aligned} & \left[\frac{\sin^2 27^\circ + \sin^2 63^\circ}{\cos^2 24^\circ + \cos^2 66^\circ} - \sin^2 69^\circ \right] - \cos 69^\circ \sin 21^\circ \\ & \Rightarrow \left[\frac{\sin^2 27^\circ + \cos^2 27^\circ}{\cos^2 24^\circ + \sin^2 24^\circ} - (\sin^2 69^\circ + \cos 69^\circ \cos 69^\circ) \right] \Rightarrow 1 - 1 = 0 \end{aligned}$$

26. Sol. (c)

$$\begin{aligned} & \frac{\tan 50^\circ + \sec 50^\circ}{\cot 40^\circ + \operatorname{cosec} 40^\circ} + \cos^2 65^\circ \\ & + \sin 65^\circ \cos 25^\circ + \tan 30^\circ \\ & \Rightarrow 1 + \cos^2 65^\circ + \sin^2 65^\circ + \frac{1}{\sqrt{3}} \\ & \because (\tan 50^\circ = \cot 40^\circ \sec 50^\circ = \cos 40^\circ) \\ & \Rightarrow 2 + \frac{1}{\sqrt{3}} = \frac{2\sqrt{3}+1}{\sqrt{3}} = \frac{6+\sqrt{3}}{3} \end{aligned}$$

27. Sol. (d)

$$(\sin 37^\circ \cdot \cos 53^\circ + \cos 37^\circ \cdot \sin 53^\circ)$$

$$= \frac{4\cos^2 37^\circ - 7 + 4\cos^2 53^\circ}{\tan^2 47^\circ + 4 - \operatorname{cosec}^2 43^\circ}$$

$$\Rightarrow (\sin^2 37^\circ + \cos^2 37^\circ)$$

$$= \frac{4\sin^2 53^\circ - 7 + 4\cos^2 53^\circ}{\tan^2 47^\circ + 4 - \sec^2 47^\circ}$$

$$\Rightarrow 1 - \frac{-3}{3} \Rightarrow 1 + 1 = 2$$

28. Sol. (c)

$$\frac{\cos 8^\circ \cos 24^\circ \cos 60^\circ \cos 66^\circ \cos 82^\circ}{\sin 8^\circ \sin 24^\circ \sin 60^\circ \sin 66^\circ \sin 82^\circ}$$

$$\Rightarrow \frac{\cos 88^\circ \cos 24^\circ \cos 60^\circ \cos 66^\circ \cos 82^\circ}{\sin(90^\circ - 82^\circ) \sin(90^\circ - 66^\circ) \sin 60^\circ \sin(90^\circ - 24^\circ) \sin(90^\circ - 8^\circ)}$$

$$\Rightarrow \frac{\cos 8^\circ \cos 24^\circ \cos 60^\circ \cos 66^\circ \cos 82^\circ}{\cos 82^\circ \cos 66^\circ \sin 60^\circ \cos 24^\circ \cos 8^\circ}$$

$$\Rightarrow \cot 60^\circ \Rightarrow \frac{1}{\sqrt{3}}$$

29. Sol. (d)

$$\begin{aligned} & \frac{(\cos 9^\circ + \sin 81^\circ)(\sec 9^\circ + \operatorname{cosec} 81^\circ)}{\operatorname{cosec} 71^\circ + \cos^2 15^\circ - \tan^2 19^\circ + \cos^2 75^\circ} \\ & = \frac{(\cos 9^\circ + \cos 9^\circ)(\sec 9^\circ + \sec 9^\circ)}{\operatorname{cosec}^2 71^\circ + \sin^2 75^\circ - \cot^2 71^\circ + \cos^2 75^\circ} \\ & = \frac{(2\cos 9^\circ)(2\sec 9^\circ)}{(\operatorname{cosec}^2 71^\circ - \cot^2 71^\circ) + (\sin^2 75^\circ + \cos^2 75^\circ)} \\ & = \frac{(2\cos 9^\circ)\left(\frac{2}{\cos 9^\circ}\right)}{(1)+(1)} = \frac{4}{2} = 2 \end{aligned}$$

30. Sol. (d)

$$\begin{aligned} & \tan(63^\circ - \theta) - \cot(27^\circ + \theta) + \frac{\operatorname{cosec}^2 70^\circ - \tan^2 20^\circ}{\sec^2 37^\circ - \cot^2 53^\circ} \text{ is:} \\ & \Rightarrow \tan(63^\circ - \theta) - \tan(63^\circ - \theta) + \frac{\operatorname{cosec}^2 70^\circ - \tan^2 20^\circ}{\sec^2 37^\circ - \cot^2 53^\circ} \\ & = 0 + \frac{\sec^2 20^\circ - \tan^2 20^\circ}{\operatorname{cosec}^2 37^\circ - \cot^2 53^\circ} = 0 + 1 = 1 \end{aligned}$$

31. Sol. (a)

Expression

$$\sin 23^\circ \cdot \cos 67^\circ + \sec 52^\circ \cdot \sin 38^\circ +$$

$$\begin{aligned}
 & \frac{\cos 23^\circ \cdot \sin 67^\circ + \sec 52^\circ \cdot \cos 38^\circ}{\cos \sec^2 20^\circ - \tan^2 70^\circ} \\
 & \Rightarrow \sin 23^\circ \cdot \sin (90^\circ - 67^\circ) + \sec 52^\circ \cdot \cos (90^\circ - 38^\circ) \\
 & + \frac{\cos 23^\circ \cdot \cos (90^\circ - 67^\circ) + \sec 52^\circ \cdot \sin (90^\circ - 38^\circ)}{\cos \sec^2 20^\circ - \cot^2 (90^\circ - 70^\circ)} \\
 & \Rightarrow \sin 23^\circ \cdot \sin 23^\circ + \sec 52^\circ \cdot \cos 52^\circ \\
 & + \frac{\cos 23^\circ \cdot \cos 23^\circ + \sec 52^\circ \cdot \sin 52^\circ}{\cos \sec^2 20^\circ - \cot^2 20^\circ} \\
 & \left[\because \sin (90^\circ - \theta) = \cos \theta : \cos \right. \\
 & \left. (90^\circ - \theta) = \sin \theta \cdot \cot (90^\circ - \theta) = \tan \theta \right] \\
 & = \frac{\sin^2 23^\circ + \cos^2 23^\circ + 1 + 1}{1} \\
 & [\because \sec \theta \cdot \cos \theta = \operatorname{cosec} \theta \cdot \sin \theta = 1] \\
 & = 1 + 1 + 1 = 3
 \end{aligned}$$

32. Sol. (a)

$$\begin{aligned}
 & \left(\frac{\sin 23^\circ \cos 67^\circ + \sec 52^\circ \sin 38^\circ}{\cos \sec^2 20^\circ - \tan^2 70^\circ} \right) + \\
 & \left(\frac{\cos 23^\circ \sin 67^\circ + \sec 52^\circ \cos 38^\circ}{\cos \sec^2 20^\circ - \tan^2 70^\circ} \right) \\
 & \Rightarrow \left(\frac{\sin^2 23^\circ + \sec 52^\circ \sin 38^\circ}{\cos \sec^2 20^\circ - \cot^2 20^\circ} + \frac{\cos^2 23^\circ + \sec 38^\circ \cos 38^\circ}{\cos \sec^2 20^\circ - \cot^2 20^\circ} \right) \\
 & \Rightarrow \left\{ \frac{(\sin^2 23^\circ + \cos^2 23^\circ) + (\sec 52^\circ \sin 38^\circ)}{(\cos \sec^2 20^\circ - \cot^2 20^\circ)} \right. \\
 & \left. + \frac{(\sec 38^\circ \cos 38^\circ)}{\cos \sec^2 20^\circ - \cot^2 20^\circ} \right\} \\
 & = \frac{1+1+1}{1} = 3
 \end{aligned}$$

33. Sol (a)

$$\begin{aligned}
 & \frac{\tan (45^\circ - \alpha)}{\cot (45^\circ + \alpha)} - \frac{(\cos 19^\circ + \sin 71^\circ)(\sec 19^\circ + \operatorname{cosec} 71^\circ)}{\tan 12^\circ \cdot \tan 24^\circ \cdot \tan 66^\circ \cdot \tan 78^\circ} \\
 & \text{Let } \alpha = 0^\circ \Rightarrow \frac{\tan (45^\circ)}{\cot (45^\circ)}
 \end{aligned}$$

$$\begin{aligned}
 & - \frac{(\cos 19^\circ + \cos 19^\circ)(\sec 19^\circ + \sec 19^\circ)}{\tan 12^\circ \cdot \tan 24^\circ \cdot \cot 24^\circ \cot 12^\circ} \\
 & \Rightarrow 1 - \frac{2 \cos 19^\circ \cdot 2 \sec 19^\circ}{1} \Rightarrow 1 - \frac{2 \times 2}{1} \\
 & \Rightarrow 1 - 4 = -3
 \end{aligned}$$

34. Sol (b)

Given, $\operatorname{Cosec} 31^\circ = x$

$$\begin{aligned}
 & \Rightarrow \sin 31 = \frac{1}{x} \Rightarrow \cos^2 31 = \frac{x^2 - 1}{x^2} \\
 & \sin^2 59 + \frac{1}{\cos \sec^2 31} + \tan^2 59 + \frac{1}{\sin^2 59 \cdot \cos \sec^2 59}
 \end{aligned}$$

$$\Rightarrow \sin^2 59 + \sin^2 31 + \tan^2 (90 - 31) - 1$$

$$\Rightarrow 1 + \tan^2 (90 - 31) - 1$$

$$\Rightarrow \cot^2 31 = \frac{\cos^2 31}{\sin^2 31}$$

$$\Rightarrow \frac{x^2 - 1}{x^2} \times \frac{x^2}{1} = x^2 - 1$$

35. Sol(a)

$$\begin{aligned}
 & \frac{4 \tan^2 30^\circ + \sin^2 30^\circ \cos^2 45^\circ + \sec^2 48^\circ - \cot^2 42^\circ}{\cos 37^\circ \sin 53^\circ + \sin 37^\circ \cos 53^\circ + \tan 18^\circ \tan 72^\circ} \\
 & \frac{4 \times \frac{1}{3} + \frac{1}{4} \times \frac{1}{2} + \sec^2 48^\circ - \cot^2 42^\circ}{\cos 37^\circ \sin 53^\circ + \sin 37^\circ \cos 53^\circ + \tan 18^\circ \tan 72^\circ} \\
 & \frac{\frac{4}{3} + \frac{1}{8} + \sec^2 (90 - 42) - \cot^2 42^\circ}{\cos 37^\circ \sin (90 - 37) + \sin 37^\circ \cos (90 - 37) + \tan (90 - 72) \tan 72^\circ} \\
 & \frac{\frac{4}{3} + \frac{1}{8} + \operatorname{cosec}^2 42^\circ - \cot^2 42^\circ}{\cos 37^\circ \cos 37^\circ + \sin 37^\circ \sin 37^\circ + \cot 72^\circ \tan 72^\circ} \\
 & = \frac{\frac{4}{3} + \frac{1}{8} + 1}{\cos^2 37^\circ + \sin^2 37^\circ + 1} \\
 & = \frac{\frac{4}{3} + \frac{1}{8} + 1}{1 + 1} = \frac{\frac{59}{24}}{2} = \frac{59}{48}
 \end{aligned}$$

Type-5 (Formula)

1. What is the value of $\cos\left(-\frac{17\pi}{3}\right)$

[SSC CGL 2023 (Shift-3)]

- (a) 1 (b) $\frac{2}{1}$ (c) $\frac{1}{2}$ (d) 0

2. What is the value of $\cos^2 15^\circ$?

[SSC CGL 06/12/2022 (Shift-4)]

- (a) $(2 + \sqrt{3})$ (b) $\frac{(2+\sqrt{3})}{4}$
(c) $\frac{(2+\sqrt{3})}{2}$ (d) $\frac{(1+\sqrt{3})}{2}$

3. The value of $\sin 35^\circ \cos 55^\circ + \cos 35^\circ \sin 55^\circ$ is :

SSC CHSL 07/06/2022

- (a) 0 (b) $\frac{3}{4}$ (c) $\frac{1}{2}$ (d) 1

4. The value of $(\sin 30^\circ \cos 60^\circ - \cos 30^\circ \sin 60^\circ)$ is equal to:

SSC CGL 01/12/2022

- (a) $-\cos 30^\circ$ (b) $-\sin 30^\circ$
(c) $\cos 30^\circ$ (d) $\sin 30^\circ$

5. What is the value of $(4\sin^3 x - 3\sin x + \sin 3x)$?

SSC CHSL 31/05/2022

- (a) 1 (b) 0 (c) 4 (d) 3

6. If $\tan(\alpha + \beta) = a, \tan(\alpha - \beta) = b$ then the value of $\tan 2\alpha$ is:

SSC CGL 13/12/2022

- (a) $\frac{a+b}{1-ab}$ (b) $\frac{a+b}{1+ab}$ (c) $\frac{a-b}{1+ab}$ (d) $\frac{a-b}{1-ab}$

7. The value of $\frac{\sin 4\theta + \sin 2\theta}{\cos 4\theta + \cos 2\theta}$ is:

SSC CHSL 27/05/2022

- (a) $\tan 3\theta$ (b) $\cot 3\theta$
(c) $\tan \theta$ (d) $\cot \theta$

8. If $\tan A = \frac{1-\cos B}{\sin B}$, then find the value of $\tan 2A$?

- (a) $\cot B$ (b) $\tan B$
(c) $\cos B$ (d) $\operatorname{cosec} B$

9. $(\operatorname{cosec} \theta - \cot \theta)^2 = ?$, If $0^\circ < \theta < 90^\circ$

SSC CHSL 09/06/2022 (Evening)

- (a) $\frac{1-\sin \theta}{1+\cos \theta}$ (b) $\frac{1-\cos \theta}{1+\cos \theta}$
(c) $\frac{1+\cos \theta}{1-\cos \theta}$ (d) $\frac{1+\cos \theta}{1-\sin \theta}$

10. What will be the value of $\frac{(\tan 45^\circ - \tan 15^\circ)}{1 + \tan 45^\circ \tan 15^\circ}$?

SSC CGL 07/12/2022 (3rd Shift)

- (a) $\sqrt{3}$ (b) $\frac{1}{\sqrt{2}}$ (c) $\frac{1}{\sqrt{3}}$ (d) $\sqrt{2}$

11. If $2 \frac{\cos^2 x - \sec^2 x}{\tan^2 x} = a + b \cos 2x$, then $a, b = ?$

SSC CGL 09/12/2022

- (a) $\frac{-3}{2}, \frac{-1}{2}$ (b) $\frac{3}{2}, \frac{1}{2}$ (c) $-3, -1$ (d) $3, 1$

12. If $\sin Y = x$, then what will be the value of $\cos 2Y$ (where $0 \leq Y \leq 90^\circ$) ?

SSC CGL 08/12/2022 (1st Shift)

- (a) $(\sqrt{2} - 1) \times$ (b) $\sqrt{2}x$
(c) $1 - 2x$ (d) $1 - 2x^2$

13. If $\sin \theta = \frac{1}{2}$, then the value of $(3\cos \theta - 4\cos^3 \theta)$ is:

SSC CGL 06/12/2022 (3rd Shift)

- (a) 0 (b) 1 (c) 2 (d) -1

14. What is $\sin \alpha - \sin \beta$?

SSC CGL 01/12/2022 (2nd Shift)

- (a) $2\cos \frac{\alpha+\beta}{2} \sin \frac{\alpha-\beta}{2}$ (b) $2\sin \frac{\alpha+\beta}{2} \sin \frac{\alpha-\beta}{2}$
(c) $2\cos \frac{\alpha-\beta}{2} \sin \frac{\alpha+\beta}{2}$ (d) $2\cos \frac{\alpha+\beta}{2} \cos \frac{\alpha-\beta}{2}$

15. If $\tan \theta + \cot \theta = \frac{4}{\sqrt{3}}$, where $0 < \theta < \frac{\pi}{2}$, then $\sin \theta + \cos \theta$ is equal to

[CDS 2016-I]

- (a) 1 (b) $\frac{\sqrt{3}-1}{2}$ (c) $\frac{\sqrt{3}+1}{2}$ (d) $\sqrt{2}$

16. Find the value $\frac{\tan 60^\circ - \tan 15^\circ}{1 + \tan 60^\circ \tan 15^\circ}$

[SSC CHSL 12/10/2020 (Afternoon)]

- (a) $\frac{\sqrt{3}}{2}$ (b) 1 (c) $\frac{1}{2}$ (d) $\frac{1}{\sqrt{2}}$

17. If $\tan(\pi \cos \theta) = \cot(\pi \sin \theta)$, then what is the value of $\cos 2\theta$?

- (a) $\frac{\sqrt{3}}{2}$ (b) $\frac{\sqrt{7}}{2}$ (c) $\frac{\sqrt{7}}{4}$ (d) $\frac{5}{2}$

18. Which of the following is equal to $\left[\frac{\tan \theta + \sec \theta - 1}{\tan \theta - \sec \theta + 1} \right]$?

SSC CGL MAINS 08/08/2022

- (a) $\frac{1+\cos \theta}{\sin \theta}$ (b) $\frac{1+\cot \theta}{\tan \theta}$
(c) $\frac{1+\sin \theta}{\cos \theta}$ (d) $\frac{1+\tan \theta}{\cot \theta}$

19. $\cos 15^\circ \cos 7\frac{1}{2}^\circ \cdot \cos 82\frac{1}{2}^\circ = ?$

- (a) $\frac{1}{2}$ (b) $\frac{1}{8}$ (c) $\frac{1}{4}$ (d) $\frac{1}{16}$

20. The value of $\frac{2\cos^3 \theta - \cos \theta}{\sin \theta - 2\sin^3 \theta}$ is:

SSC CPO 10/11/2022 (Morning)

- (a) $\sec \theta$ (b) $\sin \theta$ (c) $\cot \theta$ (d) $\tan \theta$

21. If $\sin(A+B) = \cos(A+B)$, what is the value of $\tan A$?

SSC CGL 02/12/2022 (1st Shift)

- (a) $\frac{1-\tan B}{1+\tan B}$ (b) $\frac{1+\tan B}{1-\tan B}$
(c) $\frac{1+\sec B}{1-\sec B}$ (d) $\frac{1-\csc B}{1+\csc B}$

22. Solve it: $\frac{\sin(90-10\theta) - \cos(\pi-6\theta)}{\cos\left(\frac{\pi}{2}-10\theta\right) - \sin(\pi-6\theta)}$

SSC CGL 01/12/2022 (Shift- 02)

- (a) $\sin 2\theta$ (b) $\cos 2\theta$
(c) $\cot 2\theta$ (d) $\tan 2\theta$

23. The value of $\left(\frac{\sin A}{1-\cos A} + \frac{1-\cos A}{\sin A} \right) \div \left(\frac{\cot^2 A}{1+\csc A} + 1 \right)$ is:

SSC CGL TIER II (12/09/2019)

- (a) $\frac{3}{2}$ (b) $\frac{1}{2}$ (c) 1 (d) 2

24. $\frac{2\cos 40^\circ - \cos 20^\circ}{\sin 20^\circ} = ?$

- (a) 0 (b) $\sqrt{3}$ (c) -1 (d) 2

25. If $\tan A - \tan B - \tan C = \tan A \tan B \tan C$, what is the value of A in terms of B and C ?

SSC CGL 07/12/2022 (1st Shift)

- (a) $A = B + C$ (b) $A = 2B - 2C$
(c) $A = B - C$ (d) $A = \frac{B-C}{2}$

26. What will be the value of $\sin 10^\circ - \frac{4}{3}\sin^3 10^\circ$?

SSC CGL 06/12/2022

- (a) $\frac{1}{3\sqrt{3}}$ (b) $\frac{1}{6}$ (c) $\frac{1}{2\sqrt{3}}$ (d) $\frac{\sqrt{3}}{6}$

27. If $\cot x = a/b$, then find the value of $a \cos 2x + b \sin 2x$?

- (a) 3 (b) 2 (c) 1 (d) 5

28. $\frac{\tan 70^\circ - \tan 20^\circ - 2 \tan 40^\circ}{\tan 10^\circ}$

- (a) $\frac{4}{5}$ (b) $\frac{6}{5}$ (c) $\frac{2}{3}$ (d) $\frac{8}{3}$

29. What is the value of $\sin 75^\circ + \sin 15^\circ$?

SSC CGL 09/12/2022 (4th Shift)

- (a) $\frac{1}{\sqrt{2}}$ (b) $\frac{\sqrt{3}}{2}$ (c) $\sqrt{\frac{3}{2}}$ (d) $\frac{3}{\sqrt{2}}$

30. If $\cot A = 15/8$, then what will be the value of $\tan 2A$?

SSC CGL 06/12/2022

- (a) $\frac{200}{161}$ (b) $\frac{240}{161}$ (c) $\frac{240}{173}$ (d) $\frac{220}{171}$

31. $\tan 13\theta - \tan 9\theta - \tan 4\theta = ?$

- (a) $\tan 14\theta \tan 8\theta \tan 4\theta$
 (b) $\tan 13\theta \tan 9\theta \tan 4\theta$
 (c) $\tan 26\theta \tan 6\theta \tan 3\theta$
 (d) None of these

32. What is the value of the expression $\cos 2A \cos 2B + \sin^2(A - B) - \sin^2(A + B)$?

SSC CGL, 12/12/2022 (1st Shift)

- (a) $\sin(2A - 2B)$ (b) $\sin(2A + 2B)$
 (c) $\cos(2A + 2B)$ (d) $\cos(2A - 2B)$

33. If $\tan \alpha = \frac{1}{7}$, and $\tan \beta = \frac{1}{3}$, then $\cos 2\alpha = ?$

- (a) $\sin 2\beta$ (b) $\sin 4\beta$
 (c) $\sin 3\beta$ (d) $\cos 3\beta$

34. If $\sin x + \cos x = c$, then $\sin^6 x + \cos^6 x$ is equal to?

- (a) $\frac{1+6c^2-3c^4}{16}$ (b) $\frac{1+6c^2-3c^4}{4}$
 (c) $\frac{1+6c^2+3c^4}{16}$ (d) $\frac{1+6c^2+3c^4}{4}$

35. If $\cos(\alpha + \beta) = \frac{4}{5}$, $\sin(\alpha - \beta) = \frac{5}{13}$ and α, β lie b/w 0 & $\frac{\pi}{4}$ then find $\tan 2\alpha$?

SSC CGL 02/12/2022 (Shift-01)

- (a) $\frac{23}{56}$ (b) $\frac{56}{33}$ (c) $\frac{52}{21}$ (d) None

36. What is the value of $[1 - \sin(90 - 2A)]/[1 + \sin(90 + 2A)]$?

- (a) $\sin A \cos A$ (b) $\cot^2 A$
 (c) $\tan^2 A$ (d) $\sin^2 A \cos A$

37. The expression

$$\frac{\tan^6 \theta - \sec^6 \theta + 3 \sec^2 \theta \tan^2 \theta}{\tan^2 \theta + \cot^2 \theta + 2} \quad 0^\circ < \theta < 90^\circ, \text{ is equal to}$$

- (a) $\sec^2 \theta \csc^2 \theta$ (b) $-\sec^2 \theta \csc^2 \theta$
 (c) $\cos^2 \theta \sin^2 \theta$ (d) $-\cos^2 \theta \sin^2 \theta$

38. $2\sqrt{2} \sin 10^\circ \left(\frac{\sec 5^\circ}{2} + \frac{\cos 40^\circ}{\sin 5^\circ} - 2 \sin 35^\circ \right) = ?$

- (a) 1 (b) 4 (c) $\sqrt{2}$ (d) -1

39. If $\sin(x + 3\alpha) = 3 \sin(\alpha - x)$, then

- (a) $\tan x = \tan \alpha$ (b) $\tan x = \tan^2 \alpha$

- (c) $\tan x = \tan^3 \alpha$ (d) $\tan x = 3 \tan \alpha$

40. If $\tan(A + B) = p$ and $\tan(A - B) = q$, then the value of $\tan 2A$ is

- (a) $\frac{p+q}{p-q}$ (b) $\frac{p-q}{1+pq}$ (c) $\frac{p+q}{1-pq}$ (d) $\frac{1+pq}{p-q}$

41. Simplify.

$$\cos(36^\circ - A) \cos(36^\circ + A) + \cos(54^\circ - A) \cos(54^\circ + A)$$

SSC CPO 11/09/2022 (Shift - 01)

- (a) $\cos A$ (b) $\sin 2A$
 (c) $\cos 2A$ (d) $\sin A$

42. If $A + B = C$, then $\tan A \tan B \tan C = ?$

SSC CGL 08/12/2022 (1st Shift)

- (a) $\tan C + \tan A - \tan B$
 (b) $\tan C + \tan A + \tan B$
 (c) $\tan A - \tan B - \tan C$
 (d) $\tan C - \tan A - \tan B$

43. $\frac{\sin^8 \theta - \cos^8 \theta}{\cos 2\theta(1 + \cos^2 2\theta)} = ?$

- (a) 1 (b) $-\frac{1}{2}$ (c) -1 (d) 2

44. The value of $\frac{\sec \theta (\sin \theta - 2 \sin^3 \theta)}{2 \cos^3 \theta - \cos \theta}$ is:

DP Head Constable 18/10/2022 (Shift - 01)

- (a) $\sin \theta \cdot \cos \theta$ (b) $\sec \theta \cdot \tan \theta$
 (c) $\tan \theta \cdot \cos \theta$ (d) $\sec \theta \sin \theta$

45. What is the value of $[1 - \tan(90 - \theta) + \sec(90 - \theta)]/[\tan(90 - \theta) + \sec(90 - \theta) + 1]$?

- (a) $\cot(\theta/2)$ (b) $\tan(\theta/2)$
 (c) $\sin \theta$ (d) $\cos \theta$

46.
$$\frac{\operatorname{cosec}^2 51^\circ - \tan^2 39^\circ + \cot^2 (90^\circ + \theta) \operatorname{cosec}^2 (270^\circ - \theta) + \tan^2 (180^\circ - \theta)}{\cot(90^\circ - \theta) - \tan^3 \theta}$$

- (a) $4 \operatorname{cosec} 4\theta$ (b) $6 \sec 4\theta$
(c) $2 \operatorname{cosec} 4\theta$ (d) None of these

47. Consider the following :

[CDS 2016-1]

1
$$\sqrt{\frac{1-\cos \theta}{1+\cos \theta}} = \operatorname{cosec} \theta - \cot \theta$$

2
$$\sqrt{\frac{1+\cos \theta}{1-\cos \theta}} = \operatorname{cosec} \theta + \cot \theta$$

Which of the following is correct

- (a) only 1 (b) only 2
(c) Both 1 and 2 (d) Neither 1 or 2

48. What is the value of the following in terms of trigonometry ratios?

$$\frac{\sin A}{1+\cos A} + \frac{1+\cos A}{\sin A}$$

SSC CPO 10/11/2022 (Afternoon)

- (a) $2 \operatorname{cosec} A$ (b) $2 \cos A$
(c) $2 \sec A$ (d) $2 \sin A$

49. The value of $\sin 73^\circ + \cos 137^\circ$ is:

SSC CHSL 10/06/2022 (Evening)

- (a) $\sin 13^\circ$ (b) $\cos 13^\circ$
(c) $\cos 18^\circ$ (d) $\sin 18^\circ$

50. What is the value of
$$\frac{2 \cot \left(\frac{\pi - A}{2} \right)}{\left[1 + \tan^2 \left(\frac{2\pi - A}{2} \right) \right]} = ?$$

- (a) $2 \sin^2 A/2$ (b) $\cos A$
(c) $\sin A$ (d) $2 \cos^2 A/2$

51. The value of

$$\frac{\sin(78^\circ + \theta) - \cos(12^\circ - \theta) + \tan^2 70^\circ - \operatorname{cosec}^2 20^\circ}{\sin 25^\circ \cos 65^\circ + \cos 25^\circ \sin 65^\circ}$$

- (a) -1 (b) 0 (c) 2 (d) -2

52. $\tan \alpha + 2 \tan 2\alpha + 4 \tan 4\alpha + 8 \cot 8\alpha = ?$

- (a) $\tan \alpha$ (b) $\tan 2\alpha$
(c) $\cot \alpha$ (d) $\cot 2\alpha$

53. What is the value of $\frac{[\sin(90^\circ - A) + \cos(180^\circ - 2A)]}{[\cos(90^\circ - 2A) + \sin(180^\circ - A)]} ?$

- (a) $\sin(A/2) \cos A$ (b) $\cot(A/2)$
(c) $\tan(A/2)$ (d) $\sin A \cos(A/2)$

Type-5 ANSWER KEY

1	C	2	B	3	D	4	B	5	B	6	A	7	A	8	B
9	B	10	C	11	C	12	D	13	A	14	A	15	C	16	B
17	C	18	C	19	B	20	C	21	A	22	B	23	D	24	B
25	A	26	B	27	A	28	A	29	C	30	B	31	B	32	C
33	B	34	B	35	B	36	C	37	D	38	B	39	C	40	C
41	C	42	D	43	B	44	B	45	B	46	A	47	C	48	A
49	A	50	C	51	A	52	C	53	C						

Type-5 (Formula) Solution

1. Sol. (c)

$$\cos\left(-\frac{17}{3}\pi\right) = \cos\left(\frac{\pi}{3} - 6\pi\right)$$

We know, $\cos(A - B) = \cos A \cos B - \sin A \sin B$

$$\Rightarrow \cos\left(\frac{\pi}{3} - 6\pi\right) = \cos\frac{\pi}{3} \cos 6\pi - \sin\frac{\pi}{3} \sin 6\pi$$

$$\because \cos 6\pi = 1, \sin 6\pi = 0, \cos\frac{\pi}{3} = \frac{1}{2}$$

$$\Rightarrow \cos\frac{\pi}{3} \cdot 1 = \frac{1}{2}$$

2. Sol. (b)

$$\cos^2 15^\circ = \cos^2(45^\circ - 30^\circ)$$

We know, $\cos(A - B) = \cos A \cos B + \sin A \sin B$

$$\Rightarrow \cos^2(45^\circ - 30^\circ) = (\cos 45^\circ \cos 30^\circ +$$

$$\sin 45^\circ \sin 30^\circ)^2$$

$$= \left(\frac{1}{\sqrt{2}} \times \frac{\sqrt{3}}{2} + \frac{1}{\sqrt{2}} \times \frac{1}{2}\right)^2$$

$$= \left(\frac{\sqrt{3}}{2\sqrt{2}} + \frac{1}{2\sqrt{2}}\right)^2 = \left(\frac{\sqrt{3}+1}{2\sqrt{2}}\right)^2$$

$$= \frac{3+1+2\sqrt{3}}{8} = \frac{2+\sqrt{3}}{4}$$

3. Sol. (d)

Formula used :

$$\sin(A + B) = \sin A \cos B + \cos A \sin B$$

$$\sin 35^\circ \cos 55^\circ + \cos 35^\circ \sin 55^\circ = \sin$$

$$(35^\circ + 55^\circ) = \sin 90^\circ = 1$$

4. Sol. (b)

$$\sin(a^\circ - b^\circ) = (\sin a^\circ \cos b^\circ - \cos a^\circ \sin b^\circ)$$

Now,

$$(\sin 30^\circ \cos 60^\circ - \cos 30^\circ \sin 60^\circ)$$

$$= \sin(30^\circ - 60^\circ)$$

$$\sin(-30^\circ) = -\sin 30^\circ$$

$$(\sin(-a^\circ) = -\sin a^\circ)$$

5. Sol. (b)

As per trigonometric identity,

$$\text{we have } \sin 3x = 3\sin x - 4\sin^3 x$$

$$\text{Now, } (4\sin^3 x - 3\sin x + \sin 3x)$$

$$= 4\sin^3 x - 3\sin x + 3\sin x - 4\sin^3 x = 0$$

6. Sol. (a)

Formula :-

$$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$\tan 2\alpha = \tan\{(\alpha + \beta) + (\alpha - \beta)\} =$$

$$\frac{\tan(\alpha + \beta) + \tan(\alpha - \beta)}{1 - \tan(\alpha + \beta)\tan(\alpha - \beta)} = \frac{a+b}{1-ab}$$

7. Sol. (a)

$$\frac{\sin 4\theta + \sin 2\theta}{\cos 4\theta + \cos 2\theta}$$

$$= \frac{\sin\left(\frac{4\theta + 2\theta}{2}\right) \cos\left(\frac{4\theta - 2\theta}{2}\right)}{\cos\left(\frac{4\theta + 2\theta}{2}\right) \cos\left(\frac{4\theta - 2\theta}{2}\right)}$$

$$= \frac{\sin 3\theta \cos \theta}{\cos 3\theta \cos \theta} = \frac{\sin 3\theta}{\cos 3\theta} = \tan 3\theta$$

8. Sol. (b)

$$\tan A = \frac{1 - \left(1 - 2\sin^2 \frac{B}{2}\right)}{2\sin \frac{B}{2} \cdot \cos \frac{B}{2}} = \frac{2\sin^2 \frac{B}{2}}{2\sin \frac{B}{2} \cdot \cos \frac{B}{2}}$$

$$\tan A = \tan \frac{B}{2}$$

$$\tan 2A = \tan B$$

9. Sol. (b)

$$(\operatorname{cosec} \theta - \cot \theta)^2$$

$$= \left(\frac{1}{\sin \theta} - \frac{\cos \theta}{\sin \theta}\right)^2$$

$$= \frac{(1 - \cos \theta)^2}{\sin^2 \theta} = \frac{(1 - \cos \theta)(1 - \cos \theta)}{1 - \cos^2 \theta}$$

$$= \frac{(1-\cos\theta)(1-\cos\theta)}{(1-\cos\theta)(1+\cos\theta)} = \frac{(1-\cos\theta)}{(1+\cos\theta)}$$

10. Sol. (c)

$$\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

$$\frac{(\tan 45^\circ - \tan 15^\circ)}{1 + \tan 45^\circ \tan 15^\circ} = \tan(45^\circ - 15^\circ)$$

$$= \tan 30^\circ = \frac{1}{\sqrt{3}}$$

11. Sol. (c)

$$\text{Formula: } (\cos 2x = 2\cos^2 x - 1)$$

$$2 \frac{\cos^2 x - \sec^2 x}{\tan^2 x} = a + b \cos 2x$$

$$\Rightarrow 2 \frac{\cos^2 x - \frac{1}{\cos^2 x}}{\frac{\sin^2 x}{\cos^2 x}} = 2 \frac{\cos^4 x - 1}{\sin^2 x}$$

$$= 2 \frac{(\cos^2 x - 1)(\cos^2 x + 1)}{1 - \cos^2 x} = -2(\cos^2 x + 1)$$

$$= -2\cos^2 x - 2$$

$$= -(\cos 2x + 1) - 2 = a + b \cos 2x$$

$$-3 - \cos 2x = a + b \cos 2x$$

Comparing both side, we get,

$$a = -3 \text{ and } b = -1$$

12. Sol. (d)

$$\text{Formula: } \cos 2A = 1 - 2\sin^2$$

$$\sin Y = x \text{ then, } \cos 2Y = 1 - 2x^2$$

13. Sol. (a)

$$\text{Formula :- } \cos 3\theta = -(3\cos\theta - 4\cos^3\theta)$$

$$\sin\theta = \frac{1}{2} \Rightarrow \theta = 30^\circ - (3\cos\theta - 4\cos^3\theta) =$$

$$\cos 3\theta = \cos 90^\circ = 0$$

14. Sol. (a)

Formula :-

$$\sin a - \sin b = 2\sin\left(\frac{a-b}{2}\right)\cos\left(\frac{a+b}{2}\right)$$

$$\sin\alpha - \sin\beta = 2\cos\frac{\alpha+\beta}{2}\sin\frac{\alpha-\beta}{2}$$

15. Sol. (c)

$$\tan\theta + \cot\theta = \frac{4}{\sqrt{3}}$$

$$\Rightarrow \frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta} = \frac{4}{\sqrt{3}}$$

$$\Rightarrow \frac{1}{\sin\theta\cos\theta} = \frac{4}{\sqrt{3}}$$

$$\Rightarrow \sin\theta\cos\theta = \frac{\sqrt{3}}{4}$$

$$\Rightarrow 2\sin\theta\cos\theta = \frac{\sqrt{3}}{2}$$

$$\Rightarrow \sin 2\theta = \sin 60^\circ \Rightarrow 2\theta = 60^\circ \Rightarrow \theta = 30^\circ$$

$$\Rightarrow \sin\theta + \cos\theta$$

$$= \sin 30^\circ + \cos 30^\circ$$

$$= \frac{1}{2} + \frac{\sqrt{3}}{2}$$

$$= \frac{\sqrt{3}+1}{2}$$

$\therefore$ Option (c) is correct.

16. Sol. (b)

$$\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

$$\frac{\tan 60^\circ - \tan 15^\circ}{1 + \tan 60^\circ \tan 15^\circ} = \tan(60^\circ - 15^\circ) = \tan(45^\circ) =$$

$$1$$

17. Sol. (c)

$$\tan(\pi\cos\theta) = \cot(\pi\sin\theta)$$

$$\pi(\cos\theta + \sin\theta) = \frac{\pi}{2}$$

$$\cos\theta + \sin\theta = \frac{1}{2}$$

$$\cos\theta - \sin\theta = \sqrt{1 + 1 - \frac{1}{4}} = \frac{\sqrt{7}}{2}$$

$$\cos 2\theta = \cos^2\theta - \sin^2\theta = \frac{1}{2} \times \frac{\sqrt{7}}{2} = \frac{\sqrt{7}}{4}$$

18. Sol. (c)

$$\frac{\tan\theta + \sec\theta - 1}{\tan\theta - \sec\theta + 1}$$

$$\frac{\tan\theta + \sec\theta - 1}{\tan\theta - \sec\theta + 1}$$

Put $\sec^2\theta - \tan^2\theta = 1$ in numerator

$$\frac{(\tan\theta + \sec\theta) - [(sec^2\theta - tan^2\theta)]}{\tan\theta - \sec\theta + 1}$$

$$\frac{(\tan\theta + \sec\theta)(1 - \sec\theta + \tan\theta)}{(\tan\theta - \sec\theta + 1)}$$

$$\sec\theta + \tan\theta = \frac{1 + \sin\theta}{\cos\theta}$$

19. Sol. (b)

$$\frac{1}{2} \left(\cos 15^\circ \cdot \cos 7\frac{1}{2}^\circ \cdots \cos 82\frac{1}{2}^\circ \right) \times 2$$

$$\Rightarrow \frac{1}{2} \left(\cos 15^\circ \cdot 2 \times \cos 7\frac{1}{2}^\circ \cdot \sin 7\frac{1}{2}^\circ \right)$$

(Multiply and divide by 2)

$$\Rightarrow \frac{1}{2} \cos 15^\circ \cdot \sin 15^\circ$$

$$\Rightarrow \frac{1}{2} \times \frac{1}{2} \times 2 \cos 15^\circ \sin 15^\circ$$

$$\Rightarrow \frac{1}{2} \times \frac{1}{2} \times \sin 2 \times 15^\circ$$

$$\Rightarrow \frac{1}{2} \times \frac{1}{2} \times \sin 30^\circ \Rightarrow \frac{1}{8}$$

20. Sol. (c)

Formula used :

$$\cos 2\theta = 2\cos^2 \theta - 1 \text{ or } 1 - 2\sin^2 \theta$$

$$\text{Now } \frac{2\cos^3 \theta - \cos \theta}{\sin \theta - 2\sin^3 \theta} = \frac{\cos \theta (2\cos^2 \theta - 1)}{\sin \theta (1 - 2\sin^2 \theta)}$$

$$= \frac{\cos \theta \cdot \cos 2\theta}{\sin \theta \cdot \cos 2\theta} = \cot \theta$$

21. Sol. (a)

Formula

$$\tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A \cdot \tan B}$$

$$\sin(A + B) = \cos(A + B) \quad \dots \text{(given)}$$

Clearly value of $\sin \theta$ and $\cos \theta$ are equal at 45°

$$(A + B) = 45^\circ \Rightarrow A = 45^\circ - B$$

$$\text{Now, } \tan A = \tan(45^\circ - B)$$

$$= \frac{\tan 45^\circ - \tan B}{1 + \tan 45^\circ \cdot \tan B} = \frac{1 - \tan B}{1 + \tan B}$$

22. Sol. (b)

$$\frac{\cos 10\theta + \cos 6\theta}{\sin 10\theta - \sin 6\theta}$$

$$= \frac{2\cos 8\theta + \cos 2\theta}{2\sin 2\theta - \cos 8\theta} = \cot 2\theta$$

23. Sol. (d)

$$\left(\frac{\sin A}{1 - \cos A} + \frac{1 - \cos A}{\sin A} \right) \div \left(\frac{\cot^2 A}{1 + \operatorname{cosec} A} + 1 \right)$$

$$\Rightarrow \left(\frac{\sin^2 A + (1 - \cos A)^2}{(1 - \cos A)\sin A} \right)$$

$$\div \left(\frac{\operatorname{cosec}^2 A - 1}{1 + \operatorname{cosec} A} + 1 \right)$$

$$\Rightarrow \left(\frac{(1 - \cos^2 A) + (1 - \cos A)^2}{(1 - \cos A)\sin A} \right) \div$$

$$\left(\frac{(\operatorname{cosec} A - 1)(\operatorname{cosec} A + 1)}{1 + \operatorname{cosec} A} + 1 \right)$$

$$\Rightarrow \left(\frac{(1 - \cos A)[(1 + \cos A) + (1 - \cos A)]}{(1 - \cos A)\sin A} \right)$$

$$\div \operatorname{cosec} A \Rightarrow \left(\frac{2 \times \sin A}{\sin A} \right) = 2$$

24. Sol. (b)

$$\frac{2\cos 40^\circ - \cos 20^\circ}{\sin 20^\circ}$$

$$= \frac{\cos 40^\circ - \cos 20^\circ + \cos 40^\circ}{\sin 20^\circ}$$

Using formula, $\cos C - \cos D$

$$= 2\sin \frac{C + D}{2} \sin \frac{D - C}{2}$$

$$= \frac{2\sin 30^\circ \cdot \sin(-10^\circ) + \cos 40^\circ}{\sin 20^\circ}$$

$$\left[\begin{array}{l} \sin(-\theta) = -\sin \theta \\ \cos(90^\circ - 50^\circ) = \sin 50^\circ \end{array} \right]$$

$$= \frac{\sin 50^\circ - \sin 10^\circ}{\sin 20^\circ}$$

Use $\sin C - \sin D$

$$= 2\sin \frac{C - D}{2} \cos \frac{C + D}{2}$$

$$= \frac{2\sin 20^\circ \cdot \cos 30^\circ}{\sin 20^\circ}$$

$$= 2\cos 30^\circ = \sqrt{3}$$

25. Sol. (a)

In a right angled triangle right angled at A,

$$\Rightarrow \angle A = \angle B + \angle C = 90^\circ$$

$$\Rightarrow \angle A - \angle B - \angle C = 0^\circ$$

$$\tan(A - B - C) = \tan 0^\circ = 0$$

$$\tan(A - B - C)$$

$$= \frac{\tan A - \tan B - \tan C - \tan A \tan B \tan C}{1 - \tan A \tan B - \tan B \tan C + \tan C \tan A}$$

$$\tan A - \tan B - \tan C - \tan A \tan B \tan C = 0$$

$$\tan A - \tan B - \tan C = \tan A \tan B \tan C$$

26. Sol. (b)

Formula :-

$$\sin 3\theta = 3\sin \theta - 4\sin^3 \theta$$

$$\sin 10^\circ - \frac{4}{3}\sin^3 10^\circ = \frac{3\sin 10^\circ - 4\sin^3 10^\circ}{3}$$

$$= \frac{\sin 30^\circ}{3} = \frac{1}{6}$$

27. Sol. (a)

$$\cos 2x = 1 - \frac{2 \times 16}{25} = \frac{-7}{25}$$

$$\sin 2x = 2 \times \frac{3}{5} \times \frac{4}{5} = \frac{24}{25}$$

$$a \cos 2x + b \sin 2x = 3 \times \frac{-7}{25} + \frac{4 \times 24}{25} = \frac{75}{25} = 3$$

28. Sol. (a)

$$\frac{\cot 20^\circ - \tan 20^\circ - 2 \tan 40^\circ}{\tan 10^\circ}$$

$$\frac{\cos 20^\circ}{\sin 20^\circ} - \frac{\sin 20^\circ}{\cos 20^\circ} - 2 \tan 40^\circ$$

$$\frac{2 \cos 40^\circ}{2 \sin 20^\circ \cos 20^\circ} - 2 \tan 40^\circ$$

$$\frac{2 \left(\frac{\cos 40^\circ}{\sin 40^\circ} - \frac{\sin 40^\circ}{\cos 40^\circ} \right)}{\tan 10^\circ}$$

$$2 \times 2 \frac{\cos 80^\circ}{2 \sin 40^\circ \cos 40^\circ \tan 10^\circ}$$

$$\frac{4 \cot 80^\circ}{\tan 10^\circ} = \frac{4}{5}$$

29. Sol. (c)

Formula :

$$\sin A + \sin B = 2 \sin \left(\frac{A+B}{2} \right) \cos \left(\frac{A-B}{2} \right)$$

$$\sin 75^\circ + \sin 15^\circ$$

$$= 2 \sin \left(\frac{75+15}{2} \right) \cos \left(\frac{75-15}{2} \right)$$

$$= 2 \sin 45^\circ \cos 30^\circ$$

$$= 2 \times \frac{1}{\sqrt{2}} \times \frac{\sqrt{3}}{2} = \sqrt{\frac{3}{2}}$$

30. Sol. (b)

$$\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$$

$$\tan A = \frac{1}{\cot A} = \frac{8}{15}$$

$$\tan 2A = \frac{2 \times \frac{8}{15}}{1 - \frac{64}{225}} = \frac{16}{15} \times \frac{225}{161} = \frac{240}{161}$$

31. Sol. (b)

$$\tan (9\theta + 4\theta) = \frac{\tan 9\theta + \tan 4\theta}{1 - \tan 9\theta \tan 4\theta}$$

$$\tan 13\theta = \frac{\tan 9\theta + \tan 4\theta}{1 - \tan 9\theta \tan 4\theta}$$

$$= \tan 9\theta + \tan 4\theta$$

$$\tan 13\theta = \tan 9\theta + \tan 4\theta$$

$$= \tan 13\theta \cdot \tan 9\theta \tan 4\theta$$

32. Sol. (c)

$$\cos 2A \cos 2B + \sin^2(A-B) - \sin^2(A+B)$$

$$= \cos 2A \cdot \cos 2B +$$

$$\{ \sin(A-B) + \sin(A+B) \} \times$$

$$\{ \sin(A-B) - \sin(A+B) \}$$

$$= \cos 2A \cdot \cos 2B +$$

$$\{ 2 \sin A \cos B \times (-2 \cos A \cdot \sin B) \}$$

$$= \cos 2A \cdot \cos 2B - \sin 2A \cdot \sin 2B$$

$$= \cos(2A + 2B)$$

33. Sol. (b)

$$\cos 2\alpha = \frac{1 - \tan^2 \alpha}{1 + \tan^2 \alpha} = \frac{1 - \frac{1}{49}}{1 + \frac{1}{49}} = \frac{48}{50} = \frac{24}{25}$$

$$\sin 2\beta = \frac{2 \times \frac{1}{3}}{1 + \frac{1}{9}} = \frac{3}{5}$$

$$\sin 4\beta = 2 \times \frac{3}{5} \times \frac{4}{5} = \frac{24}{25}$$

34. Sol. (b)

$$\sin x + \cos x = c$$

Squaring both sides

$$\sin^2 x + \cos^2 x + 2\sin x \cos x = c^2$$

$$\sin x \cos x = \frac{c^2 - 1}{2}$$

We know that,

$$\sin^6 x + \cos^6 x = 1 - 3\sin^2 x \cos^2 x$$

$$= 1 - 3 \left(\frac{c^2 - 1}{2} \right)^2$$

$$= 1 - 3 \left(\frac{c^4 + 1 - 2c^2}{4} \right)$$

$$= \frac{1 + 6c^2 - 3c^4}{4}$$

35. Sol. (b)

$$\alpha + \beta = A$$

$$\alpha - \beta = B$$

$$2\alpha = A + B$$

$$\tan 2\alpha = \tan(A + B)$$

$$= \frac{\frac{3}{4} \times \frac{3}{12} + \frac{5}{12}}{1 - \frac{3}{4} \times \frac{5}{12}} = \frac{\frac{14}{12}}{\frac{11}{16}} = \frac{56}{33}$$

36. Sol. (c)

$$\frac{[1 - \sin(90 - 2A)]}{[1 + \sin(90 + 2A)]}$$

$$= \frac{1 - \cos 2A}{1 + \cos 2A} = \frac{1 - 1 + 2\sin^2 A}{1 + 1 + 2\cos^2 A - 1}$$

$$= \frac{2\sin^2 A}{2\cos^2 A} = \tan^2 A$$

$$[\therefore \cos 2A = 1 - 2\sin^2 A = 2\cos^2 A - 1]$$

37. Sol. (d)

$$\frac{-1 - 3\sec^2 \theta \cdot \tan^2 \theta + 3\sec^2 \theta \cdot \tan^2 \theta}{\frac{\sin^2 \theta}{\cos^2 \theta} + \frac{\cos^2 \theta}{\sin^2 \theta} + 2}$$

$$(\because \sec^2 \theta - \tan^2 \theta = 1 + 3\sec^2 \theta \cdot \tan^2 \theta)$$

$$= \frac{-1 \times \cos^2 \theta \cdot \sin^2 \theta}{\sin^4 \theta + \cos^4 \theta + 2\cos^2 \theta \sin^2 \theta}$$

$$= \frac{-\cos^2 \theta \cdot \sin^2 \theta}{1 - 2\sin^2 \theta \cdot \cos^2 \theta + 2\cos^2 \theta \cdot \sin^2 \theta}$$

$$= -\cos^2 \theta \cdot \sin^2 \theta$$

38. Sol. (b)

$$2\sqrt{2}\sin 10^\circ$$

$$\left(\frac{1}{2\cos 5^\circ} + \frac{\cos 40^\circ}{\sin 5^\circ} - 2\sin 35^\circ \right)$$

$$\Rightarrow 2\sqrt{2}\sin 10^\circ$$

$$\left(\frac{\sin 5^\circ + 2\cos 5^\circ \cos 40^\circ - 2\sin 35^\circ \cdot 2\sin 5^\circ \cos 5^\circ}{2\sin 5^\circ \cos 5^\circ} \right)$$

$$\text{Using formula, } 2\cos A \cos B = \cos(A + B) + \cos(A - B)$$

$$\Rightarrow 2\sqrt{2}\sin 10^\circ$$

$$\left(\frac{\sin 5^\circ + \cos 45^\circ + \cos 35^\circ - 2\sin 35^\circ \sin 10^\circ}{\sin 10^\circ} \right)$$

$$\Rightarrow 2\sqrt{2}(\sin 5^\circ + \cos 45^\circ + \cos 35^\circ - 2\sin 35^\circ \cdot \sin 10^\circ)$$

$$\Rightarrow 2\sqrt{2}$$

$$\left[\sin 5^\circ + \frac{1}{\sqrt{2}} + \cos 35^\circ - (\cos 25^\circ - \cos 45^\circ) \right]$$

$$\Rightarrow 2\sqrt{2}$$

$$\left[\sin 5^\circ + \frac{1}{\sqrt{2}} + \cos 35^\circ - \cos 25^\circ + \frac{1}{\sqrt{2}} \right]$$

$$\Rightarrow 2\sqrt{2} \left[\sin 5^\circ + \cos 35^\circ - \cos 25^\circ + \frac{2}{\sqrt{2}} \right]$$

$$\Rightarrow 2\sqrt{2} \left[\sin 5^\circ - 2\sin 30^\circ \cdot \sin 5^\circ + \frac{2}{\sqrt{2}} \right]$$

$$\Rightarrow 2\sqrt{2}[\sin 5^\circ - \sin 5^\circ + \sqrt{2}] = 4$$

39. Sol. (c)

$$\sin(x + 3\alpha) = 3\sin(\alpha - x)$$

$$\Rightarrow \sin x \cos 3\alpha + \cos x \sin 3\alpha = 3$$

$$(\sin \alpha \cos x - \cos \alpha \sin x)$$

$$\Rightarrow \sin x \cos \alpha + 3\sin x \cos \alpha = 3$$

$$\sin \alpha \cos x - \cos x \sin 3\alpha$$

$$\Rightarrow \sin x [\cos 3\alpha + 3\cos \alpha] = \cos x$$

$$[3\sin \alpha - \sin 3\alpha]$$

$$\Rightarrow \sin x \times 4 \cos^2 \alpha = \cos x \cdot 4 \sin^2 \alpha$$

$$[\because \sin 3\theta = 3\sin\theta - 4\sin^3\theta] \&$$

$$[\cos 3\theta = 4\cos^3\theta - 3\cos\theta]$$

$$\Rightarrow \tan x = \tan^3 \alpha$$

40. Sol. (c)

$$\tan 2A = \tan(A+B+A-B)$$

$$= \frac{\tan(A+B) + \tan(A-B)}{1 - \tan(A+B) \cdot \tan(A-B)} = \frac{p+q}{1-pq}$$

41. Sol. (c)

$$\cos(36^\circ - A)\cos(36^\circ + A) + \cos(54^\circ - A)\cos(54^\circ + A)$$

$\Rightarrow$ Using,

$$\cos(A+B)\cos(A-B) = \cos^2 A - \sin^2 B$$

$$\Rightarrow \cos^2 36^\circ - \sin^2 A + \cos^2 54^\circ - \sin^2 A$$

$$\Rightarrow \cos^2 36^\circ - \sin^2 A + \sin^2 36^\circ - \sin^2 A$$

$$\Rightarrow 1 - 2\sin^2 A$$

$$\Rightarrow \cos 2A$$

42. Sol. (d)

$$\tan(A+B+C)$$

$$= \frac{\tan A + \tan B + \tan C - \tan A \tan B \tan C}{1 - \tan A \tan B - \tan B \tan C - \tan C \tan A}$$

In a right angled triangle, right angled at C.

$$\Rightarrow \angle C = \angle A + \angle B = 90^\circ$$

$$\Rightarrow \angle A + \angle B - \angle C = 0^\circ$$

$$\tan(A+B+C) = \tan 0^\circ = 0$$

$$\tan(A+B-C)$$

$$= \frac{\tan A + \tan B + \tan C - \tan A \tan B \tan C}{1 - \tan A \tan B - \tan B \tan C - \tan C \tan A}$$

$$\tan A + \tan B - \tan C + \tan A \tan B \tan C = 0$$

$$\tan A + \tan B - \tan C = -\tan A \tan B \tan C$$

$$\tan C - \tan A - \tan B = \tan A \tan B \tan C$$

43. Sol. (b)

$$\frac{\sin^8 \theta - \cos^8 \theta}{\cos 2\theta(1 + \cos^2 2\theta)}$$

$$= \frac{(\sin^4 \theta + \cos^4 \theta)(\sin^2 \theta - \cos^2 \theta)(\sin^2 \theta + \cos^2 \theta)}{(\cos^2 \theta - \sin^2 \theta)(1 + (\cos^2 \theta - \sin^2 \theta))^2}$$

$$= -\frac{(\sin^4 \theta + \cos^4 \theta)}{(1 + \cos^4 \theta + \sin^4 \theta - 2\sin^2 \theta \cdot \cos^2 \theta)}$$

We can say

$$\sin^4 \theta + \cos^4 \theta = (\sin^2 \theta + \cos^2 \theta)^2 -$$

$$2\sin^2 \theta \cos^2 \theta$$

$$= -\frac{(1 - 2\sin^2 \theta \cdot \cos^2 \theta)}{(1 + 1 - 2\sin^2 \theta \cdot \cos^2 \theta - 2\sin^2 \theta \cdot \cos^2 \theta)}$$

$$= -\frac{1}{2}$$

44. Sol. (b)

$$\frac{\sec \theta (\sin \theta - 2\sin^3 \theta)}{2\cos^3 \theta - \cos \theta} \Rightarrow \frac{\sec \theta \times \sin \theta (1 - 2\sin^2 \theta)}{\cos \theta (2\cos^2 \theta - 1)}$$

$$\Rightarrow \frac{\sec \theta \times \sin \theta (\cos 2\theta)}{\cos \theta (\cos 2\theta)}$$

$$\Rightarrow \sec \theta \times \tan \theta.$$

45. Sol. (b)

$$\frac{[1 - \tan(90^\circ - \theta) + \sec(90^\circ - \theta)]}{[\tan(90^\circ - \theta) + \sec(90^\circ - \theta) + 1]}$$

$$\Rightarrow \frac{[1 - \cot \theta + \operatorname{cosec} \theta]}{[\cot \theta + \operatorname{cosec} \theta + 1]}$$

$$\Rightarrow \frac{\left[1 - \frac{\cos \theta}{\sin \theta} + \frac{1}{\sin \theta}\right]}{\left[\frac{\cos \theta}{\sin \theta} + \frac{1}{\sin \theta} + 1\right]}$$

$$\Rightarrow \frac{[\sin \theta - \cos \theta + 1]}{[\sin \theta + \cos \theta + 1]}$$

$$\Rightarrow \frac{(\sin \theta + 1) - \cos \theta}{(\sin \theta + 1) + \cos \theta}$$

$$\left[\begin{aligned} \sin \theta &= 2 \sin \frac{\theta}{2} \cos \frac{\theta}{2} \\ \cos \theta &= 1 - 2 \sin^2 \frac{\theta}{2} \\ \cos \frac{\theta}{2} &= 2 \cos^2 \frac{\theta}{2} - 1 \end{aligned} \right]$$

$$\Rightarrow \frac{2\sin\frac{\theta}{2}\cos\frac{\theta}{2} + 1 - 1 + 2\sin^2\frac{\theta}{2}}{2\sin\frac{\theta}{2}\cos\frac{\theta}{2} + 1 + 2\cos^2\frac{\theta}{2} - 1}$$

$$\Rightarrow \frac{2\sin\frac{\theta}{2}\left(\sin\frac{\theta}{2} + \cos\frac{\theta}{2}\right)}{2\cos\frac{\theta}{2}\left(\sin\frac{\theta}{2} + \cos\frac{\theta}{2}\right)} \Rightarrow \tan\left(\frac{\theta}{2}\right)$$

46. Sol. (a)

$$\frac{1 + \tan^2 \theta \sec^2 \theta + \tan^2 \theta}{\tan \theta - \tan^3 \theta}$$

$$\frac{\sec^2 \theta + \tan^2 \theta \cdot \sec^2 \theta}{\tan \theta - \tan^3 \theta}$$

$$\frac{\sec^2 \theta (1 + \tan^2 \theta)}{\tan \theta (1 - \tan^2 \theta)} \quad \left[\because \cos 2\theta = \frac{1 - \tan^2 \theta}{1 + \tan^2 \theta} \right]$$

$$= \frac{\sec^2 \theta \times 1}{\tan \theta \times \cos^2 \theta}$$

$$= \frac{1 + \tan^2 \theta}{\frac{1}{2} \times 2 \tan \theta \cdot \cos 2\theta} \quad \left[\sin 2\theta = \frac{2 \tan \theta}{1 + \tan^2 \theta} \right]$$

$$= \frac{2}{\frac{1}{2} \sin 2\theta \cos 2\theta}$$

$$= \frac{4}{\sin 4\theta} = 4 \operatorname{cosec} 4\theta$$

47. Sol. (c)

Statement (1) $\sqrt{\frac{1 - \cos \theta}{1 + \cos \theta}} = \operatorname{cosec} \theta - \cot \theta$

$$\Rightarrow \sqrt{\frac{2\sin^2 \theta / 2}{2\cos^2 \theta / 2}} = \frac{1}{\sin \theta} - \frac{\cos \theta}{\sin \theta}$$

$$\Rightarrow \sqrt{\tan^2 \theta / 2} = \frac{1 - \cos \theta}{\sin \theta} = \frac{2\sin^2 \frac{\theta}{2}}{2\sin \frac{\theta}{2} \cos \frac{\theta}{2}}$$

$$\Rightarrow \tan \frac{\theta}{2} = \tan \frac{\theta}{2}$$

Hence, (1) is identity

(2) Statement $\sqrt{\frac{1 + \cos \theta}{1 - \cos \theta}} = \operatorname{cosec} \theta + \cot \theta$

$$\sqrt{\frac{2\cos^2 \frac{\theta}{2}}{2\sin^2 \frac{\theta}{2}}} = \frac{1}{\sin \theta} + \frac{\cos \theta}{\sin \theta} = \frac{1 + \cos \theta}{\sin \theta}$$

$$= \frac{2\cos^2 \frac{\theta}{2}}{2\sin \frac{\theta}{2} \cos \frac{\theta}{2}}$$

$$\sqrt{\cot^2 \frac{\theta}{2}} = \cot^2 \frac{\theta}{2}$$

$$\Rightarrow \cot \frac{\theta}{2} = \cot \frac{\theta}{2}$$

Hence, (2) is also identity

 $\therefore$ option (c) is correct.

48. Sol. (a)

$$\frac{\sin A}{1 + \cos A} + \frac{1 + \cos A}{\sin A}$$

$$= \frac{\sin^2 A + (1 + \cos A)^2}{(1 + \cos A) \sin A}$$

$$= \frac{\sin^2 A + 1 + \cos^2 A + 2\cos A}{(1 + \cos A) \sin A}$$

$$= \frac{2 + 2\cos A}{(1 + \cos A) \sin A} \Rightarrow 2 \operatorname{cosec} A$$

49. Sol. (a)

$$\sin 73^\circ + \cos 137^\circ$$

$$\cos 137^\circ = \cos(90^\circ + 47^\circ) = -\sin 47^\circ$$

$$\sin 73^\circ - \sin 47^\circ = 2\cos\left(\frac{A+B}{2}\right)\sin\left(\frac{A-B}{2}\right)$$

$$= 2\cos\left(\frac{73+47}{2}\right) \cdot \sin\left(\frac{73-47}{2}\right)$$

$$= 2\cos\left(\frac{120^\circ}{2}\right)\sin\left(\frac{26^\circ}{2}\right)$$

$$= 2\cos 60^\circ \cdot \sin 13^\circ$$

$$= 2 \times \frac{1}{2} \times \sin 13^\circ = \sin 13^\circ$$

50. Sol. (c)

$$\frac{[2\cot(\pi - A) / 2]}{[1 + \tan^2(2\pi - a) / 2]}$$

$$\Rightarrow \frac{2 \cot(\pi/2 - A/2)}{1 + \tan^2(\pi - A/2)}$$

$$\Rightarrow \frac{2 \tan A/2}{1 + \tan^2 A/2}$$

$$\Rightarrow \sin A \left[\because \sin A = \frac{2 \tan A/2}{1 + \tan^2 A/2} \right]$$

51. Sol. (a)

$$\frac{\sin(78^\circ + \theta) - \cos(12^\circ - \theta) + \tan^2 70^\circ - \operatorname{cosec}^2 20^\circ}{\sin 25^\circ \cdot \cos 65^\circ + \cos 25^\circ \cdot \sin 65^\circ}$$

$$\frac{\cos(12^\circ - \theta) - \cos(12^\circ - \theta) + \cot^2 20^\circ - \operatorname{cosec}^2 20^\circ}{\sin(25^\circ + 65^\circ)}$$

$$= \frac{-1}{1} = -1$$

52. Sol. (c)

$$\tan \alpha + 2 \tan 2\alpha + 4 \tan 4\alpha + \frac{8(1 - \tan^2 4\alpha)}{2 \tan 4\alpha}$$

$$\left(\because \cot 2\theta = \frac{1 - \tan^2 \theta}{2 \tan \theta} \right)$$

$$= \tan \alpha + 2 \tan 2\alpha + \frac{8 \tan^2 4\alpha + 8 - 8 \tan^2 4\alpha}{2 \tan 4\alpha}$$

$$= \tan \alpha + 2 \tan 2\alpha + \frac{4}{\tan 4\alpha}$$

$$= \tan \alpha + 2 \tan 2\alpha + \frac{4(1 - \tan^2 2\alpha)}{2 \tan 2\alpha}$$

$$= \tan \alpha + \frac{4 \tan^2 2\alpha + 4 - 4 \tan^2 2\alpha}{2 \tan 2\alpha}$$

$$= \tan \alpha + \frac{2}{\tan 2\alpha}$$

$$= \tan \alpha + \frac{2(1 - \tan^2 \alpha)}{2 \tan \alpha}$$

$$= \frac{2 \tan^2 \alpha + 2 - 2 \tan^2 \alpha}{2 \tan \alpha}$$

$$= \frac{1}{\tan \alpha} = \cot \alpha$$

53. Sol. (c)

$$\frac{[\sin(90^\circ - A) + \cos(180^\circ - 2A)]}{[\cos(90^\circ - 2A) + \sin(180^\circ - A)]}$$

$$\Rightarrow \frac{\cos A + (-\cos 2A)}{\sin 2A + \sin A}$$

$$\Rightarrow \frac{\cos A - \cos 2A}{\sin 2A + \sin A}$$

$$\Rightarrow \frac{-2 \sin\left(\frac{A+2A}{2}\right) \times \sin\left(\frac{A-2A}{2}\right)}{2 \sin\left(\frac{A+2A}{2}\right) \times \cos\left(\frac{2A-A}{2}\right)}$$

$$\Rightarrow \frac{-\sin\left(\frac{A-2A}{2}\right)}{\cos\left(\frac{2A-A}{2}\right)} \Rightarrow \frac{\sin\left(\frac{2A-A}{2}\right)}{\cos\left(\frac{2A-A}{2}\right)}$$

$$\Rightarrow \frac{\sin(A/2)}{\cos(A/2)} \Rightarrow \tan(A/2)$$

Type-6 (Identities)

1. $\frac{1+\cot^2 A}{1+\tan^2 A} =$

[Higher Secondary 2023]

- (a) $\cos^2 A$ (b) $\tan^2 A$
(c) $\cot^2 A$ (d) $\sec^2 A \tan^2 A$

2. $16\sec^2 A - 16\tan^2 A =$

SSC CPO 09/11/2022 (Morning).

- (a) 9 (b) 0 (c) 16 (d) 1

3. What is the value of

$$(1+\cot^2 \theta)(1+\cos \theta)(1-\cos \theta) - (1+\tan^2 \theta)(1+\sin \theta)(1-\sin \theta)?$$

[CDS-2023]

- (a) -1 (b) 0 (c) 1 (d) 2

4. Solve the following equation $\sec^2 \theta \sqrt{1-\sin^2 \theta} ?$

SSC CPO 10/11/2022

- (a) $\tan \theta$ (b) $\operatorname{cosec} \theta$
(c) $\sec \theta$ (d) 1

5. Which of the following is equal to $\left[\frac{\cos \theta}{\sin \theta} + \frac{\sin \theta}{\cos \theta} \right] ?$

SSC CGL Tier II 08/08/2022

- (a) $\operatorname{cosec} \theta \cdot \sec \theta$ (b) $\sec \theta \cdot \tan \theta$
(c) $\operatorname{cosec} \theta \cdot \tan \theta$ (d) $\cot \theta \cdot \sec \theta$

6. $\cos A(\sec A - \cos A)(\cot A + \tan A) = ?$

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- (a) $\tan A$ (b) $\cot A$
(c) $\sec A$ (d) $\sin A$

7. If $(\sec \alpha + \tan \alpha)(\sec \beta + \tan \beta)(\sec \gamma + \tan \gamma) = (\sec \alpha - \tan \alpha)(\sec \beta - \tan \beta)(\sec \gamma - \tan \gamma)$, then each of the side is equal to

- (a) ± 1 (b) -1 (c) +1 (d) 4

8. If $\sqrt{3}\tan \theta = 3\sin \theta$, then what is the value of $\sin^2 \theta - \cos^2 \theta ?$

SSC CGL Tier II 08/08/2022

- (a) $1/5$ (b) $1/4$ (c) $1/2$ (d) $1/3$

9. If $r \sin \theta = 1$, and $r \cos \theta = \sqrt{3}$

Then the value of

$$(\sqrt{3}\tan \theta + 1) \text{ And } r$$

- (a) 2 (b) 1 (c) 4 (d) 3

10. If $\sin^2 \theta \cos^2 \theta = \frac{2}{9}$, then what will be the value of $\operatorname{cosec}^2 \theta + \sec^2 \theta ?$

SSC CGL 09/12/2022 (3rd Shift)

- (a) $\frac{7}{2}$ (b) $\frac{5}{2}$ (c) $\frac{9}{2}$ (d) $\frac{9}{\sqrt{2}}$

11. Evaluate the following expression in terms of trigonometric ratios.

$$\frac{\sec A - \tan A}{\sec A + \tan A}$$

[DP Head Constable 18/10/2022]

- (a) $1 + 2\tan^2 A + 2\sec A \tan A$
(b) $1 + 2\sec^2 A - 2\sec A \tan A$
(c) $1 + 2\tan^2 A - 2\sec A \tan A$
(d) $1 + 2\sec^2 A + 2\sec A \tan A$

12. $\frac{2\sin \theta}{\sqrt{4-4\sin^2 \theta}} = \dots\dots\dots$

Graduate Level 04/08/2022(Shift-4)

- (a) $\tan \theta$ (b) $2\tan \theta$
(c) $\cot \theta$ (d) $2\cot \theta$

13. What is $\sqrt{\frac{\sec x - \tan x}{\sec x + \tan x}}$ equal to ?

[CDS 2020-I]

- (a) $\frac{1}{\sin x + \cos x}$ (b) $\frac{1}{\tan x + \cot x}$
(c) $\frac{1}{\sec x + \tan x}$ (d) $\frac{1}{\operatorname{cosec} x + \cot x}$

14. The value of $\sin 18^\circ$ is given as $\frac{\sqrt{5}-1}{4}$. Using this value, find the value of $\cos 18^\circ$

SSC CHSL 30/05/2022 (Afternoon)

- (a) $\frac{\sqrt{10+2\sqrt{5}}}{4}$ (b) $\frac{\sqrt{5}+1}{4}$
(c) $\frac{\sqrt{6}+\sqrt{2}}{4}$ (d) $\frac{\sqrt{10-2\sqrt{5}}}{4}$

15. Which of the following is equal to $\left(\frac{1}{\tan \theta} + \tan \theta\right)$

- (a) $\sec \theta \cdot \csc \theta$
(b) 1
(c) $\frac{\csc \theta}{\sec \theta}$
(d) $\tan^2 \theta$

(SSC CGL Tier-II (CBE) Exam 08.08.2022)

16. Evaluate the expression $\frac{\sin^2 63^\circ + \sin^2 27^\circ}{\cos^2 17^\circ + \cos^2 73^\circ}$

SSC CGL 08/12/2022 (Shift- 04)

- (a) 0 (b) 3 (c) 1 (d) 2

17. The value of $(2\cos^2 \theta - 1) \left[\frac{1+\tan \theta}{1-\tan \theta} + \frac{1-\tan \theta}{1+\tan \theta} \right]$ is;

SSC CPO 09/11/2022 (Morning)

- (a) 2 (b) 0 (c) $\frac{\sqrt{3}}{2}$ (d) $\frac{2}{1}$

18. $\frac{(1+\cos \theta)^2 + \sin^2 \theta}{(\csc^2 \theta - 1)\sin^2 \theta} = ?$

SSC CGL TIER II (11/09/2019)

- (a) $\cos \theta (1 + \sin \theta)$
(b) $2\cos \theta (1 + \sec \theta)$
(c) $\sec \theta (1 + \sin \theta)$
(d) $2\sec \theta (1 + \sec \theta)$

19. The Expression

$$\frac{\cos^4 \theta - \sin^4 \theta + 2\sin^2 \theta + 3}{(\csc \theta + \cot \theta + 1)(\csc \theta - \cot \theta + 1)} - 2$$

$0^\circ < \theta < 90^\circ$ is equal to

SSC CGL Tier II 03/02/2022

- (a) $\frac{1}{2} \sin \theta$ (b) $2 \sin \theta$
(c) $\sec \theta$ (d) $2 \csc \theta$

20. The value of

$$\frac{\cos^6 \theta + \sin^6 \theta + 3\sin^2 \theta \cos^2 \theta}{\csc \theta \sec \theta (\sin \theta + \cos \theta - 1)(\sin \theta + \cos \theta + 1)}$$
 is :

SSC CGL Tier -II Exam 15.11.2020

- (a) 3 (b) 2 (c) 1 (d) $\frac{1}{2}$

21. If $\frac{\sec^2 70^\circ - \cot^2 20^\circ}{2(\csc^2 59^\circ - \tan^2 31^\circ)} = \frac{2}{m}$ then m is equal to:

- (a) 2 (b) 3 (c) 4 (d) 1

22. If $\tan^2 \theta + \tan^4 \theta = 1$, then:

SSC CGL 13/12/2022 (3rd Shift)

- (a) $\cot^2 \theta + \cot^4 \theta = 1$
(b) $\cos^2 \theta + \cos^4 \theta = 1$
(c) $\sin^2 \theta + \sin^4 \theta = 1$
(d) $\csc^2 \theta + \sec^4 \theta = 1$

23. If $x + y = 90^\circ$, then what is $\sqrt{\cos x \cdot \csc y - \cos x \cdot \sin y}$ equal to?

- (a) $\cos x$ (b) $\sin x$
(c) $\sqrt{\cos x}$ (d) $\sqrt{\sin x}$

24. Find the value of

$$\frac{\sec \theta + \tan \theta - 1}{\tan \theta - \sec \theta + 1}$$

- (a) $\frac{\cos^3 \theta}{1 - \sin \theta}$ (b) $\frac{\cos \theta}{1 - \sin \theta}$
(c) $\frac{\cos^2 \theta}{1 - \sin \theta}$ (d) None

25. $\sin^4 \theta + \cos^4 \theta$ in terms of $\sin \theta$ can be written as:

SSC CGL 03/12/2022 (2nd Shift)

- (a) $2\sin^4 \theta + 2\sin^2 \theta - 1$
(b) $2\sin^4 \theta - 2\sin^2 \theta$
(c) $2\sin^4 \theta - 2\sin^2 \theta - 1$

(d) $2\sin^4 \theta - 2\sin^2 \theta + 1$

26. Which of the following is equal to $\left[\frac{\tan \theta + \sec \theta - 1}{\tan \theta - \sec \theta + 1} \right]$?

[(SSC CGL Tier-II (CBE) Exam, 08/08/2022)]

- (a) $\frac{1+\sin \theta}{\cos \theta}$ (b) $\frac{1+\tan \theta}{\cot \theta}$
(c) $\frac{1+\cot \theta}{\tan \theta}$ (d) $\frac{1+\cos \theta}{\sin \theta}$

27. $\left(\frac{\tan^3 \theta}{\sec^2 \theta} + \frac{\cot^3 \theta}{\csc^2 \theta} + 2 \sin \theta \cos \theta \right) \div (1 + \csc^2 \theta + \tan^2 \theta)$, $0^\circ < \theta < 90^\circ$, is equal to :

- (a) $\csc \theta \sec \theta$ (b) $\csc \theta$
(c) $\sin \theta \cos \theta$ (d) $\sec \theta$

[(SSC CGL Tier-II (CBE) Exam. 29.01.2022)]

28. Which of the following is equal to $\frac{1}{\tan \theta} + \tan \theta$?

SSC CGL Tier II 08/08/2022

- (a) $\sec \theta \cdot \csc \theta$ (b) 1
(c) $\frac{\csc \theta}{\sec \theta}$ (d) $\tan^2 \theta$

29. Find the value of

$$\sin^4 30^\circ + \cos^4 30^\circ - \sin 25^\circ \cos 65^\circ - \sin 65^\circ \cdot \cos 25^\circ$$

SSC CGL 18/08/2021 (Morning)

- (a) $5/8$ (b) $-3/8$ (c) $13/8$ (d) 0

30. The value of $\tan(63^\circ - \theta) - \cot(27^\circ + \theta) + \frac{\csc^2 70^\circ - \tan^2 20^\circ}{\sec^2 37^\circ - \cot^2 53^\circ}$ is:

[(SSC CHSL (10 + 2) 19/10/2020)]

- (a) 2 (b) 3 (c) 0 (d) 1

31. if $29 \tan \theta = 31$, find the value of $\frac{1+2\sin \theta \cos \theta}{1-2\sin \theta \cos \theta}$

- (a) 900 (b) 300 (c) 500 (d) 600

32. Given that A and B are second quadrant angles, $\sin A = \frac{1}{3}$ and $\sin B = \frac{1}{5}$ then find the value of $\cos(A - B)$.

SSC CPO 09/11/2022 (Evening)

- (a) $\frac{4\sqrt{3}+1}{15}$ (b) $\frac{8\sqrt{3}-1}{15}$
(c) $\frac{8\sqrt{3}+1}{15}$ (d) $\frac{4\sqrt{3}-1}{15}$

33. $\left(\frac{1}{\cos \theta} - \frac{1}{\sin \theta} \right) + \frac{1}{\csc \theta - \cot \theta} - \frac{1}{\sec \theta + \tan \theta} = ?$

SSC CGL Tier-II Exam, 15.11.2020

- (a) $\sin \theta \cos \theta$ (b) $\sin \theta \tan \theta$
(c) $\sec \theta \csc \theta$ (d) $\csc \theta \cot \theta$

34. If $p = \sec \theta - \tan \theta$ and $q = \csc \theta + \cot \theta$, then what is $p + q(p - 1)$ equal to?

[CDS 2021-I]

- (a) -1 (b) 0 (c) 1 (d) 2

Type-6 ANSWER KEY

1	C	2	C	3	B	4	C	5	A	6	A	7	A	8	D
9	A	10	C	11	C	12	A	13	C	14	A	15	A	16	C
17	A	18	D	19	B	20	D	21	C	22	A	23	B	24	*
25	D	26	A	27	C	28	A	29	B	30	D	31	A	32	C
33	C	34	A												

Type-6 (Identities) Solution

1. Sol. (c).

$$\frac{1+\cot^2 A}{1+\tan^2 A} = \frac{\operatorname{cosec}^2 A}{\sec^2 A} = \cot^2 A$$

2. Sol. (c).

$$16\sec^2 A - 16\tan^2 A = 16(\sec^2 A - \tan^2 A) \\ = 16 \times 1 = 16 \text{ [As, } \sec^2 A - \tan^2 A = 1]$$

3. Sol. (b)

$$(1+\cot^2 \theta)(1+\cos \theta)(1-\cos \theta) - (1+\tan^2 \theta)(1+\sin \theta)(1-\sin \theta) \\ \operatorname{cosec}^2 \theta (1-\cos^2 \theta) - \sec^2 \theta (1-\sin^2 \theta)$$

$$\left[\because 1+\tan^2 \theta = \sec^2 \theta \right] \\ \left[1+\cot^2 \theta = \operatorname{cosec}^2 \theta \right]$$

$$\operatorname{cosec}^2 \theta \sin^2 \theta - \sec^2 \theta \cos^2 \theta \quad \left[\because \sin^2 \theta + \cos^2 \theta = 1 \right] \\ \Rightarrow 1 - 1 = 0$$

4. Sol. (c)

$$\sec^2 \theta (\sqrt{1-\sin^2 \theta}) \\ = \sec^2 \theta \times \sqrt{\cos^2 \theta} = \sec^2 \theta \times \cos \theta = \sec \theta$$

5. Sol. (a)

$$\left[\frac{\cos \theta}{\sin \theta} + \frac{\sin \theta}{\cos \theta} \right] \\ = \frac{\cos^2 \theta + \sin^2 \theta}{\sin \theta \times \cos \theta} \\ = \frac{1}{\sin \theta \times \cos \theta} \Rightarrow \operatorname{cosec} \theta \cdot \sec \theta$$

6. Sol. (a)

The expression

$$= \cos A (\sec A - \cos A)(\cot A + \tan A) \\ = \cos A \left(\frac{1}{\cos A} - \cos A \right) \left(\frac{\cos A}{\sin A} + \frac{\sin A}{\cos A} \right) \\ = \frac{\cos A (1 - \cos^2 A)(\cos^2 A + \sin^2 A)}{\cos A \cdot \sin A \cdot \cos A} \\ = \frac{\sin^2 A}{\sin A \cdot \cos A} \quad \left[\because 1 - \cos^2 \theta = \sin^2 \theta \right] \\ = \tan \theta$$

7. Sol. (a)

$$k = (\sec \alpha + \tan \alpha)(\sec \beta + \tan \beta)(\sec \gamma + \tan \gamma) \quad \dots (i)$$

$$k = (\sec \alpha - \tan \alpha)(\sec \beta - \tan \beta)(\sec \gamma - \tan \gamma) \quad \dots (ii)$$

Multiplying equation (i) & (ii)

$$k^2 = (\sec^2 \alpha - \tan^2 \alpha)(\sec^2 \beta - \tan^2 \beta) \\ (\sec^2 \gamma - \tan^2 \gamma)$$

$$k^2 = 1 \Rightarrow k = \pm 1$$

8. Sol. (d)

$$\sqrt{3} \tan \theta = 3 \sin \theta \\ \Rightarrow \frac{\tan \theta}{\sin \theta} = \frac{3}{\sqrt{3}} = \sqrt{3} \Rightarrow \frac{1}{\cos \theta} = \sqrt{3} \\ \Rightarrow \cos^2 \theta = \left(\frac{1}{\sqrt{3}} \right)^2 = \frac{1}{3}$$

As per trigonometric identities, we have

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$\Rightarrow \sin^2 \theta = 1 - \frac{1}{3} = \frac{2}{3}$$

$$\text{So, } \sin^2 \theta - \cos^2 \theta = \frac{2}{3} - \frac{1}{3} = \frac{1}{3}$$

9. Sol. (a)

$$r \sin \theta = 1 \quad \dots (i)$$

$$r \cos \theta = \sqrt{3} \quad \dots (ii)$$

$$(i)^2 + (ii)^2$$

$$(r \sin \theta)^2 + (r \cos \theta)^2 = (1)^2 + (\sqrt{3})^2$$

$$r^2 \sin^2 \theta + r^2 \cos^2 \theta = 1 + 3$$

$$r^2 (\sin^2 \theta + \cos^2 \theta) = 4$$

$$r^2 = 4$$

$$r = 2$$

$$(i) / (ii)$$

$$\frac{r \sin \theta}{r \cos \theta} = \frac{1}{\sqrt{3}}$$

$$\tan \theta = \frac{1}{\sqrt{3}}$$

$$\text{Now, } (\sqrt{3} \tan \theta + 1)$$

$$\text{Put the value of } \tan \theta$$

$$= \sqrt{3} \times \frac{1}{\sqrt{3}} + 1 = 2$$

10. Sol. (c)

$$\operatorname{cosec}^2 \theta + \sec^2 \theta = \frac{1}{\sin^2 \theta} + \frac{1}{\cos^2 \theta}$$

$$= \frac{\sin^2 \theta + \cos^2 \theta}{\sin^2 \theta \cos^2 \theta} = \frac{1}{\frac{2}{9}} = \frac{9}{2}$$

11. Sol. (c)

$$\begin{aligned} & \frac{(\sec A - \tan A)(\sec A - \tan A)}{(\sec A + \tan A)(\sec A - \tan A)} \\ & \frac{(\sec A - \tan A)^2}{\sec^2 A - \tan^2 A} = [\sec^2 A - \tan^2 A = 1] \\ & \Rightarrow \sec^2 A + \tan^2 A - 2\sec A \cdot \tan A \\ & \Rightarrow 1 + \tan^2 A + \tan^2 A - 2\sec A \cdot \tan A \\ & \Rightarrow 1 + 2\tan^2 A - 2\sec A \cdot \tan A \end{aligned}$$

12. Sol. (a)

$$\begin{aligned} & \frac{2\sin \theta}{\sqrt{4-4\sin^2 \theta}} \\ & = \frac{2\sin \theta}{\sqrt{4(1-\sin^2 \theta)}} \\ & = \frac{2\sin \theta}{\sqrt{4\cos^2 \theta}} = \frac{2\sin \theta}{2\cos \theta} = \tan \theta \end{aligned}$$

13. Sol. (c)

$$\begin{aligned} & \sqrt{\frac{\sec x - \tan x}{\sec x + \tan x}} = \sqrt{\frac{\sec^2 x - \tan^2 x}{(\sec x + \tan x)^2}} \\ & \sqrt{\frac{1}{(\sec x + \tan x)^2}} = \frac{1}{\sec x + \tan x} \\ & \therefore \sec^2 x - \tan^2 x = 1 \end{aligned}$$

14. Sol. (a)

As we know that,
 $\sin^2 \theta + \cos^2 \theta = 1$

$$\begin{aligned} \cos^2 18^\circ &= 1 - \left(\frac{\sqrt{5}-1}{4}\right)^2 \\ &= \frac{16 - (5 + 1 - 2\sqrt{5})}{16} = \frac{10 + 2\sqrt{5}}{16} \\ \cos 18^\circ &= \frac{\sqrt{10 + 2\sqrt{5}}}{4} \end{aligned}$$

15. Sol. (1)

$$\begin{aligned} \text{Expression} &= \frac{1}{\tan \theta} + \tan \theta = \\ & \cot \theta + \tan \theta \\ &= \frac{\cos \theta}{\sin \theta} + \frac{\sin \theta}{\cos \theta} \\ &= \frac{\cos^2 \theta + \sin^2 \theta}{\sin \theta \cdot \cos \theta} = \frac{1}{\sin \theta} \cdot \frac{1}{\cos \theta} \\ &= \sec \theta \cdot \operatorname{cosec} \theta \end{aligned}$$

16. Sol. (c)

We know that

$$\begin{aligned} \sin(90 - \theta) &= \cos \theta \text{ and } \cos(90 - \theta) \\ &= \sin \theta, \text{ also, } \sin^2 \theta + \cos^2 \theta = 1 \end{aligned}$$

$$\begin{aligned} \text{consider, } & \frac{\sin^2 63^\circ + \sin^2 27^\circ}{\cos^2 17^\circ + \cos^2 73^\circ} \\ & \frac{\sin^2(90-27) + \sin^2 27^\circ}{\cos^2(90-73) + \cos^2 73^\circ} \end{aligned}$$

$$\frac{\cos^2 27^\circ + \sin^2 27^\circ}{\sin 27^\circ + \cos^2 27^\circ} = \frac{1}{1}$$

17. Sol. (a)

$$\begin{aligned} & (2\cos^2 \theta - 1) \left[\frac{1+\tan \theta}{1-\tan \theta} + \frac{1-\tan \theta}{1+\tan \theta} \right] \\ &= \cos 2\theta \left[\frac{(1+\tan \theta)^2 + (1-\tan \theta)^2}{1-\tan^2 \theta} \right] \\ & (\because \cos 2\theta = \cos^2 \theta - \sin^2 \theta = 2\cos^2 \theta - 1) \\ &= \cos 2\theta \left[\frac{2(1+\tan^2 \theta)}{1-\tan^2 \theta} \right] \\ &= \cos 2\theta \left[\frac{2(\cos^2 \theta + \sin^2 \theta)}{\cos^2 \theta - \sin^2 \theta} \right] \\ &= \cos 2\theta \times \frac{2}{\cos 2\theta} = 2 \end{aligned}$$

18. Sol. (d)

$$\begin{aligned} & \frac{(1+\cos \theta)^2 + \sin^2 \theta}{(\operatorname{cosec}^2 \theta - 1)\sin^2 \theta} \\ & \Rightarrow \frac{1+\cos^2 \theta + 2\cos \theta + \sin^2 \theta}{\cot^2 \theta \cdot \sin^2 \theta} \\ & \Rightarrow \frac{1+1+2\cos \theta}{\frac{\cos^2 \theta}{\sin^2 \theta} \cdot \sin^2 \theta} = \frac{2+2\cos \theta}{\cos^2 \theta} \\ & \Rightarrow \frac{2}{\cos^2 \theta} + \frac{2}{\cos \theta} = 2\sec \theta (1 + \sec \theta) \end{aligned}$$

19. Sol. (b)

$$\begin{aligned} & \frac{\cos^4 \theta - \sin^4 \theta + 2\sin^2 \theta + 3}{(\operatorname{cosec} \theta + \cot \theta + 1)(\operatorname{cosec} \theta - \cot \theta + 1) - 2} \\ &= \frac{\cos^2 \theta - \sin^2 \theta + 2\sin^2 \theta + 3}{(\operatorname{cosec} + 1)^2 - \cot^2 - 2} \\ &= \frac{\cos^2 \theta + \sin^2 \theta + 3}{\operatorname{cosec}^2 \theta + 1 + 2\operatorname{cosec} \theta - \cot^2 \theta - 2} \\ &= \frac{1+3}{1+1+2\operatorname{cosec} \theta - 2} = \frac{4}{2\operatorname{cosec} \theta} = 2\sin \theta \end{aligned}$$

20. Sol. (4)

The expression =

$$\begin{aligned} & \frac{\cos^6 \theta + \sin^6 \theta + 3\sin^2 \theta \cos^2 \theta}{\operatorname{cosec} \theta \sec \theta (\sin \theta + \cos \theta - 1)} \\ & (\sin \theta + \cos \theta + 1) \\ &= \frac{(\cos^2 \theta)^3 + (\sin^2 \theta)^3 + 3\sin^2 \theta \cos^2 \theta (\sin^2 \theta + \cos^2 \theta)}{\frac{1}{\sin \theta \cdot \cos \theta} 1 (\sin \theta + \cos \theta)^2 - 1^2} \\ &= \frac{1(\cos^2 \theta + \sin^2 \theta)^3}{\frac{1}{\sin \theta \cdot \cos \theta} [\sin^2 \theta + \cos^2 \theta + 2\sin \theta \cos \theta - 1]} \\ &= \frac{1}{\frac{1}{\sin \theta \cos \theta} [(1+2\sin \theta(\cos \theta - \theta))]} = \frac{1}{2} \end{aligned}$$

21. Sol. (c)

$$\begin{aligned} & \frac{\sec^2 70^\circ - \cot^2 20^\circ}{2(\operatorname{cosec}^2 59^\circ - \tan^2 31^\circ)} = \frac{2}{m} \\ & \frac{\sec^2 70^\circ - \cot^2 (90-70)}{2(\operatorname{cosec}^2 59^\circ - \tan^2 (90-59))} = \frac{2}{m} \end{aligned}$$

$$\frac{\sec^2 70^\circ - \cot^2 70^\circ}{2(\operatorname{cosec}^2 59^\circ - \cot^2 59^\circ)} = \frac{2}{m}$$

$$\frac{1}{2} = \frac{2}{m} \Rightarrow m = 4$$

22. Sol. (a)

$$\tan^2 \theta + \tan^4 \theta = 1$$

$$\Rightarrow \tan^2 \theta (1 + \tan^2 \theta) = 1$$

$$\Rightarrow \tan^2 \theta \times \sec^2 \theta = 1$$

$$\Rightarrow \frac{\sin^2 \theta}{\cos^4 \theta} = 1 \Rightarrow \sin^2 \theta = \cos^4 \theta$$

$$\Rightarrow 1 - \cos^2 \theta = \cos^4 \theta (\because \sin^2 \theta + \cos^2 \theta = 1)$$

$$\Rightarrow \cos^4 \theta + \cos^2 \theta = 1$$

23. Sol. (b)

$$\sqrt{\cos x \operatorname{cosec} y - \cos x \sin y} (\because x + y = 90^\circ, \text{ given})$$

$$= \sqrt{\cos x \operatorname{cosec}(90^\circ - x) - \cos x \cdot \sin(90^\circ - x)}$$

$$= \sqrt{\cos x \cdot \sec x - \cos^2 x}$$

$$= \sqrt{1 - \cos^2 x} = \sqrt{\sin^2 x} = \sin x$$

24. Sol. (i)

$$\frac{\sec \theta + \tan \theta - 1}{\tan \theta - \sec \theta + 1}$$

$$\Rightarrow \frac{(\sec \theta + \tan \theta) - (\sec^2 \theta - \tan^2 \theta)}{\tan \theta - \sec \theta + 1}$$

$$(\because \sec^2 \theta - \tan^2 \theta = 1)$$

$$\Rightarrow \frac{(\sec \theta + \tan \theta) - (\sec \theta + \tan \theta)(\sec \theta - \tan \theta)}{\tan \theta - \sec \theta + 1}$$

$$\Rightarrow \frac{(\sec \theta + \tan \theta) \times (1 - \sec \theta + \tan \theta)}{(\tan \theta - \sec \theta + 1)}$$

$$\Rightarrow \sec \theta + \tan \theta$$

$$\Rightarrow \frac{1}{\cos \theta} + \frac{\sin \theta}{\cos \theta} = \frac{1 + \sin \theta}{\cos \theta} \times \frac{1 - \sin \theta}{1 - \sin \theta}$$

$$\Rightarrow \frac{1 - \sin^2 \theta}{\cos \theta (1 - \sin \theta)} = \frac{\cos^2 \theta}{\cos \theta (1 - \sin \theta)}$$

25. Sol. (d)

We know that,

$$\cos^2 \theta = (1 - \sin^2 \theta)$$

$$\sin^2 \theta + \cos^2 \theta = 1 \dots \dots \dots \text{eq. (1)}$$

On squaring eq. (1), we get

$$(\sin^2 \theta + \cos^2 \theta)^2 = (1)^2$$

$$\sin^4 \theta + \cos^4 \theta + 2\sin^2 \theta \cos^2 \theta = 1$$

$$\sin^4 \theta + \cos^4 \theta = 1 - 2\sin^2 \theta \cos^2 \theta$$

$$\sin^4 \theta + \cos^4 \theta = 1 - 2\sin^2 \theta (1 - \sin^2 \theta)$$

$$\sin^4 \theta + \cos^4 \theta = 1 - 2\sin^2 \theta + 2\sin^4 \theta$$

26. Sol. (1)

Expression

$$= \frac{\tan \theta + \sec \theta - 1}{\tan \theta - \sec \theta + 1}$$

$$= \frac{(\tan \theta + \sec \theta) - (\sec^2 \theta - \tan^2 \theta)}{\tan \theta - \sec \theta + 1}$$

$$[\because \sec^2 \theta - \tan^2 \theta = 1]$$

$$= \frac{(\tan \theta + \sec \theta) - (\sec \theta + \tan \theta)(\sec \theta - \tan \theta)}{\tan \theta - \sec \theta + 1}$$

$$= \frac{(\tan \theta + \sec \theta) \{1 - (\sec \theta - \tan \theta)\}}{\tan \theta - \sec \theta + 1}$$

$$= \frac{\tan \theta - \sec \theta + 1}{(\tan \theta + \sec \theta)(1 - \sec \theta + \tan \theta)}$$

$$= \frac{\tan \theta - \sec \theta + 1}{\tan \theta - \sec \theta + 1}$$

$$= \tan \theta + \sec \theta$$

$$= \frac{\sin \theta}{\cos \theta} + \frac{1}{\cos \theta}$$

$$= \frac{\sin \theta + 1}{\cos \theta}$$

27. Sol. (c)

$$\left(\frac{\tan^2 \theta}{\sec^2 \theta} + \frac{\cot^3 \theta}{\operatorname{cosec}^2 \theta} + 2\sin \theta \cos \theta \right)$$

$$\div (1 + \operatorname{cosec}^2 \theta + \tan^2 \theta)$$

$$= \left(\frac{\sin^3 \theta}{\cos^3 \theta \sec^2 \theta} + \frac{\cos^3 \theta}{\sin^3 \theta \operatorname{cosec}^2 \theta} + 2\sin \theta \cos \theta \right)$$

$$\div (\sec^2 \theta + \operatorname{cosec}^2 \theta)$$

$$[\because 1 + \tan^2 \theta = \sec^2 \theta]$$

$$= \left(\frac{\sin^3 \theta}{\cos \theta} + \frac{\cos^3 \theta}{\sin \theta} + 2\sin \theta \cos \theta \right)$$

$$+ \left(\frac{1}{\cos^2 \theta} + \frac{1}{\sin^2 \theta} \right)$$

$$[\because \cos \theta \cdot \sec \theta = \sin \theta \cdot \operatorname{cosec} \theta = 1]$$

$$= \left(\frac{\sin^4 \theta + \cos^4 \theta + 2\sin^2 \theta \cos^2 \theta}{\cos \theta \sin \theta} \right)$$

$$+ \left(\frac{\sin^2 \theta + \cos^2 \theta}{\sin^2 \theta \cos^2 \theta} \right)$$

$$\begin{aligned}
 &= \frac{(\sin^2 \theta + \cos^2 \theta)^2}{\cos \theta \cdot \sin \theta} \div \frac{1}{\sin^2 \theta \cdot \cos^2 \theta} \\
 &= \frac{1}{\cos \theta \cdot \sin \theta} \times \frac{1}{\sin^2 \theta \cdot \cos^2 \theta} \\
 &[\because \sin^2 \theta + \cos^2 \theta = 1] \\
 &= \sin \theta \cdot \cos \theta
 \end{aligned}$$

28. Sol. (a)

$$\begin{aligned}
 \frac{1}{\tan \theta} + \tan \theta &= \frac{\cos \theta}{\sin \theta} + \frac{\sin \theta}{\cos \theta} \\
 &= \frac{\cos^2 \theta + \sin^2 \theta}{\sin \theta \times \cos \theta} = \frac{1}{\sin \theta \times \cos \theta} \\
 &= \frac{\sec \theta \times \cos \theta}{1} = \sec \theta \times \cos \theta
 \end{aligned}$$

29. Sol. (b)

$$\begin{aligned}
 &\sin^4 30^\circ + \cos^4 30^\circ - \\
 &\sin 25^\circ \cos 65^\circ - \sin 65^\circ \cos 25^\circ \\
 &\Rightarrow \left(\frac{1}{2}\right)^4 + \left(\frac{\sqrt{3}}{2}\right)^4 - (\sin^2 25^\circ + \cos^2 25^\circ) \\
 &\Rightarrow \frac{1}{16} + \frac{9}{16} - 1 = \frac{-3}{8}
 \end{aligned}$$

30. Sol. (4)

$$\begin{aligned}
 &\tan(63^\circ - \theta) - \cot(27^\circ + \theta) + \\
 &\frac{\operatorname{cosec}^2 70^\circ - \tan^2 20^\circ}{\sec^2 37^\circ - \cot^2 53^\circ} \\
 &= \tan(63^\circ - \theta) - \tan(90^\circ - (27^\circ + \theta)) \\
 &+ \frac{\operatorname{cosec}^2 70^\circ - \cot^2(90^\circ - 20^\circ)}{\sec^2 37^\circ - \tan^2(90^\circ - 53^\circ)} \\
 &= \tan(63^\circ - \theta) - \tan(63^\circ - \theta) \\
 &+ \frac{\operatorname{cosec}^2 70^\circ - \cot^2 70^\circ}{\sec^2 37^\circ - \tan^2 37^\circ} = 1 \\
 &[\because \tan(90^\circ - \theta) = \cot \theta; \cot(90^\circ - \theta) = \tan \theta; \operatorname{cosec}^2 \theta - \cot^2 \theta = \sec^2 \theta - \tan^2 \theta = 1]
 \end{aligned}$$

31. Sol. (a)

$$\begin{aligned}
 (\sin \theta + \cos \theta)^2 &= \sin^2 \theta + \cos^2 \theta + 2\sin \theta \cos \theta \\
 &= 1 + 2\sin \theta \cos \theta \text{ and } (\sin \theta -
 \end{aligned}$$

$$\cos \theta)^2 = 1 - 2\sin \theta \cos \theta.$$

$$\text{Now, } = \frac{1+2\sin \theta \cos \theta}{1-2\sin \theta \cos \theta}$$

$$= \frac{(\sin \theta + \cos \theta)^2}{(\sin \theta - \cos \theta)^2}$$

Divide $\cos \theta$ all terms

$$\left(\frac{\tan \theta + 1}{\tan \theta - 1}\right)^2$$

$$\therefore \tan \theta = \frac{31}{29} \text{ (given)}$$

Put the value of $\tan \theta$

$$= \left(\frac{\frac{31}{29} + 1}{\frac{31}{29} - 1}\right)^2 = (30)^2 = 900$$

32. Sol. (c)

As we know that, $\cos^2 \theta + \sin^2 \theta = 1$

$$\text{Then, } \cos A = \sqrt{1 - \left(\frac{1}{3}\right)^2} = \sqrt{\frac{8}{9}}$$

$$= -\frac{2\sqrt{2}}{3} \text{ and}$$

$$\cos B = \sqrt{1 - \left(\frac{1}{5}\right)^2}$$

$$= \sqrt{\frac{24}{25}} = -\frac{2\sqrt{6}}{5}$$

($\because A$ and B are in second quadrant)

$$\cos(A - B) = \cos A \cdot \cos B + \sin A \sin B$$

$$= \left(-\frac{2\sqrt{2}}{3}\right) \times \left(-\frac{2\sqrt{6}}{5}\right) + \frac{1}{3} \times \frac{1}{5}$$

$$= \frac{8\sqrt{3} + 1}{15}$$

33. Sol. (c)

The expression

$$= \left(\frac{1}{\cos \theta} - \frac{1}{\sin \theta}\right) + \frac{1}{\operatorname{cosec} \theta - \cot \theta}$$

$$- \frac{1}{\sec \theta + \tan \theta}$$

$$= \sec \theta - \operatorname{cosec} \theta + \frac{1}{(\operatorname{cosec} \theta - \cot \theta)} \times$$

$$\frac{(\operatorname{cosec} \theta + \cot \theta)}{(\operatorname{cosec} \theta + \cot \theta)}$$

$$\begin{aligned}
 & -\frac{1}{(\sec \theta + \tan \theta)} \times \frac{(\sec \theta - \tan \theta)}{(\sec \theta - \tan \theta)} \\
 & = \sec \theta - \operatorname{cosec} \theta + \frac{\operatorname{cosec} \theta + \cot \theta}{\operatorname{cosec}^2 \theta - \cot^2 \theta} - \frac{\sec \theta - \tan \theta}{\sec^2 \theta - \tan^2 \theta} \\
 & = \sec \theta - \operatorname{cosec} \theta + \operatorname{cosec} \theta + \cot \theta - \sec \theta + \\
 & \tan \theta \left[\begin{array}{l} \because \operatorname{cosec}^2 \theta - \cot^2 \theta = 1 \\ \sec^2 \theta - \tan^2 \theta = 1 \end{array} \right] \\
 & = \cot \theta + \tan \theta \\
 & = \frac{\cos \theta}{\sin \theta} + \frac{\sin \theta}{\cos \theta} \\
 & = \frac{\cos^2 \theta + \sin^2 \theta}{\sin \theta \cos \theta}
 \end{aligned}$$

$$\begin{aligned}
 & = \frac{1}{\sin \theta \cdot \cos \theta} \\
 & \{\because \sin^2 \theta + \cos^2 \theta = 1\}
 \end{aligned}$$

34. Sol. (a)

$$\begin{aligned}
 p + q(p - 1) & = (\sec \theta - \tan \theta) + (\operatorname{cosec} \theta + \cot \theta) \\
 & = \left(\frac{1 - \sin \theta}{\cos \theta} \right) + \left(\frac{1 + \cos \theta}{\sin \theta} \right) \left(\frac{1 - \sin \theta - \cos \theta}{\cos \theta} \right) \\
 & = \frac{(1 - \sin \theta) \cdot \sin \theta + (1 - \cos^2 \theta) - \sin \theta \cdot (1 + \cos \theta)}{\sin \theta \cdot \cos \theta} \\
 & = \frac{\sin \theta - \sin^2 \theta + 1 - \cos^2 \theta - \sin \theta - \sin \theta \cdot \cos \theta}{\sin \theta \cdot \cos \theta} \\
 & = -1
 \end{aligned}$$

* * * * *

Type-7 (Morris Law)

1. The value of $\cos \alpha \cdot \cos(60^\circ - \alpha) \cdot \cos(60^\circ + \alpha)$ is

DP Head Constable 2023 (Shift - 01)

- (a) $\frac{1}{3} \cos 3\alpha$ (b) $\frac{1}{4} \cos 3\alpha$
(c) $\frac{1}{2} \cos 3\alpha$ (d) $\frac{1}{4} \sin \alpha$

2. $\tan 6^\circ \tan 42^\circ \tan 66^\circ \tan 78^\circ$

(CDS-2019-II)

- (a) 0 (b) 1
(c) 3 (d) 4

3. $\sin 12^\circ \sin 48^\circ \sin 54^\circ = ?$

- (a) $\frac{1}{16}$ (b) $\frac{1}{8}$
(c) $\frac{1}{4}$ (d) $\frac{1}{32}$

4. $\sin 12^\circ \sin 24^\circ \sin 48^\circ \sin 84^\circ = ?$

- (a) $\cos 20^\circ \cos 40^\circ \cos 60^\circ \cos 80^\circ$
(b) $\sin 20^\circ \sin 40^\circ \sin 60^\circ \sin 80^\circ$
(c) $\frac{3}{16}$ (d) $\frac{1}{16}$

5. $\cos \frac{\pi}{15} \cdot \cos \frac{2\pi}{15} \cdot \cos \frac{4\pi}{15} \cdot \cos \frac{8\pi}{15} = ?$

(SSC CGL 15/11/2020)

- (a) $\frac{1}{16}$ (b) $\frac{-1}{16}$
(c) $\frac{1}{15}$ (d) $\frac{3}{16}$

6. The value of $\sin \frac{\pi}{9} \cdot \sin \frac{5\pi}{9} \cdot \sin \frac{7\pi}{9} \cdot \sin \frac{3\pi}{9}$ is equal to

- (a) $\frac{4}{17}$ (b) $\frac{3}{16}$
(c) $\frac{2}{15}$ (d) $\frac{1}{16}$

7. $\tan 20^\circ \tan 40^\circ \tan 80^\circ \tan 60^\circ = ?$

- (a) 2 (b) $1/\sqrt{3}$
(c) 3 (d) $3\sqrt{3}$

8. The value of $\sin \beta \cdot \sin(60^\circ - \beta) \cdot \sin(60^\circ + \beta)$ where, $\beta = \alpha$?

[SSC CHSL (10+2) 19/10/2020]

- (a) $\frac{1}{4} \sin \alpha$ (b) $\frac{1}{4} \sin 3\alpha$
(c) $\frac{1}{4} \cos 3\alpha$ (d) $\frac{1}{4} \cos \beta$

9. Find the value of $\sin \frac{\pi}{9} \sin \frac{2\pi}{9} \sin \frac{3\pi}{9} \sin \frac{4\pi}{9}$

- (a) $\frac{1}{16}$ (b) $\frac{3}{16}$
(c) $\frac{5}{16}$ (d) $\frac{3}{8}$

10. What is the value of $(32\cos^6 x - 48\cos^4 x + 18\cos^2 x - 1)/[4\sin x \cos x \sin(60 - x)\cos(60 - x)\sin(60 + x)\cos(60 + x)]$?

- (a) $4\tan 6x$ (b) $4\cot 6x$
(c) $8\cot 6x$ (d) $8\tan 6x$

Type-7 ANSWER KEY

1	B	2	B	3	B	4	D	5	B	6	B	7	C
8	B	9	B	10	A								

Type-7 (Morris Law) Solution

1. Sol. (b).

We know that

$$\cos \alpha \cos(60 - \alpha) \cos(60 + \alpha) = \frac{1}{4} \cos 3\alpha$$

2. Sol. (b).

$$\tan 6^\circ \cdot \tan 42^\circ \tan 66^\circ \tan 78^\circ$$

$$\tan 6^\circ \cdot \tan 42^\circ \tan 66^\circ \tan 78^\circ \times \frac{\tan 54^\circ}{\tan 54^\circ}$$

$$\tan 3 \times 6^\circ \tan 42^\circ \tan 78^\circ \times \frac{1}{\tan 54^\circ}$$

$$\frac{\tan 3 \times 18^\circ}{\tan 54^\circ} = \frac{\tan 54^\circ}{\tan 54^\circ} = 1$$

3. Sol. (b)

divide and multiply by $\sin 72^\circ$,

$$\frac{\sin 12^\circ \cdot \sin 48^\circ \cdot \sin 72^\circ \cdot \sin 54^\circ}{\sin 72^\circ}$$

$$\text{Use } \frac{1}{4} \sin 3\theta$$

$$= \sin(60^\circ - \theta) \cdot \sin \theta \cdot \sin(60^\circ + \theta)$$

$$\text{Here, } \theta = 12^\circ$$

$$= \frac{1}{4} \cdot \frac{\sin 36^\circ \cdot \sin 54^\circ}{2 \sin 36^\circ \cos 36^\circ}$$

$$= \frac{1}{8} \cdot \frac{\sin 54^\circ}{\sin 54^\circ} = \frac{1}{8}$$

4. Sol. (d)

$$\frac{(\sin 12^\circ \cdot \sin 48^\circ \cdot \sin 72^\circ) \cdot (\sin 24^\circ \cdot \sin 36^\circ \cdot \sin 84^\circ)}{\sin 72^\circ \cdot \sin 36^\circ}$$

Multiply and divide by $\sin 36^\circ$ & $\sin 72^\circ$

$$\sin \theta \cdot \sin(60 - \theta) \cdot \sin(60 + \theta) = \frac{1}{4} \sin 3\theta$$

$$= \frac{1}{4} \sin 36^\circ \times \frac{1}{4} \sin 72^\circ \times \frac{1}{\sin 72^\circ \sin 36^\circ}$$

$$= \frac{1}{16}$$

5. Sol. (b)

$$\cos \frac{\pi}{15} \cdot \cos \frac{2\pi}{15} \cdot \cos \frac{4\pi}{15} \cdot \cos \frac{8\pi}{15}$$

$$\cos 12^\circ \cdot \cos 24^\circ \cos 48^\circ \cdot \cos 96^\circ \cdot \frac{\cos 72^\circ}{\cos 72^\circ}$$

$$\frac{1}{4} \cos 36^\circ \cdot \cos 24^\circ \cdot \cos 96^\circ \times \frac{1}{\cos 72^\circ}$$

$$(\because \cos(180 - 72) = -\cos 72^\circ)$$

$$\frac{1}{4} \times \frac{1}{4} \times \frac{\cos 108^\circ}{\cos 72^\circ} = -\frac{1}{16}$$

6. Sol. (b)

$$\sin \frac{\pi}{9} \cdot \sin \frac{5\pi}{9} \cdot \sin \frac{7\pi}{9} \cdot \sin \frac{3\pi}{9}$$

$$\text{Put value of } \pi = 180^\circ$$

$$\Rightarrow \sin 20^\circ \cdot \sin 100^\circ \cdot \sin 140^\circ \cdot \sin 60^\circ$$

$$\Rightarrow \sin 20^\circ \cdot \sin(180^\circ - 80^\circ)$$

$$\Rightarrow \sin(180^\circ - 40^\circ) \cdot \frac{\sqrt{3}}{2}$$

$$\Rightarrow \sin 20^\circ \cdot \sin 40^\circ \cdot \sin 80^\circ \cdot \frac{\sqrt{3}}{2}$$

$$\Rightarrow [\because \sin(180^\circ - \theta) = \sin \theta]$$

$$\Rightarrow \frac{1}{4} \sin 60^\circ \times \frac{\sqrt{3}}{2}$$

$$\Rightarrow \frac{1}{4} \times \frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{2} \Rightarrow \frac{3}{16}$$

7. Sol. (c)

$$\tan(3 \times 20) \sqrt{3}$$

$$(\because \tan \theta \cdot \tan(60 - \theta) \cdot \tan(60 + \theta) = \tan 3\theta)$$

$$\Rightarrow \tan 60^\circ \cdot \sqrt{3}$$

$$\Rightarrow \sqrt{3} \cdot \sqrt{3}$$

$$= 3$$

8. Sol. (b)

We know that

$$\sin \beta \sin(60^\circ - \beta) \sin(60^\circ + \beta)$$

$$= \frac{1}{4} \sin 3\beta$$

$$= \frac{1}{4} \sin 3\alpha$$

$$\because (\beta = \alpha \text{ given})$$

9. Sol. (b)

$$\sin\left(\frac{180^\circ}{9}\right) \sin\left(2 \cdot \frac{180^\circ}{9}\right)$$

$$\sin\left(3 \cdot \frac{180^\circ}{9}\right) \left(4 \cdot \frac{180^\circ}{9}\right)$$

$$= \sin 20^\circ \sin 40^\circ \sin 60^\circ \sin 80^\circ$$

$$= \sin 20^\circ \cdot \sin 40^\circ \cdot \frac{\sqrt{3}}{2} \cdot \sin 80^\circ$$

$$\left(\because \sin 60^\circ = \frac{\sqrt{3}}{2} \right)$$

$$\Rightarrow \frac{1}{4} \sin[3 \times 20^\circ] \times \frac{\sqrt{3}}{2}$$

$$\left[\because \sin A \cdot \sin 2A \cdot \sin 4A = \frac{1}{4} \sin 3A \right]$$

$$\Rightarrow \frac{1}{4} \times \frac{\sqrt{3}}{2} \times \sin 60^\circ$$

$$= \frac{1}{4} \times \frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{2} = \frac{3}{16}$$

10. Sol. (a)

$$\frac{32\cos^6 x - 48\cos^4 x + 18\cos^2 x - 1}{4\sin x \cos x \sin(60-x)}$$

$$\cos(60-x) \times \sin(60+x) \cos(60+x)$$

adding +4 and -4,

$$\rightarrow 32\cos^6 x - 4 - 48\cos^4 x + 18\cos^2 x + 3$$

$$\rightarrow 32\cos^6 x - 4 - 48\cos^4 x + 24\cos^2 x$$

$$-6\cos^2 x + 3$$

$$\rightarrow 32\cos^6 x - 4 - 48\cos^4 x + 24$$

$$\cos^2 x - 3\cos 2x$$

$$\rightarrow 4(2\cos^2 x - 1)^3 - 3\cos 2x$$

$$[\because \cos 2x = 2\cos^2 x - 1]$$

$$\rightarrow 4\cos^3 2x - 3\cos 2x$$

$$\rightarrow \cos 6x$$

$$\left[\begin{array}{l} \because \cos 3x \rightarrow 4\cos^3 x - 3\cos x \\ \text{and} \\ \because \cos 6x \rightarrow 4\cos^3 2x - 3\cos 2x \end{array} \right]$$

$$4\sin x \cdot \cos x \cdot \sin(60-x) \cdot \cos(60-x) \cdot$$

$$\sin(60+x) \cdot \cos(60+x)$$

$$\left[\because \sin x \cdot \sin(60-x) \cdot \sin(60+x) = \frac{1}{4} \sin 3x \right]$$

$$\left[\because \cos x \cdot \cos(60-x) \cdot \cos(60+x) = \frac{1}{4} \cos 3x \right]$$

$$= \frac{\cos 6x}{\frac{1}{4} \sin 3x \cos 3x}$$

$$= \frac{2}{2} \times \frac{4\cos 6x}{\sin 3x \cos 3x}$$

$$= \frac{8\cos 6x}{2\sin 3x \cos 3x} = \frac{8\cos 6x}{\sin 6x}$$

$$= 8\cot 6x$$

Type-8 (C & D)

1. If $\frac{\tan \theta + \sin \theta}{\tan \theta - \sin \theta} = \frac{k+1}{k-1}$, then $k = ?$

SSC CGL 2023 (Morning)

- (a) $\operatorname{cosec} \theta$ (b) $\sec \theta$ (c) $\cos \theta$ (d) $\sin \theta$

2. If $\frac{\cot \theta + \cos \theta}{\cot \theta - \cos \theta} = \frac{k+1}{1-k}$, $k \neq 1$, then k is equal to:

(SSC CHSL (10+2) Tier-I)

Exam, 09.08.2021 (Shift-I)

- (a) $\sin \theta$ (b) $\operatorname{cosec} \theta$ (c) $\cos \theta$ (d) $\sec \theta$

3. $\frac{\tan \theta + \cot \theta}{\tan \theta - \cot \theta} = 2$, ($0 \leq \theta \leq 90^\circ$), then the value of $\sin \theta$ is

- (a) $\frac{2}{\sqrt{3}}$ (b) $\frac{\sqrt{3}}{2}$ (c) $\frac{1}{2}$ (d) 1

4. If $\frac{\sin \theta + \cos \theta}{\sin \theta - \cos \theta} = \frac{5}{4}$, the value of $\frac{\tan^2 \theta + 1}{\tan^2 \theta - 1}$ is

- (a) $\frac{25}{16}$ (b) $\frac{41}{9}$ (c) $\frac{41}{40}$ (d) $\frac{40}{41}$

5. If $\frac{\sec \theta + \tan \theta}{\sec \theta - \tan \theta} = \frac{5}{3}$, then $\sin \theta$ is equal to;

[SSC CGL 13/08/2021]

- (a) $\frac{1}{4}$ (b) $\frac{1}{3}$ (c) $\frac{2}{3}$ (d) $\frac{3}{4}$

6. If $a^2 = \frac{1+2\sin \theta \cos \theta}{1-2\sin \theta \cos \theta}$, then what is the value of $\frac{a+1}{a-1}$?

[CDS 2018]

- (a) $\sec \theta$ (b) 1 (c) 0 (d) $\tan \theta$

7. If $\frac{\sin \theta + \cos \theta}{\sin \theta - \cos \theta} = 3$ then the value of $\sin^4 \theta$ is :

- (a) $\frac{16}{25}$ (b) $\frac{2}{5}$ (c) $\frac{1}{5}$ (d) $\frac{3}{5}$

8. If $A + B = C$ and $\tan A = k \tan B$, and $A - B = \phi$, then $\sin C = ?$

- (a) 0 (b) 1
(c) $\frac{k+1}{k-1}$ (d) $\frac{k+1}{k-1} \sin \phi$

9. If $1 + 2\tan^2 \theta + 2\sin \theta \sec^2 \theta = \frac{a}{b}$, $0^\circ < \theta < 90^\circ$, then $\frac{a+b}{a-b}$?

[SSC CGL Tier-II 29/01/2022]

- (a) $\sec \theta$ (b) $\cos \theta$
(c) $\sin \theta$ (d) $\operatorname{cosec} \theta$

10. If $\cos^2 \theta - \sin^2 \theta = \tan^2 \phi$, then which of the following true?

- (a) $\cos \theta \cos \phi = 1$
(b) $\cos^2 \phi - \sin^2 \phi = \tan^2 \theta$
(c) $\cos^2 \phi - \sin^2 \phi = \tan^2 \phi$
(d) $\cos \theta \cdot \cos \phi = \sqrt{2}$

11. If $\frac{\sec \theta - \tan \theta}{\sec \theta + \tan \theta} = \frac{1}{7}$, θ lies in first quadrant, then the value of $\frac{\operatorname{cosec} \theta + \cot^2 \theta}{\operatorname{cosec} \theta - \cot^2 \theta}$ is:

SSC CGL Tier II 03/02/2022

- (a) $\frac{19}{5}$ (b) $\frac{22}{3}$ (c) $\frac{37}{12}$ (d) $\frac{37}{19}$

12. If $\frac{\sec \theta + \tan \theta}{\sec \theta - \tan \theta} = 2\frac{51}{79}$ then the value of $\sin \theta$ is

- (a) $\frac{91}{144}$ (b) $\frac{39}{72}$ (c) $\frac{65}{144}$ (d) $\frac{35}{72}$

13. If $\frac{\sin \theta + \cos \theta}{\sin \theta - \cos \theta} = \frac{5}{4}$, then $\frac{\tan^2 \theta + 1}{\tan^2 \theta - 1} = ?$

- (a) $\frac{25}{16}$ (b) $\frac{41}{9}$ (c) $\frac{41}{40}$ (d) $\frac{40}{41}$

14. $\frac{\sin(x+y)}{\sin(x-y)} = \frac{a+b}{a-b}$, then $\frac{\tan x}{\tan y} = ?$

- (a) a (b) b (c) $\frac{a}{b}$ (d) $\frac{b}{a}$

15. If $\frac{1+\cos \alpha}{1-\cos \alpha} = \frac{p^2}{q^2}$, find $\operatorname{cosec} \alpha$.

- (a) $\frac{1}{2} \left(\frac{p}{q} + \frac{q}{p} \right)$ (b) $\left(\frac{1+1}{p^2+q^2} \right)$
(c) $\frac{p^2 q^2}{p^2 + q^2}$ (d) $\frac{2p^2 q^2}{p^2 + q^2}$

16. If $\sin A = n \sin B$, then $\left(\frac{n-1}{n+1}\right) \times \tan\left(\frac{A+B}{2}\right) = ?$

(a) $\sin\left(\frac{A-B}{2}\right)$ (b) $\tan\left(\frac{A-B}{2}\right)$

(c) $\cot\left(\frac{A-B}{2}\right)$ (d) $\tan\left(\frac{A+B}{2}\right)$

17. $m \tan(\theta - 30^\circ) = n \tan(\theta + 120^\circ)$, then $\frac{m+n}{m-n} = ?$

(a) $2 \cos 2\theta$ (b) $\cos 2\theta$

(c) $2 \sin 2\theta$ (d) $\sin 2\theta$

18. If $1 + \sin \theta = m \cos \theta$, then what is the value of $\sin \theta$?

[SSC CGL 07/12/2022]

(a) $\frac{2m^2-1}{m^2+1}$ (b) $\frac{m^2-1}{m^2+1}$

(c) $\frac{m^2+1}{2m^2-1}$ (d) $\frac{m^2+1}{m^2-1}$

Type-8 ANSWER KEY													
1	B	2	A	3	B	4	C	5	A	6	D	7	A
8	D	9	D	10	B	11	A	12	C	13	C	14	C
15	A	16	B	17	A	18	B						

Type-8 (C & D) Solution

1. Sol. (b)

Applying componendo and dividendo

$$\frac{\tan \theta + \sin \theta}{\tan \theta - \sin \theta} = \frac{k+1}{k-1} \Rightarrow \frac{\tan \theta}{\sin \theta} = \frac{k}{1}$$

$$\Rightarrow \frac{\sin \theta}{\cos \theta \cdot \sin \theta} = k \Rightarrow \sec \theta = k$$

2. Sol. (a)

$$\frac{\cot \theta + \cos \theta}{\cot \theta - \cos \theta} = \frac{k+1}{1-k}$$

By componendo and dividendo, formula)

$$\frac{\cot \theta + \cos \theta + \cot \theta - \cos \theta}{\cot \theta + \cos \theta - \cot \theta + \cos \theta}$$

$$= \frac{k+1+1-k}{k+1-1+k}$$

$$\Rightarrow \frac{2 \cot \theta}{2 \cos \theta} = \frac{2}{2k}$$

$$\Rightarrow k = \frac{\cos \theta}{\cot \theta} = \cos \theta \times \frac{\sin \theta}{\cos \theta}$$

$$= \sin \theta.$$

3. Sol. (b)

$$\frac{\tan \theta + \cot \theta}{\tan \theta - \cot \theta} = 2$$

By C and D rule,

$$\frac{\tan \theta}{\cot \theta} = \frac{3}{1}$$

$$\tan^2 \theta = 3$$

$$\tan \theta = \sqrt{3} = \tan 60^\circ$$

$$\theta = 60^\circ$$

$$\therefore \sin \theta = \sin 60^\circ = \frac{\sqrt{3}}{2}$$

4. Sol. (c)

$$\frac{\sin \theta + \cos \theta}{\sin \theta - \cos \theta} = \frac{5}{4}$$

$$\Rightarrow 4 \sin \theta + 4 \cos \theta = 5 \sin \theta - 5 \cos \theta$$

$$\Rightarrow \sin \theta = 9 \cos \theta$$

$$\Rightarrow \frac{\sin \theta}{\cos \theta} = 9$$

$$\Rightarrow \tan \theta = 9$$

[Squaring both side and apply C & D rules]

$$\frac{\tan^2 \theta + 1}{\tan^2 \theta - 1} = \frac{9^2 + 1}{9^2 - 1} = \frac{82}{80} = \frac{41}{40}$$

5. Sol. (a)

$$\frac{\sec \theta + \tan \theta}{\sec \theta - \tan \theta} = \frac{5}{3}$$

$$\frac{\sec \theta + \tan \theta + \sec \theta - \tan \theta}{\sec \theta + \tan \theta - \sec \theta + \tan \theta} = \frac{8}{2} \quad (\text{By applying } (\cos \theta))$$

$$\frac{\sec \theta}{\tan \theta} = 4 \Rightarrow \operatorname{cosec} \theta = 4$$

$$\Rightarrow \sin \theta = \frac{1}{4}$$

6. Sol. (d)

$$\text{Given that, } a^2 = \frac{1+2 \sin \theta \cdot \cos \theta}{1-2 \sin \theta \cdot \cos \theta}$$

$$\Rightarrow a^2 = \frac{(\sin^2 \theta + \cos^2 \theta) + 2 \sin \theta \cdot \cos \theta}{(\sin^2 \theta + \cos^2 \theta) - 2 \sin \theta \cdot \cos \theta}$$

$$\Rightarrow a^2 = \frac{(\sin \theta + \cos \theta)^2}{(\sin \theta - \cos \theta)^2}$$

$$\Rightarrow \frac{a}{1} = \frac{\sin \theta + \cos \theta}{\sin \theta - \cos \theta}$$

(applying componendo dividendo formula)

$$\Rightarrow \frac{a+1}{a-1} = \frac{(\sin \theta + \cos \theta) + (\sin \theta - \cos \theta)}{(\sin \theta + \cos \theta) - (\sin \theta - \cos \theta)}$$

$$\Rightarrow \frac{a+1}{a-1} = \frac{2\sin \theta}{2\cos \theta} = \tan \theta$$

7. Sol. (a)

$$\frac{\sin \theta + \cos \theta}{\sin \theta - \cos \theta} = \frac{3}{1}$$

$$\frac{\sin \theta + \cos \theta}{\sin \theta - \cos \theta} = \frac{3}{1} \text{ (by componendo dividendo)}$$

$$\Rightarrow \frac{\sin \theta}{\cos \theta} = \frac{3+1}{3-1}$$

$$\Rightarrow \tan \theta = 2$$

$$\tan \theta = \frac{\text{Perpendicular}}{\text{Base}} = \frac{2}{1}$$

$$\Rightarrow \sin^4 \theta = \left(\frac{2}{\sqrt{5}}\right)^4 = \frac{16}{25}$$

8. Sol. (d)

$$A + B = C, \tan A = k \tan B \text{ and } A - B = \phi$$

$$\frac{\sin A}{\cos A} = \frac{k \sin B}{\cos B} \Rightarrow \frac{\sin A \cos B}{\cos A \sin B} = \frac{k}{1}$$

Using componendo & dividendo rule

$$\frac{\sin A \cos B + \cos A \sin B}{\cos B \sin A - \cos A \sin B} = \frac{k+1}{k-1}$$

$$\frac{\sin(A+B)}{\sin(A-B)} = \frac{k+1}{k-1}$$

$$\frac{\sin C}{\sin \phi} = \frac{k+1}{k-1}$$

$$\sin C = \frac{k+1}{k-1} \sin \phi$$

9. Sol. (d)

$$1 + 2\tan^2 \theta + 2\sin \theta \sec^2 \theta = \frac{a}{b}$$

$$1 + \tan^2 \theta + \tan^2 \theta + 2\sin \theta \sec^2 \theta = \frac{a}{b}$$

$$\sec^2 \theta + \tan^2 \theta + 2\sin \theta \sec^2 \theta = \frac{a}{b}$$

$$\sec^2 \theta + \sec^2 \theta - 1 + 2\sin \theta \sec^2 \theta = \frac{a}{b}$$

$$\frac{2\sec^2 \theta - 1 + 2\sin \theta \sec^2 \theta}{1} = \frac{a}{b}$$

Using componendo and dividendo, we get

$$\frac{2\sec^2 \theta - 1 + 2\sin \theta \sec^2 \theta + 1}{2\sec^2 \theta - 1 + 2\sin \theta \sec^2 \theta - 1} = \frac{a+b}{a-b}$$

$$\text{So, } \frac{a+b}{a-b} = \frac{2\sec^2 \theta + 2\sin \theta \sec^2 \theta}{2\sec^2 \theta - 2 + 2\sin \theta \sec^2 \theta}$$

$$= \frac{\frac{2}{\cos^2 \theta} + \frac{2\sin \theta}{\cos^2 \theta}}{\frac{2}{\cos^2 \theta} - 2 + \frac{2\sin \theta}{\cos^2 \theta}}$$

$$= \frac{2+2\sin \theta}{2-2\cos^2 \theta + 2\sin \theta} \Rightarrow \frac{2+2\sin \theta}{2\sin^2 \theta + 2\sin \theta}$$

$$= \frac{2(1+\sin \theta)}{2\sin \theta(1+\sin \theta)} \Rightarrow \frac{1}{\sin \theta} = \operatorname{cosec} \theta$$

10. Sol. (c)

$$\cos^2 \theta - \sin^2 \theta = \tan^2 \phi$$

$$\frac{\cos^2 \theta - \sin^2 \theta}{\cos^2 \theta + \sin^2 \theta} = \frac{\sin^2 \phi}{\cos^2 \phi}$$

Now apply componendo & Dividend theorem:-

$$\frac{2\cos^2 \theta}{-2\sin^2 \theta} = \frac{1}{\sin^2 \phi - \cos^2 \phi}$$

$$\Rightarrow -\cot^2 \theta = \frac{1}{\sin^2 \phi - \cos^2 \phi}$$

$$\Rightarrow \cos^2 \phi - \sin^2 \phi = \tan^2 \phi$$

11. Sol. (a)

$$\frac{\sec \theta - \tan \theta}{\sec \theta + \tan \theta} = \frac{1}{7}$$

[Using componendo and dividendo]

$$\text{we get, } \frac{\sec \theta - \tan \theta + \sec \theta + \tan \theta}{\sec \theta - \tan \theta - \sec \theta - \tan \theta} = \frac{1+7}{1-7}$$

$$\Rightarrow \frac{2\sec \theta}{-2\tan \theta} = \frac{8}{-6} \Rightarrow \frac{\sec \theta}{-\tan \theta} = \frac{4}{-3}$$

$$\Rightarrow \frac{\frac{1}{\cos \theta}}{\frac{\sin \theta}{\cos \theta}} = \frac{4}{-3} \Rightarrow \sin \theta = \frac{3}{4}$$

$$\frac{\operatorname{cosec} \theta + \cot^2 \theta}{\operatorname{cosec} \theta - \cot^2 \theta} = \frac{\frac{4}{3} + \left(\frac{\sqrt{7}}{3}\right)^2}{\frac{4}{3} - \left(\frac{\sqrt{7}}{3}\right)^2}$$

[Using Pythagoras theorem]

$$= \frac{\frac{4}{3} + \frac{7}{9}}{\frac{4}{3} - \frac{7}{9}} = \frac{\frac{19}{9}}{\frac{5}{9}} = \frac{19}{5}$$

12. Sol. (c)

$$\text{Given, } \frac{\sec \theta + \tan \theta}{\sec \theta - \tan \theta} = 2 \frac{51}{79}$$

$$\Rightarrow \frac{\sec \theta + \tan \theta}{\sec \theta - \tan \theta} = \frac{209}{79}$$

$$\left[\text{by componendo - dividendo} \right]$$

$$\frac{\frac{a}{b}}{\frac{c}{d}} = \frac{\frac{a+b}{a-b}}{\frac{c+d}{c-d}}$$

$$\Rightarrow \frac{\sec \theta}{\tan \theta} = \frac{288}{130}$$

$$\Rightarrow \frac{\frac{1}{\cos \theta}}{\frac{\sin \theta}{\cos \theta}} = \frac{288}{130} \Rightarrow \frac{1}{\sin \theta} = \frac{288}{130}$$

$$\Rightarrow \text{Therefore, } \sin \theta = \frac{130}{288}$$

$$\Rightarrow \sin \theta = \frac{65}{144}$$

13. Sol. (c)

By compendo & Dividendo theorem,

$$\text{If } \frac{a}{b} = \frac{c}{d}, \text{ then } \frac{a+b}{a-b} = \frac{c+d}{c-d}$$

$$\frac{2 \sin \theta}{2 \cos \theta} = \frac{5+4}{5-4}, \tan \theta = 9$$

$$\Rightarrow \frac{\tan^2 \theta + 1}{\tan^2 \theta - 1} = \frac{82}{80} = \frac{41}{40}$$

14. Sol. (c)

$$\frac{\sin(x+y)}{\sin(x-y)} = \frac{a+b}{a-b} \Rightarrow \frac{\sin x \cos y + \cos x \sin y}{\sin x \cos y - \cos x \sin y} = \frac{a+b}{a-b}$$

Using componendo & dividendo rule

$$\frac{2 \sin x \cdot \cos y}{2 \cos x \cdot \sin y} = \frac{2a}{2b} = \frac{\tan x}{\tan y} = \frac{a}{b}$$

15. Sol. (a)

$$\text{Given: } \frac{1+\cos \alpha}{1-\cos \alpha} = \frac{p^2}{q^2}$$

Apply C & D rule

$$\Rightarrow \frac{2}{2 \cos \alpha} = \frac{p^2+q^2}{p^2-q^2}$$

$$\Rightarrow \cos \alpha = \frac{p^2-q^2}{p^2+q^2}$$

$$\sin \alpha = \sqrt{1 - \cos^2 \alpha}$$

$$= \sqrt{1 - \left(\frac{p^2-q^2}{p^2+q^2}\right)^2} = \frac{2pq}{p^2+q^2}$$

$$\Rightarrow \frac{1}{\sin \alpha} = \frac{p^2+q^2}{2pq}$$

$$\operatorname{cosec} \alpha \Rightarrow \frac{1}{2} \left[\frac{p}{q} + \frac{q}{p} \right]$$

16. Sol. (b)

$$\sin A = n \sin B$$

$$\frac{\sin A}{\sin B} = \frac{n}{1}$$

Applying componendo and dividendo rule

$$\Rightarrow \frac{\sin A + \sin B}{\sin A - \sin B} = \frac{n+1}{n-1}$$

$$\Rightarrow \frac{2 \sin \left(\frac{A+B}{2} \right) \cos \left(\frac{A-B}{2} \right)}{2 \cos \left(\frac{A-B}{2} \right) \sin \left(\frac{A-B}{2} \right)} = \frac{n+1}{n-1}$$

$$\Rightarrow \frac{\tan \left(\frac{A+B}{2} \right)}{\tan \left(\frac{A-B}{2} \right)} = \frac{n+1}{n-1}$$

$$\left(\frac{n-1}{n+1} \right) \tan \left(\frac{A+B}{2} \right) = \tan \left(\frac{A-B}{2} \right)$$

17. Sol. (a)

$$m \tan(\theta - 30^\circ) = n \tan(\theta + 120^\circ)$$

$$m \tan(\theta - 30^\circ) = -n \cot(\theta + 30^\circ)$$

$$\tan(\theta - 30^\circ) \cdot \tan(\theta + 30^\circ) = -\frac{n}{m}$$

$$\frac{\sqrt{3} \tan \theta - 1}{\sqrt{3} + \tan \theta} \cdot \frac{\sqrt{3} \tan \theta + 1}{\sqrt{3} - \tan \theta} = -\frac{n}{m}$$

$$\left[\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B} \right]$$

$$\left[\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B} \right]$$

$$\frac{3 \tan^2 \theta - 1}{3 - \tan^2 \theta} = \frac{-n}{m}$$

$$\frac{m}{n} = \frac{3 - \tan^2 \theta}{1 - 3 \tan^2 \theta}$$

[Use Componendo and Dividendo rule]

$$\frac{m+n}{m-n} = \frac{4-4 \tan^2 \theta}{2+2 \tan^2 \theta}$$

$$\frac{4(1-\tan^2 \theta)}{2(1+2 \tan^2 \theta)} = 2 \cos 2 \theta$$

18. Sol. (b)

$$1 + \sin \theta = m \cos \theta$$

$$\frac{1+\sin \theta}{\cos \theta} = m \Rightarrow \frac{(1+\sin \theta)^2}{\cos^2 \theta} = m^2$$

$$\frac{(1+\sin \theta)^2}{(1+\sin \theta)(1-\sin \theta)} = m^2$$

$$\frac{(1+\sin \theta)}{(1-\sin \theta)} = m^2$$

By using componendo and dividendo, we get

$$\frac{(1+\sin \theta + 1 - \sin \theta)}{(1+\sin \theta - 1 + \sin \theta)} = \frac{m^2+1}{m^2-1}$$

$$\frac{(2)}{(2 \sin \theta)} = \frac{m^2+1}{m^2-1} \Rightarrow \sin \theta = \frac{m^2-1}{m^2+1}$$

Type-9 (Quadratic Equation)

1. If $\tan^2 A - 6\tan A + 9 = 0, 0 < A < 90^\circ$, What is the value of $6\cot A + 8\sqrt{10}\cos A$?

[SSC CGL 2023 (Shift- 02)]

- (a) $10\sqrt{10}$ (b) $8\sqrt{10}$
(c) 10 (d) 14

2. If $\tan^2 A + 2\tan A - 63 = 0$ Given that $0 < A < \frac{\pi}{4}$ what is the value of $(2\sin A + 5\cos A)$?

[SSC CGL 11/04/2022 (Shift- 03)]

- (a) $19\sqrt{50}$ (b) $15\sqrt{50}$
(c) $\frac{19}{\sqrt{50}}$ (d) $\frac{15}{\sqrt{50}}$

3. If $2\cos^2 \theta + \sin \theta - 2 = 0, 0 < \theta < \pi/2$, then what is the value of θ ?

[CDS-2023]

- (a) $\frac{\pi}{6}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{2}$

4. If $4 - 2\sin^2 \theta - 5\cos \theta = 0, 0^\circ < \theta < 90^\circ$, then the value of $\cos \theta + \tan \theta$ is:

[SSC CPO 23/11/2020 (Morning)]

- (a) $\frac{2+\sqrt{3}}{2}$ (b) $\frac{2-\sqrt{3}}{2}$
(c) $\frac{1+2\sqrt{3}}{2}$ (d) $\frac{1-2\sqrt{3}}{2}$

5. If $\sec^2 x - 3\sec x + 2 = 0$, then the value of $x(0 < x < 90^\circ)$ is:

[SSC CHSL 17/03/2020 (Morning)]

- (a) 45° (b) 15° (c) 60° (d) 30°

6. If $\cos \theta + \sec \theta - 2 = 0$, where $0 \leq \theta < \frac{\pi}{2}$, then what is the value of $\cos^4 \theta + \sec^4 \theta - 2$?

[CDS 2022-I]

- (a) -2 (b) -1 (c) 0 (d) 2

7. If $\frac{\cos^2 \theta - 3\cos \theta + 2}{\sin^2 \theta} = 1$, where $0^\circ < \theta < 90^\circ$ then what is $\sin^2 \theta + \cos \theta$ equal to?

[CDS - 2021-II]

- (a) $\frac{5}{4}$ (b) $\frac{3}{2}$ (c) $\frac{7}{4}$ (d) 2

8. If $2\sin \theta + 2\sin^2 \theta = 2$, then the value of $2\cos^4 \theta + 2\cos^2 \theta$ is:

[SSC CGL 12/12/2022 (3rd Shift)]

- (a) 4 (b) 2 (c) 1 (d) 0

9. If $\tan^2 \theta + 3\sec \theta - 9 = 0$, where $0 < \theta < 90^\circ$, then what is the value of $12\cot^2 \theta + 3\operatorname{cosec} \theta$?

[CDS-2022]

- (a) $(\sqrt{3} + 1)^2$ (b) $(\sqrt{3} + 2)^2$
(c) $(2\sqrt{3} + 1)^2$ (d) $(3\sqrt{3} + 1)^2$

10. If $5\sin^2 \theta = 3(1 + \cos \theta)$ $0^\circ < \theta < 90^\circ$, then the value of $\operatorname{cosec} \theta + \cot \theta$ is:

[SSC CHSL 13/04/2021 (Morning)]

- (a) $\sqrt{\frac{7}{3}}$ (b) $\frac{5}{\sqrt{21}}$ (c) $\frac{4}{\sqrt{21}}$ (d) $\sqrt{\frac{3}{7}}$

11. If $\sin^2 \theta - 3\sin \theta + 2 = 0$, then find the value of $\theta(0^\circ \leq \theta \leq 90^\circ)$.

[SSC CGL 12/12/2022 (2nd Shift)]

- (a) 45° (b) 0° (c) 60° (d) 90°

12. If $14\sin^2 \theta + 10\cos^2 \theta = 11$ where $0^\circ < \theta < 90^\circ$, then what is the value of $\tan \theta + \cot \theta$?

[CDS 2021-II]

- (a) $\frac{4}{\sqrt{3}}$ (b) $\frac{2}{\sqrt{3}}$ (c) $\sqrt{3}$ (d) $2\sqrt{3}$

13. If $8\sin^2 \theta + 2\cos \theta = 5, 0^\circ < \theta < 90^\circ$, then the value of $\tan^2 \theta + \sec^2 \theta - \sin^2 \theta$ will be:

[(SSC CHSL (10+2) Tier-I

Exam, 12.04.2021 (Shift-I)]

- (a) $\frac{305}{144}$ (b) $\frac{431}{144}$ (c) $\frac{23}{9}$ (d) $\frac{153}{72}$

14. If $2\sin^2 \theta + 3\cos \theta = 3, 0^\circ < \theta < 90^\circ$ then the value of $(\sec^2 \theta + \cot^2 \theta)$ is:

[SSC CGL 18/04/2022 (Evening)]

- (a) $3\frac{2}{3}$ (b) $3\frac{1}{3}$ (c) $4\frac{1}{3}$ (d) $4\frac{1}{2}$

15. If $2\sin\theta + 15\cos^2\theta = 7, 0^\circ < \theta < 90^\circ$, then what is the value of $\frac{3-\tan\theta}{2+\tan\theta}$?

[(SSC CAPFS SI, Delhi Police SI & CISP ASI Exam, 12.12.2019(Shift-I)]

- (a) $\frac{1}{2}$ (b) $\frac{5}{8}$ (c) $\frac{1}{4}$ (d) $\frac{3}{4}$

16. If $3\sec^2\theta + \tan\theta - 7 = 0, 0^\circ < \theta < 90^\circ$, then what is the value of $\left(\frac{2\sin\theta+3\cos\theta}{\csc\theta+\sec\theta}\right)$?

[SSC CGL 12/04/2022 (Shift- I)]

- (a) 10 (b) $5/2$
(c) $5/4$ (d) $4\sqrt{2}$

17. If $5\sin^2 A + 3\cos^2 A = 4, 0 < A < 90^\circ$, then what is the value of $\tan A$?

[SSC CGL 09/12/2022 (1st Shift)]

- (a) 0 (b) 3 (c) 1 (d) 2

18. If $\sin^2\theta - \cos^2\theta - 3\sin\theta + 2 = 0, 0^\circ < \theta < 90^\circ$, then what is the value of $1 + \sec\theta + \tan\theta$?

[SSC CGL 13/04/2022 (Evening)]

- (a) $-1 + \sqrt{3}$ (b) $-1 - \sqrt{3}$
(c) $1 + \sqrt{3}$ (d) $1 - \sqrt{3}$

19. If $6\tan A(\tan A + 1) = 5 - \tan A$, Given that $0 < A < \frac{\pi}{2}$ what is the value of $(\sin A + \cos A)$?

[(SSC CGL Tier-I (CBE)

Exam. 20.04.2022(Shift-I)]

- (a) $3\sqrt{5}$ (b) $\frac{5}{\sqrt{3}}$ (c) $5\sqrt{3}$ (d) $\frac{3}{\sqrt{5}}$

20. If $3 - 2\sin^2\theta - 3\cos\theta = 0, 0^\circ < \theta < 90^\circ$, then what is the value of $(2\operatorname{Cosec}\theta + \tan\theta)$?

[SSC CHSL 02/07/2019 (Evening)]

- (a) $7\sqrt{3}$ (b) $5\sqrt{3}$
(c) $\frac{5\sqrt{3}}{3}$ (d) $\frac{7\sqrt{3}}{3}$

21. If $8\sin^2\theta + 2\cos\theta = 5, 0^\circ < \theta < 90^\circ$, then the value of $\tan^2\theta + \sec^2\theta - \sin^2\theta$ will be:

[SSC CHSL 12/04/2021 (Morning)]

- (a) $\frac{305}{144}$ (b) $\frac{431}{144}$
(c) $\frac{23}{9}$ (d) $\frac{153}{72}$

22. The value of x , if $2\sin^2 x = 2 - 3\sin x$, is:

[SSC CHSL 16/10/2020 (Evening)]

- (a) $\frac{\pi}{6}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{3}$

23. Consider the following statements

- The equation $2\sin^2\theta - \cos\theta + 4 = 0$ is possible for all θ
- $\tan\theta + \cot\theta$ cannot be less than 2, where $0 < \theta < \frac{\pi}{2}$.

Which of the above statements is/are correct?

[CDS 2020-II]

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

24. If $2\cos^2\theta = 3\sin\theta, 0^\circ < \theta < 90^\circ$, then the value of $(\sec^2\theta - \tan^2\theta + \cos^2\theta)$ is:

[SSC CGL 13/08/2021 (Afternoon)]

- (a) $7/4$ (b) $5/4$ (c) $9/4$ (d) $3/4$

25. If $3\cos^2\theta - 4\sin\theta + 1 = 0, 0^\circ < \theta < 90^\circ$, then $\tan\theta + \sec\theta = ?$

[SSC CGL 16/08/2021 (Morning)]

- (a) $2\sqrt{3}$ (b) $2\sqrt{5}$
(c) $3\sqrt{3}$ (d) $\sqrt{5}$

26. If $\cos^2\theta - 3\cos\theta + 2 = \sin^2\theta, 0^\circ < \theta < 90^\circ$, then the value of $2\operatorname{cosec}\theta + 4\cot\theta$ is :

[SSC CGL 07/06/2019 (Afternoon)]

- (a) $\frac{8\sqrt{3}}{3}$ (b) $2\sqrt{5}$
(c) $2\sqrt{3}$ (d) $4\sqrt{3}$

27. If $3(\cot^2\theta - \cos^2\theta) = 1 - \sin^2\theta, 0^\circ < \theta < 90^\circ$, the θ is equal to:

[SSC CPO 13/12/2019 (Morning)]

- (a) 30° (b) 60° (c) 45° (d) 15°

Type-9 ANSWER KEY															
1	C	2	C	3	A	4	C	5	C	6	C	7	A	8	B
9	A	10	A	11	D	12	A	13	A	14	C	15	A	16	B
17	C	18	C	19	D	20	D	21	A	22	A	23	B	24	A
25	D	26	A	27	B										

Type-9 (Quadratic Equation) Solution

1. Sol. (c)

$$\tan^2 A - 6 \tan A + 9 = 0$$

$$\text{Let } \tan A = x$$

$$x^2 - 6x + 9 = 0$$

$$\begin{array}{c} \text{+9} \\ \swarrow \quad \searrow \\ -3 \quad -3 \\ \downarrow \quad \downarrow \\ +3 \quad +3 \\ \tan A = \frac{3}{1} \end{array}$$

$$H = \sqrt{10} (\because H^2 = P^2 + B^2)$$

$$= 6 \cot A + 8 \sqrt{10} \cos A$$

$$= 6 \cdot \frac{1}{3} + 8 \cdot \sqrt{10} \cdot \frac{1}{\sqrt{10}}$$

$$= 2 + 8 = 10$$

2. Sol. (c)

$$\tan^2 A + 2 \tan A - 63 = 0$$

$$\text{Let } \tan A = x$$

$$x^2 + 2x - 63 = 0$$

$$\begin{array}{c} -63 \\ \swarrow \quad \searrow \\ +9 \quad -7 \\ \downarrow \quad \downarrow \\ -9 \quad +7 \end{array}$$

$$\tan A = \frac{7}{1}$$

$$H = \sqrt{50} (\because P^2 + B^2 = H^2)$$

$$2 \sin A + 5 \cos A$$

$$2 \times \frac{7}{\sqrt{50}} + 5 \times \frac{1}{\sqrt{50}} \Rightarrow \frac{19}{\sqrt{50}}$$

3. Sol. (a)

$$2 \cos^2 \theta + \sin \theta - 2 = 0$$

$$2(1 - \sin^2 \theta) + \sin \theta - 2 = 0$$

$$2 \sin^2 \theta + \sin \theta - 2 = 0$$

$$\sin \theta (1 - 2 \sin \theta) = 0$$

$$1 - 2 \sin \theta = 0$$

$$2 \sin \theta = 1$$

$$\sin \theta = \frac{1}{2} \Rightarrow \theta = \frac{\pi}{6}$$

4. Sol. (c)

$$4 - 2 \sin^2 \theta - 5 \cos \theta = 0$$

$$4 - 2(1 - \cos^2 \theta) - 5 \cos \theta = 0$$

$$2 \cos 2\theta - 4 \cos \theta - \cos \theta + 2 = 0$$

$$2 + 2 \cos^2 \theta - 5 \cos \theta = 0$$

Solving this we get

$$\cos \theta = 2 \text{ or } \cos \theta = \frac{1}{2}$$

So we can say $\cos \theta = 60^\circ$

As asked in the question

$$\cos \theta + \tan \theta = \frac{1}{2} +$$

$$\sqrt{3} = \frac{1+2\sqrt{3}}{2}$$

5. Sol. (c)

$$\sec^2 x - 3 \sec x + 2 = 0$$

$$\Rightarrow \sec^2 x - 2 \sec x - \sec x + 2 = 0$$

$$\Rightarrow (\sec x - 2)(\sec x - 1) = 0$$

$$\Rightarrow \sec x = 2, 1 \Rightarrow x = 60^\circ$$

6. Sol. (c)

$$\cos \theta + \sec \theta - 2 = 0 \Rightarrow \cos \theta + \frac{1}{\cos \theta} - 2 = 0$$

$$\Rightarrow \cos^2 \theta - 2 \cos \theta + 1 = 0$$

$$(\cos \theta - 1)^2 = 0$$

$$\therefore \cos \theta = 1 = \cos(0) \Rightarrow \theta = 0$$

$$\text{Now, } \cos^4 \theta + \sec^4 \theta - 2$$

$$(1)^4 + (1)^4 - 2 = 0$$

7. Sol. (a)

$$\cos^2 \theta - 3 \cos \theta + 2 = \sin^2 \theta$$

$$\cos^2 \theta - 3 \cos \theta + 2 = 1 - \cos^2 \theta$$

$$2 \cos^2 \theta - 3 \cos \theta + 1 = 0$$

$$2 \cos^2 \theta - 3 \cos \theta - \cos \theta + 1 = 0$$

$$2\cos\theta(\cos\theta - 1) - 1(\cos\theta - 1) = 0$$

$$\cos\theta = \frac{1}{2}, 1$$

$$\theta = 60^\circ$$

$$\sin^2 60 + \cos 60^\circ$$

$$\Rightarrow \frac{3}{4} + \frac{1}{2} = \frac{5}{4}$$

8. Sol. (b)

$$2\sin\theta + 2\sin^2\theta = 2$$

$$\sin\theta + \sin^2\theta = 1 \Rightarrow \sin\theta = 1 - \sin^2\theta$$

$$\Rightarrow \sin\theta = \cos^2\theta$$

$$\text{So, } 2\cos^4\theta + 2\cos^2\theta = 2(\cos^4\theta + \cos^2\theta)$$

$$= 2(\sin^2\theta + \cos^2\theta) = 2 \times 1 = 2$$

9. Sol. (a)

$$\tan^2\theta + 3\sec\theta - 9 = 0$$

$$\Rightarrow \sec^2\theta - 1 + 3\sec\theta - 9 = 0$$

$$\Rightarrow \sec^2\theta + 3\sec\theta - 10 = 0$$

$$\Rightarrow \sec^2\theta + 5\sec\theta - 2\sec\theta - 10 = 0$$

$$\Rightarrow (\sec\theta - 2)(\sec\theta + 5) = 0$$

$$\Rightarrow \sec\theta = 2, -5(\text{neglected})$$

$$\Rightarrow \sec\theta = \sec 60^\circ$$

$$\Rightarrow \theta = 60^\circ$$

$$\text{Hence, } 12\cot^2\theta + 3\operatorname{cosec}\theta = 12\cot^2(60^\circ) + 3\operatorname{cosec}60^\circ$$

$$= 12 \times \left(\frac{1}{\sqrt{3}}\right)^2 + 3 \times \frac{2}{\sqrt{3}} = 12 \times \frac{1}{3} + 2\sqrt{3}$$

$$= 4 + 2\sqrt{3} = (\sqrt{3})^2 + 2\sqrt{3} + (1)^2 = (\sqrt{3} + 1)^2$$

10. Sol. (a)

$$5\sin^2\theta = 3(1 + \cos\theta)$$

$$5(1 - \cos^2\theta) = 3(1 + \cos\theta)$$

$$5(1 + \cos\theta)(1 - \cos\theta) = 3(1 + \cos\theta)$$

$$5(1 - \cos\theta) = 3 \Rightarrow 5 - 5\cos\theta = 3$$

$$5\cos\theta = 2 \Rightarrow \cos\theta = \frac{2}{5} = \frac{B}{H}, \text{ So, } P = \sqrt{21}$$

$$\operatorname{cosec}\theta + \cot\theta = \frac{H}{P} + \frac{B}{P} = \frac{H+B}{P}$$

$$= \frac{2+5}{\sqrt{21}} = \frac{7}{\sqrt{21}} = \frac{\sqrt{7}}{3}$$

11. Sol. (d)

$$\sin^2\theta - 3\sin\theta + 2 = 0$$

$$\sin^2\theta - 2\sin\theta - \sin\theta + 2 = 0$$

$$\sin\theta(\sin\theta - 2) - 1(\sin\theta - 2) = 0$$

$$(\sin\theta - 1)(\sin\theta - 2) = 0$$

$$\sin\theta = 1 \text{ or } 2$$

$$\text{So, } \sin\theta = 1 \text{ (As, } 0^\circ \leq \theta \leq 90^\circ) \Rightarrow \theta = 90^\circ$$

12. Sol. (a)

$$14\sin^2\theta + 10(1 - \sin^2\theta) - 11 = 0$$

$$14\sin^2\theta + 10 - 10\sin^2\theta - 11 = 0$$

$$4\sin^2\theta = 1$$

$$\sin^2\theta = \frac{1}{4}$$

$$\sin\theta = \frac{1}{2}$$

$$\theta = 30^\circ$$

$$\Rightarrow \tan 30^\circ + \cot 30^\circ$$

$$\Rightarrow \frac{1}{3} + \sqrt{3} = \frac{4}{\sqrt{3}}$$

13. Sol. (a)

$$8\sin^2\theta + 2\cos\theta = 5$$

$$\Rightarrow 8(1 - \cos^2\theta) + 2\cos\theta - 5 = 0$$

$$\Rightarrow 8 - 8\cos^2\theta + 2\cos\theta - 5 = 0$$

$$\Rightarrow -8\cos^2\theta + 2\cos\theta + 3 = 0$$

$$\Rightarrow 8\cos^2\theta - 2\cos\theta - 3 = 0$$

$$\Rightarrow 8\cos^2\theta - 6\cos\theta + 4\cos\theta - 3 = 0$$

$$\Rightarrow 2\cos\theta(4\cos\theta - 3) + 1(4\cos\theta - 3) = 0$$

$$\Rightarrow (4\cos\theta - 3)(2\cos\theta + 1) = 0$$

$$\Rightarrow 4\cos\theta - 3 = 0$$

$$\text{Because } 2\cos\theta + 1 \neq 0$$

$$[\because 0^\circ < \theta < 90^\circ]$$

$$\Rightarrow 4\cos\theta = 3$$

$$\Rightarrow \cos\theta = \frac{3}{4}$$

$$\Rightarrow \sin\theta = \sqrt{1 - \cos^2\theta}$$

$$= \sqrt{1 - \frac{9}{16}} = \sqrt{\frac{7}{16}} = \frac{\sqrt{7}}{4}$$

$$= \sqrt{1 - \frac{9}{16}} = \sqrt{\frac{7}{16}} = \frac{\sqrt{7}}{4}$$

$$\therefore \tan\theta = \frac{\sin\theta}{\cos\theta} = \frac{\sqrt{7}}{3}$$

$$\sec\theta = \frac{4}{3}$$

Expression

$$= \tan^2\theta + \sec^2\theta - \sin^2\theta$$

$$= \left(\frac{\sqrt{7}}{3}\right)^2 + \left(\frac{4}{3}\right)^2 - \left(\frac{\sqrt{7}}{4}\right)^2$$

$$= \frac{7}{9} + \frac{16}{9} - \frac{7}{16}$$

$$= \frac{112 + 256 - 63}{144} = \frac{305}{144}$$

14. Sol. (c)

$$2\sin^2 \theta + 3\cos \theta = 3$$

$$2(1 - \cos^2 \theta) + 3\cos \theta = 3$$

$$2 - 2\cos^2 \theta + 3\cos \theta = 3$$

$$2\cos^2 \theta + 3\cos \theta - 1 = 0$$

$$2\cos^2 \theta - 3\cos \theta + 1 = 0$$

$$2\cos^2 \theta - 2\cos \theta + \cos \theta + 1 = 0$$

$$2\cos \theta (\cos \theta - 1) - 1(\cos \theta - 1) = 0$$

$$(\cos \theta - 1)(2\cos \theta - 1) = 0$$

$$\cos \theta = 1 \text{ not possible as } 0^\circ < \theta < 90^\circ,$$

$$\text{So } \cos \theta = \frac{1}{2}, \theta = 60^\circ$$

$$\text{So, } \sec^2 \theta + \cot^2 \theta = \sec^2 60^\circ + \cot^2 60^\circ$$

$$= (2)^2 + \left(\frac{1}{\sqrt{3}}\right)^2 = 4 + \frac{1}{3} = 4\frac{1}{3}$$

15. Sol. (c)

$$2\sin \theta + 15\cos^2 \theta = 7$$

$$\Rightarrow 2\sin \theta + 15(1 - \sin^2 \theta) = 7$$

$$\Rightarrow 2\sin \theta + 15 - 15\sin^2 \theta = 7$$

$$\Rightarrow 15\sin^2 \theta - 2\sin \theta - 8 = 0$$

$$\Rightarrow 15\sin^2 \theta + 10\sin \theta - 12\sin \theta - 8 = 0$$

$$\Rightarrow 5\sin \theta (3\sin \theta + 2) - 4(3\sin \theta + 2) = 0$$

$$\Rightarrow (3\sin \theta + 2)(5\sin \theta - 4) = 0$$

$$\therefore 5\sin \theta - 4 = 0 \text{ because } 0 < \theta < 90^\circ$$

$$\Rightarrow 5\sin \theta = 4$$

$$\Rightarrow \sin \theta = \frac{4}{5}$$

$$\therefore \cos \theta = \sqrt{1 - \sin^2 \theta} = \sqrt{1 - \left(\frac{4}{5}\right)^2}$$

$$= \sqrt{1 - \frac{16}{25}} = \sqrt{\frac{9}{25}} = \frac{3}{5}$$

$$\therefore \tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{4}{5} / \frac{3}{5} = \frac{4}{3}$$

$$\therefore \frac{3 - \tan \theta}{2 + \tan \theta} = \frac{3 - \frac{4}{3}}{2 + \frac{4}{3}} = \frac{5}{10} = \frac{1}{2}$$

16. Sol. (b)

$$3\sec^3 \theta + \tan \theta - 7 = 0$$

$$3(1 + \tan^2 \theta) + \tan \theta - 7 = 0$$

$$3 + 3\tan^2 \theta + \tan \theta - 7 = 0$$

$$3\tan^2 \theta + \tan \theta - 4 = 0$$

$$3x^2 + x - 4 = 0$$

$$\frac{2\sin \theta + 3\cos \theta}{\csc \theta + \sec \theta} = \frac{2\sin 45^\circ + 3\cos 45^\circ}{\csc 45^\circ + \sec 45^\circ} = \frac{2 \times \frac{1}{\sqrt{2}} + 3 \times \frac{1}{\sqrt{2}}}{\sqrt{2} + \sqrt{2}}$$

17. Sol. (c)

$$5\sin^2 A + 3\cos^2 A = 4$$

$$\Rightarrow 2\sin^2 A + 3\sin^2 A + 3\cos^2 A = 4$$

$$\Rightarrow 2\sin^2 A + 3(\sin^2 A + \cos^2 A) = 4$$

$$\Rightarrow 2\sin^2 A + 3 = 4 \Rightarrow 2\sin^2 A = 1$$

$$\sin^2 A = \frac{1}{2} \Rightarrow \sin A = \frac{1}{\sqrt{2}}$$

$$\text{So, } \cos A = \sqrt{1 - \frac{1}{2}} = \frac{1}{\sqrt{2}}$$

$$\text{Now, } \tan A = \frac{\sin A}{\cos A} = \frac{\frac{1}{\sqrt{2}}}{\frac{1}{\sqrt{2}}} = 1$$

18. Sol. (c)

$$\sin^2 \theta - \cos^2 \theta - 3\sin \theta + 2 = 0$$

$$\sin^2 \theta - (1 - \sin^2 \theta) - 3\sin \theta + 2 = 0$$

$$\sin^2 \theta - 1 + \sin^2 \theta - 3\sin \theta + 2 = 0$$

$$2\sin^2 \theta - 3\sin \theta + 1 = 0$$

$$2\sin^2 \theta - 2\sin \theta - \sin \theta + 1 = 0$$

$$2\sin \theta (\sin \theta - 1) - 1(\sin \theta - 1) = 0$$

$$(\sin \theta - 1)(2\sin \theta - 1) = 0$$

$$\sin \theta = 1 \text{ not possible, so } \sin \theta = \frac{1}{2}$$

$$\theta = 30^\circ$$

$$= \text{So, } 1 + \sec \theta + \tan \theta$$

$$= 1 + \sec 30^\circ + \tan 30^\circ$$

$$= 1 + \frac{2}{\sqrt{3}} + \frac{1}{\sqrt{3}} = 1 + \frac{3}{\sqrt{3}} = 1 + \sqrt{3}$$

19. Sol. (d)

$$6\tan A(\tan A + 1) = 5 - \tan A$$

$$\Rightarrow 6\tan^2 A + 6\tan A + \tan A - 5 = 0$$

$$\Rightarrow 6\tan^2 A + 7\tan A - 5 = 0$$

$$\Rightarrow 6\tan^2 A - 3\tan A + 10\tan A - 5 = 0$$

$$\Rightarrow 3\tan A(2\tan A - 1) + 5(2\tan A - 1) = 0$$

$$\Rightarrow (3\tan A + 5)(2\tan A - 1) = 0$$

$$\Rightarrow 2\tan A - 1 = 0 \text{ because } 3\tan A + 5 \neq 0$$

$$(\because 0 < A < \frac{\pi}{2})$$

$$\Rightarrow 2\tan A = 1$$

$$\Rightarrow \tan A = \frac{1}{2} = \frac{p}{b}$$

$$\therefore h = \sqrt{p^2 + b^2} = \sqrt{1 + 4} = \sqrt{5}$$

$$\therefore \sin A = \frac{p}{h} = \frac{1}{\sqrt{5}}; \cos A = \frac{b}{h} = \frac{2}{\sqrt{5}}$$

$$\therefore \sin A + \cos A = \frac{1}{\sqrt{5}} + \frac{2}{\sqrt{5}} = \frac{1+2}{\sqrt{5}} = \frac{3}{\sqrt{5}}$$

20. Sol. (d)

$$\begin{aligned}
 3 - 2\sin^2 \theta - 3\cos \theta &= 0 \\
 \Rightarrow 3 - 2(1 - \cos^2 \theta) - 3\cos \theta &= 0 \\
 \Rightarrow 2\cos^2 \theta - 3\cos \theta + 1 &= 0 \\
 \Rightarrow 2\cos^2 \theta - 2\cos \theta - \cos \theta + 1 &= 0 \\
 \Rightarrow 2\cos \theta(\cos \theta - 1) - 1(\cos \theta - 1) &= 0 \\
 \Rightarrow \cos \theta = 1 \text{ or } \frac{1}{2} \Rightarrow \text{Clearly } \theta &= 60^\circ \\
 (2\operatorname{cosec} \theta + \tan \theta) &\Rightarrow 2\left(\frac{2}{\sqrt{3}}\right) + \sqrt{3} \\
 \Rightarrow \frac{4}{\sqrt{3}} + \sqrt{3} &= \frac{7\sqrt{3}}{3}
 \end{aligned}$$

21. Sol. (a)

$$\begin{aligned}
 8\sin^2 \theta + 2\cos \theta &= 5 \\
 8(1 - \cos^2 \theta) + 2\cos \theta &= 5 \\
 8\cos^2 \theta - 2\cos \theta - 3 &= 0 \\
 8\cos^2 \theta - 6\cos \theta + 4\cos \theta - 3 &= 0 \\
 2\cos \theta(4\cos \theta - 3) + (4\cos \theta - 3) &= 0 \\
 \cos \theta = \frac{-1}{2} \text{ or } \frac{3}{4} \Rightarrow \cos \theta &= \frac{3}{4} \\
 \Rightarrow \tan^2 \theta = \frac{7}{9} \Rightarrow \sec^2 \theta &= \frac{16}{9} \\
 \Rightarrow \sin^2 \theta &= \frac{7}{16} \\
 \Rightarrow \tan^2 \theta + \sec^2 \theta - \sin^2 \theta &= \frac{7}{9} + \frac{16}{9} - \frac{7}{16} = \frac{305}{144}
 \end{aligned}$$

22. Sol. (a)

$$\begin{aligned}
 2\sin^2 x + 3\sin x - 2 &= 0 \\
 2\sin^2 x + 4\sin x - \sin x - 2 &= 0 \\
 2\sin x(\sin x + 2) - 1(\sin x + 2) &= 0 \\
 (2\sin x - 1)(\sin x + 2) &= 0 \\
 \sin x = \frac{1}{2} \Rightarrow x = 30^\circ \text{ or } \frac{\pi}{6}
 \end{aligned}$$

23. Sol. (b)

$$\begin{aligned}
 2\sin^2 \theta - \cos \theta + 4 &= 0 \\
 \Rightarrow 2(1 - \cos^2 \theta) - \cos \theta + 4 &= 0 \\
 \Rightarrow 2\cos^2 \theta + \cos \theta - 6 &= 0 \\
 \Rightarrow (2\cos \theta - 3)(\cos \theta + 2) &= 0 \\
 \therefore \cos \theta &= \frac{3}{2} \text{ and } -2 \\
 \text{But } -1 \leq \cos \theta \leq 1 & \\
 \therefore (1) \text{ is not correct.} & \\
 (2) \tan \theta + \cot \theta &= \tan \theta + \frac{1}{\tan \theta} \\
 \text{As minimum value of } x + \frac{1}{x} &= 2 \\
 \therefore \tan \theta + \frac{1}{\tan \theta} &\geq 2
 \end{aligned}$$

(b) Hence, (2) is correct.

24. Sol. (a)

$$\begin{aligned}
 2\cos^2 \theta &= 3\sin \theta \\
 2(1 - \sin^2 \theta) &= 3\sin \theta \Rightarrow 2 - 2\sin^2 \theta = 3\sin \theta \\
 2\sin^2 \theta + 3\sin \theta - 2 &= 0 \Rightarrow \sin \theta = -2 \text{ or } 0.5 \\
 \text{So, } \theta &= 30^\circ \\
 (\sec^2 \theta - \tan^2 \theta + \cos^2 \theta) & \\
 (\text{Put } \theta = 30^\circ) & \\
 \Rightarrow \frac{4}{3} - \frac{1}{3} + \frac{3}{4} &= \frac{7}{4}
 \end{aligned}$$

25. Sol. (d)

$$\begin{aligned}
 3\cos^2 \theta - 4\sin \theta + 1 &= 0 \\
 3(1 - \sin^2 \theta) - 4\sin \theta + 1 &= 0 \\
 3 - 3\sin^2 \theta - 4\sin \theta + 1 &= 0 \\
 3\sin^2 \theta + 4\sin \theta - 4 &= 0 \\
 3\sin^2 \theta + 6\sin \theta - 2\sin \theta - 4 &= 0 \\
 (\sin \theta + 2)(3\sin \theta - 2) &= 0 \\
 \sin \theta = \frac{2}{3} \text{ or } -2 & \text{ (-2 is not possible value of } \sin \theta) \\
 \text{To calculate the value of } \tan \theta + \sec \theta & \\
 \frac{\sin \theta}{\cos \theta} + \frac{1}{\cos \theta} &\Rightarrow \frac{1 + \sin \theta}{\cos \theta} \\
 \Rightarrow \frac{1 + \sin \theta}{\sqrt{1 - \sin^2 \theta}} &= \frac{\frac{5}{3}}{\sqrt{1 - \frac{4}{9}}} \\
 = \frac{5 \times 3}{\sqrt{5 \times 3}} &= \sqrt{5}
 \end{aligned}$$

26. Sol. (a)

$$\begin{aligned}
 \cos^2 \theta - 3\cos \theta + 2 &= \sin^2 \theta \\
 \Rightarrow \cos^2 \theta - 3\cos \theta + 2 &= 1 - \cos^2 \theta \\
 \Rightarrow 2\cos^2 \theta - 3\cos \theta + 1 &= 0 \\
 \Rightarrow 2\cos^2 \theta - 2\cos \theta - \cos \theta + 1 &= 0 \\
 \Rightarrow 2\cos \theta(\cos \theta - 1) - 1(\cos \theta - 1) &= 0 \\
 \Rightarrow \cos \theta = 1 \text{ or } \frac{1}{2} & \\
 \text{Clearly } \theta = 60^\circ, \text{ (as } 0^\circ < \theta < 90^\circ) & \\
 2\operatorname{cosec} \theta + 4\cot \theta &\Rightarrow 2\left(\frac{2}{\sqrt{3}}\right) + 4\left(\frac{1}{\sqrt{3}}\right) = \frac{8\sqrt{3}}{3}
 \end{aligned}$$

27. Sol. (b)

$$\begin{aligned}
 3(\cot^2 \theta - \cos^2 \theta) &= 1 - \sin^2 \theta \\
 3\left[\frac{\cos^2 \theta}{\sin^2 \theta} - \cos^2 \theta\right] &= \cos^2 \theta \\
 3\left[\frac{1 - \sin^2 \theta}{\sin^2 \theta}\right] &= 1 \\
 \cot^2 \theta = \frac{1}{3} \Rightarrow \cot \theta &= \frac{1}{\sqrt{3}} \Rightarrow \theta = 60^\circ
 \end{aligned}$$

Type-10 (Algebraic formula in Trigonometry) MCQ

1. If $\tan \theta + \cot \theta = 4$, then find the value of $\tan^2 \theta + \cot^2 \theta$.

[SSC CHSL 2023 (Morning)]

- (a) 10 (b) 12 (c) 16 (d) 14

2. Simplify. $\frac{\cos^4 \theta - \sin^4 \theta}{\sin^2 \theta}$

[SSC CPO 11/11/2022 (Afternoon)]

- (a) $1 - \tan^2 \theta$ (b) $\tan^2 \theta - 1$
(c) $\cot^2 \theta - 1$ (d) $1 - \cot^2 \theta$

3. $[(\sin \theta \tan \theta + \cos \theta)^2 - 1]$ is equal to:

[Graduate Level 02/08/2022 (Shift - 3)]

- (a) $\tan^2 \theta$ (b) $\operatorname{cosec} \theta$
(c) $\sec^2 \theta$ (d) $\sec \theta$

4. Simplify $\sec^2 \alpha \left(1 + \frac{1}{\operatorname{cosec} \alpha}\right) \left(1 - \frac{1}{\operatorname{cosec} \alpha}\right)$.

[SSC CGL 24/08/2022 (Shift - 2)]

- (a) $\tan^4 \alpha$ (b) -1 (c) 1 (d) $\sin 2 \alpha$

5. If $\tan \alpha, \tan \beta$ are the roots of $x^2 + px + q = 0$ ($p \neq q$) then $\tan(\alpha + \beta) = ?$

- (a) $p - 1$ (b) $\frac{p}{q-1}$
(c) $2q + p$ (d) None of these

6. Let $0^\circ < \theta < 90^\circ$. $(1 + \cot^2 \theta)(1 + \tan^2 \theta) \times (\sin \theta - \operatorname{cosec} \theta)(\cos \theta - \sec \theta)$ is equal to:

[SSC CGL Tier II 29/01/2022]

- (a) $\sin \theta \cos \theta$ (b) $\sin \theta + \cos \theta$
(c) $\sec \theta \operatorname{cosec} \theta$ (d) $\sec \theta + \operatorname{cosec} \theta$

7. Which of the following is the value of $\sqrt{\frac{1 - \sin 45^\circ}{1 + \sin 45^\circ}}$

[SSC CPO 09/11/2022 (Evening)]

- (a) $\cos 45^\circ - \tan 45^\circ$ (b) $\tan 45^\circ - \sec 45^\circ$
(c) $\tan 45^\circ$ (d) $\sec 45^\circ - \tan 45^\circ$

8. Solve the following to find its value in terms of trigonometric ratios. $(\sin A + \cos A)(1 - \sin A \cos A)$

[SSC CGL 06/12/2022 (3rd Shift)]

- (a) $\sin^3 A + \cos^3 A$
(b) $\sin^2 A - \cos^2 A$
(c) $[\cos A - \sin A][\sin^2 A + \cos^2 A]$
(d) $\sin^3 A - \cos^3 A$

9. $\frac{1 + \sin \theta}{\cos \theta}$ is equal to which of the following (where $\theta \neq \frac{\pi}{2}$)?

[SSC CGL 12/12/2022 (2nd Shift)]

- (a) $\frac{1 + \cos \theta}{\sin \theta}$ (b) $\frac{\tan \theta + 1}{\tan \theta - 1}$
(c) $\frac{\tan \theta - 1}{\tan \theta + 1}$ (d) $\frac{\cos \theta}{1 - \sin \theta}$

10. What is $\frac{\sin^3 \theta + \cos^3 \theta}{\sin \theta + \cos \theta} + \frac{\sin^3 \theta - \cos^3 \theta}{\sin \theta - \cos \theta}$ equal to?

[CDS 2021-II]

- (a) 0 (b) 1 (c) 2 (d) 4

11. If $\sin \theta + \operatorname{cosec} \theta = 7$, then what is the value of $\sin^3 \theta + \operatorname{cosec}^3 \theta$?

[SSC CHSL 06/08/2021 (Afternoon)]

- (a) 350 (b) 382 (c) 322 (d) 367

12. If $\tan^2 \alpha = 3 + Q^2$, then $\sec \alpha + \tan^3 \alpha \operatorname{cosec} \alpha = ?$

[SSC CGL 07/12/2022 (1st Shift)]

- (a) $(3 + Q^2)^{\frac{3}{2}}$ (b) $(7 + Q^2)^{\frac{3}{2}}$
(c) $(5 - Q^2)^{\frac{3}{2}}$ (d) $(4 + Q^2)^{\frac{3}{2}}$

13. If $\cos \alpha + \sec \alpha = \sqrt{3}$, then value of $\cos^3 \alpha + \sec^3 \alpha = ?$

- (a) 2 (b) 4 (c) 0 (d) 1

14. If $\tan \theta + \frac{1}{\tan \theta} = 2$, then the value of $\tan^2 \theta + \frac{1}{\tan^2 \theta}$ is _____

[SSC CHSL 06/06/2022 (Morning)]

- (a) -4 (b) 2 (c) 4 (d) 3

15. If $\tan \theta$ & $\sec \theta$ are the root of the equation $px^2 + qx + \gamma = 0$, then which one is true.?

(a) $q^2 + P\sqrt{q^2 - 4pr} = 0$

(b) $p^2 + q\sqrt{q^2 - 4pr} = 0$

(c) $p^2 - q^2 = \sqrt{q^2 - 4pr}$

(d) $p^2 + pq = \sqrt{q^2 - 4pr}$

16. If $x = 8(\sin \theta + \cos \theta)$ and $y = 9(\sin \theta - \cos \theta)$, then the value of $\frac{x^2}{8^2} + \frac{y^2}{9^2}$ is:

[SSC CGC 8/12 | 2022]

- (a) 4 (b) 6 (c) 8 (d) 2

17. The value of $4 \left[\frac{(1 - \sec A)^2 + (1 + \sec A)^2}{1 + \sec^2 A} \right]$ is:

[SSC CGL 06/03/2020 (Evening)]

- (a) 2 (b) 4 (c) 8 (d) 1

18. If $\sec 31^\circ = x$, then $\sin^2 59^\circ + \frac{1}{\sec^2 31^\circ} - \frac{1}{\sin^2 59^\circ \csc^2 59^\circ}$ is equal to:

[SSC CGL 24/08/2021 (Evening)]

- (a) $\frac{x^2 - 2}{x}$ (b) $\frac{2 - x^2}{x^2}$ (c) $\frac{x^2 - 2}{x^2}$ (d) $\frac{2 - x^2}{x}$

19. If $5k = \tan \theta$ and $\frac{5}{k} = \sec \theta$, then what is the value of $10 \left(k^2 - \frac{1}{k^2} \right)$?

[SSC CHSL 16/04/2021 (Evening)]

- (a) 2 (b) -2 (c) $-\frac{2}{5}$ (d) $\frac{2}{5}$

20. If $(\cos \theta + \sin \theta) : (\cos \theta - \sin \theta) = (\sqrt{3} + 1) : (\sqrt{3} - 1)$, $0^\circ < \theta < 90^\circ$, then what is the value of $\sec \theta$?

[SSC CPO 09/12/2019 (Evening)]

- (a) 1 (b) 2 (c) $\sqrt{2}$ (d) $\frac{2\sqrt{3}}{3}$

21. The elimination of θ from $x \cos \theta - y \sin \theta = 2$ and $x \sin \theta - y \cos \theta = 4$ will give:

[SSC CHSL 21/10/2020 (Evening)]

(a) $3x^2 - y^2 = 20$ (b) $x^2 + y^2 = 20$

(c) $3x^2 + y^2 = 20$ (d) $x^2 - y^2 = 20$

22. If $\sec \theta$ and $\sin \theta$ ($0 < \theta < 90^\circ$) are the roots of the equation $\sqrt{6}x^2 - kx + \sqrt{6} = 0$, then the value of k is:

[SSC CHSL 14/10/2020 (Morning)]

(a) $\sqrt{3}$ (b) $3\sqrt{2}$ (c) $2\sqrt{3}$ (d) $3\sqrt{3}$

23. $(\sqrt{\sec^2 \theta + \csc^2 \theta}) \left(\frac{\sin \theta (1 + \cos \theta)}{1 + \cos \theta - \sin^2 \theta} \right)$, $0^\circ < \theta < 90^\circ$ is equal to:

[SSC CGL 17/08/2021 (Morning)]

(a) $\cot \theta$ (b) $\csc^2 \theta$

(c) $\sec^2 \theta$ (d) $\tan \theta$

24. What is the value of $\frac{1 - 2\sin^2 \theta \cos^2 \theta}{\sin^4 \theta + \cos^4 \theta} + 4$ equal to?

[CDS-2020 I]

- (a) 0 (b) 1 (c) 2 (d) 5

25. The value of $\frac{\sec^6 \theta - \tan^6 \theta - 3\sec^2 \theta \tan^2 \theta + 1}{\cos^4 \theta - \sin^4 \theta + 2\sin^2 \theta + 2}$

[SSC CGL 05/03/2020 (Morning)]

- (a) $\frac{2}{3}$ (b) 1 (c) $\frac{3}{4}$ (d) $\frac{1}{2}$

26. $\frac{1 + \cos \theta - \sin^2 \theta}{\sin \theta (1 + \cos \theta)} \times \frac{\sqrt{\sec^2 \theta + \csc^2 \theta}}{\tan \theta + \cot \theta}$, $0^\circ < \theta < 90^\circ$, is equal to:

[SSC CGL Tier II 29/01/2022]

(a) $\tan \theta$ (b) $\sec \theta$

(c) $\csc \theta$ (d) $\cot \theta$

27. $\frac{(1 + \cos \theta)^2 + \sin^2 \theta}{(\csc^2 \theta - 1)\sin^2 \theta} = ?$

[SSC CGL TIER II (11/09/2019)]

(a) $\cos \theta (1 + \sin \theta)$ (b) $2\cos \theta (1 + \sec \theta)$

(c) $\sec \theta (1 + \sin \theta)$ (d) $2\sec \theta (1 + \sec \theta)$

Type-10 ANSWER KEY															
1	D	2	C	3	A	4	C	5	B	6	C	7	D	8	A
9	D	10	C	11	C	12	D	13	C	14	B	15	B	16	D
17	C	18	B	19	C	20	D	21	B	22	D	23	C	24	D
25	A	26	D	27	D										

Type-10 (Algebraic formula in Trigonometry) Solution

1. Sol. (d)

$$\tan \theta + \frac{1}{\tan \theta} = 4$$

$$\tan^2 \theta + \frac{1}{\tan^2 \theta} = 4^2 - 2 = 14$$

$$\text{Formula used: } x^2 + \frac{1}{x^2} = \left(x + \frac{1}{x}\right)^2 - 2$$

2. Sol. (c)

$$\frac{\cos^4 \theta - \sin^4 \theta}{\sin^2 \theta}$$

$$= \frac{(\cos^2 \theta - \sin^2 \theta)(\sin^2 \theta + \cos^2 \theta)}{\sin^2 \theta}$$

$$= \cot^2 \theta - 1$$

3. Sol. (a)

$$[(\sin \theta \tan \theta + \cos \theta)^2 - 1] = \sin^2 \theta$$

$$\tan^2 \theta + \cos^2 \theta + 2 \sin \theta \cdot \tan \theta \cdot \cos \theta - 1$$

$$= \sin^2 \theta \tan^2 \theta + \cos^2 \theta + 2 \sin^2 \theta - 1$$

$$= \sin^2 \theta \tan^2 \theta + \cos^2 \theta + \sin^2 \theta + \sin^2 \theta - 1$$

$$= \sin^2 \theta (1 + \tan^2 \theta) + (\sin^2 \theta + \cos^2 \theta) - 1$$

$$= \sin^2 \theta \cdot \sec^2 \theta + 1 - 1 = \tan^2 \theta$$

4. Sol. (c)

$$\sec^2 \alpha \left[1 + \frac{1}{\operatorname{cosec} \alpha}\right] \left[1 - \frac{1}{\operatorname{cosec} \alpha}\right]$$

$$= \sec^2 \alpha \left[\frac{\operatorname{cosec} \alpha + 1}{\operatorname{cosec} \alpha}\right] \left[\frac{\operatorname{cosec} \alpha - 1}{\operatorname{cosec} \alpha}\right]$$

$$\because (a+b)(a-b) = a^2 - b^2 \text{ and } 1 + \cot^2 \alpha$$

$$= \operatorname{cosec}^2 \alpha$$

$$= \sec^2 \alpha \frac{[\operatorname{cosec}^2 \alpha - 1]}{\operatorname{cosec}^2 \alpha}$$

$$= \sec^2 \alpha \times \frac{\cot^2 \alpha}{\operatorname{cosec}^2 \alpha} = \frac{\sin^2 \alpha}{\cos^2 \alpha} \cot^2 \alpha = 1$$

5. Sol. (b)

$$\tan \alpha, \tan \beta \text{ are roots of } x^2 + px + q = 0$$

$$\tan \alpha + \tan \beta = -p$$

$$\tan \alpha \cdot \tan \beta = q$$

$$\tan(\alpha + \beta) = \frac{\tan \alpha + \tan \beta}{1 - \tan \alpha \tan \beta}$$

$$= \frac{-p}{1-q} = \frac{p}{q-1}$$

6. Sol. (c)

$$(1 + \cot^2 \theta)(1 + \tan^2 \theta) \times (\sin \theta -$$

$$\operatorname{cosec} \theta)(\cos \theta - \sec \theta)$$

$$= \operatorname{cosec}^2 \theta \times \sec^2 \theta \times \left(\sin \theta - \frac{1}{\sin \theta}\right) \left(\cos \theta -$$

$$\frac{1}{\cos \theta}\right)$$

$$= \operatorname{cosec}^2 \theta \times \sec^2 \theta \times \frac{\sin^2 \theta - 1}{\sin \theta} \times \frac{\cos^2 \theta - 1}{\cos \theta}$$

$$\frac{\operatorname{cosec}^2 \theta \times \sec^2 \theta \times (1 - \sin^2 \theta) \times (1 - \cos^2 \theta)}{\sin \theta \times \cos \theta}$$

$$= \frac{\operatorname{cosec}^2 \theta \times \sec^2 \theta \times \cos^2 \theta \times \sin^2 \theta}{\sin \theta \times \cos \theta}$$

$$= \frac{1}{\sin \theta \times \cos \theta} = \sec \theta \times \operatorname{cosec} \theta$$

7. Sol. (d)

$$\sqrt{\frac{1 - \sin 45^\circ}{1 + \sin 45^\circ}}$$

On rationalization, we get:

$$\sqrt{\frac{(1 - \sin 45^\circ)(1 - \sin 45^\circ)}{(1 + \sin 45^\circ)(1 - \sin 45^\circ)}}$$

$$= \sqrt{\frac{(1 - \sin 45^\circ)^2}{1 - \sin^2 45^\circ}}$$

$$= \frac{1 - \sin 45^\circ}{\cos 45^\circ} = \sec 45^\circ - \tan 45^\circ$$

8. Sol. (a)

Formula :-

$$a^3 + b^3 = (a + b)(a^2 + b^2 - ab)$$

$$\begin{aligned}
 & (\sin A + \cos A)(1 - \sin A \cos A) \\
 &= (\sin A + \cos A) \\
 & (\sin^2 A + \cos^2 A - \sin A \cos A) \\
 &= \sin^3 A + \cos^3 A
 \end{aligned}$$

9. Sol. (d)

$$\begin{aligned}
 & \frac{1+\sin \theta}{\cos \theta} \\
 &= \frac{(1+\sin \theta)(1-\sin \theta)}{\cos \theta(1-\sin \theta)} = \frac{1-\sin^2 \theta}{\cos \theta(1-\sin \theta)} \\
 &= \frac{\cos^2 \theta}{\cos \theta(1-\sin \theta)} = \frac{\cos \theta}{1-\sin \theta}
 \end{aligned}$$

10. Sol. (c)

$$\begin{aligned}
 & \frac{(\sin \theta + \cos \theta)(1 + \sin \theta \cos \theta)}{(\sin \theta + \cos \theta)} + \frac{(\sin \theta - \cos \theta)(1 - \sin \theta \cos \theta)}{\sin \theta - \cos \theta} \\
 &= 2
 \end{aligned}$$

11. Sol. (c)

$$\begin{aligned}
 & \sin \theta + \frac{1}{\sin \theta} = 7 \\
 & \sin^3 \theta + \operatorname{cosec}^3 \theta = \sin^3 \theta + \frac{1}{\sin^3 \theta} \\
 &= 7^3 \cdot 3 \times 7 = 322
 \end{aligned}$$

12. Sol. (d)

$$\begin{aligned}
 & 1 + \tan^2 \alpha = 4 + Q^2 \text{ (adding 1 both sides)} \\
 & \sec^2 \alpha = 4 + Q^2 \\
 & \cos \alpha = (4 + Q^2)^{-1/2} \\
 & \sec \alpha + \tan^3 \alpha \operatorname{cosec} \alpha = \frac{1}{\cos \alpha} + \frac{\sin^3 \alpha}{\cos^3 \alpha \times \sin \alpha} \\
 &= \frac{1}{\cos \alpha} + \frac{\sin^2 \alpha}{\cos^2 \alpha \times \cos \alpha} \\
 &= \frac{1 + \tan^2 \alpha}{\cos \alpha} = \frac{(4 + Q^2)}{(4 + Q^2)^{-1/2}} \\
 &= (4 + Q^2)^{\frac{3}{2}}
 \end{aligned}$$

13. Sol. (c)

$$\begin{aligned}
 & x + \frac{1}{x} = \sqrt{3} \\
 & x^3 + \frac{1}{x^3} = (\sqrt{3})^3 - 3\sqrt{3} = 0 \\
 & \therefore \text{If } x + \frac{1}{x} = k \\
 & x^3 + \frac{1}{x^3} = k^3 - 3k
 \end{aligned}$$

14. Sol. (b)

$$\begin{aligned}
 & \tan \theta + \frac{1}{\tan \theta} = 2 \\
 & \tan^2 \theta + \frac{1}{\tan^2 \theta} = 2^2 - 2 = 2
 \end{aligned}$$

15. Sol. (b)

$$\text{Put } \theta = 0^\circ, \tan \theta, \sec \theta = 0, 1$$

$$px^2 + qx + \gamma$$

$$p = 1, q = -1, \gamma = 0$$

$$(x - 0)(x - 1) = 0$$

$$x^2 - x = 0$$

16. Sol. (d)

$$x = 8(\sin \theta + \cos \theta) \text{ and}$$

$$y = 9(\sin \theta - \cos \theta), \frac{x^2}{8^2} + \frac{y^2}{9^2}$$

$$= \frac{64(\sin^2 \theta + \cos^2 \theta + 2\sin \theta \cdot \cos \theta)}{64}$$

$$= \frac{81(\sin^2 \theta + \cos^2 \theta - 2\sin \theta \cdot \cos \theta)}{81}$$

$$= 1 + 2\sin \theta \cdot \cos \theta + 1 - 2\sin \theta \cdot \cos \theta = 2$$

17. Sol. (c)

$$\begin{aligned}
 & 4 \left[\frac{(1 - \sec A)^2 + (1 + \sec A)^2}{1 + \sec^2 A} \right] \\
 &= 4 \left[\frac{(1 + \sec^2 A - 2\sec A) + (1 + \sec^2 A + 2\sec A)}{1 + \sec^2 A} \right] = 8
 \end{aligned}$$

18. Sol. (b)

$$\sin^2 59^\circ + \frac{1}{\sec^2 31^\circ} - \frac{1}{\sin^2 59^\circ \operatorname{cosec}^2 59^\circ}$$

$$\Rightarrow \cos^2 31^\circ + \frac{1}{x^2} - \frac{1}{x^2}$$

$$\Rightarrow \frac{1}{x^2} + \frac{1}{x^2} - 1 = \frac{2}{x^2} - 1 = \frac{2 - x^2}{x^2}$$

19. Sol. (c)

$$\tan^2 \theta - \sec^2 \theta - \sec^2 \theta = -1$$

$$[\sec^2 \theta - \tan^2 \theta = 1]$$

$$25k^2 - \frac{25}{k^2} = -1 \Rightarrow k^2 - \frac{1}{k^2} = \frac{-1}{25}$$

Multiply both sides by 10

$$10 \left(k^2 - \frac{1}{k^2} \right) = \frac{-10}{25} = \frac{-2}{5}$$

20. Sol. (d)

Given that:

$$\frac{(\cos \theta + \sin \theta)}{(\cos \theta - \sin \theta)} = \frac{(\sqrt{3}+1)}{(\sqrt{3}-1)} \text{ (divide by 2 in nominator \& denominator)}$$

$$\Rightarrow \frac{(\cos \theta + \sin \theta)}{(\cos \theta - \sin \theta)} = \frac{\left(\frac{\sqrt{3}}{2} + \frac{1}{2}\right)}{\left(\frac{\sqrt{3}}{2} - \frac{1}{2}\right)}$$

$$\text{Thus, } \theta = 30^\circ \Rightarrow \sec 30^\circ = \frac{2}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$$

21. Sol. (b)

$$x \cos \theta - y \sin \theta = 2 \quad \dots(i)$$

$$x \sin \theta - y \cos \theta = 4 \quad \dots(ii)$$

[Multiply and add equation (i) and (ii)]

$$x^2 + y^2 \Rightarrow 2^2 + 4^2 \Rightarrow 20$$

22. Sol. (d)

$$\text{Sum of roots} = \sec \theta + \sin \theta = \frac{-b}{a} = \frac{k}{\sqrt{6}}$$

$$\text{Product of roots} = \sec \theta \times \sin \theta$$

$$= \tan \theta = \frac{c}{a} = \frac{\sqrt{6}}{\sqrt{6}} = 1 \Rightarrow \tan \theta = 1$$

$$\text{it means, } \theta = 45^\circ$$

$$\sec \theta + \sin \theta = \frac{k}{\sqrt{6}} \Rightarrow \sqrt{2} + \frac{1}{\sqrt{2}} = \frac{k}{\sqrt{6}}$$

$$\frac{3}{\sqrt{2}} = \frac{k}{\sqrt{6}} \Rightarrow k = 3\sqrt{3}$$

23. Sol. (c)

$$(\sqrt{\sec^2 \theta + \operatorname{cosec}^2 \theta}) \left(\frac{\sin \theta (1 + \cos \theta)}{1 + \cos \theta - \sin^2 \theta} \right)$$

$$\left(\sqrt{\frac{1}{\cos^2 \theta} + \frac{1}{\sin^2 \theta}} \right) \left(\frac{\sin \theta (1 + \cos \theta)}{1 + \cos \theta - 1 + \cos^2 \theta} \right)$$

$$\frac{1}{\sin \theta \cdot \cos \theta} \times \frac{\sin \theta}{\cos \theta} = \sec^2 \theta$$

24. Sol. (d)

$$\frac{1 - 2\sin^2 \theta \cos^2 \theta}{\sin^4 \theta + \cos^4 \theta}$$

$$= \frac{(\sin^2 \theta + \cos^2 \theta)^2 - 2\sin^2 \theta \cos^2 \theta}{\sin^4 \theta + \cos^4 \theta}$$

$$= \frac{\sin^4 \theta + \cos^4 \theta}{\sin^4 \theta + \cos^4 \theta} = 1$$

$$\text{Hence, required sum} = 1 + 4 = 5$$

25. Sol. (a)

$$\frac{\sec^6 \theta - \tan^6 \theta - 3\sec^2 \theta \tan^2 \theta + 1}{\cos^4 \theta - \sin^4 \theta + 2\sin^2 \theta + 2}$$

$$\Rightarrow a^3 - b^3 = (a - b)(a^2 + b^2 + ab)$$

$$\Rightarrow \frac{\sec^6 \theta - \tan^6 \theta - 3\sec^2 \theta \tan^2 \theta + 1}{\cos^4 \theta - \sin^4 \theta + 2\sin^2 \theta + 2}$$

$$\frac{(\sec^2 \theta - \tan^2 \theta)(\sec^4 \theta + \tan^4 \theta + \sec^2 \theta \tan^2 \theta) - 3\sec^2 \theta \tan^2 \theta + 1}{(\cos^2 \theta - \sin^2 \theta)(\cos^2 \theta + \sin^2 \theta) + 2\sin^2 \theta + 2}$$

$$\Rightarrow \frac{(\sec^4 \theta + \tan^4 \theta - 2\sec^2 \theta \tan^2 \theta) + 1}{(\cos^2 \theta - \sin^2 \theta) + 2\sin^2 \theta + 2}$$

$$\Rightarrow \frac{(\sec^2 \theta - \tan^2 \theta)(\sec^2 \theta - \tan^2 \theta) + 1}{\cos^2 \theta + \sin^2 \theta + 2}$$

$$\Rightarrow \frac{1 \times 1 + 1}{3} = \frac{2}{3}$$

26. Sol. (d)

$$\frac{1 + \cos \theta - \sin^2 \theta}{\sin \theta (1 + \cos \theta)} \times \frac{\sqrt{\sec^2 \theta + \operatorname{cosec}^2 \theta}}{\tan \theta + \cot \theta}$$

$$= \frac{1 - \sin^2 \theta + \cos \theta}{\sin \theta (1 + \cos \theta)} \times \frac{\sqrt{\frac{1}{\cos^2 \theta} + \frac{1}{\sin^2 \theta}}}{\frac{\sin \theta}{\cos \theta} + \frac{\cos \theta}{\sin \theta}}$$

$$= \frac{\cos^2 \theta + \cos \theta}{\sin \theta (1 + \cos \theta)} \times \frac{\sqrt{\frac{\sin^2 \theta + \cos^2 \theta}{\cos^2 \theta \times \sin^2 \theta}}}{\frac{\sin^2 \theta + \cos^2 \theta}{\cos \theta \times \sin \theta}}$$

$$= \frac{\cos \theta (1 + \cos \theta)}{\sin \theta (1 + \cos \theta)} \times \frac{\frac{1}{\cos \theta \times \sin \theta}}{\frac{1}{\cos \theta \times \sin \theta}}$$

$$= \frac{\cos \theta}{\sin \theta} = \cot \theta$$

27. Sol. (d)

$$\frac{(1 + \cos \theta)^2 + \sin^2 \theta}{(\operatorname{cosec}^2 \theta - 1)\sin^2 \theta}$$

$$\Rightarrow \frac{1 + \cos^2 \theta + 2\cos \theta + \sin^2 \theta}{\cot^2 \theta \cdot \sin^2 \theta}$$

$$\Rightarrow \frac{1 + 1 + 2\cos \theta}{\frac{\cos^2 \theta}{\sin^2 \theta} \cdot \sin^2 \theta} \Rightarrow \frac{2 + 2\cos \theta}{\cos^2 \theta}$$

$$\Rightarrow \frac{2}{\cos^2 \theta} + \frac{2}{\cos \theta} = 2\sec \theta (1 + \sec \theta)$$

* * * * *

Type-11 (Putting) MCQ

1. If $\tan^8 \theta + \cot^8 \theta = m$, then what is the value of $\tan \theta + \cot \theta = ?$

[CDS 2023]

- (a) $\sqrt{\sqrt{m+2}+2}$
 (b) $\sqrt{\sqrt{\sqrt{m+4}+2}}$
 (c) $\sqrt{\sqrt{\sqrt{m+2}+2}+2}$
 (d) $\sqrt{\sqrt{\sqrt{m+4}+2}+2}$

2. The expression $\frac{\cos^4 \theta - \sin^4 \theta + 2 \sin^2 \theta + 3}{(\operatorname{cosec} \theta + \cot \theta + 1)(\operatorname{cosec} \theta - \cot \theta + 1) - 2}$ $0^\circ < \theta < 90^\circ$, is equal to

[SSC CGL MAINS 03/02/2022]

- (a) $\frac{1}{2} \sin \theta$ (b) $2 \sin \theta$
 (c) $\sec \theta$ (d) $2 \operatorname{cosec} \theta$

3. If $1 + \sin \theta = m \cos \theta$, then what is the value of $\sin \theta$?

[SSC CGL 07/12/2022 (Shift-02)]

- (a) $\frac{2m^2-1}{m^2+1}$ (b) $\frac{m^2-1}{m^2+1}$
 (c) $\frac{m^2+1}{2m^2-1}$ (d) $\frac{m^2+1}{m^2-1}$

4. If $\sin^2 \theta - \cos^2 \theta - 3 \sin \theta + 2 = 0$, $0^\circ < \theta < 90^\circ$, Then what is the value of $1 + \sec \theta + \tan \theta$?

[SSC CGL 13/04/2022 (Shift-3)]

- (a) $-1 - \sqrt{3}$ (b) $-1 + \sqrt{3}$
 (c) $1 + \sqrt{3}$ (d) $1 - \sqrt{3}$

5. If A, B, C are acute angles and $\sin(B + C - A) = \cos(C + A - B) = \tan(A + B - C) = 1$ then what is $(A + B + C)$ equal to?

[CDS 2022-I]

- (a) 90° (b) 120° (c) 135° (d) 150°

6. If $1 + \sin^2 \theta - 3 \sin \theta \cos \theta = 0$, then the value of $\cot \theta$ is:

[SSC CPO 11/11/2022 (Evening)]

- (a) 0 (b) 1 (c) $\frac{1}{2}$ (d) $\frac{1}{3}$

7. Find the value of $\cos^4 a - \frac{\cos 4a}{8} - \frac{\cos 2a}{2}$.

- (a) $\frac{1}{8}$ (b) $\frac{3}{5}$ (c) $\frac{1}{4}$ (d) $\frac{3}{8}$

8. If $\sec^2 \alpha + 4 \cos^2 \alpha = 4$ and $0^\circ \leq \alpha \leq 90^\circ$, then find the value of α .

[SSC CGL 21/04/2022 (Evening)]

- (a) 30° (b) 0° (c) 45° (d) 60°

9. $\tan^2 \alpha = 1 + 2 \tan^2 \beta$, then find the value of $\sqrt{2} \cos \alpha - \cos \beta = ?$

- (a) 0 (b) 1 (c) 2 (d) $\sqrt{2}$

10. $(\operatorname{cosec} A - \sin A)^2 + (\sec A - \cos A)^2 - (\cot A - \tan A)^2$ is equal to:

[SSC CPO 16/03/2019 (Evening)]

- (a) 2 (b) 0 (c) 1 (d) -1

11. If $3 + \cos^2 \theta = 3(\cot^2 \theta + \sin^2 \theta)$, $0^\circ < \theta < 90^\circ$, then what is the value of $(\cos \theta + 2 \sin \theta)$?

[SSC CPO 11/12/2019 (Morning)]

- (a) $3\sqrt{2}$ (b) $\frac{\sqrt{3}+2}{2}$ (c) $\frac{2\sqrt{3}+1}{2}$ (d) $\frac{3\sqrt{3}+1}{2}$

12. If $\tan^2 \alpha = 3 + Q^2$, then $\sec \alpha + \tan^3 \alpha \operatorname{cosec} \alpha = ?$

[SSC CGL 07/12/2022 (1st Shift)]

- (a) $(3 + Q^2)^{\frac{3}{2}}$ (b) $(7 + Q^2)^{\frac{3}{2}}$
 (c) $(5 - Q^2)^{\frac{3}{2}}$ (d) $(4 + Q^2)^{\frac{3}{2}}$

13. Solve the following equation and find the value of $3 \cot \theta + \tan \theta - 2\sqrt{3} = 0$, Where $0^\circ < \theta < 90^\circ$

[SSC CHSL 04/08/2021 (Afternoon)]

- (a) 30° (b) 45° (c) 60° (d) 15°

14. If $\frac{\tan \theta}{1 - \cot \theta} + \frac{\cot \theta}{1 - \tan \theta} = 1 + k$, then $k = ?$

- (a) $\cot \theta + \sec \theta$ (b) $\tan \theta + \sec \theta$

- (c) $\tan \theta + \operatorname{cosec} \theta$ (d) $\operatorname{cosec} \theta \cdot \sec \theta$
15. Let $0^\circ < \theta < 90^\circ$. $(1 + \cot^2 \theta)(1 + \tan^2 \theta) \times (\sin \theta - \operatorname{cosec} \theta)(\cos \theta - \sec \theta)$ is equal to:

[SSC CGL Tier II 29/01/2022]

- (a) $\sin \theta \cos \theta$ (b) $\sin \theta + \cos \theta$
 (c) $\sec \theta \operatorname{cosec} \theta$ (d) $\sec \theta + \operatorname{cosec} \theta$
16. If $0^\circ < \theta < 90^\circ$, then
- $$\frac{(1 - \sin \theta)(\sec \theta + \tan \theta)\tan \theta}{(\sec \theta + \tan \theta + 1)(\cot \theta - \operatorname{cosec} \theta + 1)} = ?$$

[SSC CHSL 13/04/2021 (Afternoon)]

- (a) $\sin \theta$ (b) $\frac{\sin \theta}{2}$ (c) $\cos \theta$ (d) $\frac{\cos \theta}{2}$
17. The value of $\tan^2 \theta + \cot^2 \theta - \sec^2 \theta \operatorname{cosec}^2 \theta$ is:
- (a) 2 (b) -2 (c) 0 (d) $\frac{1}{2}$
18. If θ is an acute angle and $\sin \theta + \operatorname{cosec} \theta = 2$ is then the value of $\sin^{33} \theta + \operatorname{cosec}^{99} \theta$ is

[Graduate Level 02/08/2022 (Shift-3)]

- (a) -1 (b) 1 (c) 0 (d) 2
19. If $3\sec^2 \theta + \tan \theta - 7 = 0$, $0^\circ < \theta < 90^\circ$, then what is the value of $\left(\frac{2\sin \theta + 3\cos \theta}{\operatorname{cosec} \theta + \sec \theta}\right)$?

[SSC CGL 12/04/2022 (Morning)]

- (a) 10 (b) $\frac{5}{2}$ (c) $\frac{5}{4}$ (d) $4\sqrt{2}$
20. The value of $(1 + \cot A - \operatorname{cosec} A)(1 + \tan A + \sec A) - 1$ is:

[SSC CPO 09/11/2022 (Shift-02)]

- (a) 1 (b) 2 (c) 3 (d) 0
21. If $\sin \theta + \operatorname{cosec} \theta = 2$, then what is the value of $(\sin^{153} \theta + \operatorname{cosec}^{253} \theta)$?

[SSC CHSL 10/07/2019 (Morning)]

- (a) $\frac{1}{153 \times 253}$ (b) $\frac{253}{123}$
 (c) 2 (d) $\frac{153}{253}$

22. If $x = \operatorname{cosec} A + \cos A$ and $y = \operatorname{cosec} A - \cos A$, then find the value of $\left(\frac{2}{x+y}\right)^2 + \left(\frac{x-y}{2}\right)^2 - 1$

[SSC CHSL 19/10/2020 (Morning)]

- (a) 3 (b) 0 (c) 2 (d) 1
23. If $\tan A = \frac{1 - \cos B}{\sin B}$, then what is $A = \frac{2 \tan A}{1 - \tan^2 A}$ equal to?
- (a) $\frac{\tan B}{2}$ (b) $2 \tan B$
 (c) $\tan B$ (d) $4 \tan B$
24. The expression $(\cos^6 \theta + \sin^6 \theta - 1)(\tan^2 \theta + \cot^2 \theta + 2) + 3$ is equal to:

[SSC CGL 13/04/2022 (Afternoon)]

- (a) 0 (b) 1 (c) 2 (d) -1
25. $\frac{(1 + \tan \theta + \sec \theta)(1 + \cot \theta - \operatorname{cosec} \theta)}{(\sec \theta + \tan \theta)(1 - \sin \theta)}$ is equal to:

[SSC CGL Tier-II Exam, 16.11.2020]

- (a) $2 \sec \theta$ (b) $2 \operatorname{cosec} \theta$
 (c) $\operatorname{cosec} \theta$ (d) $\sec \theta$
26. If $\sin \theta \cos \theta = \sqrt{3}/4$, then $\sin^4 \theta + \cos^4 \theta$ is equal to
- (a) $7/8$ (b) $5/8$ (c) $3/8$ (d) $1/8$
27. If $k = \frac{2 \sin x}{1 + \cos x + \sin x}$ then $\frac{1 - \cos x + \sin x}{1 + \sin x}$?
- (a) k (b) $\frac{1}{k}$ (c) $k + 1$ (d) $k - 2$
28. The numerical value of $\frac{1}{1 + \cot^2 \theta} + \frac{3}{1 + \tan^2 \theta} + 2 \sin^2 \theta$ will be
- (a) 2 (b) 5 (c) 6 (d) 3
29. If $2 \cos \theta + \sec \theta - 2\sqrt{2} = 0$, where θ is an acute angle. Find the value of θ .

[SSC CHSL 12/04/2021 (Evening)]

- (a) 60° (b) 30° (c) 15° (d) 45°
30. Find the value of the following expression.
- $$5(\sin^4 \theta + \cos^4 \theta) + 3(\sin^6 \theta + \cos^6 \theta) + 19 \sin^2 \theta \cos^2 \theta$$

[SSC CGL 07/12/2022 (3rd Shift)]

- (a) 8 (b) 5 (c) 6 (d) 7

31. The value of $1 + \sqrt{\frac{\cot \theta + \cos \theta}{\cot \theta - \cos \theta}}$ if $0^\circ < \theta < 90^\circ$, is equal to :

[SSC CGL 12/04/202 (Afternoon)]

- (a) $1 - \sec \theta + \tan \theta$ (b) $1 - \sec \theta - \tan \theta$
(c) $1 + \sec \theta - \tan \theta$ (d) $1 + \sec \theta + \tan \theta$

32. If $\cot \theta = \frac{1}{\sqrt{3}}$, then the value of $\frac{2 - \sin^2 \theta}{1 - \cos^2 \theta} + \operatorname{cosec}^2 \theta + \sec \theta$ is:

[SSC CHSL 02/07/2019 (Morning)]

- (a) 4 (b) 6 (c) 7 (d) 5

33. If $\cos^2 \alpha + \cos^2 \beta = 2$, then the value of $\tan^3 \alpha + \sin^5 \beta$ is ;

- (a) -1 (b) 0 (c) 1 (d) $\frac{1}{\sqrt{3}}$

34. $\frac{(\operatorname{cosec} \theta - \sec \theta)(\cot \theta - \tan \theta)}{(\operatorname{cosec} \theta + \sec \theta)(\sec \theta \cdot \operatorname{cosec} \theta - 2)} = ?$

- (a) 2 (b) 1 (c) 3 (d) -1

35. The expression

$$\frac{(1 - \sin \theta + \cos \theta)^2 (1 - \cos \theta) \sec^3 \theta \operatorname{cosec}^2 \theta}{(\sec \theta - \tan \theta)(\tan \theta + \cot \theta)}, \quad 0^\circ < \theta < 90^\circ, \text{ is equal to}$$

[SSC CGL MAINS 03/02/2022]

- (a) $\sin \theta$ (b) $2 \cos \theta$
(c) $\cot \theta$ (d) $2 \tan \theta$

36. If $\tan^2 \alpha \tan^2 \beta + \tan^2 \beta \cdot \tan^2 \gamma + \tan^2 \gamma \cdot \tan^2 \alpha + 2 \tan^2 \alpha \tan^2 \beta \cdot \tan^2 \gamma = 1$, then $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma = ?$

- (a) 0 (b) 1 (c) -1 (d) 3

37. $\frac{\sec A (\sec A + \tan A) (1 - \sin A)}{(\operatorname{cosec}^2 A - 1) \sin A}$ is equal to.

[SSC CGL Tier II 16/11/2020]

- (a) $\sec^2 A$ (b) $\cos^2 A$
(c) $\cot A$ (d) $\cos A$

38. The value of $\left[\frac{(1 + \sin^2 A)}{(1 + \cos^2 A)} \right] + \frac{(1 + \operatorname{cosec}^2 A)}{(1 + \sec^2 A)}$ is equal to:

- (a) $\frac{(1 + \sin^2 A)}{(1 + \cos^2 A)}$ (b) $\frac{(1 + \sin^2 A)}{(1 + \sec^2 A)}$
(c) $\frac{(1 + \operatorname{cosec}^2 A)}{(1 + \cos^2 A)}$ (d) $\frac{(1 + \operatorname{cosec}^2 A)}{(1 + \sec^2 A)}$

39. $[\tan^2(90 - \theta) - \sin^2(90 - \theta)] \operatorname{cosec}^2(90 - \theta) \cdot \cot^2(90 - \theta)$

- (a) 1 (b) 4 (c) 3 (d) 6

40. If $\sin \theta (2 \sin \theta + 3) = 2$, $0^\circ < \theta < 90^\circ$, then what is the value of $(\sec^2 \theta + \cot^2 \theta - \cos^2 \theta)$?

[SSC CHSL 19/04/2021 (Morning)]

- (a) $\frac{13}{3}$ (b) $\frac{31}{12}$ (c) $\frac{7}{2}$ (d) $\frac{43}{12}$

41. If $\cos^2 \theta - \sin^2 \theta = \tan^2 \phi$, then which of the following is true?

[SSC CPO 13/12/2019 (Evening)]

- (a) $\cos \theta \cos \phi = 1$
(b) $\cos \theta \cos \phi = \sqrt{2}$
(c) $\cos^2 \phi - \sin^2 \phi = \cot^2 \theta$
(d) $\cos^2 \phi - \sin^2 \phi = \tan^2 \theta$

42. If $\frac{\cos^2 \theta}{\cot^2 \theta - \cos^2 \theta} = 3$ and $0^\circ < \theta < 90^\circ$, then value of θ is:

- (a) 30° (b) 45°
(c) 60° (d) None of these

43. $\frac{\sin \theta - \cos \theta + 1}{\sin \theta + \cos \theta - 1} = ?$

[SSC CGL 06/06/2019 (Morning)]

- (a) $\sec \theta \sin \theta$ (b) $\sec \theta \tan \theta$
(c) $\sec \theta + \tan \theta$ (d) $\sec \theta - \tan \theta$

44. If $\sin \theta + \operatorname{cosec} \theta = 2$, then the value of $\sin^5 \theta + \operatorname{cosec}^5 \theta$, when $0^\circ \leq \theta \leq 90^\circ$ is

- (a) 0 (b) 1 (c) 10 (d) 2

45. The value of

$$\sqrt{\sec^2 \theta + \operatorname{cosec}^2 \theta} \times \sqrt{\tan^2 \theta - \sin^2 \theta} \text{ is equal to :}$$

[SSC CGL 06/06/2019 (Morning)]

- (a) $\frac{\operatorname{cosec} \theta \sec^2 \theta}{\sin \theta \sec^2 \theta}$ (b) $\frac{\sin \theta \sec^2 \theta}{\operatorname{cosec} \theta \cos^2 \theta}$
 (c) $\sin \theta \cos^2 \theta$ (d) $\operatorname{cosec} \theta \cos^2 \theta$
46. $(r \cos \theta - \sqrt{3})^2 + (r \sin \theta - 1)^2 = 0$, find $\frac{r \tan \theta + \sec \theta}{r \sec \theta + \tan \theta}$
 (a) $\frac{4}{5}$ (b) $\frac{3}{8}$ (c) $\frac{8}{5}$ (d) $\frac{2}{5}$

47. For $0^\circ < \theta < 90^\circ$, $3 \sec \theta + 4 \cos \theta = 4\sqrt{3}$, find the value of $(1 - \sin \theta + \cos \theta)$

[SSC CHSL 10/08/2021 (Morning)]

- (a) $\frac{1+2\sqrt{3}}{2}$ (b) $\frac{1+\sqrt{3}}{2}$ (c) $\frac{1-\sqrt{3}}{2}$ (d) $\frac{1-2\sqrt{3}}{2}$

48. If $3 \cos \theta = 2 \sin^2 \theta$, $0^\circ < \theta < 90^\circ$, what is the value of $(\tan^2 \theta + \sec^2 \theta - \operatorname{cosec}^2 \theta)$?

[SSC CHSL 10/08/2021 (Evening)]

- (a) $\frac{17}{3}$ (b) $-\frac{7}{3}$ (c) $-\frac{17}{3}$ (d) $\frac{7}{3}$

49. What is the value of $\frac{\tan A - \sin A}{\sin^3 A}$?

- (a) $\frac{\sec A}{1 - \cos A}$ (b) $\frac{\sec A}{1 + \cos^2 A}$
 (c) $\frac{\sec A}{1 + \cos A}$ (d) None of these

50. If $\cos \theta + \sin \theta = m$ and $\sec \theta + \operatorname{cosec} \theta = n$, then the value of $n(m^2 - 1)$ is equal to

- (a) $2m$ (b) mn (c) $4mn$ (d) $2n$

51. $\left(\frac{1}{\cos \theta} - \frac{1}{\sin \theta}\right) + \frac{1}{\operatorname{cosec} \theta - \cot \theta} - \frac{1}{\sec \theta + \tan \theta} = ?$

[SSC CGL Tier-II 15/11/2020]

- (a) $\sec \theta \operatorname{cosec} \theta$ (b) $\sin \theta \tan \theta$
 (c) $\operatorname{cosec} \theta \cot \theta$ (d) $\sin \theta \cos \theta$

52. $P \cos^2 \alpha + 3P \sin^2 \alpha \cdot \cos \alpha = m$ & $P \sin^3 \alpha + 3P \sin \alpha \cdot \cos^2 \alpha = N$ find the value of $(M + N)^{2/3} + (M - N)^{2/3}$

- (a) $2(p)^{2/3}$ (b) $(P)^{2/3}$
 (c) 0 (d) None of these

53. If $\tan \theta - \cot \theta = 0$, find the value of $\sin \theta + \cos \theta$,

- (a) 0 (b) 1 (c) $\sqrt{2}$ (d) 2

54. If $\sin \theta = a \cos \phi$ and $\cos \theta = b \sin \phi$, then the value of $(a^2 - 1) \cot^2 \phi + (1 - b^2) \cot^2 \theta$ is equal to

- (a) $\frac{a^2 + b^2}{a^2}$ (b) $\frac{a^2 + b^2}{b^2}$ (c) 1 (d) $\frac{a^2 - b^2}{a^2}$

55. If $a \cos^3 \theta + 3a \sin^2 \theta \cdot \cos \theta = m$ and $a \sin^3 \theta + 3a \sin \theta \cdot \cos^2 \theta = n$, then find the value of $(m + n)^{2/3} + (m - n)^{2/3}$ is equal to -

- (a) $a^{2/3}$ (b) $2a^{2/3}$
 (c) $(a \sin \theta \cos \theta)^{2/3}$ (d) $2a^{1/3}$

56. If $3 \sec \theta + 4 \cos \theta - 4\sqrt{3} = 0$, where θ is an acute angle then the value of θ is:

[SSC CGL 13/08/2021 (Evening)]

- (a) 20° (b) 30° (c) 60° (d) 45°

57. The value of $(2 \cos^2 \theta - 1) \left(\frac{1 + \tan \theta}{1 - \tan \theta} + \frac{1 - \tan \theta}{1 + \tan \theta} \right)$ is

- (a) 4 (b) 1 (c) 3 (d) 2

58. Simplify $\frac{(\sin \theta + \sec \theta)^2 + (\cos \theta + \operatorname{cosec} \theta)^2}{(1 + \sec \theta \operatorname{cosec} \theta)^2}$ $0^\circ < \theta < 90^\circ$.

[SSC CGL 24/08/2021 (Evening)]

- (a) 0 (b) 2 (c) -1 (d) 1

59. If $x = \sec \theta - \tan \theta$ and $y = \operatorname{cosec} \theta + \cot \theta$, then which of the following relation is true?

- (a) $xy - 1 = x + y$ (c) $xy + 1 = y - x$
 (b) $xy + 1 = x + y$ (d) $xy - 1 = y - x$

60. Consider the following:

- $\sin^4 \theta - \sin^2 \theta = \cos^4 \theta - \cos^2 \theta$
- $\sin^4 \theta + \sin^4 \theta = 1 + 2 \sin^2 \theta \cos^2 \theta$
- $\tan^4 \theta + \tan^2 \theta = \sec^4 \theta - \sec^2 \theta$

Which of the above are identities?

[CDS 2021-II]

- (a) 1 and 2 only (b) 2 and 3 only
 (c) 1 and 3 only (d) 1, 2 and 3

61. If $\operatorname{cosec} \theta - \sin \theta = 1$ & $\sec \theta - \cos \theta = m$, then $l^2 m^2 (l^2 + m^2 + 3) = ?$

- (a) 0 (b) 1 (c) -1 (d) 2
62. If $\sin \theta = \frac{x^2 - y^2}{x^2 + y^2}$, the which one of the following is correct?

(a) $\cos \theta = \frac{2xy}{x^2 - y^2}$ (b) $\cos \theta = \frac{2xy}{x^2 + y^2}$
 (c) $\cos \theta = \frac{x - y}{x^2 + y^2}$ (d) $\cos \theta = \frac{xy(x - y)}{x^2 + y^2}$

63. $\frac{\sin^8 \theta - \cos^8 \theta}{\cos 2\theta(1 + \cos^2 2\theta)} = ?$

(a) $\frac{1}{2}$ (b) $-\frac{1}{2}$ (c) 2 (d) 1

64. If $\frac{1}{\operatorname{cosec} \theta - 1} + \frac{1}{\operatorname{cosec} \theta + 1} = 2 \sec \theta, 0^\circ < \theta < 90^\circ$, then the value of $(\cot \theta + \cos \theta)$ is:

[SSC CGL 07/06/2019 (Evening)]

(a) $\frac{1 + \sqrt{2}}{2}$ (b) $\frac{2 + \sqrt{2}}{2}$
 (c) $\frac{2 + \sqrt{3}}{\sqrt{2}}$ (d) $1 + \sqrt{2}$

65. The value of $3(\sin x - \cos x)^4 + 6(\sin x + \cos x)^2 + 4(\sin^6 x + \cos^6 x)$ is

(a) 14 (b) 11 (c) 12 (d) 13

66. $\frac{\tan A}{1 - \cot A} + \frac{\cot A}{1 - \tan A} - \frac{2}{\sin 2A} = ?$

(a) -1 (b) 1 (c) 0 (d) 2

67. If $\cos(\theta - A) = a, \cos(\theta - B) = b$, then $\sin^2(A - B) + 2ab \cos(A - B)$ is equal to

(a) $a^2 - b^2$ (b) $a^2 + b^2$
 (c) $b^2 - a^2$ (d) $2ab$

68. If $\alpha + \beta = 90^\circ$, then the value of $(1 - \sin^2 \alpha)(1 - \cos^2 \alpha) \times (1 + \cot^2 \beta)(1 + \tan^2 \beta)$ is

(a) 1 (b) -1 (c) 0 (d) 2

69. If $x = \frac{\cos \theta}{1 - \sin \theta}$, then $\frac{\cos \theta}{1 + \sin \theta}$ is equal to

(a) $x - 1$ (b) $\frac{1}{x}$ (c) $\frac{1}{x + 1}$ (d) $\frac{1}{1 - x}$

70. If $A + B + C = \pi$, then $\cos A + \cos B + \cos C = ?$

(a) $1 + 4 \sin A \sin B \sin C$
 (b) $1 + 4 \sin \frac{A}{2} \sin \frac{B}{2} \sin \frac{C}{2}$
 (c) $1 + 4 \cos A \cos B \cos C$
 (d) $1 + 4 \cos \frac{A}{2} \cos \frac{B}{2} \cos \frac{C}{2}$

Type-11 ANSWER KEY

1	A	2	B	3	B	4	C	5	C	6	B	7	D	8	C
9	A	10	C	11	C	12	D	13	C	14	D	15	C	16	B
17	B	18	D	19	C	20	A	21	C	22	B	23	C	24	A
25	A	26	B	27	A	28	D	29	D	30	A	31	D	32	D
33	B	34	B	35	D	36	B	37	A	38	C	39	A	40	D
41	D	42	C	43	C	44	D	45	B	46	A	47	B	48	A
49	C	50	A	51	A	52	A	53	C	54	D	55	B	56	B
57	D	58	D	59	C	60	C	61	B	62	B	63	B	64	B
65	D	66	B	67	B	68	A	69	B	70	A				

Type-11 (Putting) Solution

1. Sol. (a)

$$\text{Put } \theta = 45^\circ \text{ in } \tan^8 \theta + \cot^8 \theta = m,$$

$$\tan 45^\circ + \cot 45^\circ = 1$$

Check option (a) will give the correct option.

2. Sol. (b)

$$\text{Put } \theta = 45^\circ \text{ then we get the value } = \frac{2}{\sqrt{2}} \text{ then}$$

check through option we get (b) option right.

3. Sol. (b)

$$\text{Given, } 1 + \sin \theta = m \cos \theta$$

$$\text{Put } \theta = 30^\circ$$

$$\Rightarrow 1 + \sin 30^\circ = m \cos 30^\circ$$

$$\Rightarrow 1 + \frac{1}{2} = m \frac{\sqrt{3}}{2}$$

$$\Rightarrow m = \sqrt{3}$$

$$\text{Put } m = \sqrt{3} \text{ in options}$$

We find that option (b)

$$= \frac{m^2 - 1}{m^2 + 1} = \frac{(\sqrt{3})^2 - 1}{(\sqrt{3})^2 + 1} = \frac{1}{2} = \sin 30^\circ$$

4. Sol. (c)

In such type of questions

Put $\theta = 30^\circ$ or $\theta = 60^\circ$ and verify

Since $\theta = 30^\circ$ satisfy

$$\sin^2 \theta - \cos^2 \theta - 3 \sin \theta + 2 = 0^\circ$$

$$\therefore \text{Put } \theta = 30^\circ \text{ in } 1 + \sec \theta + \tan \theta$$

$$= 1 + \frac{2}{\sqrt{3}} + \frac{1}{3} = 1 + \sqrt{3}$$

5. Sol. (c)

$$\sin(B + C - A) = \cos(C + A - B)$$

$$= \tan(A + B - C) = 1$$

$$B + C - A = 90 \quad \dots(i)$$

$$C + A - B = 0 \quad \dots(ii)$$

$$A + B - C = 45 \quad \dots(iii)$$

$$A + B + C = 135^\circ$$

[$\therefore$ add equation (i), (ii) & (iii)]

6. Sol. (b)

$$\text{Put } \theta = 45^\circ \quad 1 + \sin^2 \theta - 3 \sin \theta \cos \theta = 0$$

$$\Rightarrow 1 + \frac{1}{2} - \frac{3}{2} = 0$$

$$\text{Now, } \cot \theta = 1$$

7. Sol. (d)

$$\text{Put } a = 0^\circ$$

$$\text{So, } \cos^4 0^\circ - \frac{\cos 0^\circ}{8} - \frac{\cos 0^\circ}{2}$$

$$\Rightarrow 1 - \frac{1}{8} - \frac{1}{2}$$

$$\Rightarrow \frac{8-1-4}{8} = \frac{3}{8}$$

8. Sol. (c)

Check by options

Take option (c), $\theta = 45^\circ$

$$\sec^2 \alpha + 4 \cos^2 \alpha = 4$$

$$\sqrt{2}^2 + 4 \left(\frac{1}{\sqrt{2}} \right)^2 = 2 + 2 = 4 \text{ (satisfies)}$$

9. Sol. (a)

$$\text{Put } \beta = 0^\circ,$$

$$\tan^2 \alpha = 1 + 2 \times 0$$

$$\tan^2 \alpha = 1$$

$$\alpha = 45^\circ$$

$$\text{Put } \beta = 0^\circ, \text{ and } \alpha = 40^\circ \text{ in } \sqrt{2} \cos \alpha - \cos \beta$$

$$\sqrt{2} \times \frac{1}{\sqrt{2}} - 1 = 1 - 1 = 0$$

10. Sol. (c)

$$\text{Let } A = 45^\circ$$

$$(\operatorname{cosec} A - \sin A)^2 + (\sec A - \cos A)^2 - (\cot A - \tan A)^2$$

$$\Rightarrow (\operatorname{cosec} 45 - \sin 45)^2 + (\sec 45 - \cos 45)^2$$

$$- (\cot 45 - \tan 45)^2$$

$$\Rightarrow \left(\sqrt{2} - \frac{1}{\sqrt{2}} \right)^2 + \left(\sqrt{2} - \frac{1}{\sqrt{2}} \right)^2$$

$$(1-1)^2 \Rightarrow \frac{1}{2} + \frac{1}{2} - 0 = 1$$

11. Sol. (c)

In such questions, take values of θ on your own and check for them in the equations given.

Now, since $0^\circ < \theta < 90^\circ$

So, consider $\theta = 30^\circ, 45^\circ, 60^\circ$

Clearly, on putting these values in equation

$$3 + \cos^2 \theta = 3(\cot^2 \theta + \sin^2 \theta)$$

We find that only $\theta = 60^\circ$ satisfies the given equation.

$$\text{So, } \cos \theta + 2\sin \theta = \frac{2\sqrt{3}+1}{2}$$

12. Sol. (d)

Put, $\alpha = 60^\circ$, then,

$$\tan^2 60^\circ = 3 + Q^2 \Rightarrow Q = 0$$

$$\text{Now, } \sec \alpha + \tan^3 \alpha \operatorname{cosec} \alpha = 2 + 3\sqrt{3} \times \frac{2}{\sqrt{3}} = 8$$

Clearly, option (d) satisfy the given

$$\Rightarrow (4 + Q^2)^{3/2} = (4 + 0^2)^{3/2} = (2^2)^{3/2}$$

$$= 2^3 = 8$$

13. Sol. (c)

Short-Trick:

$$\text{L.H.S } 3\cot \theta + \tan \theta - 2\sqrt{3}$$

$$\text{Put } \theta = 60^\circ \Rightarrow \sqrt{3} + \sqrt{3} - 2\sqrt{3} = 0$$

$$\text{L.H.S} = \text{R.H.S.}$$

14. Sol. (d)

$$\text{Put } Q = 135^\circ, \frac{-1}{2} - \frac{1}{2} = 1 + K$$

$$K = -2$$

15. Sol. (c)

Put $\theta = 45^\circ$

$$(1 + \cot^2 \theta)(1 + \tan^2 \theta) \times (\sin \theta - \operatorname{cosec} \theta)(\cos \theta - \sec \theta)$$

$$= (1+1)(1+1) \left(\frac{1}{\sqrt{2}} - \sqrt{2} \right) \left(\frac{1}{\sqrt{2}} - \sqrt{2} \right)$$

$$= 4 \times \left(-\frac{1}{\sqrt{2}} \right) \left(-\frac{1}{\sqrt{2}} \right) = 2$$

Checking through options only option (c) satisfy.

$$\sec \theta \times \operatorname{cosec} \theta = \sqrt{2} \times \sqrt{2} = 2$$

16. Sol. (b)

Short-Trick:

Put $\theta = 30^\circ$ in

$$\frac{(1-\sin \theta)(\sec \theta + \tan \theta) \tan \theta}{(\sec \theta + \tan \theta + 1)(\cot \theta - \operatorname{cosec} \theta + 1)}$$

$$= \frac{\left(1 - \frac{1}{2}\right) \left(\frac{2}{\sqrt{3}} + \frac{1}{\sqrt{3}}\right) \frac{1}{\sqrt{3}}}{\left(\frac{2}{\sqrt{3}} + \frac{1}{\sqrt{3}} + 1\right) (\sqrt{3} - 2 + 1)}$$

$$= \frac{\left(\frac{1}{2}\right) \left(\frac{3}{\sqrt{3}}\right) \frac{1}{\sqrt{3}}}{\left(\frac{3}{\sqrt{3}} + 1\right) (\sqrt{3} - 1)}$$

$$= \frac{\left(\frac{1}{2}\right)}{(\sqrt{3}+1)(\sqrt{3}-1)} = \frac{1}{4} = \frac{\sin \theta}{2}$$

17. Sol. (b)

$$\tan^2 \theta + \cot^2 \theta - \sec^2 \theta \operatorname{cosec}^2 \theta$$

Let $\theta = 45^\circ$

$$\Rightarrow \tan^2 45^\circ + \cot^2 45^\circ - \sec^2 45^\circ \cdot \operatorname{cosec}^2$$

$$\Rightarrow 1 + 1 - 2.2$$

$$\Rightarrow 2 - 4 = -2 = -2$$

2nd Method

$$\tan^2 \theta + \cot^2 \theta - \sec^2 \theta \operatorname{cosec}^2 \theta$$

$$\Rightarrow \frac{\sin^2 \theta}{\cos^2 \theta} + \frac{\cos^2 \theta}{\sin^2 \theta} - \frac{1}{\cos^2 \theta} \cdot \frac{1}{\sin^2 \theta}$$

$$\Rightarrow \frac{\sin^4 \theta + \cos^4 \theta - 1}{\cos^2 \theta \sin^2 \theta}$$

$$\Rightarrow \frac{(\sin^2 \theta + \cos^2 \theta)^2 - 2\sin^2 \theta \cos^2 \theta - 1}{\cos^2 \theta \sin^2 \theta}$$

$$\Rightarrow \frac{1 - 2\sin^2 \theta \cos^2 \theta - 1}{\cos^2 \theta \sin^2 \theta}$$

$$\Rightarrow \frac{-2\sin^2 \theta \cos^2 \theta}{\cos^2 \theta \sin^2 \theta} = -2$$

18. Sol. (d)

$$\text{Put } \theta = 90^\circ, \sin \theta + \operatorname{cosec} \theta = 2$$

$$\text{Then, } \sin^{99} \theta + \operatorname{cosec}^{99} \theta = 1 + 1 = 2$$

19. Sol. (c)

$$\text{Put } \theta = 45^\circ$$

$$3\sec^2 \theta + \tan \theta - 7 = 3 \times (\sqrt{2})^2 + 1 - 7 \\ = 6 + 1 - 7 = 0$$

$$\text{LHS} = \text{RHS}$$

$$\text{So, } \frac{2\sin \theta + 3\cos \theta}{\csc \theta + \sec \theta} \\ = \frac{2\sin 45^\circ + 3\cos 45^\circ}{\csc 45^\circ + \sec 45^\circ} \\ = \frac{2\left(\frac{1}{\sqrt{2}}\right) + 3\left(\frac{1}{\sqrt{2}}\right)}{\sqrt{2} + \sqrt{2}} = \frac{\frac{5}{\sqrt{2}}}{2\sqrt{2}} = \frac{5}{4}$$

20. Sol. (a)

$$(1 + \cot A - \csc A)(1 + \tan A + \sec A) - 1$$

$$\Rightarrow \left(1 + \frac{\cos A}{\sin A} - \frac{1}{\sin A}\right) \left(1 + \frac{\sin A}{\cos A} + \frac{1}{\sin A}\right) - 1$$

$$\Rightarrow \frac{(\sin A + \cos A - 1)(\sin A + \cos A + 1)}{\sin A \cdot \cos A}$$

$$\Rightarrow \frac{(\sin A + \cos A)^2 - 1}{\sin A \cdot \cos A} - 1 \Rightarrow \frac{1 + 2\sin A \cdot \cos A - 1}{\sin A \cdot \cos A} - 1 = 1$$

Short trick: by putting

$$\text{Put } A = 45^\circ$$

$$\Rightarrow (1 + \cot 45^\circ - \csc 45^\circ)$$

$$(1 + \tan 45^\circ + \sec 45^\circ) - 1$$

$$(1 + 1 - \sqrt{2})(1 + 1 + \sqrt{2}) - 1$$

$$\Rightarrow (2 - \sqrt{2})(2 + \sqrt{2}) - 1$$

$$\Rightarrow (2)^2 - (\sqrt{2})^2 - 1 \Rightarrow 4 - 2 - 1 = 1$$

21. Sol. (c)

$$\text{Short-Trick: } \sin \theta + \csc \theta = 2$$

$$\text{Put } \theta = 90^\circ$$

$$\sin \theta + \csc \theta = 2 \Rightarrow 1 + 1 = 2$$

$$\Rightarrow 2 = 2 \text{ condition satisfied}$$

$$\sin^{153} \theta + \csc^{253} \theta = 1^{153} + 1^{253} = 2$$

22. Sol. (b)

$$x = \csc A + \cos A$$

$$\text{Put } A = 45^\circ$$

$$x = \sqrt{2} + \frac{1}{\sqrt{2}} = \frac{3}{\sqrt{2}}$$

$$y = \csc A - \cos A = \sqrt{2} - \frac{1}{\sqrt{2}} = \frac{1}{\sqrt{2}}$$

$$x + y = \frac{3}{\sqrt{2}} + \frac{1}{\sqrt{2}} = 2\sqrt{2}$$

$$x - y = \frac{3}{\sqrt{2}} - \frac{1}{\sqrt{2}} = \sqrt{2}$$

$$\Rightarrow \left(\frac{2}{x+y}\right)^2 + \left(\frac{x-y}{2}\right)^2 - 1$$

$$= \left(\frac{2}{2\sqrt{2}}\right)^2 + \left(\frac{\sqrt{2}}{2}\right)^2 - 1 = 0$$

23. Sol. (c)

$$\tan A = \frac{1 - \cos B}{\sin B}$$

$$\text{Put } A = 30^\circ, B = 60^\circ$$

$$\tan 30^\circ = \frac{1 - \cos 60^\circ}{\sin 60^\circ}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{1 - \frac{1}{2}}{\frac{\sqrt{3}}{2}}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{1}{\sqrt{3}} \text{ (Satisfy)}$$

$$\therefore \frac{2\tan A}{1 - \tan^2 A} = \frac{2\tan 30^\circ}{1 - \tan^2 30^\circ}$$

$$= \frac{2 \times \frac{1}{\sqrt{3}}}{1 - \left(\frac{1}{\sqrt{3}}\right)^2} = \frac{\frac{2}{\sqrt{3}}}{\frac{2}{3}} = \sqrt{3}$$

Now check the option, Option (c):- $\tan B$

$$\tan 60^\circ = \sqrt{3}$$

24. Sol. (a)

$$\text{Let } \theta = 45^\circ, \text{ now}$$

$$(\cos^6 \theta + \sin^6 \theta - 1)$$

$$(\tan^2 \theta + \cot^2 \theta + 2) + 3$$

$$= \left[\left(\frac{1}{\sqrt{2}}\right)^6 + \left(\frac{1}{\sqrt{2}}\right)^6 - 1\right] [1^2 + 1^2 + 2] + 3$$

$$= \left[\frac{1}{8} + \frac{1}{8} - 1\right] [4] + 3 = -3 + 3 = 0$$

25. Sol. (a)

The expression

$$= \frac{(1 + \tan \theta + \sec \theta)(1 + \cot \theta - \csc \theta)}{(\sec \theta + \tan \theta)(1 - \sin \theta)}$$

$$\text{Putting } \theta = 45^\circ$$

$$= \frac{(1 + \tan 45^\circ + \sec 45^\circ)(1 + \cot 45^\circ - \csc 45^\circ)}{(\sec 45^\circ + \tan 45^\circ)(1 - \sin 45^\circ)}$$

$$\frac{(1 + 1 + \sqrt{2})(1 + 1 - \sqrt{2})}{(\sqrt{2} + 1)\left(1 - \frac{1}{\sqrt{2}}\right)} = \frac{(2 + \sqrt{2})(2 - \sqrt{2})}{(\sqrt{2} + 1)(2 - \sqrt{2})} \times \sqrt{2} = \sqrt{2}$$

$$= 2\sec 45^\circ = 2\sec \theta$$

26. Sol. (b)

$$\sin \theta \cos \theta = \frac{\sqrt{3}}{4}$$

$$\text{Put } \theta = 30^\circ$$

$$\sin 30^\circ \cos 30^\circ = \frac{\sqrt{3}}{4}$$

$$\Rightarrow \frac{1}{2} \times \frac{\sqrt{3}}{2} = \frac{\sqrt{3}}{4}$$

$$\Rightarrow \frac{\sqrt{3}}{4} = \frac{\sqrt{3}}{4} \text{ (Satisfy)}$$

$$\therefore \sin^4 \theta + \cos^4 \theta \Rightarrow \sin^4 30^\circ + \cos^4 30^\circ$$

$$\Rightarrow \left(\frac{1}{2}\right)^4 + \left(\frac{\sqrt{3}}{2}\right)^4$$

$$\Rightarrow \frac{1}{16} + \frac{9}{16}$$

$$\Rightarrow \frac{1+9}{16} = \frac{10}{16}$$

$$\Rightarrow \frac{5}{8}$$

27. Sol. (a)

Given,

$$k = \frac{2\sin x}{1 + \cos x + \sin x}$$

$$\text{put } x = 30^\circ$$

$$k = \frac{2 \times \frac{1}{2}}{1 + \frac{\sqrt{3}}{2} + \frac{1}{2}} = \frac{2}{3 + \sqrt{3}} = \frac{2(3 - \sqrt{3})}{9 - 3} = \frac{3 - \sqrt{3}}{3}$$

Consider,

$$\frac{1 - \cos x + \sin x}{1 + \sin x} = \frac{1 - \frac{\sqrt{3}}{2} + \frac{1}{2}}{1 + \frac{1}{2}} = \frac{3 - \sqrt{3}}{3} = k$$

28. Sol. (a)

$$\frac{1}{1 + \cot^2 \theta} + \frac{3}{1 + \tan^2 \theta} + 2\sin^2 \theta$$

$$\text{Put } \theta = 45^\circ$$

$$\Rightarrow \frac{1}{1+1} + \frac{3}{1+1} + 2 \times \frac{1}{2}$$

$$\Rightarrow \frac{1}{2} + \frac{3}{2} + 1$$

$$\Rightarrow \frac{1+3+2}{2} = \frac{6}{2} = 3$$

29. Sol. (d)

$$2\cos \theta + \sec \theta - 2\sqrt{2} = 0$$

$$\text{Put } \theta = 45^\circ$$

$$2\cos 45^\circ + \sec 45^\circ - 2\sqrt{2} = 0$$

$$\Rightarrow 2 \frac{1}{\sqrt{2}} + \sqrt{2} - 2\sqrt{2} = 0$$

$$\Rightarrow \sqrt{2} + \sqrt{2} - 2\sqrt{2} = 0 \Rightarrow 0 = 0, \text{ satisfy}$$

30. Sol. (a)

$$\text{Put } \theta = 90^\circ$$

$$5(\sin^4 \theta + \cos^4 \theta) + 3(\sin^6 \theta + \cos^6 \theta)$$

$$19\sin^2 \theta \cos^2 \theta$$

$$= 5 \times 1 + 3 \times 1 + 19 \times 0 = 8$$

31. Sol. (d)

$$\text{Putting } \theta = 45^\circ$$

$$1 + \frac{\cot \theta + \cos \theta}{\cot \theta - \cos \theta}$$

$$= 1 + \frac{\cot 45^\circ + \cos 45^\circ}{\cot 45^\circ - \cos 45^\circ}$$

$$= 1 + \frac{1 + \frac{1}{\sqrt{2}}}{1 - \frac{1}{\sqrt{2}}} = 1 + \sqrt{\frac{\sqrt{2}+1}{\sqrt{2}-1}}$$

$$= 1 + \sqrt{\frac{\sqrt{2}+1}{\sqrt{2}-1}} \times \frac{\sqrt{2}+1}{\sqrt{2}+1}$$

$$= 1 + \sqrt{\frac{(\sqrt{2}+1)^2}{1}} = 1 + \sqrt{2} + 1 = 2 + \sqrt{2}$$

Putting $\theta = 45^\circ$ in options, we find that option

(d) gets satisfied.

$$1 + \sec \theta + \tan \theta = 1 + \sec 45^\circ + \tan 45^\circ$$

$$= 1 + \sqrt{2} + 1 \Rightarrow 2 + \sqrt{2}$$

32. Sol. (d)

Short-Trick:

$$\cot \theta = \frac{1}{\sqrt{3}}, \text{ clearly } \theta = 60^\circ$$

$$\Rightarrow \frac{2 - \sin^2 \theta}{1 - \cos^2 \theta} + \operatorname{cosec}^2 \theta + \sec \theta$$

$$\Rightarrow \frac{2 - \left(\frac{\sqrt{3}}{2}\right)^2}{1 - \left(\frac{1}{2}\right)^2} + \left(\frac{2}{\sqrt{3}}\right)^2 + 2$$

$$\Rightarrow \frac{5}{3} + \frac{4}{3} + 2 = 5$$

33. Sol. (b)

$$\cos^2 \alpha + \cos^2 \beta = 2$$

put value of $\alpha = \beta = 0^\circ$

$$\Rightarrow \cos^2 0^\circ + \cos^2 0^\circ = 2$$

$$\Rightarrow (1)^2 + (1)^2 = 2$$

$$\Rightarrow 2 = 2$$

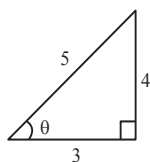
[If satisfies the question]

$$\tan^3 \alpha + \sin^5 \beta$$

$$= \tan^3 0^\circ + \sin^5 0^\circ = 0 + 0 = 0$$

34. Sol. (b)

Let this triples



$$\left(\frac{5}{4} - \frac{5}{3} \right) \times \left(\frac{3}{4} - \frac{4}{3} \right)$$

$$\left(\frac{5}{4} + \frac{5}{3} \right) \left(\frac{5}{4} \times \frac{5}{3} - 2 \right)$$

$$= \frac{-5}{12} \times \frac{-7}{12} = 1$$

$$\frac{35}{12} \times \frac{1}{12}$$

35. Sol. (d)

$$\frac{(1 - \sin \theta + \cos \theta)^2 (1 - \cos \theta) \sec^3 \theta \operatorname{cosec}^2 \theta}{(\sec \theta - \tan \theta)(\tan \theta + \cot \theta)},$$

$$0^\circ < \theta < 90^\circ$$

Put $\theta = 45^\circ$

$$= \frac{\left(1 - \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}}\right)^2 \left(1 - \frac{1}{\sqrt{2}}\right) 2\sqrt{2} \times \sqrt{2}}{(\sqrt{2}-1)(1+1)} = \frac{(\sqrt{2}-1)^4}{(\sqrt{2}-1)^2} = 2$$

From given options, $2 \tan 45^\circ = 2$ $\therefore$ (d) $2 \tan \theta$ is correct option

36. Sol. (b)

$$\text{Put } \gamma = 0^\circ, \tan^2 \alpha + \tan^2 \beta + 0 + 0 + 0 = 1$$

$$\tan \alpha \tan \beta = 1, \alpha + \beta = 90^\circ$$

$$\therefore \sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma = 1 + 0 = 1$$

37. Sol. (a)

Short-Trick: Put $A = 45^\circ$

$$\frac{\sqrt{2}(\sqrt{2}+1)\left(1-\frac{1}{\sqrt{2}}\right)}{\frac{1}{2}}$$

$$(\sqrt{2}+1)(\sqrt{2}-1) \times 2 = 2$$

Now, go through option A

$$\sec^2 \theta = \sec^2 45^\circ = (\sqrt{2})^2 = 2 \text{ (which satisfies)}$$

38. Sol. (c)

$$\frac{1+\sin^2 A}{1+\cos^2 A} + \frac{1+\operatorname{cosec}^2 A}{1+\sec^2 A}$$

Put $A = 30^\circ$ Put $A = 30^\circ$ in options

We find that

Option (C) gives $\frac{20}{7}$, which is the right answers.

39. Sol. (a)

Put, $\theta = 45^\circ$

$$\left(1 - \frac{1}{2}\right) \times 2$$

$$\frac{1}{2} \times 2 = 1$$

40. Sol. (d)

$$\sin \theta (2 \sin \theta + 3) = 2$$

$$\theta = 30^\circ \text{ (by hit and trial)}$$

$$\sec^2 \theta + \cot^2 \theta - \cos^2 \theta$$

$$= \sec^2 30 + \cot^2 30 - \cos^2 30$$

$$= \frac{4}{3} + 3 - \frac{3}{4} = \frac{43}{12}$$

41. Sol. (d)

$$\cos^2 \theta - \sin^2 \theta = \tan^2 \phi$$

$$\Rightarrow \cos 2\theta = \tan^2 \phi \text{ and Let } \phi = 45^\circ$$

$$\text{Then, } \cos 2\theta = 1 \Rightarrow \theta = 0^\circ$$

When we put $\phi = 45^\circ$ and $\theta = 0^\circ$ in all options, we see that option (d) is the right answer.

42. Sol. (c)

Put $\theta = 60^\circ$

$$\frac{\cos^2 60^\circ}{\cot^2 60^\circ - \cos^2 60^\circ} = 3$$

$$\Rightarrow \text{LHS} = \frac{\frac{1}{4}}{\frac{1}{3} - \frac{1}{4}} = \frac{\frac{1}{4}}{\frac{1}{12}} = 3$$

$$\therefore \text{LHS} = \text{RHS} = 3$$

Here,

$$3 = 3$$

$$\text{So, } \theta = 60^\circ$$

43. Sol. (c)

$$\text{Put } \theta = 45^\circ,$$

$$\frac{\sin \theta - \cos \theta + 1}{\sin \theta + \cos \theta - 1} = \frac{\frac{1}{\sqrt{2}} - \frac{1}{\sqrt{2}} + 1}{\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} - 1}$$

$$= \frac{1}{\sqrt{2} - 1} = \sqrt{2} + 1$$

Going through the options

$$\sec \theta + \tan \theta = \sqrt{2} + 1$$

44. Sol. (d)

$$\sin \theta + \operatorname{cosec} \theta = 2 \text{ put } \theta = 90^\circ$$

$$\Rightarrow \sin 90^\circ + \operatorname{cosec} 90^\circ = 2$$

$$\Rightarrow 1 + 1 = 2$$

$$\Rightarrow 2 = 2$$

It, satisfies the question $\sin^5 \theta + \operatorname{cosec}^5 \theta$

$$= \sin^5 90^\circ + \operatorname{cosec}^5 90^\circ$$

$$= (1)^5 + (1)^5 = 1 + 1 = 2$$

45. Sol. (b)

$$\text{Put } \theta = 45^\circ$$

$$\sqrt{\sec^2 \theta + \operatorname{cosec}^2 \theta} \times \sqrt{\tan^2 \theta - \sin^2 \theta}$$

$$\Rightarrow \sqrt{(\sqrt{2})^2 + (\sqrt{2})^2} \times \sqrt{1 - \left(\frac{1}{\sqrt{2}}\right)^2} = \sqrt{2}$$

Going through options

$$\sin \theta \sec^2 \theta \Rightarrow \frac{1}{\sqrt{2}} \times (\sqrt{2})^2 = \sqrt{2}$$

46. Sol. (a)

Equate with zero

$$r \cos \theta - \sqrt{3} = 0$$

$$r \cos \theta = \sqrt{3} \quad \dots(i)$$

$$r \sin \theta = 1 \quad \dots(ii)$$

Equation (i) $\div$ (ii)

$$\cot \theta = \sqrt{3}$$

$$\theta = 30^\circ$$

$$r = 2$$

$$\text{Put this value in } \frac{r \tan \theta + \sec \theta}{y \sec \theta + \tan \theta} = \frac{2x \frac{1}{\sqrt{3}} + \frac{2}{\sqrt{3}}}{2 \times \frac{2}{\sqrt{3}} + \frac{1}{\sqrt{3}}}$$

$$= \frac{4}{5}$$

47. Sol. (b)

$$3 \sec \theta + 4 \cos \theta = 4\sqrt{3},$$

$$\text{Put } \theta = 30^\circ, 3 \times \frac{2}{\sqrt{3}} + 4 \times \frac{\sqrt{3}}{2} = 4\sqrt{3}$$

Equation satisfies $(1 - \sin \theta + \cos \theta)$

$$= (1 - \sin 30^\circ + \cos 30^\circ) = \frac{1 + \sqrt{3}}{2}$$

48. Sol. (a)

$$3 \cos \theta = 2 \sin^2 \theta$$

$$\text{Put } \theta = 60^\circ$$

$$\Rightarrow \frac{3}{2} = \frac{3}{2}; \text{ equation satisfies}$$

$$(\tan^2 \theta + \sec^2 \theta - \operatorname{cosec}^2 \theta)$$

$$\Rightarrow 3 + 4 - \frac{4}{3} \Rightarrow \frac{17}{3}$$

49. Sol. (c)

$$\frac{\tan A - \sin A}{\sin^3 A}$$

$$\text{Put } A = 45^\circ$$

$$\frac{\tan 45^\circ - \sin 45^\circ}{\sin^3 45^\circ} = \frac{1 - \frac{1}{\sqrt{2}}}{\left(\frac{1}{\sqrt{2}}\right)^3}$$

$$= \frac{\sqrt{2} - 1}{\frac{1}{2\sqrt{2}}} = \frac{\sqrt{2} - 1}{\sqrt{2}} \times 2\sqrt{2}$$

$$= 2(\sqrt{2} - 1)$$

Now check from options

$$\text{Option: } \frac{\sec A}{1 + \cos A}$$

$$= \frac{\sec 45^\circ}{1 + \cos 45^\circ} = \frac{\frac{\sqrt{2}}{1}}{1 + \frac{1}{\sqrt{2}}}$$

$$= \frac{\sqrt{2} \times \sqrt{2}}{\sqrt{2} + 1} = \frac{2}{\sqrt{2} + 1}$$

Rationalise above equation

$$= \frac{2}{\sqrt{2} + 1} \times \frac{\sqrt{2} - 1}{\sqrt{2} - 1}$$

$$= \frac{2(\sqrt{2} - 1)}{2 - 1} = 2(\sqrt{2} - 1) \text{ (Satisfy)}$$

50. Sol. (a)

Use $\theta = 45^\circ$

$$\cos \theta + \sin \theta = m$$

$$\Rightarrow \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} = m$$

$$\Rightarrow m = \sqrt{2}$$

$$\sec \theta + \operatorname{cosec} \theta = n$$

$$\Rightarrow \sqrt{2} + \sqrt{2} = n$$

$$\Rightarrow n = 2\sqrt{2}$$

$$n(m^2 - 1) = 2\sqrt{2}((\sqrt{2})^2 - 1)$$

$$= 2\sqrt{2}(2 - 1) = 2\sqrt{2} = 2m$$

51. Sol. (a)

put $\theta = 45^\circ$

$$\left(\frac{1}{\cos \theta} - \frac{1}{\sin \theta} \right) + \frac{1}{\operatorname{cosec} \theta - \cot \theta}$$

$$- \frac{1}{\sec \theta + \tan \theta} = 0 + \frac{1}{\sqrt{2} - 1} - \frac{1}{\sqrt{2} + 1}$$

$$= \sqrt{2} + 1 - (\sqrt{2} - 1) = \sqrt{2} + 1 - \sqrt{2} + 1 = 2$$

Put $\theta = 45^\circ$ in options, option (a) satisfy.

$$\sec \theta \operatorname{cosec} \theta = \sqrt{2} \times \sqrt{2} = 2$$

52. Sol. (a)

put $\alpha = 0$

$$M = P$$

$$N = 0$$

Put this value in $(M + N)^{2/3} + (m - N)^{2/3}$

$$p^{2/3} + p^{2/3}$$

$$2(p)^{2/3}$$

53. Sol. (c)

$$\tan \theta - \cot \theta = 0$$

Put $\theta = 45^\circ$

$$\tan 45^\circ - \cot 45^\circ = 0$$

$$1 - 1 = 0$$

$$0 = 0 \text{ (matched)}$$

So, $\theta = 45^\circ$

$$\sin \theta + \cos \theta$$

$$= \sin 45^\circ + \cos 45^\circ$$

$$= \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} = \sqrt{2}$$

54. Sol. (d)

$$\sin \theta = 45^\circ$$

$$\sin 45^\circ = a \cos \phi \Rightarrow \cos \phi = \frac{1}{\sqrt{2}a}$$

$$\cos 45^\circ = b \sin \phi \Rightarrow \sin \phi = \frac{1}{\sqrt{2}b}$$

$$\cot \phi = \frac{b}{a} \text{ and } \cot \theta = 1$$

$$(a^2 - 1)\cot^2 \phi + (1 - b^2)\cot \theta$$

$$= (a^2 - 1)\frac{b^2}{a^2} + (1 - b^2)1^2$$

$$= b^2 - \frac{b^2}{a^2} + 1 - b^2$$

$$= \frac{a^2 - b^2}{a^2}$$

55. Sol. (b)

put $\theta = 0^\circ$,

$$m = a + 0, m = a. \quad n = 0 + 0, n = 0$$

$$a^{2/3} + a^{2/3} = 2a^{2/3}$$

56. Sol. (b)

Going through option Put the value of $\theta = 30^\circ$

$$3 \times \frac{2}{\sqrt{3}} + 4 \times \frac{\sqrt{3}}{2} - 4\sqrt{3} = 0$$

$$\Rightarrow 2\sqrt{3} + 2\sqrt{3} - 4\sqrt{3} = 0 \text{ (Hence Verified)}$$

57. Sol. (d)

Put $\theta = 60^\circ$

$$\Rightarrow \left(2\cos^2 60^\circ - 1 \right) \left[\frac{1 + \tan 60^\circ}{1 - \tan 60^\circ} + \frac{1 - \tan 60^\circ}{1 + \tan 60^\circ} \right]$$

$$= \left[2 \left(\frac{1}{2} \right)^2 - 1 \right] \left[\frac{1 + \sqrt{3}}{1 - \sqrt{3}} + \frac{1 - \sqrt{3}}{1 + \sqrt{3}} \right]$$

$$\begin{aligned}
 &= \left[\frac{1}{2} - 1 \right] \left[\frac{(1+\sqrt{3})^2 + (1-\sqrt{3})^2}{(1-\sqrt{3})(1+\sqrt{3})} \right] \\
 &= \left(-\frac{1}{2} \right) \left[\frac{(1+3+2\sqrt{3}) + (1+3-2\sqrt{3})}{1-3} \right] \\
 &= \left(-\frac{1}{2} \right) \left[\frac{4+2\sqrt{3}+4-2\sqrt{3}}{-2} \right] \\
 &= -\frac{1}{2} \left[-\frac{8}{2} \right] - \frac{1}{2} \times 4 = 2
 \end{aligned}$$

58. Sol. (d)

Putting the value of $\theta = 45^\circ$

$$\begin{aligned}
 \frac{\left(\frac{1}{\sqrt{2}} + \sqrt{2} \right)^2 + \left(\frac{1}{\sqrt{2}} - \sqrt{2} \right)^2}{(1+\sqrt{2}\sqrt{2})^2} &= \frac{2\left(\frac{2+1}{\sqrt{2}} \right)^2}{(3)^2} \\
 &= \frac{2 \times \frac{9}{2}}{9} = 1
 \end{aligned}$$

59. Sol. (c)

Use $\theta \Rightarrow 45^\circ$

$$x = \sec 45^\circ - \tan 45^\circ = \sqrt{2} - 1$$

$$y = \operatorname{cosec} 45^\circ + \cot 45^\circ = \sqrt{2} + 1$$

$$xy = (\sqrt{2} - 1)(\sqrt{2} + 1) = 2 - 1 = 1$$

$$y - x = (\sqrt{2} + 1) - (\sqrt{2} - 1) = 2$$

$$y - x = xy + 1$$

60. Sol. (c)

take $\theta = 45^\circ$

$$1. \sin^4 45^\circ + \tan^2 45^\circ = \sec^4 45^\circ - \sec^2 45^\circ$$

$$\Rightarrow \frac{1}{4} - \frac{1}{2} = \frac{1}{4} - \frac{1}{2}$$

$$\Rightarrow \frac{-1}{4} = \frac{-1}{4}$$

$$2. \sin^4 45^\circ + \cos^4 45^\circ = 1 + 2 \sin^2 45^\circ \cdot \cos^2 45^\circ$$

$$\Rightarrow \frac{1}{4} + \frac{1}{4} = 1 + \frac{1}{2}$$

$$\Rightarrow \frac{1}{2} \neq \frac{3}{2}$$

$$3. \tan^4 45^\circ + \tan^2 45^\circ = \sec^4 45^\circ - \sec^2 45^\circ$$

$$\Rightarrow 2 = 4 - 2$$

$$2 = 2$$

Identities (1) & (3) are correct.

61. Sol. (b)

Put $\theta = 45^\circ$,

$$\sqrt{2} - \frac{1}{\sqrt{2}} = \ell,$$

$$\ell = \frac{1}{\sqrt{2}} \quad m = \frac{1}{\sqrt{2}}$$

Put this value in $\ell^2 m^2 (\ell^2 + m^2 + 3)$

$$\frac{1}{2} \times \frac{1}{2} \left(\frac{1}{2} + \frac{1}{2} + 3 \right)$$

$$= \frac{1}{4} \times \frac{8}{2} = 1$$

62. Sol. (b)

$$\sin \theta = \frac{x^2 - y^2}{x^2 + y^2}$$

Put $\theta = 30^\circ$

$$x = \sqrt{3}$$

$$y = 1$$

$$\sin 30^\circ = \frac{(\sqrt{3})^2 - (1)^2}{(\sqrt{3})^2 + (1)^2}$$

$$\frac{1}{2} = \frac{3-1}{3+1}$$

$$\frac{1}{2} = \frac{2}{4}$$

$$\frac{1}{2} = \frac{1}{2} \text{ (Satisfy)}$$

63. Sol. (b)

Put $\theta = 0^\circ$,

$$\frac{-1}{1 \times 2} = \frac{-1}{2}$$

64. Sol. (b)

Put $\theta = 45^\circ$

$$LHS \Rightarrow \frac{1}{\operatorname{cosec} \theta - 1} + \frac{1}{\operatorname{cosec} \theta + 1}$$

$$= \frac{1}{\sqrt{2}-1} + \frac{1}{\sqrt{2}+1}$$

$$= \sqrt{2} + 1 + \sqrt{2} - 1 = 2\sqrt{2}$$

$$RHS = 2 \sec \theta = 2\sqrt{2}$$

$$\cot \theta + \cos \theta \Rightarrow 1 + \frac{1}{\sqrt{2}} = \frac{\sqrt{2}+1}{\sqrt{2}}$$

$$= \frac{2+\sqrt{2}}{2}$$

65. Sol. (d)

Use $x = 0^\circ$

$$\begin{aligned}
 & 3(\sin x - \cos x)^4 + 6(\sin x + \cos x)^2 + \\
 & 4(\sin^6 x + \cos^6 x) \\
 & = 3(0 - 1)^4 + 6(0 + 1)^2 + 4(0^6 + 1^6) \\
 & = 3 + 6 + 4 = 13
 \end{aligned}$$

66. Sol. (b)

$$\text{put } A = 135, -\frac{1}{2} - \frac{1}{2} + 2 = 1$$

67. Sol. (b)

$$\cos(\theta - A) = a$$

$$\cos(\theta - B) = b$$

$$\text{Put } \theta = 90^\circ$$

$$\cos(90^\circ - A) = a$$

$$a = \sin A$$

$$b = \sin B$$

$$\text{Put } A = 60^\circ$$

$$B = 30^\circ$$

$$a = \frac{\sqrt{3}}{2}$$

$$b = \frac{1}{2}$$

$$\therefore \sin^2(A - B) + 2ab\cos(A - B)$$

$$\sin^2(60^\circ - 30^\circ) + 20 \times \frac{\sqrt{3}}{2} \times \frac{1}{2} \cos(60^\circ - 30^\circ)$$

$$\Rightarrow \frac{1}{4} + \frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{2}$$

$$\Rightarrow \frac{1}{4} + \frac{3}{4} = 1$$

Now check the option

Option (b):- $a^2 + b^2$

$$\Rightarrow \left(\frac{\sqrt{3}}{2}\right)^2 + \left(\frac{1}{2}\right)^2$$

$$\Rightarrow \frac{3}{4} + \frac{1}{4} = \frac{4}{4} = 1 \text{ (Satisfy)}$$

68. Sol. (a)

$$(1 - \sin^2 \alpha)(1 - \cos^2 \alpha) \times (1 + \cot^2 \beta)(1 + \tan^2 \beta)$$

$$= (\cos^2 \alpha)(\sin^2 \alpha)(\operatorname{cosec}^2 \beta)(\sec^2 \beta)$$

$$\text{Put } \alpha = \beta = 45^\circ,$$

$$= \cos^2 45^\circ \cdot \sin^2 45^\circ \cdot \operatorname{cosec}^2 45^\circ \cdot \sec^2 45^\circ$$

$$= \frac{1}{2} \cdot \frac{1}{2} \cdot 2 \cdot 2 = 1$$

69. Sol. (b)

$$\therefore x = \frac{\cos \theta}{1 - \sin \theta}$$

$$\text{put } \theta = 0^\circ$$

$$x = \frac{\cos 0^\circ}{1 - \sin 0^\circ} = \frac{1}{1 - 0}$$

$$\Rightarrow x = 1$$

$$= \frac{\cos \theta}{1 + \sin \theta} = \frac{\cos 0^\circ}{1 + \sin 0^\circ} = \frac{1}{1 + 0} = 1$$

now check option by putting $x = 1$ only option

(b) satisfying.

70. So. (a)

Use $A = B = C = 60^\circ$

$$\sin 2A + \sin 2B + \sin 2C = \frac{\sqrt{3}}{2} + \frac{\sqrt{3}}{2} + \frac{\sqrt{3}}{2} = \frac{3\sqrt{3}}{2}$$

$$4 \sin A + \sin B + \sin C = 4 \times \frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{2}$$

$$= \frac{3\sqrt{3}}{2}$$

* * * * *

Type-12 (Maxima & Minima)

1. What is the minimum value of $6 - 4\sin\theta$ $0 \leq \theta \leq \frac{\pi}{2}$?

[CDS-2023-I]

(a) 1 (b) 2 (c) 4 (d) 6

2. Find the minimum value of $\sin^2\theta + \cos^4\theta$

(a) $\frac{1}{2}$ (b) $\frac{3}{4}$ (c) $\frac{4}{5}$ (d) $-\frac{1}{2}$

3. Find the maximum value of expression

$$\left\{ \cos^2\left(\frac{\pi}{3} - \theta\right) - \cos^2\left(\frac{\pi}{3} + \theta\right) \right\} ?$$

(a) $\frac{1}{2}$ (b) $\frac{1}{\sqrt{2}}$ (c) $\frac{\sqrt{3}}{2}$ (d) $\frac{3}{2}$

4. Find the maximum value of $\sin^{140}\theta \cdot \cos^{140}\theta$.

[SSC CGL 01/12/2022]

(a) $\frac{1}{2}$ (b) $\frac{1}{2^{140}}$
(c) 0 (d) None of these

5. If x is a real quantity, what is the minimum value of $(25\cos^2 x + 9\sec^2 x)$?

[SSC CGL 23/08/2021 (Morning)]

(a) 30 (b) 20 (c) 15 (d) 40

6. The minimum Value of $\sin^2\theta + \cos^2\theta + \sec^2\theta + \csc^2\theta + \tan^2\theta + \cot^2\theta$.

(a) 1 (b) 3 (c) 5 (d) 7

7. Find the Maximum and Minimum value of $\sin \cdot \sin x$?

(a) -1,1 (b) $\sin - 1, \sin + 1$
(c) $\sin 1, -\sin 1$ (d) Do not exist

8. What is the minimum value of $9\tan^2\theta + 4\cot^2\theta$?

[CDS - 2017-I]

(a) 6 (b) 9 (c) 12 (d) 13

9. What is the minimum value of $\sin^4\theta + \cos^4\theta - 2\sin^2\theta \cos^2\theta$?

[CDS - 2022 - I]

(a) 0
(b) 1
(c) 2
(d) Minimum value does not exist

10. The least value of $8\operatorname{cosec}^2\theta + 25\sin^2\theta$ is:

[SSC CHSL 12/10/2020 (morning)]

(a) $20\sqrt{2}$ (b) $10\sqrt{2}$ (c) $40\sqrt{2}$ (d) $30\sqrt{2}$

11. Find the maximum value of $\sin^{113}\theta \cdot \cos^{113}\theta$:

(a) $\left(\frac{3}{2}\right)^{113}$ (b) 1 (c) $\left(\frac{1}{4}\right)^{113}$ (d) $\left(\frac{1}{2}\right)^{113}$

12. Consider the following statements :

1. $\sin\theta = x + \frac{1}{x}$ is possible for some real value of x .
2. $\cos\theta = x + \frac{1}{x}$ is possible for some real value of x .

Which of the above statements is/are correct?

[CDS 2020 II]

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor?

13. What is the least value of $(25\operatorname{cosec}^2 x + \sec^2 x)$?

[CDS 2020-I]

(a) 40 (b) 36 (c) 26 (d) 24

14. Find the maximum and minimum value of $2 + \frac{\cos\theta\cos\phi + \sin\theta\sin\phi}{2}$?

(a) $\frac{5}{2}, \frac{3}{2}$ (b) $\frac{3}{4}, 5$ (c) $3, \frac{2}{5}$ (d) None

15. Find the minimum and maximum value of $\sin^3\theta \cdot \cos^3\theta$.

[SSC CPO 03/11/2022]

- (a) $\frac{-1}{2^3}, \frac{1}{2^3}$ (b) $\frac{-1}{2^3}, 0$
 (c) $0, \frac{1}{2^3}$ (d) None of these

16. What is the maximum value of $3\sin\theta - 4$?

[CDS 2020 II]

- (a) -4 (b) -1 (c) 0 (d) 1

17. Find the minimum value of $(\sin\theta + \operatorname{cosec}\theta)^2 + (\cos\theta + \sec\theta)^2$

- (a) 0 (b) 2 (c) 7 (d) 9

18. Find the minimum value of $(\sin\theta + \operatorname{cosec}\theta)^2 + (\cos\theta + \sec\theta)^2$?

- (a) 8 (b) 9 (c) 7 (d) 6

19. Find the maxima and Minima of $1 + \sin\theta\cos\theta$?

- (a) $\frac{3}{2}, \frac{1}{2}$ (b) $\frac{3}{4}, \frac{1}{4}$ (c) $\frac{3}{2}, -\frac{1}{2}$ (d) None

20. What is the least value of $9\sin^2\theta + 16\cos^2\theta$?

[CDS 2020-II]

- (a) 0 (b) 9 (c) 16 (d) 25

21. The maximum value of $\sin x \cdot \cos x$ is:

- (a) 2 (b) $\sqrt{2}$ (c) $\frac{1}{2}$ (d) 1

22. Find the minimum value of $\sin^4\theta + \cos^4\theta$?

- (a) $\frac{1}{2}$ (b) $\frac{-1}{2}$ (c) 2 (d) 0

23. Find maximum and minimum value of $4\sin^3 x \cos x - 4\cos^3 x \sin x$?

- (a) 2, -2 (b) 3, -3 (c) 1, -1 (d) None

24. Find Maximum and Minimum value of $2\sin^2\theta + 8\cos^2\theta - 11$?

- (a) 4, -10 (b) -3, -9
 (c) 2, -8 (d) 1, -6

25. Find the maximum value of $\cos\theta + \sin(\theta + 60^\circ)$

- (a) $\sqrt{3} - 1/2$ (b) $\sqrt{3} + 1/2$
 (c) $2/\sqrt{3} + 1$ (d) $\sqrt{3} + 1/\sqrt{2}$

26. Find the maximum and minimum value of $8\cos A + 15\sin A + 15$.

- (a) $11\sqrt{2} + 15, 15$ (b) 30, 8
 (c) 32, -2 (d) 23, 8

27. If $\alpha + \beta = 90^\circ$, then the maximum value of $\sin\alpha \cdot \sin\beta$ is:

- (a) 1 (b) $\frac{1}{2}$ (c) $\frac{3}{2}$ (d) 4

28. Find the minimum value of $\frac{\sec^4\alpha}{\tan^2\beta} + \frac{\sec^4\beta}{\tan^2\alpha}$?

- (a) 8 (c) 6 (b) 7 (d) 9

29. What is the minimum value of $\sin^6\theta + \cos^6\theta$?

- (a) $\frac{1}{2}$ (b) $\frac{1}{4}$
 (c) 1 (d) None of these

Type-12 ANSWER KEY

1	B	2	B	3	C	4	B	5	A	6	D	7	C	8	C
9	A	10	A	11	D	12	D	13	B	14	A	15	A	16	B
17	D	18	B	19	A	20	B	21	C	22	A	23	C	24	B
25	D	26	C	27	B	28	A	29	B						

Type-12 (Maxima & Minima) Solution

1. (b) Sol.

$$6 - 4\sin \theta$$

$$= 6 - 4 = 2$$

2. Sol. (b)

$$\sin^2 \theta + \cos^4 \theta$$

$$\text{Put } \theta = 45^\circ$$

$$\left[\because \sin^{2n} \theta + \cos^{2m} \theta \right]$$

$$\min(\theta = 45^\circ)$$

$$\left(\frac{1}{\sqrt{2}} \right)^2 + \left(\frac{1}{\sqrt{2}} \right)^4$$

$$\frac{1}{2} + \frac{1}{4} = \frac{3}{4}$$

3. Sol. (c)

$$\cos^2 \left(\frac{\pi}{3} - \theta \right) - \cos^2 \left(\frac{\pi}{3} + \theta \right)$$

$$\sin(A+B) \cdot \sin(A-B) = \sin^2 A - \sin^2 B$$

$$= 1 - \cos^2 A - 1 + \cos^2 B$$

$$= \cos^2 B - \cos^2 A$$

$$\cos^2(60 - \theta) - \cos^2(60 + \theta)$$

$$= \sin 120 \times \sin 2\theta$$

$$= \frac{\sqrt{3}}{2} \times \sin 2\theta$$

$$\max = \frac{\sqrt{3}}{2}$$

4. Sol. (b)

$$\frac{2^{140}}{2^{140}} \sin^{140} \theta \cdot \cos^{140} \theta$$

$$\frac{\sin^{140} 2\theta}{2^{140}}$$

$$\text{Maximum value} = \frac{1}{2^{140}}$$

5. Sol. (a)

$$(25\cos^2 x + 9\sec^2 x) \text{ a } = 25, b = 9$$

$$\text{Minimum value} = 2\sqrt{ab} = 2\sqrt{25 \times 9} = 30$$

6. Sol. (d)

$$\sin^2 \theta + \cos^2 \theta + \sec^2 \theta + \operatorname{cosec}^2 \theta + \tan^2 \theta + \cot^2 \theta$$

$$= 1 + 1 + \tan^2 \theta + 1 + \cot^2 \theta + \tan^2 \theta + \cot^2 \theta$$

$$= 3 + 2(\tan^2 \theta + \cot^2 \theta) = 3 + 2 \times 2 = 7$$

7. Sol. (c)

We know that, min. and max value of $\sin x = -1$ and $+1$

So,

$$\text{min value is } = \sin(-1) = -\sin 1$$

$$\text{max value is } = \sin(+1) = \sin 1$$

8. Sol. (c)

$$9\tan^2 \theta + 4\cot^2 \theta$$

$$\Rightarrow (3\tan \theta)^2 + (2\cot \theta)^2 - 2(3\tan \theta)(2)\cot \theta + 2(3\tan \theta)^2 \cot \theta$$

$$\Rightarrow (3\tan \theta - 2\cot \theta)^2 + 12$$

$$\text{since } (3\tan \theta - 2\cot \theta)^2 \geq 0$$

Minimum value is 12

9. Sol. (a)

$$y = \sin^4 \theta + \cos^4 \theta - 2\sin^2 \theta \cdot \cos^2 \theta$$

$$= (\cos^2 \theta - \sin^2 \theta)^2$$

$$\therefore y_{\min} = 0$$

10. Sol. (a)

$$\text{Minimum value of } 8 \operatorname{cosec}^2 \theta + 25\sin^2 \theta =$$

$$2\sqrt{25 \times 8} = 20\sqrt{2}$$

11. Sol. (d)

$$\text{The maximum value of } \sin^n \theta \cdot \cos^n \theta = \left(\frac{1}{2} \right)^n$$

$$\text{The maximum value of } \sin^{113} \theta \cdot \cos^{113} \theta =$$

$$\left(\frac{1}{2} \right)^{113}$$

12. Sol. (d)

$$\text{Minimum values of } x + \frac{1}{x} = 2$$

$$\text{But, } -1 \leq (\sin \theta, \cos \theta) \leq 1$$

Hence, both (1) and (2) are not correct.

13. Sol. (b)

$$\text{Min Value} = (\sqrt{25} + 1)^2 = 36$$

14. Sol. (a)

$$2 + \frac{\cos \theta \cos \phi + \sin \theta \sin \phi}{2}$$

$$\Rightarrow 2 + \frac{1}{2} \cos(\theta - \phi)$$

$$\cos(\theta - \phi) \max 1, \min -1$$

$$\max = 2 + \frac{1}{2} \times (1) = \frac{5}{2}$$

$$\min = 2 + \frac{1}{2}(-1) = 2 - \frac{1}{2} = \frac{3}{2}$$

15. Sol. (a)

$$\frac{2^3}{2^3} \sin^3 \theta \cdot \cos^3 \theta$$

$$\frac{\sin^3 2\theta}{2^3}$$

$$\text{Min} \rightarrow \frac{-1}{2^3}$$

$$\text{Max} \rightarrow \frac{1}{2^3}$$

16. Sol. (b)

$$y = 3 \sin \theta - 4$$

$$y_{\max} = 3(1) - 4 = -1$$

$$\{\because -1 \leq \sin \theta \leq 1\}$$

17. (d) Sol.

$$(\sin \theta + \operatorname{cosec} \theta)^2 + (\cos \theta + \sec \theta)^2$$

$$= \sin^2 \theta + \operatorname{cosec}^2 \theta + 2 + \cos^2 \theta + \sec^2 \theta + 2$$

$$= 1 + 2 + 2 + \operatorname{cosec}^2 \theta + \sec^2 \theta$$

$$= 5 + (\sqrt{1} + \sqrt{1})^2 = 5 + 4 = 9$$

18. Sol. (b)

$$(\sin \theta + \operatorname{cosec} \theta)^2 + (\cos \theta + \sec \theta)^2$$

$$= \sin^2 \theta + \operatorname{cosec}^2 \theta + 2 \sin \theta$$

$$\operatorname{cosec} \theta + \cos^2 \theta + \sec^2 \theta + 2 \cos \theta \sec \theta$$

$$= (\sin^2 \theta + \cos^2 \theta) + \operatorname{cosec}^2 \theta + \sec^2 \theta + 2 + 2$$

$$[\because \sin \cdot \operatorname{cosec} \theta = 1 \text{ and } \cos \theta \cdot \sec \theta = 1]$$

$$= 1 + (1 + \cot^2 \theta) + (1 + \tan^2 \theta) + 4$$

$$= 7 + \tan^2 \theta + \cot^2 \theta$$

For min value of $\tan^2 \theta + \cot^2 \theta$

$$= 2\sqrt{ab}$$

$$= 2\sqrt{1} = 2$$

$$\therefore \text{The minimum value} = 7 + 2 = 9$$

19. Sol. (a)

$$1 + \sin \theta \cos \theta$$

$$\Rightarrow 1 + \frac{2}{2} \sin \theta \cos \theta$$

$$\Rightarrow 1 + \frac{1}{2} 2 \sin \theta \cos \theta$$

$$\Rightarrow 1 + \frac{1}{2} \sin 2\theta$$

$$\sin 2\theta = \text{Max} = 1, \text{Min} = -1$$

$$\Rightarrow \text{max value} = 1 + \frac{1}{2} = \frac{3}{2}$$

$$\text{min value} = 1 - \frac{1}{2} = \frac{1}{2}$$

20. Sol. (b)

$$y = 9 \sin^2 \theta + 16 \cos^2 \theta$$

$$= 9(\sin^2 \theta + \cos^2 \theta) + 7 \cos^2 \theta$$

$$= 9 + 7(0) = 9$$

21. Sol. (c)

$$\sin x \cdot \cos x = \frac{1}{2} (2 \sin x \cdot \cos x)$$

$$= \frac{1}{2} \sin 2x \leq \frac{1}{2}$$

$$[\because -1 \leq \sin 2x \leq 1]$$

Hence max. value of $\sin x, \cos x$ is $\frac{1}{2}$.

22. Sol. (a)

$$\text{minimum value} - \sin^4 \theta + \cos^4 \theta$$

$$\text{put } \theta = 45^\circ$$

$$\left(\frac{1}{\sqrt{2}}\right)^4 + \left(\frac{1}{\sqrt{2}}\right)^4 = \frac{1}{2}$$

23. Sol. (c)

$$4 \sin^3 x \cos x - 4 \cos^3 x \sin x$$

$$= -4 \cos x \sin x (\cos^2 x - \sin^2 x)$$

$$(\because \cos^2 x - \sin^2 x = \cos 2x)$$

$$= -2\sin 2x \cos 2x$$

$$= -\sin 4x$$

$$\sin 4x \begin{cases} \text{Max} + 1 \\ \text{Min} - 1 \end{cases}$$

$$\text{maximum Value } \pm -1(-1) = +1$$

$$\text{minimum Value} = -1(-1) = +1$$

24. Sol. (b)

$$\therefore 2\sin^2 \theta + 8\cos^2 \theta - 11$$

$$\text{maximum} = 8 - 11 (\because a < b)$$

$$\text{minimum} = 2 - 11 = -9$$

25. Sol. (d)

$$\cos \theta + \sin(\theta + 60) = \cos \theta + \sin \theta \times$$

$$\frac{1}{2} + \cos \theta \frac{\sqrt{3}}{2}$$

$$= \frac{1}{2} \sin \theta + \frac{(2 + \sqrt{3})}{2} \cos \theta$$

$$\text{Max} \rightarrow \sqrt{\left(\frac{1}{2}\right)^2 + \left(\frac{2 + \sqrt{3}}{2}\right)^2}$$

$$= \sqrt{\frac{1 + 4 + 3 + 4\sqrt{3}}{4}} = \sqrt{\frac{8 + 4\sqrt{3}}{4}} = \sqrt{2 + \sqrt{3}} = \frac{\sqrt{3} + 1}{\sqrt{2}}$$

26. Sol. (c)

$$8\cos A + 15\sin A + 15$$

$$\text{Max} = \pm \sqrt{(8)^2 + (15)^2} + 15$$

$$\text{Max} = +17 + 15 = 32$$

$$\text{Min} = -17 + 15 = -2$$

27. Sol. (b)

$$y = \frac{1}{2}(\sin 2\alpha)$$

Since, Maximum value of $\sin 2\alpha$ is 1.

$$\therefore \text{Maximum value of } y = \frac{1}{2}$$

28. Sol. (a)

We know that

$$AM \geq GM$$

$$\frac{\frac{\sec^4 \alpha}{\tan^2 \beta} + \frac{\sec^4 \beta}{\tan^2 \alpha}}{2} \geq \sqrt{\frac{\sec^4 \alpha}{\tan^2 \beta} \times \frac{\sec^4 \beta}{\tan^2 \alpha}}$$

$$\frac{\frac{\sec^4 \alpha}{\tan^2 \beta} + \frac{\sec^4 \beta}{\tan^2 \alpha}}{2} \geq \frac{\sec^2 \alpha \sec^2 \beta}{\tan \alpha \tan \beta}$$

$$\sec^4 \alpha + \sec^4 \beta$$

$$\frac{\tan^2 \beta + \tan^2 \alpha}{2} \geq \frac{1}{\cos^2 \alpha} \frac{\cos \alpha}{\sin \alpha} \frac{1}{\cos^2 \beta} \frac{\cos \beta}{\sin \beta}$$

$$\sec^4 \alpha \sec^4 \beta$$

$$\frac{\tan^2 \beta + \tan^2 \alpha}{2} \geq \frac{2}{2\sin \alpha \cos \alpha} \cdot \frac{2}{2\sin \beta \cos \beta}$$

$$\frac{\frac{\sec^4 \alpha}{\tan^2 \beta} + \frac{\sec^4 \beta}{\tan^2 \alpha}}{2} \geq \frac{4}{\sin 2\alpha \sin 2\beta}$$

$$\frac{\sec^4 \alpha}{\tan^2 \beta} + \frac{\sec^4 \beta}{\tan^2 \alpha} \geq \frac{8}{-1x-1}$$

$$(\because -1 \leq \sin 2\alpha, \sin 2\beta \leq 1)$$

$$\frac{\sec^4 \alpha}{\tan^2 \beta} + \frac{\sec^4 \beta}{\tan^2 \alpha} \geq 8$$

The minimum value = 8

29. Sol. (b)

$$x = \sin^6 \theta + \cos^6 \theta$$

$$\Rightarrow x = (\sin^2 \theta)^3 + (\cos^2 \theta)^3$$

$$\Rightarrow x = (\sin^2 \theta + \cos^2 \theta)$$

$$(\sin^4 \theta + \cos^4 \theta - \sin^2 \theta \cdot \cos^2 \theta)$$

$$x = 1 \times [(\sin^2 \theta + \cos^2 \theta)^2 - 3\sin^2 \theta \cdot \cos^2 \theta]$$

$$x = 1 - 3\sin^2 \theta \cdot \cos^2 \theta$$

$$x = 1 - \frac{3}{4}(2\sin \theta \cdot \cos \theta)^2$$

$$x = 1 - \frac{3}{4}(\sin 2\theta)^2$$

$$= 1 - \frac{3}{4}\sin^2 2\theta$$

$$\therefore 0 \leq \sin^2 2\theta \leq 1$$

$$\therefore \text{at } \sin^2 2\theta = 0$$

$$x = 1 - \frac{3}{4}(0) = 1$$

$$\text{and at } \sin^2 2\theta = 1$$

$$x = 1 - \frac{3}{4}(1) = \frac{1}{4}$$

$$\text{i.e. } \frac{1}{4} \leq x \leq 1$$

$$\text{i.e. least value of } \sin^6 \theta + \cos^6 \theta = \frac{1}{4}$$

Type-13 (Inverse function, Series, Comparison)

1. If $\sec A + \tan A = 5$, then $\sec A - \tan A = ?$

DP Head Constable 2023

- (a) $\frac{5}{2}$ (b) $\frac{1}{5}$ (c) 5 (d) $\frac{2}{5}$

2. If the value of $\operatorname{cosec} A + \cot A = m$, then the value of $\operatorname{cosec} A - \cot A$ is:

SSC CPO 10/11/2022 (Afternoon)

- (a) $\frac{1}{m}$ (b) m (c) $\sqrt{m}$ (d) m^2

3. The value of

$$\frac{(\tan 25^\circ \cot 65^\circ - \operatorname{cosec}^2 65^\circ) + \cot^2 61^\circ - \sec^2 29^\circ}{\sin^2 5^\circ + \sin^2 7^\circ + \sin^2 9^\circ + \dots + \sin^2 85^\circ} \text{ is?}$$

SSC - Phase IX 2022

- (a) $\frac{4}{25}$ (b) $\frac{-4}{41}$ (c) $-\frac{2}{41}$ (d) $\frac{2}{25}$

4. If $x = \frac{2\sin \theta}{(1+\cos \theta + \sin \theta)}$ then the value of $\frac{1-\cos \theta + \sin \theta}{(1+\sin \theta)}$ is:

SSC CPO 09/11/2022 (Shift- 01)

- (a) $\frac{x}{(1+x)}$ (b) x (c) $\frac{1}{x}$ (d) $\frac{(1+x)}{x}$

5. If $\operatorname{cosec} \theta + \cot \theta = p$, then the value of $\frac{p^2-1}{p^2+1}$ is:

SSC CGL 12/12/2022 (1st Shift)

- (a) $\cos \theta$ (b) $\sin \theta$
(c) $\cot \theta$ (d) $\operatorname{cosec} \theta$

6. If $\cos A = \sin^2 A$, and $a \sin^{12} A + b \sin^{10} A + c \sin^8 A + \sin^6 A = 1$, then $a + b + c = ?$

SSC CPO 11/09/2022 (Shift - 01)

- (a) 7 (b) 8 (c) 9 (d) 6

7. If $\tan 8\theta = \cot 2\theta$, where $0 < 8\theta < \frac{\pi}{2}$, then what is the value of $\tan 5\theta$?

- (a) $\frac{1}{\sqrt{3}}$ (b) 1 (c) $\sqrt{3}$ (d) 0

8. If $\sin \theta - \cos \theta = \frac{4}{5}$, then find the value of $\sin \theta + \cos \theta$

SSC CGL 08/12/2022 (2nd Shift)

- (a) $\frac{5}{\sqrt{34}}$ (b) $\frac{5}{\sqrt{24}}$ (c) $\frac{\sqrt{34}}{5}$ (d) $\frac{\sqrt{24}}{5}$

9. If $a \sec \theta + b \tan \theta + c = 0$ and $p \sec \theta + q \tan \theta + r = 0$, then $(br - qc)^2 - (pc - ar)^2 = ?$

- (a) $(aq - bp)^2$ (b) $(ap - bq)^2$
(c) $(aq + bp)^2$ (d) $(aq - bp)^3$

10. If $\sec^2 \theta = \frac{4}{3}$, then the value of $\operatorname{cosec}(\theta + 30^\circ)$ if $[\theta \text{ is an acute angle.}]$

SSC CHSL 08/06/2022 (Evening)

- (a) $-\frac{2}{\sqrt{3}}$ (b) $\frac{2}{\sqrt{3}}$ (c) $\frac{1}{\sqrt{3}}$ (d) $-\frac{1}{\sqrt{3}}$

11. If $\tan 3\theta = \cot(\theta - 22^\circ)$, where 3θ is an acute angle, find the value of θ .

Higher Secondary 01/08/2022 (Shift - 3)

- (a) 26° (b) 29° (c) 28° (d) 27°

12. If $\sec \theta + \tan \theta = 2 + \sqrt{5}$ and θ is an acute angle, then the value of $\sin \theta$ is:

SSC CHSL 21/10/2020 (Evening)

- (a) $\frac{2\sqrt{5}}{5}$ (b) $\frac{3}{5}$ (c) $\frac{\sqrt{5}}{5}$ (d) $\frac{1}{5}$

13. If $\sec \theta + \tan \theta = \sqrt{21 + \sqrt{21 - \sqrt{21 + \sqrt{21 - \dots}}}}$

..... ∞ find $\sin \theta + \cos \theta$

- (a) $\frac{17}{13}$ (b) $\frac{17}{21}$ (c) $\frac{13}{21}$ (d) $\frac{21}{13}$

14. $\cos^2 5^\circ + \cos^2 10^\circ + \cos^2 15^\circ + \dots + \cos^2 85^\circ + \cos^2 90^\circ$

- (a) 8.5 (b) 10.5 (c) 9.5 (d) 8

15. If $4\cos\theta + 3\sin\theta = x$ and $4\sin\theta - 3\cos\theta = y$, find the value of $x^2 + y^2$.

SSC CPO 11/11/2022 (Morning)

- (a) 16 (b) 9 (c) 25 (d) 1

16. If $\frac{\sin\theta}{1+\cos\theta} + \frac{1+\cos\theta}{\sin\theta} = \frac{4}{\sqrt{3}}$, $0^\circ < \theta < 90^\circ$. then the value of $(\tan\theta + \sec\theta)^{-1}$

- (a) $2 + \sqrt{5}$ (b) $2 - \sqrt{3}$
(c) $3 - \sqrt{2}$ (d) $3 + \sqrt{2}$

17. If $\left\{\left(\frac{\sec\theta-1}{\sec\theta+1}\right)\right\}^n = \operatorname{cosec}\theta - \cot\theta$, then $n = ?$

SSC CPO 09/11/2022 (Shift- 01)

- (a) 1 (b) 0.5
(c) -1 (d) -0.5

18. If $\cot x - \tan x = \frac{3}{2}$, then what will be the value of $\cot x + \tan x$?

SSC CGL 02/12/2022 (1st Shift)

- (a) 3 (b) 2 (c) $\frac{5}{2}$ (d) $\frac{7}{2}$

19. What is the average of the sixty terms given below?

$$\cos^2 x + \cos^2 2x + \cos^2 3x + \dots + \cos^2 30x + \sin^2 x + \sin^2 2x + \sin^2 3x + \dots + \sin^2 30x$$

SSC MTS 12/10/2021 (Afternoon)

- (a) $\cos^2 x$ (b) 0.5
(c) 1 (d) $\cos^2 x \sin^2 x$

20. If $\operatorname{cosec}\theta - \cot\theta = m$, then what is $\operatorname{cosec}\theta$ equal to?

[CDS - 2021-I]

- (a) $m + \frac{1}{m}$ (b) $m - \frac{1}{m}$
(c) $\frac{m}{2} + \frac{2}{m}$ (d) $\frac{m}{2} + \frac{1}{2m}$

21. If $\sin^6\theta + \cos^6\theta = \frac{1}{3}$, $0^\circ < \theta < 90^\circ$, then what is the value of $\sin\theta \cdot \cos\theta$?

SSC CGL 18/08/2021 (Evening)

- (a) $\frac{\sqrt{6}}{6}$ (b) $\frac{\sqrt{2}}{3}$ (c) $\frac{\sqrt{2}}{\sqrt{3}}$ (d) $\frac{2}{9}$

22. If $a\sec\theta + b\tan\theta = 1$ and $a^2\sec^2\theta - b^2\tan^2\theta = 5$, then $a^2b^2 + 4a^2$ is equal to:

- (a) $9b^2$ (b) $\frac{9}{a^2}$
(c) $\frac{-2}{b}$ (d) 9

23. If $\tan\theta + \sec\theta = 3$, then what is the value of $3\tan\theta + 9\sec\theta$?

[CDS - 2022]

- (a) 15 (b) 17 (c) 19 (d) 21

24. If $\operatorname{cosec}\theta + \cot\theta = 5$, then $\operatorname{cosec}\theta$ is equal to.

SSC CHSL 03/06/2022 (Morning)

- (a) $\left(5 + \frac{1}{5}\right)$ (b) $\frac{1}{2}\left(3 + \frac{1}{3}\right)$
(c) $\frac{1}{2}\left(5 + \frac{1}{5}\right)$ (d) $\left(3 + \frac{1}{3}\right)$

25. If $\cos A, \sin A, \cot A$ are in geometric progression, then the value of $\tan^6 A - \tan^2 A$ is:

SSC CHSL 13/10/2020 (Afternoon)

- (a) $\frac{1}{2}$ (b) 3 (c) $\frac{1}{3}$ (d) 1

26. If $\sin\theta, \cos\theta$, and $\tan\theta$ are in G.P then find $\cot^6\theta - \cot^2\theta = ?$

- (a) -1 (b) 1 (c) 0 (d) 2

27. If $\sin A + \sin^2 A = 1$, $a\cos^{12} A + b\cos^{10} A + C\cos^8 A + d\cos^6 A = 1$, then find $\frac{b+c}{a+d} =$

- (a) 2 (b) 4 (c) 3 (d) 1

28. If $\frac{\cos\alpha}{\sin\beta} = n$ and $\frac{\cos\alpha}{\cos\beta} = m$ then the value of $\cos^2\beta$ is

- (a) $\frac{m^2}{m^2+n^2}$ (b) $\frac{1}{m^2+n^2}$
(c) $\frac{n^2}{m^2+n^2}$ (d) 0

29. If $\sec\theta + \tan\theta = 3$, θ being acute, the value of $5\sin\theta$ is:

- (a) $\sqrt{3/5}$ (b) $\sqrt{5/3}$ (c) 4 (d) $\frac{5}{2}$

30. If $\sec \theta + \tan \theta = 5$ then the value of $\frac{\tan \theta + 1}{\tan \theta - 1}$ is
 (a) $\frac{11}{7}$ (b) $\frac{13}{7}$ (c) $\frac{15}{7}$ (d) $\frac{17}{7}$

31. If $\operatorname{cosec}^2 \theta + \cot^2 \theta = \frac{5}{3}$, then what is the value of $\cot 2\theta$

SSC CHSL 07/06/2022 (Morning)

- (a) $\frac{1}{\sqrt{3}}$ (b) $-\frac{1}{\sqrt{3}}$ (c) $\frac{2}{\sqrt{3}}$ (d) $-\frac{2}{\sqrt{3}}$

32. If $\tan(70 - 3\theta) = \cot(9\theta - 280)$, then $\tan \frac{6\theta}{5} + \cos(\theta - 20) = ?$

- (a) $\frac{3\sqrt{3}}{2}$ (b) 2 (c) 1 (d) 0

33. If a is an acute angle, $\tan(4a - 50^\circ) = \cot(50^\circ - a)$, then find the value of a (in degrees).

SSC CGL 08/12/2022 (4th Shift)

- (a) 60° (b) 45° (c) 30° (d) 90°

34. if $6(\sec^2 59 - \cot^2 31^\circ) - \frac{2}{3} \sin^2 90^\circ - 3 \tan^2 56^\circ \tan^2 34^\circ = \frac{y}{3}$, then the value of y is +

- (a) $\frac{8}{5}$ (b) $-\frac{8}{5}$ (c) $\frac{2}{3}$ (d) $-\frac{2}{3}$

35. $152(\sin 30 + 2\cos^2 45 + 3\sin 30 + 4\cos^2 45 + \dots 17\sin 30 + 18\cos^2 45) = ?$

- (a) An integer but not perfect square
 (b) A rational number but not an integer
 (c) A perfect square of an integer
 (d) Irrational

36. If $\sec \theta + \tan \theta = p$, ($p > 1$) then $\frac{\operatorname{cosec} \theta + 1}{\operatorname{cosec} \theta - 1} = ?$

SSC CGL TIER II (13/09/2019)

- (a) $\frac{p+1}{p-1}$ (b) p^2 (c) $\frac{p-1}{p+1}$ (d) $2p^2$

37. The value of the expression $\frac{1}{\cos 0^\circ \cos 1^\circ} + \frac{1}{\cos 1^\circ \cos 2^\circ} + \frac{1}{\cos 2^\circ \cos 3^\circ} + \dots + \frac{1}{\cos 44^\circ \cos 45^\circ}$ is equal to

- (a) 1 (b) $\sin 1^\circ$
 (c) $\operatorname{cosec} 1^\circ$ (d) $\cos 1^\circ$

38. If $\cot \theta(1 + \sin \theta) = 4m$ and $\cot \theta(1 - \sin \theta) = 4n$, then which one of the following is correct?

- (a) $(m^2 + n^2) = mn$
 (b) $(m^2 - n^2)^2 = mn$
 (c) $(m^2 - n)^2 = m^2 n^2$
 (d) $(m^2 + n^2)^2 = m^2 n^2$

39. The value of $(\tan 29^\circ \cot 61^\circ - \operatorname{cosec}^2 61^\circ) + \cot^2 54^\circ - \sec^2 36^\circ + (\sin^2 1^\circ + \sin^2 3^\circ + \sin^2 5^\circ + \dots + \sin^2 89^\circ)$ is :

SSC CGL TIER II (12/09/2019)

- (a) $20\frac{1}{2}$ (b) 21 (c) $22\frac{1}{2}$ (d) 22

40. If $\tan A + \sec A = \frac{3}{2}$ and A is an acute angle, then the value of $\frac{10\cot A + 13\cos A}{12\tan A + 5\operatorname{cosec} A}$ is:

SSC CHSL 12/08/2021 (Evening)

- (a) 5 (b) 1 (c) 4 (d) 2

41. The value of $\cot^2 46^\circ - \sec^2 44^\circ + (\sin^2 1^\circ + \sin^2 3^\circ + \sin^2 5^\circ + \dots + \sin^2 89^\circ)$

SSC CHSL 10/08/2021 (Evening)

- (a) 23.5 (b) 20.5 (c) 22.5 (d) 21.5

42. $\sin^2 5^\circ + \sin^2 10^\circ + \sin^2 15^\circ + \dots + \sin^2 85^\circ + \sin^2 90^\circ$ is equal to

- (a) $7\frac{1}{2}$ (b) $8\frac{1}{2}$ (c) 9 (d) $9\frac{1}{2}$

43. If $\sqrt[3]{\sqrt[4]{\sin^2 \alpha}} = (\sin \alpha)^{\tan \alpha}$, then find the value of $\tan \alpha \sin \alpha$.

- (a) $\frac{11}{12}\sqrt{147}$ (b) $\frac{1}{12\sqrt{145}}$
 (c) $\frac{11}{8}\sqrt{40}$ (d) $\frac{9}{11}\sqrt{141}$

44. If $\sec \theta - \tan \theta = P$, then $\operatorname{cosec} \theta = ?$

SSC CGL 04/06/ 2019 (Evening)

- (a) $\frac{2P}{1-P^2}$ (b) $\frac{1-P^2}{1+P^2}$
 (c) $\frac{P^2+1}{1-P^2}$ (d) $\frac{2P}{1+P^2}$

45. If $x \sin^3 \theta + y \cos^3 \theta = \sin \theta \cos \theta$ and $x \sin \theta = y \cos \theta$, then the value of $x^2 + y^2$ is:

SSC CHSL 20/10/2020 (Morning)

- (a) 0 (b) 4 (c) 1 (d) 2

46. The simplified value of $1 + \frac{1}{-1 + \frac{1}{1 - \frac{1}{1 + \frac{\sin^2 \theta}{1 - \sin^2 \theta}}}}$ is

- (a) $\sin^2 \theta$ (b) $\operatorname{cosec}^2 \theta$
(c) $\sec^2 \theta$ (d) $\tan^2 \theta$

47. What is the value of $\sin^2 6^\circ + \sin^2 12^\circ + \sin^2 18^\circ + \dots + \sin^2 84^\circ + \sin^2 90^\circ$?

CDS [2020 - I]

- (a) 1 (b) 2 (c) 4 (d) 8

48. If $\operatorname{cosec} \theta - \sin \theta = m$ and $\sec \theta - \cos \theta = n$ then find a relation between m and n , independent of θ

- (a) 1 (b) 2 (c) 4 (d) None

Type-13 ANSWER KEY															
1	B	2	A	3	B	4	B	5	A	6	A	7	B	8	C
9	A	10	B	11	C	12	A	13	A	14	A	15	C	16	B
17	B	18	C	19	B	20	D	21	B	22	A	23	C	24	C
25	D	26	B	27	C	28	C	29	C	30	D	31	B	32	A
33	C	34	A	35	C	36	B	37	C	38	B	39	A	40	D
41	D	42	C	43	D	44	B	45	C	46	C	47	C	48	D
49	A														

Type-13 (Inverse function, Series ,Comparison)

1. Sol. (b)

If $\sec A + \tan A = k$, then $\sec A - \tan A = \frac{1}{k}$

$$\Rightarrow \sec A - \tan A = \frac{1}{5}$$

2. Sol. (a)

As we know, that

$$\operatorname{cosec}^2 A - \cot^2 A = 1$$

$$\Rightarrow (\operatorname{cosec} A + \cot A)(\operatorname{cosec} A - \cot A) = 1$$

$$\Rightarrow m \times (\operatorname{cosec} A - \cot A) = 1$$

$$\Rightarrow (\operatorname{cosec} A - \cot A) = \frac{1}{m}$$

3. Sol. (b)

$$\frac{(\tan 25^\circ \cot 65^\circ - \operatorname{cosec}^2 65^\circ) + \cot^2 61^\circ - \sec^2 29^\circ}{\sin^2 5^\circ + \sin^2 7^\circ + \sin^2 9^\circ + \dots + \sin^2 85^\circ}$$

We know,

$$\tan(90^\circ - \theta) = \cot \theta$$

$$\cot(90^\circ - \theta) = \tan \theta$$

$$\sin(90^\circ - \theta) = \cos \theta$$

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$1 + \cot^2 \theta = \operatorname{cosec}^2 \theta$$

Now, Above equation can be written as:

$$= \frac{(\cot^2 65^\circ - \operatorname{cosec}^2 65^\circ) + \cot^2 61^\circ - \operatorname{cosec}^2 61^\circ}{\sin^2(90^\circ - 85^\circ) + \sin^2(90^\circ - 83^\circ) + \dots + \sin^2(90^\circ - 45^\circ) + \dots + \sin^2 6^\circ}$$

$$= \frac{-1-1}{\cos^2 85^\circ + \cos^2 83^\circ + \dots + \frac{1}{2} + \dots + \sin^2 85^\circ}$$

$$= \frac{-2}{20 + \frac{1}{2}} = \frac{-4}{41}$$

4. Sol. (b)

We know that,

$$\frac{2 \sin \theta}{1 + \cos \theta + \sin \theta} = \frac{1 - \cos \theta + \sin \theta}{1 + \sin \theta}$$

$$x = \frac{1 - \cos \theta + \sin \theta}{1 + \sin \theta}$$

5. Sol. (a)

$$\operatorname{cosec} \theta + \cot \theta = p \quad \dots (i)$$

$$\operatorname{cosec} \theta - \cot \theta = \frac{1}{p} \quad \dots (ii)$$

$$(\text{As } \operatorname{cosec}^2 \theta - \cot^2 \theta = 1)$$

Adding eqn. (1) and (2) we get :

$$\operatorname{cosec} \theta = \frac{p^2 + 1}{2p}, \text{ then, } \cot \theta = \frac{p^2 - 1}{2p}$$

$$\text{Now, } \frac{\frac{p^2-1}{2p}}{\frac{p^2+1}{2p}} = \frac{p^2-1}{p^2+1} = \frac{\cot \theta}{\operatorname{cosec} \theta} = \cos \theta$$

6. Sol. (a)

We know that Highest and lowest power coefficient is 1 and coefficient of middle power = 3

$$\Rightarrow a = 1, b = 3, c = 3$$

$$a + b + c = 3 + 3 + 1 = 7$$

OR

$$\Rightarrow a \cos 6A + b \cos 5A + c \cos 4A + \cos^3 A$$

$$\text{We know that } (\cos A + \cos^2 A)^3$$

$$\Rightarrow \cos^3 A + \cos 6A + 3 \cos 4A + 3 \cos 5A$$

on comparing

$$a = 1, b = 3, c = 3, a + b + c = 7$$

7. Sol. (b)

$$\tan 8\theta = \cot 2\theta$$

$$\Rightarrow \tan 8\theta = \tan(90^\circ - 2\theta)$$

$$\Rightarrow 8\theta = 90^\circ - 2\theta$$

$$\Rightarrow \theta = 9^\circ$$

$$\therefore \tan 5\theta$$

$$\Rightarrow \tan 45^\circ = 1$$

8. Sol. (c)

$$(\sin \theta - \cos \theta)^2 = \sin^2 \theta + \cos^2 \theta - 2 \sin \theta \cos \theta$$

$$\Rightarrow \left(\frac{4}{5}\right)^2 = 1 - 2 \sin \theta \cos \theta$$

$$\Rightarrow 1 - \frac{16}{25} = 2 \sin \theta \cos \theta$$

$$\Rightarrow \frac{9}{25} = 2 \sin \theta \cos \theta$$

$$\sin \theta + \cos \theta$$

$$= \sqrt{(\sin \theta - \cos \theta)^2 + 4 \sin \theta \cos \theta}$$

$$= \sqrt{\frac{16}{25} + \frac{18}{25}} = \sqrt{\frac{34}{25}} = \frac{\sqrt{34}}{5}$$

9. Sol. (a)

$$a \sec \theta + b \tan \theta + c = 0$$

$$p \sec \theta + q \tan \theta + r = 0$$

Apply cross multiplication method to solve these equation

$$\frac{\sec \theta}{br - qc} = \frac{\tan \theta}{pc - ar} = \frac{1}{aq - bp}$$

$$\sec \theta = \frac{br - qc}{aq - bp} \text{ \& } \tan \theta = \frac{pc - ar}{aq - bp}$$

$$\sec^2 \theta - \tan^2 \theta = 1$$

$$\left(\frac{br - qc}{aq - bp}\right)^2 - \left(\frac{pc - ar}{aq - bp}\right)^2 = 1$$

$$\text{Then, } (br - qc)^2 - (pc - ar)^2 = (aq - bp)^2$$

10. Sol. (b)

$$\sec^2 \theta = \frac{4}{3}$$

$$\sec \theta = \frac{2}{\sqrt{3}} \text{ or } \theta = 30^\circ$$

$$\operatorname{Cosec}(\theta + 30^\circ) = \operatorname{Cosec} 60^\circ = \frac{2}{\sqrt{3}}$$

11. Sol. (c)

$$\text{Formula: } \cot(90^\circ - \theta) = \tan \theta$$

$$\tan 3\theta = \cot(\theta - 22^\circ)$$

$$\Rightarrow \cot(90^\circ - 3\theta) = \cot(\theta - 22^\circ)$$

$$\Rightarrow 90^\circ - 3\theta = \theta - 2^\circ$$

$$\Rightarrow 4\theta = 112^\circ \Rightarrow \theta = 28^\circ$$

12. Sol. (a)

$$\sec \theta + \tan \theta = 2 + \sqrt{5} \quad \dots (1)$$

$$\sec \theta - \tan \theta = 1/(2 + \sqrt{5}) = \sqrt{5} - 2 \quad \dots (2)$$

Add eq. 1 and eq. 2, we get

$$2 \sec \theta = 2\sqrt{5} \Rightarrow \sec \theta = \sqrt{5} = \frac{H}{B}$$

$$H = \sqrt{5}, B = 1 \text{ therefore } P = 2$$

$$\sin \theta = \frac{p}{H} = \frac{2}{\sqrt{5}} = \frac{2\sqrt{5}}{5}$$

13. Sol. (a)

$$\sec \theta + \tan \theta = 5$$

$$\sec \theta - \tan \theta = 1/5$$

$$\sqrt{a + \sqrt{a - \sqrt{a + \sqrt{a - \dots}}}}$$

$$= \frac{\sqrt{4a - 3} + 1}{2}$$

$$= \frac{\sqrt{4 \times 21 - 3} + 1}{2} = \frac{10}{2} = 5$$

$$\sec \theta = \frac{13 \rightarrow 4}{5 \rightarrow 8} \rightarrow P = 12$$

$$\sin \theta + \cos \theta = \frac{12}{13} + \frac{5}{13} = \frac{17}{13}$$

14. Sol. (a)

$$16 + \cos^2 45^\circ$$

$$= 8 + 1/2 = 8.5$$

15. Sol. (c)

$$4 \cos \theta + 3 \sin \theta = x \quad \dots (i)$$

$$4 \sin \theta - 3 \cos \theta = y \quad \dots (ii)$$

Squaring eq.(1) and (2), we get

$$16 \cos^2 \theta + 9 \sin^2 \theta + 24 \sin \theta \cdot \cos \theta = x^2 \quad \dots (iii)$$

$$16 \sin^2 \theta + 9 \cos^2 \theta - 24 \sin \theta \cdot \cos \theta = y^2 \quad \dots (iv)$$

Adding eq. (iii) and (iv),

$$16(\sin^2 \theta + \cos^2 \theta) + 9(\sin^2 \theta + \cos^2 \theta)$$

$$= x^2 + y^2$$

$$x^2 + y^2 = 16 + 9 = 25$$

16. Sol. (b)

$$\frac{1 - \cos \theta}{\sin \theta} + \frac{1 + \cos \theta}{\sin \theta} = \frac{4}{\sqrt{3}}$$

$$\frac{2}{\sin \theta} = \frac{4}{\sqrt{3}}, \sin \theta = \frac{\sqrt{3}}{2}$$

$$\theta = 60^\circ$$

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$\sin^2 \theta = 1 - \cos^2 \theta$$

$$\sin \theta \cdot \sin \theta = (1 - \cos \theta)(1 + \cos \theta)$$

$$\left\{ \frac{\sin \theta}{1 + \cos \theta} = \frac{1 - \cos \theta}{\sin \theta} \right\}$$

$$(\tan \theta + \sec \theta)^{-1} = (\sqrt{3} + 2)^{-1}$$

$$= \frac{1}{\sqrt{3} + 2} \cdot \frac{\sqrt{3} - 2}{\sqrt{3} - 2} = (2 - \sqrt{3})$$

17. Sol. (b)

$$\text{Put } \theta = 45^\circ$$

$$\left\{ \left(\frac{\sqrt{2}-1}{\sqrt{2}+1} \right) \right\}^n = \sqrt{2} - 1$$

$$\left\{ \left(\frac{\sqrt{2}-1}{\sqrt{2}+1} \times \frac{\sqrt{2}-1}{\sqrt{2}-1} \right) \right\}^n = \sqrt{2} - 1$$

On comparing $n = 0.5$

18. Sol. (c)

$$\cot x - \tan x = \frac{3}{2} \dots \dots \dots (\text{given})$$

On squaring, we get

$$\cot^2 x + \tan^2 x - 2 \cot x \cdot \tan x = \frac{9}{4}$$

$$\cot^2 x + \tan^2 x = \frac{9}{4} + 2 = \frac{17}{4}$$

Adding 2 both sides,

$$\cot^2 x + \tan^2 x + 2 = \frac{17}{4} + 2$$

$$\cot^2 x + \tan^2 x + 2 \cot x \cdot \tan x = \frac{25}{4}$$

$$\dots (\cot x \cdot \tan x = 1)$$

$$\cot x + \tan x = \sqrt{\frac{25}{4}} = \frac{5}{2}$$

19. Sol. (b)

$$\text{As, } (\cos^2 \theta + \sin^2 \theta) = 1$$

$$\text{So, } (\cos^2 x + \sin^2 x) + (\cos^2 2x + \sin^2 2x) +$$

$$(\cos^2 3x + \sin^2 3x) + \dots \dots \dots +$$

$$(\cos^2 30x + \sin^2 30x)$$

$$= 1 + 1 + 1 + \dots \dots \dots + 1 = 1 \times 30 = 30$$

$$\text{So, required average} = \frac{30}{60} = 0.5$$

20. Sol. (d)

$$m = \operatorname{cosec} \theta - \cot \theta$$

$$\text{As, } \operatorname{cosec}^2 \theta - \cot^2 \theta = 1$$

$$\therefore \operatorname{cosec} \theta + \cot \theta = \frac{1}{m}$$

$$\text{then } 2 \operatorname{cosec} \theta = m + \frac{1}{m}$$

$$\therefore \operatorname{cosec} \theta = \frac{m}{2} + \frac{1}{2m}$$

21. Sol. (b)

$$\sin^6 \theta + \cos^6 \theta = \frac{1}{3}$$

$$(\sin^2 \theta + \cos^2 \theta)[(\sin^2 \theta + \cos^2 \theta)^2 - 3$$

$$\sin^2 \theta \cdot \cos^2 \theta] = \frac{1}{3}$$

$$3 \sin^2 \theta \cdot \cos^2 \theta = \frac{2}{3}$$

$$\sin^2 \theta \cdot \cos^2 \theta = \frac{2}{9}$$

$$\Rightarrow \sin \theta \cdot \cos \theta = \sqrt{2}/3$$

22. Sol. (a)

$$\text{Given, } a \sec^2 \theta - b \tan^2 \theta = 5$$

$$(a \sec \theta + b \tan \theta)(a \sec \theta - b \tan \theta) = 5$$

$$a \sec \theta - b \tan \theta = 5$$

$$\Rightarrow a \sec \theta = 5 + b \tan \theta$$

$$\text{and } b \tan \theta = a \sec \theta - 5$$

On putting these values in (1)

$$\text{We get } b = \frac{-2}{\tan \theta}, a = \frac{2}{\sec \theta}$$

So,

$$a^2 b^2 + 4a^2$$

$$= a^2(b^2 + 4)$$

$$= \frac{9}{2 \sec^2 \theta} \left(\frac{4}{\tan^2 \theta} + 4 \right) = \frac{36}{\sec^2 \theta} \times \left(\frac{1 + \tan^2 \theta}{\tan^2 \theta} \right)$$

$$= \frac{36}{\tan^2 \theta} = 9 \times \frac{4}{\tan^2 \theta} = 9 \times b^2 = 9b^2$$

23. Sol. (c)

$$\tan \theta + \sec \theta = 3$$

$$\Rightarrow \sec \theta + \tan \theta = 3 \quad \dots(i)$$

$$\text{So, } \sec \theta - \tan \theta = \frac{1}{3} \quad \dots(ii)$$

From eq. (i) + eq. (ii)

$$\Rightarrow 2 \sec \theta = 3 + \frac{1}{3} = \frac{10}{3}$$

$$\Rightarrow \sec \theta = \frac{5}{3}$$

From eq. (i),

$$\Rightarrow \tan \theta = 3 - \frac{5}{3} = \frac{9-5}{3} = \frac{4}{3}$$

$$\text{Hence, } 3 \tan \theta + 9 \sec \theta = 3 \times \frac{4}{3} + 9 \times \frac{5}{3} = 4 +$$

$$15 = 19$$

24. Sol. (c)

$$\operatorname{cosec} \theta + \cot \theta = 5 \quad \dots(i)$$

$$\operatorname{cosec} \theta - \cot \theta = \frac{1}{5} \quad \dots(ii)$$

From equation (i) and (ii)

$$\operatorname{cosec} \theta = \frac{5 + \frac{1}{5}}{2} = \frac{1}{2} \left(5 + \frac{1}{5} \right)$$

25. Sol. (d)

If $\cos A, \sin A, \cot A$ are in G.P.

$$\sin^2 A = \cos A \times \cot A$$

$$\sin^2 A = \cos A \times \frac{\cos A}{\sin A} \Rightarrow \sin^3 A = \cos^2 A$$

After dividing by $\cos^3 A$

$$\frac{\sin^3 A}{\cos^3 A} = \frac{1}{\cos A} \Rightarrow \tan^3 A = \sec A$$

$$\tan^6 A - \tan^2 A = \sec^2 A - \tan^2 A = 1$$

26. Sol. (b)

$$\cos^2 \theta = \sin \theta \cdot \frac{\sin \theta}{\cos \theta}$$

$$(\cos^3 \theta) = \sin^2 \theta \text{ (Divide by } \sin^2 \theta)$$

$$\frac{\cos^3 \theta}{\sin^3 \theta} = \frac{\sin^2 \theta}{\sin^3 \theta} \Rightarrow \cot^3 \theta = \operatorname{cosec} \theta$$

$$\cot^5 \theta = \operatorname{cosec}^2 \theta, \rightarrow \cot^6 \theta - \cot^2 \theta$$

$$= \operatorname{cosec}^2 \theta - \cot^2 \theta = 1$$

27. Sol. (c)

$$\sin A + \sin^2 A$$

$$= 1, a \cos^{12} A + b \cos^{10} A + \cos^8 A + \cos^6 A = 1$$

$$\sin A = 1 - \sin^2 A$$

$$\sin^2 A = (\cos^2 A)^2$$

$$1 - \cos^2 A = \cos^4 A \quad \dots(i)$$

$$(\cos^4 A + \cos^2 A)^3 = 1$$

$$\Rightarrow \cos^{12} A + 3(\cos^4 A)^2 \cos^2 A + 3 \cos^4 A (\cos^4 A)^1$$

$$(\cos^2 A)^3 = 1$$

$$\Rightarrow \cos^{12} A + 3 \cos^8 A (\cos^2 A + 1) + \cos^6 A - 1 = 0$$

$$\Rightarrow \cos^{12} A + 3 \cos^{10} A + 3 \cos^8 A + \cos^6 A - 1 = 0$$

Comparing by equation (ii)

$$a = 1, b = 3, c = 3, d = 1$$

$$\Rightarrow \frac{b+c}{a+d} = \frac{6}{2} = 3$$

28. Sol. (c)

$$\frac{\cos \alpha}{\sin \beta} = n$$

$$\Rightarrow \cos \alpha = n \sin \beta$$

$$\text{and } \frac{\cos \alpha}{\cos \beta} = m$$

$$\Rightarrow \cos \alpha = m \cos \beta$$

Comparing above equations, we get :

$$\Rightarrow n \sin \beta = m \cos \beta$$

Squaring both sides :

$$\Rightarrow n^2 \sin^2 \beta = m^2 \cos^2 \beta$$

$$\Rightarrow n^2 (1 - \cos^2 \beta) = m^2 \cos^2 \beta$$

$$\Rightarrow n^2 = (n^2 + m^2) \cos^2 \beta$$

$$\Rightarrow \cos^2 \beta = \frac{n^2}{m^2 + n^2}$$

29. Sol. (c)

$$\tan \theta + \sec \theta = 3$$

$$\sec \theta - \tan \theta = \frac{1}{3}$$

$$2 \sec \theta = \frac{10}{3}$$

$$\cos \theta = \frac{3}{5}; \sin \theta = \frac{4}{5}$$

$$5 \sin \theta = 4$$

30. Sol. (d)

$$\text{If } \sec \theta + \tan \theta = 5 \quad \dots (i)$$

$$\therefore \sec^2 \theta - \tan^2 \theta = 1$$

$$(\sec \theta + \tan \theta)(\sec \theta - \tan \theta) = 1$$

$$(\sec \theta - \tan \theta) = \frac{1}{5} \quad \dots (ii)$$

subtracting eq. (ii) from (i)

$$\Rightarrow (\sec \theta + \tan \theta) - (\sec \theta - \tan \theta)$$

$$= 5 - \frac{1}{5}$$

$$\Rightarrow 2 \tan \theta = \frac{25-1}{5} = \frac{24}{5}$$

$$\tan \theta = \frac{12}{5}$$

$$\Rightarrow \frac{\tan \theta + 1}{\tan \theta - 1} = \frac{\frac{12}{5} + 1}{\frac{12}{5} - 1} = \frac{12+5}{12-5} = \frac{17}{7}$$

31. Sol. (b)

$$\Rightarrow \operatorname{cosec}^2 \theta + \cot^2 \theta = \frac{5}{3}$$

$$\Rightarrow \frac{1}{\sin^2 \theta} + \frac{\cos^2 \theta}{\sin^2 \theta} = \frac{5}{3}$$

$$\Rightarrow \frac{1+1-\sin^2 \theta}{\sin^2 \theta} = \frac{5}{3} \Rightarrow \frac{2-\sin^2 \theta}{\sin^2 \theta} = \frac{5}{3}$$

$$\Rightarrow 6 - 3 \sin^2 \theta = 5 \sin^2 \theta$$

$$\Rightarrow 6 = 8 \sin^2 \theta \Rightarrow \sin^2 \theta = \frac{6}{8} = \frac{3}{4}$$

$$\Rightarrow \sin \theta = \frac{\sqrt{3}}{2} = \sin 60^\circ \Rightarrow \theta = 60^\circ$$

$$\cot 2\theta = \cot(2 \times 60^\circ) = \cot 120^\circ = -\frac{1}{\sqrt{3}}$$

32. Sol. (a)

$$6\theta - 210 = 90^\circ$$

$$\theta = 50^\circ$$

$$\tan \frac{6\theta}{5} + \cos(\theta - 20)$$

$$= \tan 60 + \cos 30$$

$$= \sqrt{3} + \frac{\sqrt{3}}{2} = \frac{3\sqrt{3}}{2}$$

33. Sol. (c)

$$\tan(4a - 50^\circ) = \cot(50^\circ - a)$$

$$\tan(4a - 50^\circ)$$

$$= \tan(90^\circ - 50^\circ + a) = \tan(40^\circ + a)$$

Comparing both side, we have :

$$4a - 50^\circ = 40^\circ + a$$

$$3a = 90^\circ \Rightarrow a = \frac{90^\circ}{3} = 30^\circ$$

34. Sol. (a)

$$6(\sec^2 59 - \tan^2 59) - \frac{2}{3} - 3y = y/3$$

$$\Rightarrow 6 - \frac{2}{3} - 3y = \frac{y}{3}$$

$$\frac{16}{3} = \frac{10y}{3} \Rightarrow y = \frac{16}{10} = \frac{8}{5}$$

35. Sol. (c)

$$152 \left(\frac{1}{2} + 2 \times \frac{1}{2} + 3 \times \frac{1}{2} + 4 \times \frac{1}{2} + \dots + 18 \times \frac{1}{2} \right)$$

$$= 152 \times \frac{1}{2} (1 + 2 + 3 + 4 \dots + 17 + 18)$$

$$= 76 \times \frac{18 \times 19}{2} = 76 \times 9 \times 19$$

$$= 4 \times 19 \times 9 \times 19 \rightarrow \text{A perfect square.}$$

36. Sol. (b)

$$\text{Given, } \sec \theta + \tan \theta = p \dots (i)$$

$$\Rightarrow \sec \theta - \tan \theta = \frac{1}{p} \quad \dots (ii)$$

$$\Rightarrow 2 \sec \theta = p + \frac{1}{p}$$

Put $p = 2$

$$\Rightarrow \sec \theta = \frac{\text{Hypotenuse}}{\text{Base}} = \frac{5}{4}$$

$$\Rightarrow \operatorname{cosec} \theta = \frac{\text{Hypotenuse}}{\text{Perpendicular}} = \frac{5}{3}$$

$$\frac{\operatorname{cosec} \theta + 1}{\operatorname{cosec} \theta - 1} \Rightarrow \frac{\frac{5}{3} + 1}{\frac{5}{3} - 1} = \frac{\frac{8}{3}}{\frac{2}{3}} = 4$$

Going through options

Chose option $b \Rightarrow p^2 = 2^2 = 4$

Condition satisfied.

We can put this value in any option; no other option will satisfy the condition. Hence option b is the correct option.

37. Sol. (c)

$$\frac{1}{\cos 0^\circ \cos 1^\circ} + \frac{1}{\cos 1^\circ \cos 2^\circ} + \frac{1}{\cos 2^\circ \cos 3^\circ} + \dots + \frac{1}{\cos 44^\circ \cos 45^\circ}$$

Multiply and divide the eq. by $\sin 1^\circ$

=

$$\frac{1}{\sin 1^\circ} \left[\frac{\sin 1^\circ}{\cos 0^\circ \cos 1^\circ} + \frac{\sin 1^\circ}{\cos 1^\circ \cos 2^\circ} + \frac{\sin 1^\circ}{\cos 2^\circ \cos 3^\circ} + \dots + \frac{\sin 1^\circ}{\cos 44^\circ \cos 45^\circ} \right]$$

=

$$\frac{1}{\sin 1^\circ} \left[\frac{\sin(1^\circ - 0^\circ)}{\cos 0^\circ \cos 1^\circ} + \frac{\sin(2^\circ - 1^\circ)}{\cos 1^\circ \cos 2^\circ} + \frac{\sin(3^\circ - 2^\circ)}{\cos 2^\circ \cos 3^\circ} + \dots + \frac{\sin(45^\circ - 44^\circ)}{\cos 44^\circ \cos 45^\circ} \right]$$

$\Rightarrow$

$$\frac{1}{\sin 1^\circ} \left[\frac{\sin 1^\circ \cos 0^\circ - \cos 1^\circ \sin 2^\circ}{\cos 0^\circ \cos 1^\circ} + \frac{\sin 2^\circ \cos 1^\circ - \cos 2^\circ \sin 1^\circ}{\cos 1^\circ \cos 2^\circ} + \frac{\sin 3^\circ \cos 2^\circ - \cos 3^\circ \sin 2^\circ}{\cos 2^\circ \cos 3^\circ} + \dots + \frac{\sin 45^\circ \cos 44^\circ - \cos 45^\circ \sin 44^\circ}{\cos 44^\circ \cos 45^\circ} \right]$$

$$= \frac{1}{\sin 1^\circ} [\tan 1^\circ + (\tan 2^\circ - \tan 1^\circ) +$$

$$(\tan 3^\circ - \tan 2^\circ)$$

$$\dots (\tan 45^\circ - \tan 44^\circ)]$$

$$= \frac{1}{\sin 1^\circ} [\tan 45^\circ]$$

$$= \frac{1}{\sin 1^\circ} = \operatorname{cosec} 1^\circ$$

38. Sol. (b)

Given, $\cot \theta (1 + \sin \theta) = 4m$

$$\Rightarrow \left(\frac{\cos \theta}{\sin \theta} \right) (1 + \sin \theta) = 4m \quad \dots (i)$$

Also, $\cot \theta (1 - \sin \theta) = n$

$$= \left(\frac{\cos \theta}{\sin \theta} \right) (1 + \sin \theta) = 4n \quad \dots (ii)$$

(i) and (ii)

$$\Rightarrow \left(\frac{\cos^2 \theta}{\sin^2 \theta} \right) (1 - \sin^2 \theta) = 16mn \quad [\because 1 - \sin^2 \theta = \cos^2 \theta]$$

$$\Rightarrow \frac{\cos^4 \theta}{16 \sin^2 \theta} = mn \quad \dots (iii)$$

Now, from (i) and (ii)

$$\Rightarrow 16(m^2 + n^2) = \left(\frac{\cos^2 \theta}{\sin^2 \theta} \right) (1 + \sin^2 \theta + 2 \sin \theta - 2 \sin \theta)$$

$$\Rightarrow (m^2 + n^2) = \frac{1}{8} \left(\frac{\cos^2 \theta}{\sin^2 \theta} \right) (1 + \sin^2 \theta)$$

$$\Rightarrow (m^2 + n^2) = \frac{1}{64} \left(\frac{\cos^4 \theta}{\sin^4 \theta} \right) (1 + \sin^2 \theta)^2$$

comparing with (iii)

$$\Rightarrow (m^2 + n^2) \neq mn$$

Also, $(m^2 + n^2) \neq m^2 n^2$

$$\Rightarrow 16(m^2 - n^2) = \left(\frac{\cos^2 \theta}{\sin^2 \theta} \right)$$

$$(1 + \sin^2 \theta + 2 \sin \theta - 1 - \sin^2 \theta + 2 \sin \theta)$$

$$\Rightarrow (m^2 - n^2) = \frac{1}{4} \left(\frac{\cos^2 \theta}{\sin^2 \theta} \right) (\sin \theta)$$

$$\Rightarrow (m^2 - n^2)^2 = \frac{1}{16} \left(\frac{\cos^4 \theta}{\sin^4 \theta} \right) (\sin^2 \theta)$$

$$\Rightarrow (m^2 - n^2)^2 = \frac{\cos^4 \theta}{16 \sin^2 \theta}$$

$$\rightarrow (m^2 - n^2)^2 = mn \quad (\text{from (iii)})$$

39. Sol. (a)

$$(\tan 29^\circ \cot 61^\circ - \operatorname{cosec}^2 61^\circ) +$$

$$\cot^2 54^\circ - \sec^2 36^\circ + (\sin^2 1^\circ + \sin^2 3^\circ$$

$$+ \sin^2 5^\circ + \dots + \sin^2 89^\circ)$$

$$\begin{aligned} &\Rightarrow (\cot(90^\circ - 61^\circ)\cot 61^\circ - \operatorname{cosec}^2 61^\circ) + \\ &\cot^2(90^\circ - 36^\circ) - \sec^2 36^\circ + (\sin^2 1^\circ \\ &+ \sin^2 3^\circ + \sin^2 5^\circ + \dots + \sin^2 89^\circ) \\ &\Rightarrow (\cot^2 61^\circ - \operatorname{cosec}^2 61^\circ) + (\tan^2 36^\circ \\ &- \sec^2 36^\circ) + (\sin^2 1^\circ + \sin^2 3^\circ + \sin^2 5^\circ + \dots + \\ &\sin^2 89^\circ) \end{aligned}$$

We know that

$$(\sin^2 1^\circ + \sin^2 3^\circ + \sin^2 5^\circ + \dots + \sin^2 89^\circ) = \frac{n+1}{2}$$

[Here $n = \frac{\theta - \phi}{2}$ and θ = angle of last term and ϕ = angle of first term. But $\theta + \phi$ must be 90° for this rule]

$$\Rightarrow n = \frac{89-1}{2} = 44$$

$$\Rightarrow (\sin^2 1^\circ + \sin^2 3^\circ + \sin^2 5^\circ + \dots +$$

$$+ \sin^2 89^\circ) = \frac{44+1}{2} = 22\frac{1}{2}$$

$$\Rightarrow (\cot^2 61^\circ - \operatorname{cosec}^2 61^\circ) + (\tan^2 36^\circ$$

$$- \sec^2 36^\circ) + (\sin^2 1^\circ + \sin^2 3^\circ +$$

$$+ \sin^2 5^\circ + \dots + \sin^2 89^\circ) = -1 - 1 + 22\frac{1}{2}$$

$$= 20\frac{1}{2}$$

40. Sol. (d)

$$\tan A + \sec A = \frac{3}{2} \quad \dots(i)$$

$$\sec^2 A - \tan^2 A = 1$$

$$(\sec A + \tan A)(\sec A - \tan A) = 1$$

$$(\sec A - \tan A) = \frac{2}{3} \quad \dots(ii)$$

Adding (i) and (ii)

$$2\sec A = \frac{13}{6} \Rightarrow \sec A = \frac{13}{12} = \frac{H}{B}$$

$P = 5$ (By Pythagoras triplet)

$$\cot A = \frac{12}{5}, \cos A = \frac{12}{13}$$

$$\tan A = \frac{5}{12}, \operatorname{cosec} A = \frac{13}{5}$$

$$\frac{10\cot A + 13\cos A}{12\tan A + 5\operatorname{cosec} A}$$

$$\frac{10 \times \frac{12}{5} + 13 \times \frac{12}{13}}{12 \times \frac{5}{12} + 5 \times \frac{13}{5}} = 2$$

41. Sol. (d)

$$\sin^2 1^\circ + \sin^2 3^\circ + \sin^2 5^\circ + \dots + \sin^2 89^\circ$$

$$\text{No. of terms} = \frac{\text{Last term} - 1^{\text{st}} \text{ term}}{\text{common difference}} + 1$$

$$= \frac{89-1}{2} + 1 = 45$$

$$\sin^2 1^\circ + \sin^2 3^\circ + \sin^2 5^\circ + \dots + \sin^2 89^\circ$$

$$= \frac{45}{2} = 22.5$$

$$\cot^2 46^\circ - \sec^2 44^\circ + (\sin^2 1^\circ + \sin^2 3^\circ + \sin^2 5^\circ + \dots + \sin^2 89^\circ)$$

$$\Rightarrow \tan^2 44^\circ - \sec^2 44^\circ + (\sin^2 1^\circ + \sin^2 3^\circ + \sin^2 5^\circ + \dots + \sin^2 89^\circ)$$

$$\Rightarrow -1^2 + (\sin^2 1^\circ + \sin^2 3^\circ + \sin^2 5^\circ + \dots + \sin^2 89^\circ)$$

$$= -1 + 22.5 = 21.5$$

42. Sol. (c)

$$\sin \alpha + \sin \beta = p \quad \dots(i)$$

And

$$\cos \alpha + \cos \beta = q \quad \dots(ii)$$

On squaring and adding eq. (i) and (ii)

$$= \sin^2 \alpha + \sin^2 \beta + 2\sin \alpha \sin \beta + \cos^2 \alpha + \cos^2 \beta + 2$$

$$\cos \alpha \cos \beta = p^2 + q^2$$

$$= 2 + 2\cos(\alpha - \beta) = p^2 + q^2$$

$$= \cos(\alpha - \beta) = \frac{p^2 + q^2 - 2}{2}$$

Now

$$\tan\left(\frac{\alpha - \beta}{2}\right) = \pm \sqrt{\frac{1 - \cos(\alpha - \beta)}{1 + \cos(\alpha - \beta)}}$$

$$= \pm \sqrt{\frac{1 - \frac{p^2 + q^2 - 2}{2}}{1 + \frac{p^2 + q^2 - 2}{2}}}$$

$$= \pm \sqrt{\frac{4 - p^2 - q^2}{p^2 + q^2}}$$

43. Sol. (d)

$$(\sin^2 5^\circ + \sin^2 10^\circ + \dots + \sin^2 85^\circ) + \sin^2 90^\circ$$

$$\text{No. of terms} = \left\{ \left(\frac{85-5}{5} \right) + 1 \right\} = 17$$

$$\text{Sum of series} = \frac{17}{2} + 1 = 9\frac{1}{2}$$

44. Sol. (b)

$$\sqrt[3]{\sqrt[4]{\sin^2 \alpha}} = (\sin \alpha)^{\tan \alpha}$$

$$= \sqrt[24]{\sin^2 \alpha} = (\sin \alpha)^{\tan \alpha}$$

$$= (\sin \alpha)^{2/24} = (\sin \alpha)^{\tan \alpha}$$

$$\Rightarrow \tan \alpha = \frac{2}{24} = \frac{1}{12}$$

$$\Rightarrow \cot \alpha = 12$$

$$\Rightarrow \operatorname{cosec}^2 \alpha = \cot^2 \alpha + 1 = (12)^2 + 1 = 145$$

$$\Rightarrow \sin^2 \alpha = \frac{1}{145} \Rightarrow \sin \alpha = \frac{1}{\sqrt{145}}$$

Now

$$\tan \alpha \sin \alpha = \frac{1}{12} \times \frac{1}{\sqrt{145}} = \frac{1}{12\sqrt{145}}$$

45. Sol. (c)

$$\sec \theta - \tan \theta = P$$

$$\sec \theta + \tan \theta = \frac{1}{P}$$

$$2\sec \theta = P + \frac{1}{P} \Rightarrow \cos \theta = \frac{2P}{P^2+1}$$

[Squaring Both Side]

$$\cos^2 \theta = \left[\frac{2P}{P^2+1} \right]^2$$

$$1 - \sin^2 \theta = \frac{4P^2}{2P^2+1+P^4}$$

$$\sin^2 \theta = 1 - \frac{4P^2}{2P^2+1+P^4}$$

$$= \frac{2P^2+1+P^4-4P^2}{2P^2+1+P^4}$$

$$\sin \theta = \frac{1-P^2}{P^2+1}, \operatorname{cosec} \theta = \frac{P^2+1}{1-P^2}$$

46. Sol. (c)

$$x \sin \theta = y \cos \theta$$

$$\Rightarrow x \sin^3 \theta + y \cos^3 \theta = \sin \theta \cos \theta$$

$$\Rightarrow x \sin^3 \theta + \frac{x \sin \theta}{\cos \theta} \times \cos^3 \theta = \sin \theta \cos \theta$$

$$\Rightarrow x \sin^3 \theta + x \sin \theta \times \cos^2 \theta = \sin \theta \cos \theta$$

$$\Rightarrow x \sin \theta (\sin^2 \theta + \cos^2 \theta) = \sin \theta \cos \theta$$

$$\Rightarrow x \sin \theta = \sin \theta \cos \theta \Rightarrow x = \cos \theta$$

$$\Rightarrow x \sin \theta = y \cos \theta$$

$$\Rightarrow \cos \theta \cdot \sin \theta = y \cos \theta \Rightarrow y = \sin \theta$$

$$\Rightarrow x^2 + y^2 = \sin^2 \theta + \cos^2 \theta = 1$$

47. Sol. (c)

$$1 + \frac{1}{-1 + \frac{1}{1 - \frac{1}{1 + \frac{\sin^2 \theta}{1 - \sin^2 \theta}}}}$$

$$= 1 + \frac{1}{-1 + \frac{1}{1 - \frac{1 - \sin^2 \theta + \sin^2 \theta}{1 - \sin^2 \theta}}}$$

$$= 1 + \frac{1}{-1 + \frac{1}{1 - (1 - \sin^2 \theta)}}$$

$$= 1 + \frac{1}{-1 + \operatorname{cosec}^2 \theta}$$

$$= 1 + \tan^2 \theta = \sec^2 \theta$$

48. Sol. (d)

$$\sin^2 6^\circ + \sin^2 12^\circ + \sin^2 18^\circ + \dots + \sin^2 84^\circ + \sin^2 90^\circ$$

$$\text{Now, } \sin^2 84^\circ = \sin^2 (90^\circ - 6^\circ) = \cos^2 6^\circ$$

$$\therefore \sin^2 6^\circ + \sin^2 12^\circ + \sin^2 18^\circ + \dots + \cos^2 12^\circ + \cos^2 6^\circ + \sin^2 90^\circ$$

$$\sin^2 6^\circ + \cos^2 6^\circ + \dots + \sin^2 42^\circ + \cos^2 42^\circ +$$

$$\sin^2 90^\circ = 7 + 1 = 8$$

Type-14 (Degree & Radian)

1. Find the degree measure corresponding to $\left(\frac{1}{6}\right)^c$.
- (a) $9^\circ 32'$ (b) $9^\circ 32' 43.6''$
 (c) 10° (d) N.O.T

2. In circular measure, the value of the angle $11^\circ 15'$ is

[(SSC CHSL DEO & LDC
Exam. 2023, 1st Sitting)]

- (a) $\frac{\pi^c}{16}$ (b) $\frac{\pi^c}{8}$ (c) $\frac{\pi^c}{4}$ (d) $\frac{\pi^c}{12}$

3. The complement angle of 80° is

[CDS 2015-I]

- (a) $\frac{\pi}{9}$ (b) $\frac{5\pi}{9}$ radian
 (c) $\frac{\pi}{18}$ radian (d) $\frac{9}{5\pi}$ radian

4. The value of $\frac{\sin 1^\circ}{\sin 1^c}$ where 1^c represents 1 radian is

- (a) Equal to 1
 (b) Less than 1
 (c) Greater than 1 but less than 2
 (d) Greater than 2

5. The sum of two angles is 155° and their difference is $\pi/2$. The value of the greater angle (in radian) is:

[DP Head Constable 17/10/2022 (Shift - 01)]

- (a) $\frac{52\pi}{72}$ (b) $\frac{51\pi}{72}$ (c) $\frac{49\pi}{72}$ (d) $\frac{50\pi}{72}$

6. Radian measure of $72^\circ 40'$ is

- (a) $\frac{109\pi}{270}$ rad (b) $\frac{109\pi}{180}$ rad
 (c) $\frac{219\pi}{540}$ rad (d) $\frac{219\pi}{360}$ rad

7. Consider the following :

1. $\sin 1^\circ > \sin 1^c$
2. $\cos 1^\circ < \cos 1^c$

3. $\tan 1^\circ > \tan 1^c$.

Which of the above are not correct?

[CDS 2016-II]

- (a) 1 and 2 only (b) 2 and 3 only
 (c) 1 and 3 only (d) 1, 2 and 3

8. In $\triangle UVW$ measure of angle V is 90° . If $\tan U = \frac{12}{5}$, and $UV = 10$ cm, then what is the length (in cm.) of side VW?

[(SSC CHSL (10 + 2) Tier-I CBE
(Exam) 04.03.2018 (First Sitting)]

- (a) 26 (b) 24 (c) 25 (d) 5

9. The angle in degree through which a pendulum of length 100 cm swings and the tip describes an arc length of 10 cm is

- (a) $5^\circ 43' 38''$ (b) $7^\circ 43' 38''$
 (c) $5^\circ 34' 18''$ (d) $7^\circ 34' 18''$

10. If $\tan\left(\frac{\theta}{2}\right) \tan\left(\frac{2\theta}{5}\right) = 1$, what is the value (in degrees) of θ ?

[(SSC CAPFs ASI & Delhi Police SI Online Exam,
(Shift-II) 03.07.2017)]

- (a) 45° (b) 90° (c) 100° (d) 120°

11. If the sum and difference of two angle are $22/9$ radian and 36° respectively, then the value of the smallest angle in degree measure is

- (a) 52 (b) 60 (c) 56 (d) 48

12. In a circle of diameter 30 cm, the length of the chord is 15 cm. Find the length of the minor arc corresponding to the chord.

- (a) $\frac{5\pi}{3}$ cm (b) 5π cm
 (c) $\frac{5\pi}{2}$ cm (d) None of these

13. When a pendulum of length 50 cm oscillates, it produce an arc of 16 cm. The angle so formed in degree measure is (approx)

(a) $22\frac{1}{2}$ (b) $18^\circ 35'$
(c) $27\frac{1}{2}$ (d) 45°

14. Radius of a circle is 54 cm. If an arc of circle subtends an angle of 20° at centre then length of the arc is

(a) $19\frac{1}{7}$ (b) $17\frac{4}{7}$ cm
(c) $18\frac{6}{7}$ cm (d) None of these

15. A wheel makes 360 revolutions in one minute. What is the number of radians it turns in one second?

[CDS 2020-I]

(a) 4π (b) 6π (c) 12π (d) 16π

16. Find the central angle made by an arc of length 11 cm and radius 14 cm.

(a) 90 (b) 45 (c) 60 (d) 75

17. The earth revolves in its axis in 24 hours. How much angle does it move in 4 hours and 12 minutes?

(a) 63° (b) 64° (c) 65° (d) 70°

18. The circular measure of the included angle formed by the hour hand and minute hand of a clock at 3 p.m. will be

[(SSC CHSL (10+2) Tier-I (CBE)

Exam. 08.09.2016) (1st Sitting)]

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{3}$ (c) $\frac{5\pi}{12}$ (d) $\frac{\pi}{2}$

19. What is the length of the chord of a unit circle which subtends an angle 2θ at the centre, where $< 45^\circ$?

[CDS 2022-I]

(a) $\sin 2\theta$ (b) $\cos 2\theta$

(c) $2\sin \theta$ (d) $2\cos \theta$

20. What is the measure of central angle of the arc whose length is 11 cm and radius of the circle 14 cm?

[SSCCHSL(10+2) Tier-1 (CBE)

Exam 16.01 .2017 (2nd sitting)]

(a) 45° (b) 60° (c) 75° (d) 90°

Type-14 ANSWER KEY

1	B	2	A	3	D	4	A	5	C	6	A	7	C	8	B
9	A	10	C	11	A	12	B	13	B	14	C	15	C	16	B
17	A	18	D	19	C	20	A								

Type-14 (Degree & Radian) Solution

1. Sol. (b)

$$\begin{aligned}\left(\frac{1}{6}\right)^\circ &= \left(\frac{1}{6} \times \frac{180}{\pi}\right)^\circ = \left(\frac{1}{6} \times \frac{180}{22} \times 7\right)^\circ \\ &= \left(\frac{105}{11}\right)^\circ \\ &= \left(9\frac{6}{11}\right)^\circ = 9^\circ \left(\frac{6}{11} \times 60\right)' = 9^\circ \left(32\frac{8}{11}\right)' \\ &= 9^\circ 32' \left(\frac{8}{11} \times 60\right)'' = 9^\circ 32' 43.6''\end{aligned}$$

2. Sol. (a)

Using Rule 1

$$11^\circ 15' = 11^\circ + \frac{15^\circ}{60}$$

$$= 11^\circ + \frac{1}{4} = \frac{45^\circ}{4}$$

$$[\because 180^\circ = \pi^c]$$

$$\therefore \frac{45^\circ}{4} = \frac{\pi}{180} \times \frac{45}{4} = \frac{\pi^c}{16}$$

3. **Sol. (d)**
Complementary angle of $80^\circ = 90^\circ - 80^\circ = 10^\circ$
 10° can be written as $= 10 \times \frac{\pi}{180} \text{ Rad} = \frac{\pi}{18} \text{ rad}$.

4. **Sol. (a)**
$$\frac{\sin 1^\circ}{\sin 1^c} = \frac{0.0174}{\sin\left(\frac{180}{\pi}\right)} = \frac{0.0174}{0.8415} = 0.0206 < 1$$

5. **Sol. (c)**
Let greater angle be x smaller be y .

$$A/q$$

$$x + y = 155^\circ$$

$$x - y = 90^\circ$$

$$2x = 245^\circ$$

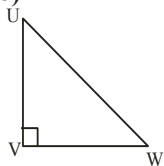
$$x = \frac{245^\circ}{2} \times \frac{\pi}{180^\circ}$$

$$x = \frac{49\pi}{72}$$

6. **Sol. (a)**
 $72^\circ 40' = \left(72 \frac{40}{60}\right)^\circ = \left(72 \frac{2}{3}\right)^\circ$
 $= \left(\frac{218}{3}\right)^\circ = \left(\frac{218}{3} \times \frac{\pi}{180}\right)$
 $= \left(\frac{109\pi}{3 \times 90}\right) = \frac{109\pi}{270} \text{ rad}$

7. **Sol. (c)**
1 and 3 only
 $\sin 1^c = \sin 57^\circ$ (approx)
 $\cos 1^c = \cos 57^\circ$
 $\tan 1^c = \tan 57^\circ \left[\because 180^\circ = \frac{22^\circ}{7} \right]$
 $\cos 0^\circ = 1, \cos 1^\circ = 0.99$
 $\cos 57^\circ = 0.54$

Sol. (b)



$$\tan U = \frac{VW}{UV} \Rightarrow \frac{12}{5} = \frac{VW}{10}$$

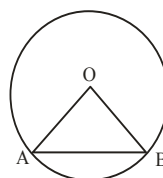
$$\Rightarrow VW = \frac{12}{5} \times 10 = 24 \text{ cm.}$$

9. **Sol. (a)**
From $\theta = \frac{l}{r}, \theta = \frac{10}{100}$
 $= \frac{1}{10} \text{ rad} = \frac{180^\circ}{\pi \times 10} = \left(\frac{18 \times 7}{22}\right)^\circ$
 $= \left(\frac{63}{11}\right)^\circ = \left(5 \frac{8}{11}\right)^\circ$
 $= 5^\circ \left(\frac{8}{11} \times 60'\right) = 5^\circ \left(\frac{480'}{11}\right)$
 $= 5^\circ \left(43 \frac{7}{11}\right) = 5^\circ 43' \left(\frac{7}{11} \times 60''\right)$
 $= 5^\circ 43' 388''$ (approximate)

10. **Sol. (c)**
 $\tan \frac{\theta}{2} \cdot \tan \frac{2\theta}{5} = 1$
 $\Rightarrow \tan \frac{\theta}{2} = \frac{1}{\tan \frac{2\theta}{5}} = \cot \frac{2\theta}{5}$
 $\Rightarrow \tan \frac{\theta}{2} = \tan \left(90^\circ - \frac{2\theta}{5}\right)$
 $\Rightarrow \frac{\theta}{2} = 90^\circ - \frac{2\theta}{5}$
 $\Rightarrow \frac{\theta}{2} + \frac{2\theta}{5} = 90^\circ$
 $\Rightarrow \frac{5\theta + 4\theta}{10} = 90^\circ \Rightarrow 9\theta = 900^\circ$
 $\Rightarrow \theta = \frac{900}{9} = 100^\circ$

11. **Sol. (a)**
 $\alpha + \beta = \frac{22}{9} \Rightarrow \frac{180}{22/7} \times \frac{22}{9} = 140^\circ$
1 Radian $= \frac{180^\circ}{\pi}$
 $\alpha - \beta = 36, \alpha + \beta = 140^\circ$ (add both eqn.)
 $2\alpha = 176$
 $\alpha = 88, \beta = 140 - 88 = 52^\circ$

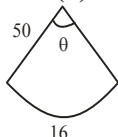
12. **Sol. (b)**
 $OA = OB = 15 \text{ cm}$ (radius)
and chord $AB = 15 \text{ cm}$
 $\therefore \triangle OAB$ is an equilateral triangle.



$$\therefore \angle AOB = 60^\circ = \left(\frac{\pi}{3}\right)^c$$

$$\theta = \frac{\text{arc}}{\text{radius}} \Rightarrow \text{arc} = \theta \times r = \frac{\pi}{3} \times 15 = 5\pi \text{ cm}$$

13. Sol. (b)



$$\theta = \frac{l}{r} \Rightarrow \theta = \frac{16}{50} \text{ rad}$$

$$= \left(\frac{16}{50} \times \frac{180}{\pi}\right)^\circ = \left(\frac{16 \times 18}{5} \times \frac{7}{22}\right)^\circ$$

$$= \left(\frac{16 \times 9 \times 7}{5 \times 11}\right)^\circ = \left(\frac{1008}{55}\right)^\circ$$

$$\left(18\frac{18}{55}\right)^\circ = 18^\circ 35' \text{ (approx)}$$

14. Sol. (c)

$$20^\circ = \frac{20^\circ}{180^\circ} \pi = \frac{\pi}{9} \text{ rad}$$

$$\text{From, } \theta = \frac{l}{r} \Rightarrow l = \theta r = \frac{\pi}{9} \times 54$$

$$= \frac{22}{7 \times 9} \times 54 \text{ cm}$$

$$= \frac{22 \times 6}{7} = \frac{132}{7} = 18\frac{6}{7} \text{ cm}$$

15. Sol. (c)

$$\text{Revolution in one minutes} = 360$$

$$\therefore \text{revolution in one sec} = \frac{360}{60} = 6$$

$$\text{Number of radian it turns in one second}$$

$$= 6 \times 2\pi = 12\pi \text{ rad/s}$$

16. Sol. (b)

$$\theta = \frac{11}{14} \times 180 \times \frac{7}{22} \quad 1 \text{ radian} = \frac{180}{\pi} = \frac{180 \times 7}{22}$$

$$\theta = 45^\circ$$

17. Sol. (a)

$$\text{Revolution in 24 hours} = 360^\circ$$

$$\therefore \text{Revolution in 1 hours} = \frac{360^\circ}{24} = 15^\circ$$

$$\text{Revolution in 4 hours} = 15^\circ \times 4 = 60^\circ$$

$$\therefore \text{Revolution in 60 minutes} = 15^\circ \text{ Revolution in}$$

$$12 \text{ minutes} = \frac{15^\circ \times 12}{60} = 3^\circ$$

$$\therefore \text{Revolution in 4 hours 12 minutes}$$

$$= 60^\circ + 3^\circ = 63^\circ$$

18. (d) The hour hand of a watch traces an angle of 30° in an hour.

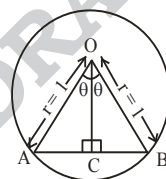
$$\therefore \text{Angle traced at 3 O'clock}$$

$$= 3 \times 30^\circ = 90^\circ$$

$$\therefore 180^\circ = \pi \text{ radian}$$

19. Sol. (c)

$$AB = ?$$



In $\triangle AOC$

$$\sin \theta = \frac{AC}{OA} = \frac{AC}{1}$$

$$\Rightarrow AC = \sin \theta$$

In $\triangle COB$,

$$\sin \theta = \frac{BC}{OB} = \frac{BC}{1}$$

$$\Rightarrow BC = \sin \theta$$

$$\text{Hence, } AB = AC + BC = \sin \theta + \sin \theta = 2\sin \theta$$

20. Sol. (a)

$$\theta = \frac{l}{r} \text{ radian} = \frac{11}{14} \text{ radian}$$

$$\therefore \pi \text{ radian} = 180$$

$$\therefore 1 \text{ radian} = \frac{180^\circ}{\pi}$$

$$\therefore \frac{11}{14} \text{ radian} = \frac{180}{\frac{22}{7}} \times \frac{11}{14} = 45^\circ$$

Type-15 (Mixed Questions)

1. $\tan(\theta - 14\pi)$ is equal to:
SSC CGL 2023 (2nd Shift)
 (a) $\tan \theta$ (b) $-\cot \theta$
 (c) $\cot \theta$ (d) $-\tan \theta$

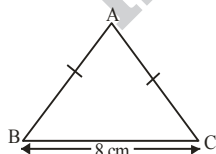
2. If $\tan A + \sec A = \frac{3}{2}$ and A is an acute angle, then the value of $\frac{10\cot A + 13\cos A}{12\tan A + 5\operatorname{cosec} A}$ is:
SSC CHSL 12/08/2021 (Evening)
 (a) 5 (b) 1 (c) 4 (d) 2

3. Simplify. $\cos(36^\circ - A)\cos(36^\circ + A) + \cos(54^\circ - A)\cos(54^\circ + A)$
SSC CPO 11/11/2022 (Morning)
 (a) $\cos A$ (b) $\sin 2A$
 (c) $\cos 2A$ (d) $\sin A$

4. If $\cos 2A = \sin 75^\circ$, then the smallest positive value of A is :
SSC CHSL 27/05/2022 (Afternoon)
 (a) 15° (b) 7.5° (c) 30° (d) 37.5°

5. What is the simplified value of $\cos^2(90^\circ - \theta) - \left[\frac{\cos(90^\circ - \theta)\cos \theta}{\cot \theta} \right]$
SSC CHSL 31/05/2022 (Evening)
 (a) 4 (b) 2 (c) 0 (d) 1

6. In the given figure, ABC is an isosceles triangle with $BC = 8$ cm and $AB = AC = 5$ cm. The value of $\tan C - \cot B$ is.



- SSC CGL 09/12/2022 (4th Shift)**
 (a) $-\frac{5}{12}$ (b) $-\frac{7}{12}$ (c) $\frac{7}{12}$ (d) $\frac{5}{12}$

7. The value of $\frac{\sin 4\theta + \sin 2\theta}{\cos 4\theta + \cos 2\theta}$ is:
SSC CHSL 27/05/2022 (Morning)
 (a) $\tan 3\theta$ (b) $\cot 3\theta$
 (c) $\tan \theta$ (d) $\cot \theta$

8. What is the value of $\tan 6^\circ \times \tan 45^\circ \times \tan 84^\circ$?

SSC CGL 08/12/2022 (2nd Shift)

- (a) 1
 (b) 3
 (c) $\tan 6^\circ \times \tan 39^\circ$
 (d) $\tan 6^\circ + \tan 45^\circ + \tan 84^\circ$

9. If $\sin^2 2\theta = \frac{4}{5}$, find the value of $(2 + \tan^2 \theta)(2 + \cot^2 \theta)$
 (a) 9 (b) 10 (c) 11 (d) 12

10. If $\frac{\sin^2 \theta - 3\sin \theta + 2}{\cos^2 \theta} = 1$, where $0^\circ < \theta < 90^\circ$, then what is the value of $(\cos 2\theta - \sin 3\theta + \operatorname{cosec} 2\theta)$?
SSC CGL 21/04/2022 (Afternoon)

- (a) $\frac{-3-4\sqrt{3}}{6}$ (b) $\frac{-3+4\sqrt{3}}{6}$
 (c) $\frac{3+4\sqrt{3}}{6}$ (d) $\frac{3-4\sqrt{3}}{6}$

11. Which one of the following is true?
 (a) $\cos 40^\circ > \tan 40^\circ > \sin 40^\circ$
 (b) $\cos 40^\circ > \sin 40^\circ > \tan 40^\circ$
 (c) $\tan 40^\circ > \cos 40^\circ > \sin 40^\circ$
 (d) $\sin 40^\circ > \cos 40^\circ > \tan 40^\circ$

12. If $\cos 48^\circ = \frac{m}{n}$, then $\sec 48^\circ - \cot 42^\circ$ is equal to:
SSC CPO 10/11/2022 (Morning)

- (a) $\frac{m-\sqrt{n^2-m^2}}{m}$ (b) $\frac{m-\sqrt{n^2-m^2}}{n}$
 (c) $\frac{n-\sqrt{n^2-m^2}}{n}$ (d) $\frac{n-\sqrt{n^2-m^2}}{m}$

13. If $t\theta + \tan \theta = 2\sec \theta$, $0^\circ < \theta < 90^\circ$, then the value of $\frac{\tan 2\theta - \sec \theta}{\cot 2\theta + \operatorname{cosec} \theta}$ is
SSC CGL 07/03/2020 (Evening)

- (a) $\frac{2\sqrt{3}-1}{11}$ (b) $\frac{2\sqrt{3}-1}{5}$
 (c) $\frac{3-\sqrt{2}}{5}$ (d) $\frac{3-\sqrt{2}}{11}$

14. If $\frac{(\cos^6 \theta + \sin^6 \theta - 1)(\tan^2 \theta + \cot^2 \theta + 2) + 2}{(\sec \theta + \tan \theta)(\sec \theta - \tan \theta)^2 \cos \theta} = \frac{1}{k-1}$, $0^\circ < \theta < 90^\circ$, then $k = ?$

ICAR Assistant 29/07/2022 (Shift-02)

- (a) $\sin \theta$ (b) $\cos \theta$
(c) $\sec \theta$ (d) $\csc \theta$
15. $\frac{(2\sin A)(1+\sin A)}{1+\sin A+\cos A}$ is equal to :
SSC CGL TIER II (11/09/2019)
(a) $1 + \sin A - \cos A$
(b) $1 - \sin A \cos A$
(c) $1 + \cos A - \sin A$
(d) $1 + \sin A \cos A$
16. $\sec \theta + \tan \theta = \frac{x-2}{x+2}$ find $\cos \theta$?
(a) $\frac{x^2+4}{x^2-4}$ (b) $\frac{x^2+2}{x^2-2}$ (c) $\frac{x^2-4}{x^2+4}$ (d) $\frac{x+\sqrt{2}}{x-\sqrt{2}}$
17. If $4\sin^2 \theta = 3(1 + \cos \theta)$, $0^\circ < \theta < 90^\circ$, then what is the value of $(2\tan \theta + 4\sin \theta - \sec \theta)$?
SSC CGL 11/04/2022 (Morning)
(a) $3\sqrt{15} - 4$ (b) $15\sqrt{3} - 4$
(c) $15\sqrt{3} + 3$ (d) $4\sqrt{15} - 318$
18. If $\sec \theta - \tan \theta = \frac{x}{y}$, ($0 < x < y$) and $0^\circ < \theta < 90^\circ$, then $\sin \theta$ is equal to:
SSC CGL 04/03/2020 (Morning)
(a) $\frac{x^2+y^2}{2xy}$ (b) $\frac{2xy}{x^2+y^2}$
(c) $\frac{y^2-x^2}{x^2+y^2}$ (d) $\frac{x^2+y^2}{y^2-x^2}$
19. If $\sin^6 \theta + \cos^6 \theta = \frac{1}{3}$, $0^\circ < \theta < 90^\circ$, then what is the value of $\sin \theta \cdot \cos \theta$?
SSC CGL 18/08/2021 (Evening)
(a) $\sqrt{6}/6$ (b) $\sqrt{2}/3$
(c) $\sqrt{2}/\sqrt{3}$ (d) $2/9$
20. What is the value of $\frac{\sin(\frac{\pi}{2}-10\theta)-\cos(\pi-6\theta)}{\cos(\frac{\pi}{2}-10\theta)-\sin(\pi-6\theta)}$?
(a) $\tan 2\theta$ (b) $\cot 2\theta$
(c) $\cot \theta$ (d) $\cot 3\theta$
21. The value of $\frac{3\tan^2 60^\circ + \sec^2 30^\circ - \sin^2 45^\circ}{(\cos 15^\circ + \sin 75^\circ)(\sec 15^\circ + \csc 75^\circ)}$ is:
SSC CHL 05/08/2021(Afternoon)
(a) $\frac{5}{12}$ (b) $\frac{65}{24}$ (c) $\frac{13}{12}$ (d) $\frac{59}{24}$

22. The value of $\frac{\cos^6 \theta + \sin^6 \theta + 3\sin^2 \theta \cos^2 \theta}{\csc \theta \sec \theta (\sin \theta + \cos \theta - 1)(\sin \theta + \cos \theta + 1)}$
SSC CGL Tier II 15/11/2020
(a) 1 (b) 2 (c) $\frac{1}{2}$ (d) 3
23. The value of $\sin 18^\circ$ is given as $\frac{\sqrt{5}-1}{4}$. Find the value of $\csc 18^\circ$.
SSC CHSL 06/06/2022 (Afternoon)
(a) $\frac{\sqrt{5}+1}{4}$ (b) $\frac{\sqrt{5}-1}{2}$
(c) $\sqrt{5}-1$ (d) $\sqrt{5}+1$
24. If $6\tan A(\tan A + 1) = 5 - \tan A$, Given that $0 < A < \frac{\pi}{2}$ What is the value of $(\sin A + \cos A)$?
SSC CGL 20/04/2022 (Morning)
(a) $3\sqrt{5}$ (b) $\frac{5}{\sqrt{3}}$ (c) $5\sqrt{3}$ (d) $\frac{3}{\sqrt{5}}$
25. If $\tan 40^\circ = a$, then find $\frac{\tan 320^\circ - \tan 310^\circ}{1 + \tan 320^\circ \cdot \tan 310^\circ}$
SSC CGL 13/12/2022 (3rd Shift)
(a) $\frac{1-a^2}{a}$ (b) $\frac{1+a^2}{2a}$ (c) $\frac{1-a^2}{2a}$ (d) $\frac{1+a^2}{a}$
26. Solve the following equation:
 $2\cos^2 \theta + (4 + \sqrt{3})\sin \theta - 2(1 + \sqrt{3}) = 0$
where θ is an acute angle.
SSC CHSL 13/04/2021 (Evening)
(a) 30° (b) 45° (c) 15° (d) 60°
27. In a $\triangle ABC$, $\angle C = 90^\circ$, then the equation whose roots are $\tan A$ & $\tan B$ is
(a) $abx^2 + c^2 + ab = 0$
(b) $abx^2 + c^2x - ab = 0$
(c) $abx^2 + c^2x - ab = 0$
(d) $abx^2 - c^2x + ab = 0$
28. The value of $4(\sin^4 30^\circ + \cos^4 30^\circ) - 3(\sin^2 45^\circ - 2\cos^2 45^\circ)$ is:
SSC CGL 16/08/2021 (Evening)
(a) 1 (b) 4 (c) 2 (d) 0
29. Simplify the following expression.
 $((\sec \theta - \cos \theta)(\cot \theta + \tan \theta))/((1 + \tan \theta + \sec \theta)(\sec \theta)(1 + \cot \theta - \csc \theta))$
 $0^\circ < \theta < 90^\circ$

ICAR Assistant 29/07/2022 (Shift- 01)

- (a) $\frac{\tan \theta}{2}$ (b) $\frac{\cot \theta}{2}$
 (c) $\operatorname{cosec} \theta \sec \theta$ (d) $\sin \theta \cos \theta$
30. If $\frac{\cos(x+A)}{a} = \frac{\cos(x+2A)}{b} = \frac{\cos(x+3A)}{c}$ and $A = 60^\circ, x = 15^\circ$, then the value of $\left(\frac{a+c}{b}\right)^2 + \left(\frac{a-c}{b}\right)^2$ is
DP Head Constable 13/10/2022 (Shift-02)
 (a) 0 (b) 2 (c) 4 (d) 1
31. If $x = \frac{1-\cos \theta + \sin \theta}{1+\sin \theta}$ then what is $\frac{\sin \theta + \cos \theta - 1}{\cos \theta}$ equal to?
[CDS 2022-I]
 (a) $\frac{1}{x}$ (b) x
 (c) $1+x$ (d) $x-1$
32. If $(\sin \theta + \operatorname{cosec} \theta)^2 + (\cos \theta + \sec \theta)^2 = k + \tan^2 \theta + \cot^2 \theta$, then the value of k is equal to:
SSC CGL Tier II 18/11/2020
 (a) 7 (b) 2 (c) 9 (d) 5
33. If $\cos 53^\circ = \frac{x}{y}$, then $\sec 53^\circ + \cot 37^\circ$ is equal to:
SSC CGL 19/04/2022 (Shift-02)
 (a) $\frac{y+\sqrt{y^2-x^2}}{x}$ (b) $\frac{x+\sqrt{y^2-x^2}}{y}$
 (c) $\frac{y+\sqrt{y^2-x^2}}{y}$ (d) None
34. If $\operatorname{cosec} \theta - \sin \theta = m$ and $\sec \theta - \cos \theta = n$ then find a relation between m and n , independent of θ
 (a) 1 (b) 2 (c) 4 (d) None
35. If $\sec \theta (\cos \theta + \sin \theta) = \sqrt{2}$, then what is the value of $(2 \sin \theta) / (\cos \theta - \sin \theta)$?
 (a) $3\sqrt{2}$ (b) $3/\sqrt{2}$
 (c) $1/\sqrt{2}$ (d) $\sqrt{2}$
36. What is the value of $\frac{1}{\sin^4(90-\theta)} + \frac{1}{\cos^2(90-\theta)-1}$
 (a) $\tan \theta \sec \theta$ (b) $\sin \theta \cos \theta$
 (c) $\operatorname{cosec}^2 \theta \cos^2$ (d) $\tan^2 \theta \sec^2 \theta$
37. If $\tan^2 \theta = 1 - a^2$ then find the value of $\sec \theta + \tan^3 \theta \operatorname{cosec} \theta$.
[SSC CGL 11/04/2022 (Morning)]
 (a) $(2 - a^2)^{\frac{1}{2}}$ (b) $(2 - a^2)^{\frac{3}{2}}$
- (c) $(2 - a)^{\frac{3}{2}}$ (d) $(2 - a)^{\frac{1}{2}}$
38. The maximum value of the expression $33 \sin^2 \theta - 28 \sin 2\theta$ is
 (a) 33 (b) 28 (c) 49 (d) 1
39. $a \sin^3 \theta + b \cos^3 \theta = \sin \theta \cos \theta$ and $a \sin \theta - b \cos \theta = 0$, then find the value of $a^2 + b^2$.
 (a) 2 (b) 1 (c) $\frac{1}{4}$ (d) $\frac{1}{2}$
40. $\frac{(1+\sec \theta \operatorname{cosec} \theta)^2 (\sec \theta - \tan \theta)^2 (1+\sin \theta)}{(\sin \theta + \sec \theta)^2 + (\cos \theta + \operatorname{cosec} \theta)^2}$, $0^\circ < \theta < 90^\circ$, is equal to:
SSC CGL Tier II 29/01/2022
 (a) $\cos \theta$ (b) $1 - \cos \theta$
 (c) $\sin \theta$ (d) $1 - \sin \theta$
41. If $\frac{\operatorname{cosec}^2 \theta}{\operatorname{cosec}^2 \theta - \cot^2 \theta} = \frac{13}{4}$, $0^\circ < \theta < 90^\circ$, then the value of $\frac{52 \cos^2 \theta - 9 \tan^2 \theta}{18 \sec^2 \theta + 8 \cot^2 \theta}$ will be:
SSC CHSL 09/08/2021 (Afternoon)
 (a) $\frac{4}{11}$ (b) $\frac{8}{11}$ (c) $\frac{8}{13}$ (d) $\frac{5}{11}$
42. If $A = \frac{\cot^2 \theta \cdot \operatorname{cosec}^2 \theta}{(\sin \frac{\theta}{2} + \cos \frac{\theta}{2})} \cdot \sqrt{\frac{\tan \theta}{\sec \theta}} + 1$ and $B = \frac{\sin^2 \theta + \sin^3 \theta + \cos \theta \sin^2}{\cos^2 \theta + \cos^3 \theta + \sin \theta \cos^2}$ then find $\sqrt{A \cdot B}$?
 (a) $\operatorname{cosec} \theta$ (b) $\sec^2 \theta$
 (c) $\cot \theta \cdot \sec \theta$ (d) Both (a) and (c)
43. If $\sin A, \cos A$ and $\tan A$ are in GP, then $\cos^3 A + \cos^2 A = ?$
 (a) 1 (b) 2 (c) 3 (d) 4
44. If $(\cos q + \sin q) = 31/25$, then what will be the value of $\cos^2 q$?
SSC CGL 03/12/2022 (1st Shift) Mrs).
 (a) $\frac{522}{625}$ (c) $\frac{513}{625}$ (b) $\frac{512}{625}$ (d) $\frac{576}{625}$
45. If $\sin \theta + \cos \theta = \sqrt{2}$, then what is $\sin^6 \theta + \cos^6 \theta + 6 \sin^2 \theta \cos^2 \theta$ equal to?
[CDS 2020 II]
 (a) $\frac{1}{4}$ (b) $\frac{3}{4}$ (c) 1 (d) $\frac{7}{4}$
46. If $\frac{1+\sin \phi}{1-\sin \phi} = \frac{p^2}{q^2}$, then $\sec \phi$ is equal to:
SSC CGL TIER II (12/09/2019)
 (a) $\frac{2p^2 q^2}{p^2 + q^2}$ (b) $\frac{1}{2} \left(\frac{q}{p} + \frac{p}{q} \right)$

(c) $\frac{1}{p^2} + \frac{1}{q^2}$ (d) $\frac{p^2 q^2}{p^2 + q^2}$

47. If $\sec 31^\circ = x$ then $\sin^2 59^\circ + \frac{1}{\sec^2 31^\circ} - \frac{1}{\sin^2 59^\circ \csc^2 59^\circ}$ is equal to:

SSC CGL 24/08/2022 (Shift- 03)

(a) $\frac{x^2-2}{x}$ (b) $\frac{2-x^2}{x^2}$ (c) $\frac{x^2-2}{x^2}$ (d) $\frac{2-x^2}{x}$

48. If $\tan(\alpha + \beta) = \sqrt{3}$, $\tan(\alpha - \beta) = 1$ Where $(\alpha + \beta)$ and $(\alpha - \beta)$ are acute angles, then what is $\tan(6\alpha)$?

SSC CGL 08/12/2022 (2nd Shift)

(a) -1 (b) 0
(c) 1 (d) $\sqrt{2} - 1$

49. $\left(\frac{\tan^3 \theta}{\sec^2 \theta} + \frac{\cot^3 \theta}{\csc^2 \theta} + 2\sin \theta \cos \theta \right) \div (1 + \csc^2 \theta + \tan^2 \theta)$, $0^\circ < \theta < 90^\circ$, is equal to:

SSC CGL Tier II 29/01/2022

(a) $\csc \theta \sec \theta$ (b) $\csc \theta$
(c) $\sin \theta \cos \theta$ (d) $\sec \theta$

50. If $\theta = 59^\circ$, then $\frac{1}{2}\sqrt{1 + \sin \theta} + \frac{1}{2}\sqrt{1 - \sin \theta}$ is equal to:

(a) $\frac{\cot \theta}{2}$ (b) $\frac{\sec \theta}{2}$
(c) $\frac{\sin \theta}{2}$ (d) $\frac{\cos \theta}{2}$

51. If $\cos \theta = \sin(2\theta) \neq 0$, what is the value of $\cos^4 \theta + \sin^4 \theta + \cos^3 \theta + \sin^3 \theta + \sin^2 \theta + \cos^2 \theta + \sin \theta + \cos \theta$?

Graduate Level 05/08/2022 (Shift-3)

(a) $\frac{8+7\sqrt{3}}{18}$ (b) $\frac{18+7\sqrt{3}}{8}$

(c) $\frac{18+8\sqrt{3}}{7}$ (d) $\frac{7+18\sqrt{3}}{8}$

52. Find the value of $\sin \frac{\pi}{14} \sin \frac{3\pi}{14} \sin \frac{5\pi}{14} \sin \frac{7\pi}{14} \sin \frac{9\pi}{14} \sin \frac{11\pi}{14} \sin \frac{13\pi}{14}$

(a) $\frac{1}{16}$ (b) $\frac{1}{32}$ (c) $\frac{1}{64}$ (d) $\frac{1}{128}$

53. The expression $\frac{(1-2\sin^2 \theta \cos^2 \theta)(\cot \theta + 1)\cos \theta}{(\sin^4 \theta + \cos^4 \theta)(1 + \tan \theta)\csc \theta} - 1$, $0^\circ < \theta < 90^\circ$, is equal to:

SSC CGL Tier II 03/02/2022

(a) $\cos^2 \theta$ (b) $-\sin^2 \theta$
(c) $\sec^2 \theta$ (d) $-\sec^2 \theta$

54. The value of $\cot 70^\circ + 4\cos 70^\circ$ is

(a) $\frac{1}{\sqrt{3}}$ (b) $\sqrt{3}$ (c) $2\sqrt{3}$ (d) $\frac{1}{2}$

55. If $E = (27)^{\sin \theta} \cdot (9)^{\sin \theta} \cdot (81)^{\cos \theta} \cdot (243)^{\cos \theta}$. $(27)^{\cos \theta}$ and P and Q are the maximum and minimum value of E , then find $\frac{P}{Q}$.

(a) 1 (b) $(3)^5$ (c) $(3)^{12}$ (d) $(3)^{26}$

56. $\frac{\tan 5\theta + \tan 3\theta}{4\cos 4\theta(\tan 5\theta - \tan 3\theta)}$ is equal to

(a) $\tan 4\theta$ (b) $\sin 2\theta$
(c) $\cot 2\theta$ (d) $\cos 2\theta$

57. The maximum value $5\cos \theta + 3\cos \left(\theta + \frac{\pi}{3} \right)$ is

(a) 3 (b) 5 (c) 7 (d) 9

Type-15 ANSWER KEY

1	A	2	D	3	C	4	B	5	C	6	B	7	A
8	A	9	C	10	B	11	C	12	D	13	A	14	A
15	A	16	C	17	A	18	C	19	B	20	B	21	D
22	C	23	D	24	D	25	C	26	D	27	D	28	B
29	A	30	C	31	B	32	A	33	A	34	A	35	D
36	D	37	B	38	C	39	B	40	D	41	B	42	D
43	A	44	D	45	D	46	B	47	B	48	A	49	C
50	D	51	B	52	C	53	B	54	B	55	D	56	D
57	A												

Type-15 (Mixed Questions) Solution

1. Sol. (a)

$$\tan(\theta - 14\pi) =$$

$$[\tan\{-(14\pi - \theta)\}] = -\tan(14\pi - \theta)$$

Values of $\tan \theta$ and $\cot \theta$ is -ve in fourth quadrant

$$-\tan(14\pi - \theta) = -(-\tan \theta) = \tan \theta$$

2. Sol. (d)

$$\tan A + \sec A = \frac{3}{2} \quad \dots(i)$$

$$\sec^2 A - \tan^2 A = 1$$

$$(\sec A + \tan^2 A)(\sec A - \tan A) = 1$$

$$(\sec A - \tan A) = \frac{2}{3} \quad \dots(ii)$$

Adding (1) and (2),

$$2\sec A = \frac{13}{6} \Rightarrow \sec A = \frac{13}{12} = \frac{H}{B}$$

P = 5 (By pythagoras triplet)

$$\cot A = \frac{12}{5}, \cos A = \frac{12}{13}$$

$$\tan A = \frac{5}{12}, \operatorname{cosec} A = \frac{13}{5}$$

$$\frac{10\cot A + 13\cos A}{12\tan A + 5\operatorname{cosec} A}$$

$$\frac{10 \times \frac{12}{5} + 13 \times \frac{12}{13}}{12 \times \frac{5}{12} + 5 \times \frac{13}{5}} = \frac{24 + 12}{5 + 13} = 2$$

3. Sol. (c)

Formula used : $\cos A \cos B$

$$= \frac{1}{2} [\cos(A + B) + \cos(A - B)]$$

$$\cos(36^\circ - A)\cos(36^\circ + A) + \cos(54^\circ - A)$$

$$\cos(54^\circ + A)$$

$$= \frac{1}{2} (\cos 72^\circ + \cos 2A) + \frac{1}{2} (\cos 108^\circ + \cos 2A)$$

$$= \frac{1}{2} (\cos(90^\circ - 18^\circ) + \cos 2A) + (\cos(90^\circ + 18^\circ) + \cos 2A)$$

$$\frac{1}{2} [\sin 18^\circ + \cos 2A - \sin 18^\circ + \cos 2A]$$

$$\frac{1}{2} \times 2\cos 2A = \cos 2A$$

4. Sol. (b)

$$\cos 2A = \sin 75^\circ$$

$$\cos 2A = \cos(90^\circ - 15^\circ) = \cos 15^\circ$$

$$2A = 15^\circ \Rightarrow A = \frac{15}{2} = 7.5^\circ$$

So, smallest positive value of $A = 7.5^\circ$

5. Sol. (c)

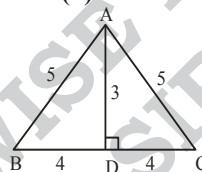
$$\cos^2(90^\circ - \theta) - \left[\frac{\cos(90^\circ - \theta) \cos \theta}{\cot \theta} \right]$$

$$\Rightarrow \sin^2 \theta - \left[\frac{\sin \theta \cos \theta}{\cot \theta} \right]$$

$$\Rightarrow \sin^2 \theta - \left[\sin \theta \cos \theta \times \frac{\sin \theta}{\cos \theta} \right]$$

$$\sin^2 \theta - \sin^2 \theta = 0$$

6. Sol. (b)



Since, $\triangle ABC$ is an isosceles triangle then, AD (median) divides BC in the ratio of 1:1.

From the given figure,

$$\text{we have } \tan C = \frac{3}{4}, \cot B = \frac{4}{3}$$

$$\text{So, } \tan C - \cot B = \frac{3}{4} - \frac{4}{3} = \frac{9-16}{12} = \frac{-7}{12}$$

7. Sol. (a)

$$\frac{\sin 4\theta + \sin 2\theta}{\cos 4\theta + \cos 2\theta}$$

$$= \frac{2\sin\left(\frac{4\theta+2\theta}{2}\right)\cos\left(\frac{4\theta-2\theta}{2}\right)}{2\cos\left(\frac{4\theta+2\theta}{2}\right)\cos\left(\frac{4\theta-2\theta}{2}\right)}$$

$$= \frac{\sin 3\theta \cos \theta}{\cos 3\theta \cos \theta} = \frac{\sin 3\theta}{\cos 3\theta} = \tan 3\theta$$

8. Sol. (a)

$$\tan 6^\circ \times \tan 45^\circ \times \tan 84^\circ =$$

$$= \tan(90^\circ - 84^\circ) \times 1 \times \tan 84^\circ$$

$$= \cot 84^\circ \tan 84^\circ = 1$$

9. Sol. (c)

$$\text{Given } \sin^2 2\theta = \frac{4}{5}$$

A.T.Q

$$= (2 + \tan^2 \theta)(2 + \cot^2 \theta)$$

$$= (1 + \sec^2 \theta)(1 + \operatorname{cosec}^2 \theta)$$

$$= 1 + \operatorname{cosec}^2 \theta + \sec^2 \theta + \sec^2 \theta \cdot \operatorname{cosec}^2 \theta$$

$$= 1 + \frac{1}{\sin^2 \theta} + \frac{1}{\cos^2 \theta} + \frac{1}{\sin^2 \theta \cdot \cos^2 \theta}$$

$$= \frac{\sin^2 \theta \cdot \cos^2 \theta + \cos^2 \theta + \sin^2 \theta + 1}{\sin^2 \theta \cdot \cos^2 \theta}$$

$$= \frac{2 + \sin^2 \theta \cdot \cos^2 \theta}{\sin^2 \theta \cdot \cos^2 \theta} = 1 + \frac{2}{\sin^2 \theta \cdot \cos^2 \theta}$$

$$= 1 + \frac{8}{\sin^2 2\theta} = 1 + \frac{8}{4/5} = 11$$

10. Sol. (b)

$$\frac{\sin^2 \theta - 3\sin \theta + 2}{\cos^2 \theta} = 1$$

$$\sin^2 \theta - 3\sin \theta + 2 = \cos^2 \theta$$

$$\sin^2 \theta - 3\sin \theta + 2 = 1 - \sin^2 \theta$$

$$2\sin^2 \theta - 3\sin \theta + 1 = 0$$

$$2\sin^2 \theta - 2\sin \theta - \sin \theta + 1 = 0$$

$$2\sin \theta(\sin \theta - 1) - 1(\sin \theta - 1) = 0$$

$$(2\sin \theta - 1)(\sin \theta - 1) = 0$$

$$\sin \theta = \frac{1}{2}, \theta = 30^\circ, 90^\circ$$

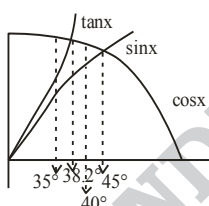
90° is not possible because $\cos \theta$ cannot be 0°

$$\cos 2\theta - \sin 3\theta + \operatorname{cosec} 2\theta$$

$$\cos 60^\circ - \sin 90^\circ + \operatorname{cosec} 60^\circ$$

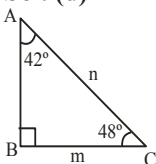
$$= \frac{1}{2} - 1 + \frac{2}{\sqrt{3}} = \frac{-3+4\sqrt{3}}{6}$$

11. Sol. (c)



$$\tan 40^\circ > \cos 40^\circ > \sin 40^\circ$$

12. Sol. (d)



$$\sec 48^\circ = \frac{n}{m} \text{ and } \cot 42^\circ = \frac{\sqrt{n^2 - m^2}}{m}$$

$$\text{So, } \sec 48^\circ - \cot 42^\circ = \frac{n}{m} - \frac{\sqrt{n^2 - m^2}}{m} = \frac{n - \sqrt{n^2 - m^2}}{m}$$

13. Sol. (a)

$$\cot \theta + \tan \theta = 2 \sec \theta$$

$$\frac{\cos \theta}{\sin \theta} + \frac{\sin \theta}{\cos \theta} = 2 \times \frac{1}{\cos \theta}$$

$$\cos^2 \theta + \sin^2 \theta = 2 \sin \theta$$

$$1 - \sin^2 \theta + \sin^2 \theta = 2 \sin \theta$$

$$\sin \theta = \frac{1}{2} \Rightarrow \theta = 30^\circ$$

$$\frac{\tan 2\theta - \sec \theta}{\cot 2\theta + \operatorname{cosec} \theta} = \frac{\tan 60^\circ - \sec 30^\circ}{\cot 60^\circ + \operatorname{cosec} 30^\circ}$$

$$= \frac{\frac{\sqrt{3}-2}{\sqrt{3}}}{\frac{1}{\sqrt{3}}+2} = \frac{3-2}{1+2\sqrt{3}} = \frac{1}{1+2\sqrt{3}}$$

$$= \frac{2\sqrt{3}-1}{11}$$

14. Sol. (a)

$$\frac{(\sin^6 \theta + \cos^6 \theta - 1)(\tan^2 \theta + \cot^2 \theta + 2) + 2}{(\sec \theta + \tan \theta)(\sec \theta - \tan \theta)^2 \cdot \cos \theta}$$

$$(1 - 3\sin^2 \theta \cdot \cos^2 \theta - 1)$$

$$\Rightarrow \frac{\left(\frac{\sin^4 \theta + \cos^4 \theta + 2\sin^2 \theta \cdot \cos^2 \theta}{\sin^2 \theta \cdot \cos^2 \theta}\right) + 2}{(\sec^2 \theta - \tan^2 \theta)(\sec \theta - \tan \theta) \cdot \cos \theta}$$

$$= \frac{-1}{1 - \sin \theta} \Rightarrow \frac{-1}{\sin \theta - 1} = \frac{k}{k-1}$$

$$\Rightarrow k = \sin \theta$$

15. Sol. (a)

Put $A = 90^\circ$

$$\frac{(2\sin A)(1 + \sin A)}{1 + \sin A + \cos A}$$

$$\Rightarrow \frac{(2\sin 90^\circ)(1 + \sin 90^\circ)}{1 + \sin 90^\circ + \cos 90^\circ}$$

$$\Rightarrow \frac{2(1)(1+1)}{1+1+0} = 2$$

Now go through options,

Choose option (a)

$$1 + \sin A - \cos A \Rightarrow 1 + \sin 90^\circ - \cos 90^\circ$$

$$\Rightarrow 1 + 1 - 0 = 2$$

Condition satisfied, hence option A is the correct answer.

Note: We can check other options also but no option will satisfy the condition.

16. Sol. (c)

we know that,

$$\sec^2 \theta - \tan^2 \theta = 1$$

$$\Rightarrow (\sec \theta + \tan \theta)(\sec \theta - \tan \theta) = 1$$

$$\sec \theta - \tan \theta = \frac{1}{\sec \theta + \tan \theta}$$

$$\Rightarrow \sec \theta + \tan \theta = \frac{x-2}{x+2} \quad \dots (i)$$

$$\sec \theta - \tan \theta = \frac{x+2}{x-2} \quad \dots (ii)$$

add eq. (i) and (ii)

$$2\sec \theta = \frac{x-2}{x+2} + \frac{x+2}{x-2}$$

$$= \frac{(x-2)^2 + (x+2)^2}{x^2 - 4}$$

$$= \frac{(x^2 + 4 - 4x + x^2 + 4 + 4x)}{x^2 - 4}$$

$$2\sec \theta = \frac{2(x^2 + 4)}{(x^2 - 4)} \quad \cos \theta = \frac{x^2 - 4}{x^2 + 4}$$

17. Sol. (a)

$$4\sin^2 \theta = 3(1 + \cos \theta)$$

$$4\sin^2 \theta = 3 + 3\cos \theta$$

$$4(1 - \cos^2 \theta) = 3 + 3\cos \theta$$

$$4 - 4\cos^2 \theta = 3 + 3\cos \theta$$

$$-4\cos^2 \theta - 3\cos \theta + 1 = 0$$

$$4\cos^2 \theta + 3\cos \theta - 1 = 0$$

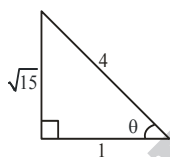
$$4\cos^2 \theta + 4\cos \theta - \cos \theta - 1 = 0$$

$$4\cos \theta (\cos \theta + 1) - 1(\cos \theta + 1) = 0$$

$$(\cos \theta + 1)(4\cos \theta - 1) = 0$$

$\cos \theta = -1$ not possible as $0^\circ < \theta < 90^\circ$, so

$$\cos \theta = \frac{1}{4}$$



$$2\tan \theta + 4\sin \theta - \sec \theta$$

$$= 2\left(\frac{\sqrt{15}}{1}\right) + 4\left(\frac{\sqrt{15}}{4}\right) - \frac{4}{1}$$

$$= 2\sqrt{15} + \sqrt{15} - 4 = 3\sqrt{15} - 4$$

18. Sol. (c)

$$\sec \theta - \tan \theta = \frac{x}{y} \quad \dots (1)$$

$$\text{Then } \sec \theta + \tan \theta = \frac{y}{x} \quad \dots (2) \text{ as}$$

$$(\sec^2 \theta - \tan^2 \theta = 1)$$

Add (1) and (2), we get:

$$2\sec \theta = \frac{x^2 + y^2}{xy} \Rightarrow \sec \theta = \frac{x^2 + y^2}{2xy},$$

$$\cos \theta = \frac{2xy}{x^2 + y^2}$$

$$\sin \theta = \sqrt{1 - \left(\frac{2xy}{x^2 + y^2}\right)^2} = \frac{y^2 - x^2}{x^2 + y^2}$$

19. Sol. (b)

$$\sin^6 \theta + \cos^6 \theta = \frac{1}{3}$$

$$(\sin^2 \theta + \cos^2 \theta)[(\sin^2 \theta + \cos^2 \theta)^2 - 3$$

$$\sin^2 \theta \cdot \cos^2 \theta] = \frac{1}{3}$$

$$[1 - 3\sin^2 \theta \cdot \cos^2 \theta] = \frac{1}{3}$$

$$3\sin^2 \theta \cdot \cos^2 \theta = \frac{2}{3}$$

$$\sin^2 \theta \cdot \cos^2 \theta = \frac{2}{9} \Rightarrow \sin \theta \cdot \cos \theta = \sqrt{2}/3$$

20. Sol. (i)

$$\frac{\sin\left(\frac{\pi}{2} - 10\theta\right) - \cos(\pi - 6\theta)}{\cos\left(\frac{\pi}{2} - 10\theta\right) - \sin(\pi - 6\theta)}$$

$$\frac{\cos 10\theta + \cos 6\theta}{\sin 10\theta - \sin 6\theta}$$

$$\frac{2\cos\frac{10\theta+6\theta}{2}\cos\frac{10\theta-6\theta}{2}}{2\cos\frac{10\theta+6\theta}{2}\sin\frac{10\theta-6\theta}{2}}$$

$$= \frac{2\cos 8\theta \cos 2\theta}{2\cos 8\theta \sin 2\theta} = \cot 2\theta$$

21. Sol. (d)

$$\frac{3\tan^2 60^\circ + \sec^2 30^\circ - \sin^2 45^\circ}{(\cos 15^\circ + \sin 75^\circ)(\sec 15^\circ + \csc 75^\circ)}$$

$$\Rightarrow \frac{3 \times 3 + \frac{4}{3} - \frac{1}{2}}{(\cos 15^\circ + \sin 75^\circ)\left(\frac{1}{\cos 15^\circ} + \frac{1}{\sin 75^\circ}\right)}$$

$$\Rightarrow \frac{3 \times 3 + \frac{4}{3} - \frac{1}{2}}{(\cos 15^\circ + \sin 75^\circ)\left(\frac{\sin 75^\circ + \cos 15^\circ}{\cos 15^\circ \cdot \sin 75^\circ}\right)}$$

$$\Rightarrow \frac{\frac{59}{6}}{\frac{(\cos 15^\circ + \sin 75^\circ)^2}{\cos 15^\circ \cdot \sin 75^\circ}}$$

$$\Rightarrow \frac{\frac{59}{6}}{\frac{\sin^2 75^\circ + \cos^2 15^\circ + 2\cos 15^\circ \cdot \sin 75^\circ}{\cos 15^\circ \cdot \sin 75^\circ}}$$

$$\Rightarrow \frac{\frac{59}{6}}{\frac{2\sin^2 75^\circ + 2\sin^2 75^\circ}{\sin^2 75^\circ}} \Rightarrow \frac{59}{4 \times 6} \Rightarrow \frac{59}{24}$$

22. Sol. (c)

$$\frac{\cos^6 \theta + \sin^6 \theta + 3\sin^2 \theta \cos^2 \theta \times 1}{\csc \theta \sec \theta (\sin \theta + \cos \theta - 1)(\sin \theta + \cos \theta + 1)}$$

$$\frac{\cos^6 \theta + \sin^6 \theta + 3\sin^2 \theta \cos^2 \theta \times (\sin^2 \theta + \cos^2 \theta)}{\csc \theta \sec \theta (\sin^2 \theta + \cos^2 \theta + 2\sin \theta \cos \theta - 1)}$$

$$\frac{(\sin^2 \theta + \cos^2 \theta)^3}{\csc \theta \sec \theta (2\sin \theta \cos \theta)}$$

$$\frac{(1)^3}{\frac{1}{\sin \theta \cos \theta} (2\sin \theta \cos \theta)} = \frac{1}{2}$$

23. Sol. (d)

$$\sin 18^\circ = \frac{\sqrt{5}-1}{4}$$

$$\begin{aligned}\operatorname{Cosec} 18^\circ &= \frac{4}{\sqrt{5}-1} = \frac{4(\sqrt{5}+1)}{5-1} \\ &= \frac{4(\sqrt{5}+1)}{4} = \sqrt{5} + 1\end{aligned}$$

24. Sol. (d)

$$\begin{aligned}6\tan A(\tan A + 1) &= 5 - \tan A \\ 6\tan^2 A + 6\tan A + \tan A - 5 &= 0 \\ 6\tan^2 A + 7\tan A - 5 &= 0 \\ 6\tan^2 A + 10\tan A - 3\tan A - 5 &= 0 \\ 2\tan A(3\tan A + 5) - 1(3\tan A + 5) &= 0 \\ (2\tan A - 1)(3\tan A + 5) &= 0 \\ \tan A &= \frac{1}{2}, -\frac{5}{3} \\ \text{Taking } \tan A &= \frac{1}{2} \dots \left(0 < A < \frac{\pi}{2}\right) \\ \sin A &= \frac{1}{\sqrt{5}}, \cos A = \frac{2}{\sqrt{5}} \\ \sin A + \cos A &= \frac{1}{\sqrt{5}} + \frac{2}{\sqrt{5}} = \frac{3}{\sqrt{5}}\end{aligned}$$

25. Sol. (c)

$$\tan 40^\circ = \cot 50^\circ = a$$

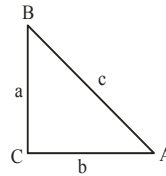
$$\begin{aligned}\text{So, } \frac{\tan 320^\circ - \tan 310^\circ}{1 + \tan 320^\circ \cdot \tan 310^\circ} &= \frac{\tan(360^\circ - 40^\circ) - \tan(360^\circ - 50^\circ)}{1 + \tan(360^\circ - 40^\circ) \cdot \tan(360^\circ - 50^\circ)} \\ &= \frac{-\tan 40^\circ + \tan 50^\circ}{1 + \tan 40^\circ \tan 50^\circ} \\ &= \frac{-a + \frac{1}{a}}{1 + a \times \frac{1}{a}} = \frac{1-a^2}{2a}\end{aligned}$$

26. Sol. (d)

$$\begin{aligned}\text{Let } \sin \theta &= x \\ 2(1-x^2) + (4+\sqrt{3})x - 2(1+\sqrt{3}) &= 0 \\ 2-2x^2 + (4+\sqrt{3})x - 2-2\sqrt{3} &= 0 \\ 2x^2 - (4+\sqrt{3})x + 2\sqrt{3} &= 0 \\ 2x^2 - 4x - \sqrt{3}x + 2\sqrt{3} &= 0 \\ (x-2)(2x-\sqrt{3}) &= 0 \\ x = \sin \theta &= \frac{\sqrt{3}}{2} \quad (\sin \theta = 2 \text{ is not possible}) \\ \theta &= 60^\circ\end{aligned}$$

27. Sol. (d)

$$\begin{aligned}\alpha + \beta &= \tan A + \tan B = \frac{a}{b} + \frac{b}{a} \\ &= \frac{a^2+b^2}{ab} \\ \alpha\beta &= \tan A \cdot \tan B = \frac{a}{b} \cdot \frac{b}{a} = 1\end{aligned}$$



then equation

$$x^2 - (\alpha + \beta)x + \alpha\beta = 0$$

$$x^2 - \left(\frac{a^2+b^2}{ab}\right)x + 1 = 0$$

$$abx^2 - (a^2 + b^2)x + ab = 0$$

$$abx^2 - c^2x + ab = 0$$

$$(\because a^2 + b^2 = c^2)$$

28. Sol. (b)

$$\begin{aligned}&4(\sin^4 30^\circ + \cos^4 30^\circ) \\ &3(\sin^2 45^\circ - 2\cos^2 45^\circ) \\ &\Rightarrow 4\left(\frac{1}{16} + \frac{9}{16}\right) - 3\left(\frac{1}{2} - 1\right) \\ &\Rightarrow 4\left(\frac{10}{16}\right) + \frac{3}{2} = \frac{10}{4} + \frac{6}{4} = 4\end{aligned}$$

29. Sol. (a)

$$\begin{aligned}&\Rightarrow \frac{(\sec \theta - \cos \theta)(\cot \theta + \tan \theta)}{(1 + \tan \theta + \sec \theta)(\sec \theta)(1 + \cot \theta - \operatorname{cosec} \theta)} \\ &\Rightarrow \frac{\left(\frac{1-\cos^2 \theta}{\cos \theta}\right)\left(\frac{\cos^2 \theta + \sin^2 \theta}{\cos \theta \sin \theta}\right)}{\left(\frac{\cos \theta + \sin \theta + 1}{\cos \theta}\right)\left(\frac{1}{\cos \theta}\right)\left(\frac{\sin \theta + \cos \theta - 1}{\sin \theta}\right)} \\ &\Rightarrow \frac{(\sin^2 \theta)(1)}{[(\cos \theta + \sin \theta) + 1][(\cos \theta + \sin \theta) - 1]} \\ &\Rightarrow \frac{\sin^2 \theta}{[(\cos \theta + \sin^2 - (1)^2)]} \Rightarrow \frac{\sin^2 \theta}{1 + 2\cos \theta \sin \theta - 1} \\ &\Rightarrow \frac{\sin^2 \theta}{2\cos \theta \sin \theta} \Rightarrow \frac{\tan^2 \theta}{2}\end{aligned}$$

30. Sol. (c)

On putting the value of x & A

we get

$$\Rightarrow a : b : c = \cos 75^\circ : -\sin 45^\circ : \cos 15^\circ$$

$$\Rightarrow a = \cos 75^\circ = \frac{\sqrt{3}-1}{2\sqrt{2}}, b = -\frac{1}{\sqrt{2}}$$

$$\Rightarrow c = \cos 15^\circ = \frac{-(\sqrt{3}+1)}{2\sqrt{2}}$$

$$\Rightarrow \frac{a+c}{b} = \frac{\frac{\sqrt{3}-1}{2\sqrt{2}} + \frac{(\sqrt{3}+1)}{2\sqrt{2}}}{-\frac{1}{\sqrt{2}}} = \frac{\frac{-2}{2\sqrt{2}}}{-\frac{1}{\sqrt{2}}} = 1$$

$$\Rightarrow \frac{a-c}{b} = \frac{\frac{2\sqrt{3}}{2\sqrt{2}}}{-\frac{1}{\sqrt{2}}} \Rightarrow (-\sqrt{3})$$

$$\Rightarrow \left(\frac{a+c}{b}\right)^2 + \left(\frac{a-c}{b}\right)^2 \Rightarrow 1^2 + (-\sqrt{3})^2$$

$$\Rightarrow 1 + 3 = 4$$

31. Sol. (b)

$$\begin{aligned} x &= \frac{1 - \cos \theta + \sin \theta}{1 + \sin \theta} \\ &= \frac{(1 - \cos \theta + \sin \theta)(1 - \sin \theta)}{(1 + \sin \theta)(1 - \sin \theta)} \\ &= \frac{(1 - \sin \theta)(1 + \sin \theta) - \cos \theta(1 - \sin \theta)}{1 - \sin^2 \theta} \\ &= \frac{(1 - \sin^2 \theta) - \cos \theta(1 - \sin \theta)}{\cos^2 \theta} \\ &= \frac{\cos^2 \theta - \cos \theta(1 - \sin \theta)}{\cos^2 \theta} = \frac{\cos \theta(\cos \theta + \sin \theta - 1)}{\cos^2 \theta} \\ &= \frac{\sin \theta + \cos \theta - 1}{\cos \theta} \end{aligned}$$

32. Sol. (a)

$$\begin{aligned} &(\sin \theta + \operatorname{cosec} \theta)^2 + (\cos \theta + \sec \theta)^2 \\ &= k + \tan^2 \theta + \cot^2 \theta \\ &\Rightarrow \sin^2 \theta + \operatorname{cosec}^2 \theta + 2\sin \theta \operatorname{cosec} \theta + \cos^2 \theta \\ &+ \sec^2 \theta + 2\cos \theta \sec \theta \\ &= k + \tan^2 \theta + \cot^2 \theta \\ &\Rightarrow 5 + 1 + \tan^2 \theta + 1 + \cot^2 \theta = \tan^2 \theta + \cot^2 \theta + k \Rightarrow k = 7 \end{aligned}$$

Or Short Trick

Put $\theta = 45^\circ$

$$\begin{aligned} &(\sin \theta + \operatorname{cosec} \theta)^2 + (\cos \theta + \sec \theta)^2 = k + \tan^2 \theta + \cot^2 \theta \\ &\Rightarrow \left(\frac{1}{\sqrt{2}} + \sqrt{2}\right)^2 + \left(\frac{1}{\sqrt{2}} + \sqrt{2}\right)^2 = k + 1 + 1 \\ &\Rightarrow \left(\frac{3}{\sqrt{2}}\right)^2 + \left(\frac{3}{\sqrt{2}}\right)^2 = k + 2 \\ &\Rightarrow 9 = k + 2 \Rightarrow k = 7 \end{aligned}$$

33. Sol. (a)

We know,

$$\cos \theta = \frac{\text{base}}{\text{hypotenuse}}$$

$$\Rightarrow \text{Perpendicular} = \sqrt{H^2 - b^2}$$

$$\text{Here, } \cos 53^\circ = \frac{x}{y}$$

$$\Rightarrow \text{hypotenuse} = \sqrt{y^2 - x^2}$$

Now, $\sec 53^\circ + \cot 37^\circ$

$$= \sec 53^\circ + \cot(90^\circ - 53^\circ)$$

$$= \sec 53^\circ + \tan 53^\circ = \frac{h}{b} + \frac{p}{b} = \frac{y}{x} + \frac{\sqrt{y^2 - x^2}}{x} =$$

$$\frac{y + \sqrt{y^2 - x^2}}{x}$$

34. Sol. (a)

$$\operatorname{cosec} \theta - \sin \theta = m$$

$$\Rightarrow \frac{1}{\sin \theta} - \sin \theta = m$$

$$\frac{1 - \sin^2 \theta}{\sin \theta} = m \Rightarrow \frac{\cos^2 \theta}{\sin \theta} = m \quad \dots (i)$$

$$\sec \theta - \cos \theta = n \Rightarrow \frac{1}{\cos \theta} - \cos \theta = n$$

$$\Rightarrow \frac{1 - \cos^2 \theta}{\cos \theta} = n \Rightarrow \frac{\sin^2 \theta}{\cos \theta} = n \quad \dots (ii)$$

Eliminating $\cos \theta$ from (i) and (ii)

$$\frac{\cos^2 \theta}{\sin \theta} \cdot \left(\frac{\sin^2 \theta}{\cos \theta}\right)^2 = mn^2$$

$$\Rightarrow \sin^3 \theta = mn^2 \Rightarrow \sin \theta$$

$$= (mn^2)^{\frac{1}{3}} \quad \dots (iii)$$

Again, eliminating $\sin \theta$ from (i) and (ii)

$$\left(\frac{\cos^2 \theta}{\sin \theta}\right)^2 \frac{\sin^2 \theta}{\cos \theta} = m^2 n$$

$$\Rightarrow \cos^3 \theta = m^2 n \Rightarrow \cos \theta =$$

$$(m^2 n)^{\frac{1}{3}} \quad \dots (iv)$$

From (iii) and (iv)

$$\sin^2 \theta + \cos^2 \theta$$

$$= \left\{(mn^2)^{\frac{1}{3}}\right\}^2 + \left\{(m^2 n)^{\frac{1}{3}}\right\}^2$$

$$\therefore (mn^2)^{\frac{2}{3}} + (m^2 n)^{\frac{2}{3}} = 1. \text{ which is required relation.}$$

35. Sol. (d)

$$\sec \theta(\cos \theta + \sin \theta) = \sqrt{2}$$

$$\Rightarrow \sec \theta \cos \theta + \sec \theta \sin \theta = \sqrt{2}$$

$$\Rightarrow 1 + \tan \theta = \sqrt{2} \quad \dots (i)$$

Also, $\sec \theta(\cos \theta + \sin \theta) = \sqrt{2}$ can be written as,

$$\Rightarrow \cos \theta + \sin \theta = \frac{\sqrt{2}}{\sec \theta}$$

By squaring both sides,

$$\Rightarrow \cos^2 \theta + \sin^2 \theta + 2\cos \theta \sin \theta$$

$$= \frac{2}{\sec^2 \theta}$$

$$\Rightarrow 1 + 2\cos \theta \sin \theta = 2\cos^2 \theta$$

$$\Rightarrow 2\sin \theta \cos \theta = 2\cos^2 \theta - 1$$

$$\Rightarrow 2\sin \theta = \frac{2\cos^2 \theta - 1}{\cos \theta}$$

By putting this value in equation $\frac{2\sin \theta}{\cos \theta - \sin \theta}$

$$\Rightarrow \frac{\frac{2\cos^2 \theta - 1}{\cos \theta}}{\cos \theta - \sin \theta}$$

$$\Rightarrow \frac{2\cos^2 \theta - 1}{\cos \theta (\cos \theta - \sin \theta)}$$

$$\Rightarrow \frac{\cos^2 \theta - \sin^2 \theta}{\cos \theta (\cos \theta - \sin \theta)}$$

$$\Rightarrow \frac{(\cos \theta - \sin \theta)(\cos \theta + \sin \theta)}{\cos \theta (\cos \theta - \sin \theta)}$$

$$\Rightarrow \frac{\cos \theta}{\cos \theta} + \frac{\sin \theta}{\cos \theta}$$

$$\Rightarrow 1 + \tan \theta$$

By equation (i) value of

$$\Rightarrow 1 + \tan \theta = \sqrt{2}$$

36. Sol. (d)

$$\frac{1}{\sin^4(90^\circ - \theta)} + \frac{1}{\cos^2(90^\circ - \theta) - 1}$$

$$\text{put } \theta = 45^\circ$$

$$\Rightarrow \frac{1}{\sin^4 45^\circ} + \frac{1}{\cos^2 45^\circ - 1}$$

$$\Rightarrow \frac{1}{\left(\frac{1}{\sqrt{2}}\right)^4} + \frac{1}{\left(\frac{1}{\sqrt{2}}\right)^2 - 1}$$

$$= \frac{1}{\frac{1}{4}} + \frac{1}{\frac{1}{2} - 1}$$

$$= 4 + \frac{1}{\left(-\frac{1}{2}\right)} = 4 - 2 = 2$$

Here option (d)

$$\Rightarrow \tan^2 \theta \cdot \sec^2 \theta$$

$$\Rightarrow \tan^2 45^\circ \cdot \sec^2 45^\circ$$

$$\Rightarrow 1 \times (\sqrt{2})^2 = 2$$

37. Sol. (b)

$$\tan^2 \theta = 1 - a^2$$

[Adding 1 both side]

$$1 + \tan^2 \theta = 2 - a^2 \text{ or } \sec^2 \theta = 2 - a^2$$

$$\text{Now, } \sec \theta + \tan^3 \theta \operatorname{cosec} \theta = \frac{1}{\cos \theta} +$$

$$\frac{\sin^2 \theta}{\cos^3 \theta} \operatorname{cosec} \theta$$

$$= \frac{1}{\cos \theta} + \frac{\sin^3 \theta}{\cos^3 \theta} \times \frac{1}{\sin \theta}$$

$$= \frac{1}{\cos \theta} + \frac{\sin^2 \theta}{\cos^3 \theta}$$

$$= \frac{1}{\cos \theta} + \frac{1 - \cos^2 \theta}{\cos^3 \theta}$$

$$= \sec \theta + \sec^3 \theta - \sec \theta$$

$$= \sec^3 \theta = (2 - a^2)^{\frac{3}{2}}$$

38. Sol. (c)

$$33\sin^2 \theta - 28\sin 2\theta$$

$$= 33\sin^2 \theta - 28\sin \theta \cos \theta$$

$$= 49\sin^2 \theta - 16\sin^2 \theta - 28\sin \theta \cos \theta$$

Add and subtract 16 from the eqn

$$= 49\sin^2 \theta - 16\sin^2 \theta + 16 - 28\sin \theta \cos \theta - 16$$

$$= 49\sin^2 \theta - 16(\sin^2 \theta - 1) - 28\sin \theta \cos \theta - 16$$

$$= 49\sin^2 \theta - 16\cos^2 \theta - 2(7 \times 4)\sin \theta \cos \theta - 16$$

$$= (7\sin \theta - 4\cos \theta)^2 - 16$$

Maximum value of $(7\sin \theta - 4\cos \theta)$ is

$$\sqrt{7^2 + 4^2} = \sqrt{65}$$

Hence maximum value of $(7\sin \theta - 4\cos \theta)^2 - 16$

$$\text{is } = (\sqrt{65})^2 - 16 = 49$$

39. Sol. (b)

Put $\theta = 45^\circ$

$$\frac{a \times 1}{2\sqrt{2}} + \frac{b \times 1}{2\sqrt{2}} = \frac{1}{\sqrt{2}} \times \frac{1}{\sqrt{2}}$$

$$\frac{1}{2\sqrt{2}}(a + b) = \frac{1}{2}$$

$$a = b = \sqrt{2} \quad \dots (i)$$

$$\Rightarrow a = \frac{1}{\sqrt{2}}, b = \frac{1}{\sqrt{2}}$$

From, $a \sin \theta - b \cos \theta = 0$

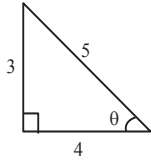
We get $a = b$ on squaring equation (1)

$$a^2 + b^2 + 2ab = 2$$

$$a^2 + b^2 = 2 - 2 \times \frac{1}{2} = 1$$

40. Sol. (d)

$$\frac{(1 + \sec \theta \operatorname{cosec} \theta)^2 (\sec \theta - \tan \theta)^2 (1 + \sin \theta)}{(\sin \theta + \sec \theta)^2 + (\cos \theta + \operatorname{cosec} \theta)^2}$$



Put $\tan \theta = \frac{3}{4}$, $\sin \theta = \frac{3}{5}$, $\cos \theta = \frac{4}{5}$ and so on.

Putting respective values in (1), we get

$$\frac{(1 + \sec \theta \operatorname{cosec} \theta)^2 (\sec \theta - \tan \theta)^2 (1 + \sin \theta)}{(\sin \theta + \sec \theta)^2 + (\cos \theta + \operatorname{cosec} \theta)^2}$$

$$= \frac{\left(1 + \frac{5}{4} \times \frac{5}{3}\right)^2 \left(\frac{5}{4} - \frac{3}{4}\right)^2 \left(1 + \frac{3}{5}\right)}{\left(\frac{3}{5} + \frac{5}{4}\right)^2 + \left(\frac{4}{5} + \frac{5}{3}\right)^2}$$

$$= \frac{\left(1 + \frac{25}{12}\right)^2 \times \left(\frac{1}{4}\right)^2 \times \left(\frac{8}{5}\right)}{\left(\frac{12+25}{20}\right)^2 + \left(\frac{12+25}{15}\right)^2}$$

$$= \frac{\frac{1}{12 \times 12} \times \frac{1}{4} \times \frac{8}{5}}{\frac{1}{400} + \frac{1}{225}}$$

$$= \frac{\frac{1}{12 \times 6} \times \frac{1}{5}}{\frac{625}{400 \times 225}} = \frac{2}{5}$$

Among all the given options, only option (d) satisfies the above obtained value.

41. Sol. (b)

$$\frac{\cos^2 \theta}{\operatorname{cosec}^2 \theta - \cot^2 \theta} = \frac{13}{4}$$

$$\Rightarrow \cos^2 \theta = \frac{13}{4} (\operatorname{cosec}^2 \theta - \cot^2 \theta = 1)$$

$$\sin \theta = \frac{2}{\sqrt{13}} = \frac{\text{Perpendicular}}{\text{Hypotenuse}}$$

By Pythagoras theorem

$$\text{Base} = \sqrt{\text{Hypotenuse}^2 - \text{Perpendicular}^2}$$

$$\Rightarrow \text{Base} = 3$$

$$\cos \theta = \frac{3}{\sqrt{13}}, \sec \theta = \frac{\sqrt{13}}{3}, \tan \theta = \frac{2}{3}$$

$$\cot \theta = \frac{3}{2}$$

$$\frac{52 \cos^2 \theta - 9 \tan^2 \theta}{18 \sec^2 \theta + 8 \cot^2 \theta} = \frac{52 \times \frac{9}{13} - 9 \times \frac{4}{9}}{18 \times \frac{13}{9} + 8 \times \frac{9}{4}} = \frac{36 - 4}{26 + 18} = \frac{32}{44} = \frac{8}{11}$$

42. Sol. (d)

$$A = \frac{\cot^2 \theta \cdot \operatorname{cosec}^2 \theta}{\left(\sin \frac{\theta}{2} + \cos \frac{\theta}{2}\right)} \times \sqrt{\frac{\tan \theta}{\sec \theta}} + 1$$

$$= \frac{\cot^2 \theta \cdot \operatorname{cosec}^2 \theta}{\sin \frac{\theta}{2} + \cos \frac{\theta}{2}} \times \sqrt{1 + \sin \theta}$$

$$= \frac{\cot^2 \theta \cdot \operatorname{cosec}^2 \theta}{\sin \frac{\theta}{2} + \cos \frac{\theta}{2}} \times \left(\sin \frac{\theta}{2} + \cos \frac{\theta}{2}\right)$$

$$= \cot^2 \theta \cdot \operatorname{cosec}^2 \theta$$

$$B = \frac{\sin^2 \theta + \sin^3 \theta + \cos \theta \sin^2 \theta}{\cos^2 \theta + \cos^3 \theta + \sin \theta \cos^2 \theta}$$

$$\Rightarrow \frac{\sin^2 \theta (1 + \sin \theta + \cos \theta)}{\cos^2 \theta (1 + \cos^2 \theta + \sin \theta)} = \tan^2 \theta$$

$$\Rightarrow \sqrt{A \times B} = \sqrt{\cot^2 \theta \cdot \operatorname{cosec}^2 \theta \cdot \tan^2 \theta} = \operatorname{cosec} \theta$$

Also, option (c) = $\cot \theta \cdot \sec \theta = \operatorname{cosec} \theta$

Both (a) and (c) are true.

43. Sol. (a)

$\sin A \cdot \cos A$ & $\tan A$ are in G.P. then,

$$\cos^2 A = \sin A \cdot \tan A$$

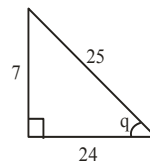
$$\cos^2 A = \frac{\sin A \cdot \sin A}{\cos A}$$

$$\cos^3 A = \sin^2 A = 1 - \cos^2 A$$

$$\cos^3 A + \cos^2 A = 1$$

44. Sol. (d)

Triplets (7,24,25) are used.



$$(\cos q + \sin q) = \frac{31}{25} \dots (\text{given})$$

$$\left(\frac{B}{H} + \frac{P}{H}\right) = \frac{B+P}{H} = \frac{24+7}{25} = \frac{31}{25}$$

satisfy the given equation

$$\text{Then, } \cos^2 q = \left(\frac{B}{H}\right)^2 = \frac{576}{625}$$

45. Sol. (d)

$$\sin \theta + \cos \theta = \sqrt{2}$$

Squaring on both sides,

$$\sin^2 \theta + \cos^2 \theta + 2\sin \theta \cdot \cos \theta = 2$$

$$\Rightarrow \sin 2\theta = 1 \Rightarrow \sin 2\theta = \sin 90^\circ$$

$$\therefore \theta = 45^\circ.$$

Now,

$$\begin{aligned} \sin^6 \theta + \cos^6 \theta + 6\sin^2 \theta \cdot \cos^2 \theta \\ &= (\sin^2 \theta)^3 + (\cos^2 \theta)^3 + 3 \cdot \sin^2 \theta \cdot \cos^2 \theta \\ &= (\sin^2 \theta + \cos^2 \theta) + 3\sin^2 \theta \cdot \cos^2 \theta \\ &= (\sin^2 \theta + \cos^2 \theta)^3 + \frac{3}{4}(2\sin \theta \cdot \cos \theta)^2 \\ &= 1 + \frac{3}{4}\sin 2\theta = 1 + \frac{3}{4} = \frac{7}{4} \end{aligned}$$

46. Sol. (b)

$$\frac{1+\sin \phi}{1-\sin \phi} = \frac{p^2}{q^2}$$

$$\Rightarrow \frac{1+\sin \phi}{1-\sin \phi} \times \frac{1+\sin \phi}{1+\sin \phi} = \frac{p^2}{q^2}$$

$$\Rightarrow \frac{(1+\sin \phi)^2}{1-\sin^2 \phi} = \frac{p^2}{q^2}$$

$$\Rightarrow \frac{1+\sin^2 \phi + 2\sin \phi}{\cos^2 \phi} = \frac{p^2}{q^2}$$

$$\Rightarrow \sec \phi + \tan \phi + 2\sec \phi \cdot \tan \phi = \frac{p^2}{q^2}$$

$$\Rightarrow (\sec \phi + \tan \phi)^2 = \frac{p^2}{q^2}$$

$$\Rightarrow \sec \phi + \tan \phi = \frac{p}{q} \quad \dots (i)$$

$$\Rightarrow \sec \phi - \tan \phi = \frac{q}{p} \quad \dots (ii)$$

$$\{\text{If } \sec \phi + \tan \phi = k, \text{ then } \sec \phi - \tan \phi = \frac{1}{k}\}$$

Add (i) and (ii)

$$\Rightarrow 2\sec \phi = \frac{p}{q} + \frac{q}{p}$$

$$\Rightarrow \sec \phi = \frac{1}{2} \left(\frac{p}{q} + \frac{q}{p} \right)$$

47. Sol. (b)

Given,

$$\sec 31^\circ = x \Rightarrow \cos 31^\circ = \frac{1}{x}$$

$$\text{Then, } \sin^2 59^\circ + \frac{1}{\sec^2 31^\circ} - \frac{1}{\sin^2 59^\circ \operatorname{cosec}^2 59^\circ}$$

$$\text{since, } \sin(90^\circ - \theta) = \cos \theta$$

$$\Rightarrow \sin^2(90^\circ - 31^\circ) + \cos^2 31^\circ - \frac{1}{1}$$

$$\Rightarrow 2\cos^2 31^\circ - 1$$

$$= \frac{2}{x^2} - 1 = \frac{2-x^2}{x^2}$$

48. Sol. (a)

$$\tan(\alpha + \beta) = \sqrt{3}$$

$$\Rightarrow \tan(\alpha + \beta) = \tan 60^\circ$$

$$\Rightarrow \alpha + \beta = 60^\circ \quad \dots (i)$$

$$\tan(\alpha - \beta) = 1$$

$$\Rightarrow \tan(\alpha - \beta) = \tan 45^\circ$$

$$\Rightarrow \alpha - \beta = 45^\circ \quad \dots (ii)$$

By solving eq. (i) and (ii) we get, $\alpha = 52.5^\circ$ and

$$\beta = 7.5^\circ$$

$$\text{Then, } \tan(6\alpha) = \tan 315^\circ = \tan(270 + 45)^\circ$$

$$= -\tan 45^\circ = -1$$

49. Sol. (c)

$$\left(\frac{\tan^3 \theta}{\sec^2 \theta} + \frac{\cot^3 \theta}{\operatorname{cosec}^2 \theta} + 2\sin \theta \cos \theta \right) \div (1 + \operatorname{cosec}^2 \theta + \tan^2 \theta)$$

$$\left(\frac{\sin^3 \theta}{\cos^3 \theta \times \sec^2 \theta} + \frac{\cos^3 \theta}{\sin^3 \theta \times \operatorname{cosec}^2 \theta} + 2\sin \theta \cos \theta \right) \div (\sec^2 \theta + \operatorname{cosec}^2 \theta)$$

$$= \left(\frac{\sin^3 \theta}{\cos \theta} + \frac{\cos^3 \theta}{\sin \theta} + 2\sin \theta \cos \theta \right) \div \left(\frac{1}{\sin^2 \theta} + \frac{1}{\cos^2 \theta} \right)$$

$$= \left(\frac{\sin^4 \theta + \cos^4 \theta + 2\sin^2 \theta \cos^2 \theta}{\sin \theta \cos \theta} \right) \div \left(\frac{\cos^2 \theta + \sin^2 \theta}{\sin^2 \theta \cos^2 \theta} \right)$$

$$= \frac{(\sin^2 \theta + \cos^2 \theta)^2}{\sin \theta \cos \theta} \div \left(\frac{1}{\sin^2 \theta \cos^2 \theta} \right)$$

$$= \frac{1}{\sin \theta \cos \theta} \div \left(\frac{1}{\sin^2 \theta \cos^2 \theta} \right) = \sin \theta \cos \theta$$

50. Sol. (d)

We know,

$$1 + \sin \theta = \left(\cos \frac{\theta}{2} + \sin \frac{\theta}{2} \right)^2$$

$$1 - \sin \theta = \left(\cos \frac{\theta}{2} - \sin \frac{\theta}{2} \right)^2$$

∴ Consider,

$$\frac{1}{2} \sqrt{1 + \sin \theta} + \frac{1}{2} \sqrt{1 - \sin \theta}$$

$$\frac{1}{2} \sqrt{\left(\cos \frac{\theta}{2} + \sin \frac{\theta}{2} \right)^2} + \frac{1}{2} \sqrt{\left(\cos \frac{\theta}{2} - \sin \frac{\theta}{2} \right)^2}$$

$$= \frac{1}{2} \left(\cos \frac{\theta}{2} + \sin \frac{\theta}{2} \right) + \frac{1}{2} \left(\cos \frac{\theta}{2} - \sin \frac{\theta}{2} \right)$$

$$= \frac{1}{2} \cos \frac{\theta}{2} + \frac{1}{2} \cos \frac{\theta}{2} = \cos \frac{\theta}{2}$$

51. Sol. (b)

$$\cos \theta = \sin(2\theta)$$

$$\sin(90^\circ - \theta) = \sin(2\theta)$$

$$90^\circ - \theta = 2\theta$$

$$\Rightarrow 90^\circ = 3\theta \Rightarrow \theta = 30^\circ$$

$$\text{Now, } (\cos^4 30^\circ + \cos^3 30^\circ + \cos 30^\circ)$$

$$+ (\sin^4 30^\circ + \sin^3 30^\circ + \sin 30^\circ)$$

$$+ (\sin^2 30^\circ + \cos^2 30^\circ)$$

$$= \left(\frac{9}{16} + \frac{3\sqrt{3}}{8} + \frac{\sqrt{3}}{2} \right) + \left(\frac{1}{16} + \frac{1}{8} + \frac{1}{2} \right)$$

$$+ 1 = \left(\frac{9+14\sqrt{3}}{16} \right) + \frac{11}{16} + 1$$

$$= \frac{9+14\sqrt{3}+11+16}{16} = \frac{36+14\sqrt{3}}{16}$$

$$= \frac{2(18+7\sqrt{3})}{16} = \frac{18+7\sqrt{3}}{8}$$

52. Sol. (c)

$$\sin \frac{\pi}{14} \cdot \sin \frac{3\pi}{14} \cdot \sin \frac{5\pi}{14} \cdot \sin \frac{\pi}{2}$$

$$\sin \left(\pi - \frac{5\pi}{14} \right) \sin \left(\pi - \frac{3\pi}{14} \right)$$

$$\sin \left(\pi - \frac{\pi}{14} \right)$$

$$= \sin \frac{\pi}{14} \sin \frac{3\pi}{14} \sin \frac{5\pi}{14} \cdot 1$$

$$\sin \frac{5\pi}{14} \cdot \sin \frac{3\pi}{14} \cdot \sin \frac{\pi}{14}$$

$$= \left(\sin \frac{\pi}{14} \sin \frac{3\pi}{14} \sin \frac{5\pi}{14} \right)^2$$

$$= \left\{ \cos \left(\frac{\pi}{2} - \frac{\pi}{14} \right) \cos \left(\frac{\pi}{2} - \frac{3\pi}{14} \right) \cos \left(\frac{\pi}{2} - \frac{5\pi}{14} \right) \right\}^2$$

$$= \left(\cos \frac{7\pi-1\pi}{14} \cdot \cos \frac{7\pi-3\pi}{14} \cdot \cos \frac{7\pi-5\pi}{14} \right)^2$$

$$= \left(\cos \frac{3\pi}{7} \cdot \cos \frac{2\pi}{7} \cdot \cos \frac{\pi}{7} \right)^2$$

$$= \left(\frac{2\sin \frac{\pi}{7}}{2\sin \frac{\pi}{7}} \cdot \cos \frac{\pi}{7} \cdot \cos \frac{2\pi}{7} \cos \frac{3\pi}{7} \right)^2$$

$$= \left(\frac{2}{2} \cdot \frac{\sin \frac{2\pi}{7} \cos \frac{2\pi}{7} \cos \frac{3\pi}{7}}{2\sin \frac{\pi}{7}} \right)^2$$

$$= \left\{ \frac{\sin \frac{4\pi}{7} \cos \left(\pi - \frac{4\pi}{7} \right)}{4\sin \frac{\pi}{7}} \right\}^2 \left(\because \frac{3\pi}{7} + \frac{4\pi}{7} = \pi \right)$$

$$= \left\{ \frac{-\sin \frac{4\pi}{7} \cos \frac{4\pi}{7}}{4\sin \frac{\pi}{7}} \right\}^2$$

$$\left(\because \cos(\pi - \theta) = -\cos \theta \right)$$

$$= \left\{ \frac{-2\sin \frac{4\pi}{7} \cos \frac{4\pi}{7}}{2 \cdot 4\sin \frac{\pi}{7}} \right\}^2 = \left\{ \frac{-\sin \frac{8\pi}{7}}{8\sin \frac{\pi}{7}} \right\}^2$$

$$= \left\{ \frac{-\sin \left(\pi + \frac{\pi}{7} \right)}{8\sin \frac{\pi}{7}} \right\}^2 = \left(\frac{\sin \frac{\pi}{7}}{8\sin \frac{\pi}{7}} \right)^2 = \frac{1}{8^2} = \frac{1}{64}$$

53. Sol. (b)

$$\frac{(1 - \sin^2 \theta \cos^2 \theta)(\cot \theta + 1) \cos \theta}{(\sin^4 \theta + \cos^4 \theta)(1 + \tan \theta) \operatorname{cosec} \theta} - 1$$

$$\text{Put } \theta = 45^\circ$$

$$\frac{\left\{ \left(1 - 2 \left(\frac{1}{\sqrt{2}} \right)^2 \left(\frac{1}{\sqrt{2}} \right)^2 \right) (1 + 1) \frac{1}{\sqrt{2}} \right\}}{\left[\left(\frac{1}{\sqrt{2}} \right)^4 + \left(\frac{1}{\sqrt{2}} \right)^4 \right] (1 + 1) \sqrt{2}} - 1$$

$$\frac{\left(1 - \frac{1}{2} \right) (1 + 1) \frac{1}{\sqrt{2}}}{\left[\frac{1}{4} + \frac{1}{4} \right] 2\sqrt{2}} - 1$$

$$\frac{1}{\sqrt{2}}$$

$$\frac{1}{2} \times 2\sqrt{2} - 1 = \frac{1}{\sqrt{2} \times \sqrt{2}} - 1 = \frac{1}{2} - 1 = -\frac{1}{2}$$

$$\text{Option (b)} \Rightarrow -\sin^2 \theta = -\left(\frac{1}{\sqrt{2}} \right)^2 = -\frac{1}{2}$$

54. Sol. (b)

$$\cot 70^\circ + 4 \cos 70^\circ$$

$$\begin{aligned}
 &= \frac{\cos 70^\circ}{\sin 70^\circ} + 4\cos 70^\circ \\
 &= \frac{\cos 70^\circ + 4\cos 70^\circ \sin 70^\circ}{\sin 70^\circ} \\
 &= \frac{\cos 70^\circ + 2\sin 140^\circ}{\sin 70^\circ} \\
 &= \frac{\cos(90^\circ - 20^\circ) + 2\sin(180^\circ - 40^\circ)}{\sin 70^\circ} \\
 &= \frac{\sin 20^\circ + \sin 40^\circ + \sin 40^\circ}{\sin 70^\circ} \\
 &= \frac{2\sin\left(\frac{40^\circ + 20^\circ}{2}\right)\cos\left(\frac{40^\circ - 20^\circ}{2}\right) + \sin 40^\circ}{\sin 70^\circ} \\
 &= \frac{2\sin 30^\circ \cos 10^\circ + \sin 40^\circ}{\sin 70^\circ} \\
 &= \frac{2(\cos 10^\circ)\frac{1}{2} + \sin 40^\circ}{\sin 70^\circ} \\
 &= \frac{\sin 80^\circ + \sin 40^\circ}{\sin 70^\circ} \\
 &= \frac{2\sin\left(\frac{80^\circ + 40^\circ}{2}\right)\cos\left(\frac{80^\circ - 40^\circ}{2}\right)}{\sin 70^\circ} \\
 &= \frac{2\sin 60^\circ \cos 20^\circ}{\sin(90^\circ - 20^\circ)} \\
 &= 2\sin 60^\circ = 2 \times \frac{\sqrt{3}}{2} = \sqrt{3}
 \end{aligned}$$

55. Sol. (d)

$$\begin{aligned}
 &(27)^{\sin \theta} (9)^{\sin \theta} (81)^{\cos \theta} (243)^{\cos \theta} (27)^{\cos \theta} \\
 &\Rightarrow (3)^{3\sin \theta} (3)^{2\sin \theta} (3)^{4\cos \theta} (3)^{5\cos \theta} (3)^{3\cos \theta} \\
 &\Rightarrow (3)^{5\sin \theta + 12\cos \theta} P = (3)^{13} \\
 &(\because -\sqrt{a^2 + b^2} \leq a\sin \theta + b\cos \theta \leq \sqrt{a^2 + b^2}) \\
 &Q = (3)^{-13} \\
 &\frac{P}{Q} = \frac{(3)^{13}}{(3)^{-13}} = (3)^{2 \times 13} = (3)^{26}
 \end{aligned}$$

56. Sol. (d)

put $\theta = 60^\circ$

$$\begin{aligned}
 &\therefore \frac{\tan 300^\circ + \tan 180^\circ}{4\cos 240^\circ (\tan 300^\circ - \tan 180^\circ)} \\
 &= \frac{\tan 300^\circ}{4\cos 240^\circ \cdot \tan 300^\circ} [\because \tan 180^\circ = 0] \\
 &= \frac{1}{4\cos 240^\circ} \\
 &= \frac{1}{4\left(-\frac{1}{2}\right)} \left[\cos 240^\circ = -\frac{1}{2}\right] = -\frac{1}{2}
 \end{aligned}$$

Now, from option (d)

$$\Rightarrow \cos 2\theta = \cos 120^\circ = -\frac{1}{2}$$

So, Answer is option (d) = $\cos 2\theta$

Alternate:-

$$\begin{aligned}
 &\Rightarrow \frac{\sin 8\theta}{4\cos 4\theta \cdot \sin 2\theta} \\
 &\left[\because \sin 5\theta \cos 3\theta + \sin 3\theta \cos 5\theta = \sin 8\theta \text{ and } \right. \\
 &\quad \left. \sin 5\theta \cos 3\theta - \sin 3\theta \cos 5\theta = \sin 2\theta \right] \\
 &\Rightarrow \frac{2\sin 4\theta \cos 4\theta}{4\cos 4\theta \sin 2\theta} \\
 &\Rightarrow \frac{2\sin 2\theta \cos 2\theta}{2\sin 2\theta} = \cos 2\theta
 \end{aligned}$$

57. Sol. (c)

$$\begin{aligned}
 &5\cos \theta + 3\cos\left(\theta + \frac{\pi}{3}\right) \\
 &= 5\cos \theta + 3\cos \theta \cdot \cos \frac{\pi}{3} - 3\sin \theta \sin \frac{\pi}{3} \\
 &= \frac{13}{2}\cos \theta - \frac{3\sqrt{3}}{2}\sin \theta \\
 &= \frac{13}{2}\cos \theta - \frac{3\sqrt{3}}{2}\sin \theta \leq \sqrt{\left(\frac{13}{2}\right)^2 + \left(\frac{3\sqrt{3}}{2}\right)^2} \\
 &(\because -\sqrt{a^2 + b^2} \leq a\sin \theta + b\cos \theta \leq \sqrt{a^2 + b^2}) \\
 &= \frac{13}{2}\cos \theta - \frac{3\sqrt{3}}{2}\sin \theta \leq 7
 \end{aligned}$$

* * * * *

GEOMETRY

INDIA'S 1ST RANK WISE BOOK
PUSHPENDRA SIR

INDIA'S 1ST TYPE WISE BOOK
PUSHPENDRA SIR

Type-1 (Line and Angle)

1. If two supplementary angles differ by 74° , then one of the angles is:
यदि दो संपूरक कोणों में 74° का अंतर है, तो उनमें से एक कोण है:

SSC CHSL 2023 (Morning)

- (a) 65° (b) 55° (c) 43° (d) 53°

2. Two angles of a triangle are equal and the third angle measures 70° . What is the measure of each of the unknown angles?

एक त्रिभुज के दो कोण बराबर होते हैं और तीसरे कोण का माप 70° होता है। प्रत्येक अज्ञात कोण का माप क्या है?

SSC CPO 09/11/2022 (Evening)

- (a) 75° (b) 45° (c) 65° (d) 55°

3. In $\triangle ABC$, $2\angle A = 3\angle B = 6\angle C$. What is the value of the largest angle among these three angles?

$\triangle ABC$ में, $2\angle A = 3\angle B = 6\angle C$. इन तीनों कोणों में से सबसे बड़े कोण का मान क्या है?

SSC CPO 11/11/2022 (Evening)

- (a) 170° (b) 90° (c) 80° (d) 150°

4. The ratio of measures of the angles of a triangle is given as 3:4:8. What is the measure of the smallest of the three angles?

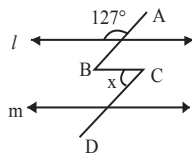
एक त्रिभुज के कोणों की माप का अनुपात 3:4:8 दिया गया है। तीनों कोणों में से सबसे छोटे कोण का माप क्या है?

SSC CHSL 31/05/2022 (Morning)

- (a) 33° (b) 39° (c) 30° (d) 36°

5. In the given figure, line $l \parallel m \parallel BC$ and $AB \parallel CD$, then find x .

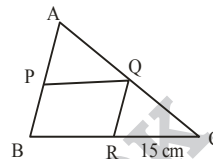
दिए गए चित्र में, रेखा $l \parallel m \parallel BC$ और $AB \parallel CD$, तो x ज्ञात कीजिए।



- (a) 51° (b) 37° (c) 53° (d) 54°

6. In the given fig. ABC is a triangle, $PQ \parallel BC$ and QR is the angle bisector of $\angle PQC$ if $RC = 15$ cm, then find QC .

दिये गये चित्र में ABC एक त्रिभुज है तथा $PQ \parallel BC$ और भुजा $QR \perp PQC$ का कोण समद्विभाजक है यदि $RC = 15$ cm तब भुजा QC की लम्बाई ज्ञात करो



- (a) 6.66 cm (b) 10 cm
(c) 18 cm (d) 15 cm

7. Select the correct option with respect to the given statement.

दिए गए कथन के संबंध में सही विकल्प का चयन करें।

Two tangents are drawn at the end of the diameter of a circle.

एक वृत्त के व्यास के अंत में दो स्पर्शरेखाएँ खींची जाती हैं।

SSC CGL 03/12/2022 (1st Shift)

- (a) They intersect each other.
(b) They pass through origin.
(c) They are parallel to each other.
(d) They are perpendicular to each other.

8. In $\triangle PQR$, $PQ = PR$ and S is a point on QR such that $\angle PSQ = 96^\circ + \angle QPS$ and $\angle QPR = 132^\circ$. What is the measure of $\angle PSR$?

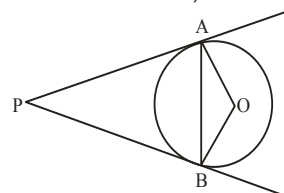
$\triangle PQR$ में, $PQ = PR$ और S , QR पर एक बिंदु इस प्रकार है कि $\angle PSQ = 96^\circ + \angle QPS$ और $\angle QPR = 132^\circ$ है। $\angle PSR$ का माप क्या है?

SSC CGL Tier II 03/02/2022

- (a) 45° (b) 56° (c) 54° (d) 52°

9. In the given figure, if PA and PB are tangents to the circle with centre O such that $\angle APB = 54^\circ$, then $\angle OBA =$

दिए गए चित्र में, यदि PA और PB केंद्र वाले वृत्त की स्पर्श रेखाएँ हैं, जैसे कि $\angle APB = 54^\circ$, तो $\angle OBA =$



SSC CGL 12/12/2022 (4th Shift)

- (a) 27° (b) 40° (c) 30° (d) 35°

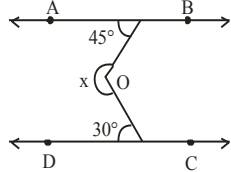
10. A, B, C are three angles of a triangle. If $\angle A - \angle B = 45^\circ$ and $\angle B - \angle C = 15^\circ$ then $\angle A = ?$

A, B, C एक त्रिभुज के तीन कोण हैं। यदि $\angle A - \angle B = 45^\circ$ और $\angle B - \angle C = 15^\circ$ है तो $\angle A = ?$

SSC CGL 03/12/2022 (3rd Shift)

- (a) 83° (b) 85° (c) 95° (d) 75°

11. In the given figure, $AB \parallel CD$, then X is equal to :
दिए गए चित्र में, $AB \parallel CD$, तो x बराबर है:



- (a) 290° (b) 300° (c) 280° (d) 285°

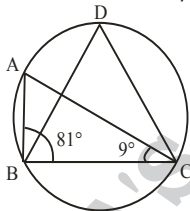
12. If A, B and C are three angles of a triangle such that $A - B = 60^\circ$ and $-C = 15^\circ$, then angle A is:
यदि A, B और C एक त्रिभुज के तीन कोण इस प्रकार हैं कि $A - B = 60^\circ$ और $C = 15^\circ$ है, तो कोण A है:

Graduate Level 03/08/2022 (Shift - 3)

- (a) 95° (b) 100° (c) 105° (d) 115°

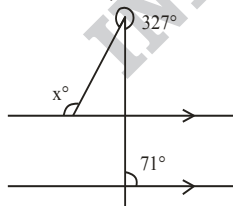
13. In the given figure, $\angle ABC = 81^\circ$ and $\angle ACB = 9^\circ$. What is the value of $\angle BDC$?
दिए गए चित्र में, $\angle ABC = 81^\circ$ और $\angle ACB = 9^\circ$ है। $\angle BDC$ का मान क्या है?

SSC CGL 13/12/2022 (4th Shift)



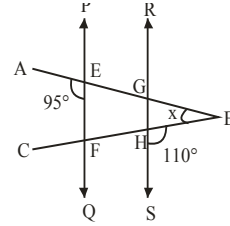
- (a) 80° (b) 90° (c) 70° (d) 60°

14. Find the value of x?
x का मान ज्ञात करें?



- (a) 142° (b) 141° (c) 143° (d) 144°

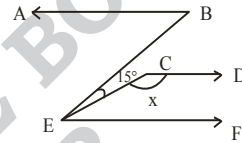
15. In the given figure PQ is parallel to RS, $\angle AEF = 95^\circ$, $\angle BHS = 110^\circ$ and $\angle ABC = x^\circ$. Then what is the value of x?
दी गई आकृति में PQ, RS के समानांतर हैं, $\angle AEF = 95^\circ$, $\angle BHS = 110^\circ$ और $\angle ABC = x^\circ$ है। तो फिर इसका x का मूल्य क्या है?



- (a) 15 (b) 25 (c) 30 (d) 35

16. In the given figure, $AB \parallel CD \parallel EF$, find x if $2\angle ABE = 3\angle CEF$.

दिए गए चित्र में, $AB \parallel CD \parallel EF$, यदि $2\angle ABE = 3\angle CEF$ है तो x ज्ञात कीजिए।



- (a) 130° (b) 90° (c) 120° (d) 150°

17. x and y are two supplementary angles. if supplementary of angle x is equals to half the complementary of y. then find x:y?

x और y एक दूसरे के सम्पूरक कोण हैं यदि x का सम्पूरक कोण y के पूरक कोण का आधा है तो x:y ज्ञात करें?

- (a) 5:3 (b) 3:1 (c) 5:1 (d) 5:2

18. If a straight line L makes an angle θ ($\theta > 90^\circ$) with the positive direction of x-axis, then the acute angle made by a straight line L_1 , perpendicular to L, with the y-axis is:

यदि एक सीधी रेखा L, x-अक्ष की धनात्मक दिशा के साथ θ ($\theta > 90^\circ$) का कोण बनाती है, तो L के लंबवत सीधी रेखा L_1 द्वारा y-अक्ष के साथ बनाया गया न्यून कोण है:

- (a) $\frac{\pi}{2} + \theta$ (b) $\frac{\pi}{2} - \theta$
(c) $\pi + \theta$ (d) $\pi - \theta$

19. The locus of a point equidistant from two intersecting lines is
दो प्रतिच्छेदी रेखाओं से समान दूरी पर स्थित एक बिंदु का स्थान है

[CDS-2018-I]

- (a) A straight line
(b) A circle
(c) A pair of straight lines
(d) None of the above

20. In any triangle, if the angles are in the ratio 1:2:3, then what will be the ratio of the sides opposite to them?

किसी त्रिभुज में यदि कोणों का अनुपात 1 : 2 : 3 है तो उनकी सम्मुख भुजाओं का अनुपात क्या होगा ?

SSC CHSL 10/8/2021 (Afternoon)

- (a) $1 : \sqrt{2} : 3$ (b) $1 : \sqrt{3} : 2$
 (c) $1 : \sqrt{3} : 1$ (d) $\sqrt{2} : \sqrt{3} : \sqrt{5}$

21. The angles of a triangle are in AP (arithmetic progression). If measure of the smallest angle is 50° less than that of the largest angle, then find the largest angle (in degrees)

त्रिभुज के कोण AP (अंकगणितीय प्रगति) में होते हैं। यदि सबसे छोटे कोण का माप सबसे बड़े कोण से 50° कम है, तो सबसे बड़ा कोण ज्ञात करें (डिग्री में)

SSC CGL 20/8/2021 (Afternoon)

- (a) 80 (b) 85 (c) 90 (d) 75

22. If one of the angles of a triangle is 74° , then the angle between the bisectors of the other two interior angles:

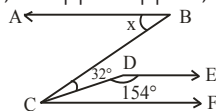
यदि किसी त्रिभुज का एक कोण 74° है, तो अन्य दो आंतरिक कोणों के समद्विभाजक के बीच का कोण:

SSC CGL 16/8/2021 (Afternoon)

- (a) 127° (b) 16° (c) 53° (d) 106°

23. In the given figure, $AB \parallel DE \parallel CF$, then find x.

दिए गए चित्र में, $AB \parallel DE \parallel CF$, फिर x मान ज्ञात करें



- (a) 53° (b) 56° (c) 58° (d) 59°

24. The measure of supplement of $\angle A$ is 40° larger than twice the measure of the complement of $\angle A$. What is the sum in degree, of the measure of the supplement and complement of $\angle A$?

कोण A के सम्पूरक कोण का मान इसके पूरक कोण के दो गुने से 40° अधिक है। कोण A के सम्पूरक तथा पूरक कोण का योग (डिग्री) क्या है?

- (a) 190 (b) 140 (c) 170 (d) 230

25. In an equilateral triangle, the value of each exterior angle is:

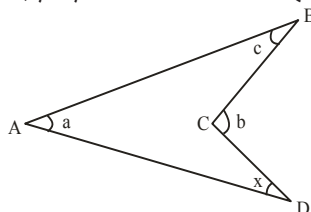
एक समबाहु त्रिभुज में प्रत्येक बाह्य कोण का मान होता है:

SSC CHSL 14/10/2020 (Morning shift)

- (a) 140° (b) 100° (c) 130° (d) 120°

26. What is the value of x in the given figure?

दिए गए चित्र में x का मान क्या है?



- (a) $b - a - c$ (b) $b - a + c$

- (c) $\pi - (a + b + c)$ (d) None of these

27. The difference between two angles is 15° and the sum of the angles in radius is $\frac{5\pi}{12}$. The bigger angle is k times the smaller angle. What is k equal to?

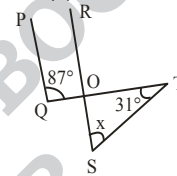
दो कोणों के बीच का अंतर 15° है और त्रिज्या में कोणों का योग $\frac{5\pi}{12}$ है। बड़ा कोण छोटे कोण का k गुना है। K किसके बराबर है?

[CDS - 2020-II]

- (a) $\frac{4}{3}$ (b) $\frac{3}{2}$ (c) $\frac{6}{5}$ (d) $\frac{7}{6}$

28. In the given figure, $PQ \parallel RS$, then find x.

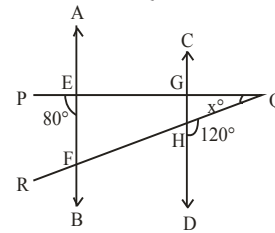
दिए गए चित्र में, $PQ \parallel RS$, फिर x खोजें।



- (a) 13° (b) 59° (c) 56° (d) 58°

29. In the given figure $AB \parallel CD$, given that $\angle PEB = 80^\circ$, $\angle QHD = 120^\circ$ and $\angle PQR = X^\circ$, find the value of x:

दिए गए चित्र में $AB \parallel CD$, दिया गया है कि $\angle PEB = 80^\circ$, $\angle QHD = 120^\circ$ और $\angle PQR = X^\circ$, x का मान ज्ञात कीजिए:



- (a) 40° (b) 20° (c) 100° (d) 30°

30. A piece of wire of length 33 cm is bent into an arc of a circle of radius 14 cm. What is the angle subtended by the arc at the centre of the circle?

33 सेमी लंबाई वाले तार के एक टुकड़े को 14 सेमी त्रिज्या वाले एक वृत्त के चाप में मोड़ा जाता है। वृत्त के केंद्र पर चाप द्वारा बनाया गया कोण क्या है?

[CDS - 2019-II]

- (a) 75° (b) 90° (c) 135° (d) 150°

31. In $\triangle ABC$, AD, the bisector of $\angle A$, meets BC at D. If $BC = a$, $AC = b$ and $AB = c$, then $BD - DC =$

$\triangle ABC$ में, AD, $\angle A$ का समद्विभाजक, BC को D पर मिलता है। यदि $BC = a$, $AC = b$ और $AB = c$ है, तो $BD - DC =$

SSC CHSL 3/07/2019 (Afternoon)

- (a) $\frac{ac}{b+c}$ (b) $\frac{a(c+b)}{c-b}$ (c) $\frac{a(c-b)}{c+b}$ (d) $\frac{ab}{b+c}$

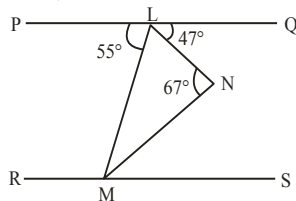
32. In $\triangle ABC$, D and E are the points on AB and AC respectively such that $D \times AC = AB \times AE$. If $\angle ADE = \angle ACB + 30^\circ$ and $\angle ABC = 78^\circ$, then $\angle A = ?$

$\triangle ABC$ में, D और E क्रमशः AB और AC पर इस प्रकार बिंदु हैं कि $AD \times AC = AB \times AE$ है। यदि $\angle ADE = \angle ACB + 30^\circ$ और $\angle ABC = 78^\circ$ है, तो $\angle A = ?$

SSC CGL TIER II (13/09/2019)

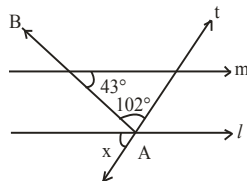
- (a) 56° (b) 54° (c) 68° (d) 48°

33. In the figure given below, PQ is parallel to RS. What is the $\angle NMS$ equal to?
नीचे दिए गए चित्र में, PQ, RS के समानांतर हैं। $\angle NMS$ किसके बराबर है?



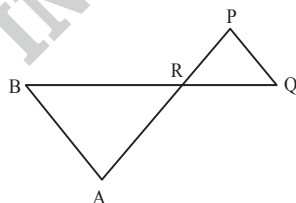
- (a) 20° (b) 23° (c) 27° (d) 47°

34. In the given figure, line l parallel to the line m , then find x .
दिए गए चित्र में, रेखा l के समान्तर रेखा m है, तो x ज्ञात कीजिए।



- (a) 25° (b) 35° (c) 45° (d) 55°

35. In the figure given below, $\triangle ABR \sim \triangle PQR$. If $PQ = 3$ cm, $AB = 6$ cm, $BR = 8.2$ cm and $PR = 5.2$ cm, then QR and AR are respectively
नीचे दिए गए चित्र में, $\triangle ABR \sim \triangle PQR$ । यदि $PQ = 3$ सेमी, $AB = 6$ सेमी, $BR = 8.2$ सेमी और $PR = 5.2$ सेमी है, तो QR और AR क्रमशः हैं



[CDS-2018-II]

- (a) 8.2 m, 10.4 cm (b) 4.1 cm, 6 cm
(c) 2.6 cm, 5.2 cm (d) 4.1 cm, 10.4 cm

36. In $\triangle ABC$, $\angle A - \angle B = 33^\circ$, $\angle B - \angle C = 18^\circ$, What is the sum of the smallest and the largest angles of the triangle?

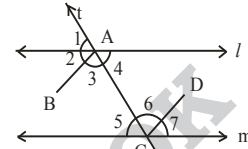
$\triangle ABC$ में, $\angle A - \angle B = 33^\circ$, $\angle B - \angle C = 18^\circ$, त्रिभुज के सबसे छोटे और सबसे बड़े कोणों का योग क्या है?

SSC CGL Tier II (15/11/2020)

- (a) 143° (b) 125° (c) 92° (d) 108°

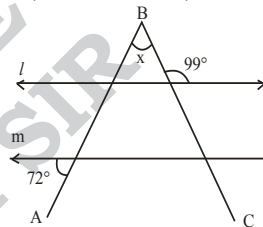
37. In the given figure, line $l \parallel m$, t is a transversal and $AB \parallel CD$. If $\angle 1 + \angle 2 = 107^\circ$ and $\angle 2 + \angle 3 = 108^\circ$, then find $\angle 7$.

दिए गए चित्र में, रेखा $l \parallel m$, t एक अनुप्रस्थ है और $AB \parallel CD$ है। यदि $\angle 1 + \angle 2 = 107^\circ$ और $\angle 2 + \angle 3 = 108^\circ$ है, तो $\angle 7$ ज्ञात कीजिए।



- (a) 32° (b) 33° (c) 27° (d) 35°

38. In the given figure, line $l \parallel m$, then find x .
दिए गए चित्र में, रेखा $l \parallel m$ है, फिर x ज्ञात कीजिए।



- (a) 108° (b) 35° (c) 27° (d) 38°

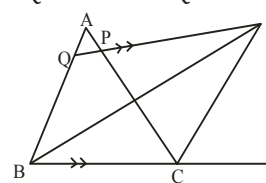
39. If two lines AB and CD intersect at O such that $\angle AOC = 5\angle AOD$, then the four angles at O are
यदि दो रेखाएँ AB और CD, O पर इस प्रकार प्रतिच्छेद करती हैं कि $\angle AOC = 5\angle AOD$ है, तो O पर चारों कोण हैं

[CDS-2018-II]

- (a) $40^\circ, 40^\circ, 140^\circ, 140^\circ$
(b) $30^\circ, 45^\circ, 75^\circ, 210^\circ$
(c) $30^\circ, 30^\circ, 150^\circ, 150^\circ$
(d) $60^\circ, 60^\circ, 120^\circ, 120^\circ$

40. In the triangle ABC, BD is internal angle bisector of $\angle B$ and CD is external Angle bisector $\angle C$. A line DQ is drawn parallel to BC which intersects AC and AB at point P and Q respectively- if $PC = 8$ cm, $PQ = 2$ cm then find $BQ = ?$

त्रिभुज ABC में BD, $\angle B$ का आंतरिक कोण समद्विभाजक है जबकि CD, $\angle C$ का बाह्य कोण समद्विभाजक है। भुजा BC के समांतर एक रेखा खींची गई है जो भुजा AC और भुजा AB को बिंदु P और बिंदु Q पर काटती है यदि भुजा $PC = 8$ सेमी, $PQ = 2$ सेमी तो BQ का मान ज्ञात करो ?



- (a) 10 cm (b) 5 cm (c) 6 cm (d) 12 cm

Type 1 (Line and Angle) Answer key													
1	D	2	D	3	B	4	D	5	C	6	D	7	C
8	(*)	9	A	10	C	11	D	12	C	13	B	14	A
15	B	16	D	17	C	18	D	19	C	20	B	21	B
22	A	23	C	24	A	25	D	26	A	27	B	28	C
29	B	30	C	31	C	32	B	33	A	34	B	35	D
36	B	37	D	38	C	39	C	40	A				

Type-1 (Line and Angle) Solution

1. Sol. (d)

According to the question,

$$x - (180^\circ - x) = 74^\circ \Rightarrow x = 127^\circ$$

So, another angle = $180^\circ - 127^\circ = 53^\circ$

2. Sol. (d)

Let the value of each of the unknown angles of a triangle be x

ATQ,

$$2x + 70^\circ = 180^\circ \Rightarrow 2x = 110^\circ \Rightarrow x = 55^\circ$$

3. Sol. (b)

Let $2\angle A = 3\angle B = 6\angle C$

Ratio of angle A, B and C = 3 : 2 : 1

$$3x + 2x + x = 180$$

$$\Rightarrow 6x = 180 \Rightarrow 3x + 2x + x = 180$$

$$\Rightarrow 6x = 180 \Rightarrow x = 30$$

So, the largest angle is 90°

4. Sol. (d)

Let the angles of a triangle be $3x$, $4x$ and $8x$ respectively.

ATQ,

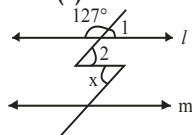
$$3x + 4x + 8x = 180^\circ \Rightarrow 15x = 180^\circ$$

$$\Rightarrow x = \frac{180^\circ}{15} = 12^\circ$$

So, the smallest angle of the three angles of triangle

$$= 3x = 12 \times 3 = 36^\circ$$

5. Sol. (c)



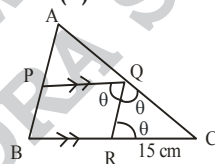
$$\angle 1 + 127^\circ = 180^\circ$$

$$\angle 1 = 53^\circ$$

$$\angle 1 = \angle 2 = 53^\circ \quad (\text{Corresponding angle})$$

$$\angle 2 = \angle x = 53^\circ \quad (\text{Alternate angle})$$

6. Sol. (d)



$\angle PQR$ and $\angle QRC$ are alternate angle

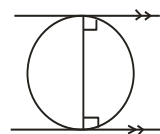
$\angle PQR$ और $\angle QRC$ एकांतर कोण है।

$$\angle PQR = \angle QRC = \angle RQC$$

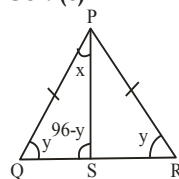
$$\therefore RC = QC = 15 \text{ cm}$$

7. Sol. (c)

Tangents drawn at the end of the diameter of a circle are always parallel to each other.



8. Sol. (c)



Let $\angle QPS = x$

so, $\angle PSQ = 96^\circ + x$, and let $\angle PQS = \angle PRQ = y$

In $\triangle PQR$, $\angle PQS + \angle PRQ + \angle QPR = 180^\circ$

$$\text{So, } y + y + 132 = 180^\circ$$

$$2y = 48^\circ \Rightarrow y = 24^\circ$$

$$\text{In } \triangle PQS, x + y + (96 + x) = 180^\circ$$

$$2x + 24^\circ + 96^\circ = 180^\circ$$

$$\Rightarrow 2x = 60^\circ \Rightarrow x = 30^\circ$$

$$\begin{aligned}\text{So, } \angle PSR &= 180^\circ - \angle PSQ = 180^\circ - (96^\circ + x) = \\ 180^\circ - (96^\circ + 30^\circ) &= 180^\circ - 126^\circ = 54^\circ\end{aligned}$$

9. Sol. (a)

PA and PB are tangents So, $\angle PAO = \angle PBO = 90^\circ$

As we can see, the figure APBO is a quadrilateral and the sum of opposite angles is 180° .

$$\text{So, } \angle AOB = 180^\circ - 54^\circ = 126^\circ$$

since, OA and OB are radius

$$\text{So, in } \triangle OAB, \angle AOB + \angle OBA + \angle OAB$$

$$= 180^\circ \Rightarrow 126^\circ + x + x = 180^\circ \Rightarrow x = 27^\circ = \angle OBA$$

10. Sol. (c)

$$\angle A - \angle B = 45^\circ \quad \dots \text{ (Given)}$$

$$\angle B = \angle A - 45^\circ \quad \dots \text{ (i)}$$

$$\angle B - \angle C = 15^\circ \quad \dots \text{ (Given)}$$

$$\angle C = \angle B - 15^\circ \quad \dots \text{ (ii)}$$

Putting the value of $\angle B$ in eq. (ii)

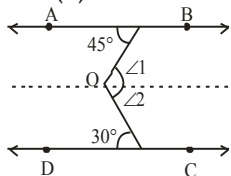
$$\angle C = (\angle A - 45^\circ) - 15^\circ = \angle A - 60^\circ \quad \dots \text{ (iii)}$$

$$\angle A + \angle B + \angle C = 180^\circ \quad (\text{Sum of all angle of triangle})$$

$$\angle A + (\angle A - 45^\circ) + (\angle A - 60^\circ) = 180^\circ$$

$$\angle A = 95^\circ$$

11. Sol. (d)



Through O, draw a line parallel to both AB & CD

$$\text{Then, } \angle 1 = 45^\circ$$

(alternate angle)

$$\text{and } \angle 2 = 30^\circ$$

(alternate angle)

$$\therefore \angle BOC = \angle 1 + \angle 2$$

$$= 45^\circ + 30^\circ = 75^\circ$$

$$\text{So, } x = 360^\circ - 75^\circ = 285^\circ$$

$$\text{Hence, } x = 285^\circ$$

12. Sol. (c)

$$A - B = 60^\circ \quad \dots \text{ (i)}$$

$$B - C = 15^\circ \quad \dots \text{ (ii)}$$

Subtracting eq. (i) and (ii), we get

$$A - 2B + C = 45^\circ \quad \dots \text{ (iii)}$$

$$\text{And, } A + B + C = 180^\circ \quad \dots \text{ (iv)}$$

Subtracting eq. (iii) and (iv), we get

$$\Rightarrow -3B = -135 \Rightarrow B = 45^\circ$$

Put the value of B in eq. (1), $A = 105^\circ$

13. Sol. (b)

In $\triangle ABC$,

$$\angle BAC = 180^\circ - (81^\circ + 9^\circ) = 180^\circ - 90^\circ$$

$$= 90^\circ \quad (\text{Sum of all angles of a triangle is } 180^\circ)$$

$$\angle BAC = \angle BDC = 90^\circ \quad (\text{angles in same segment})$$

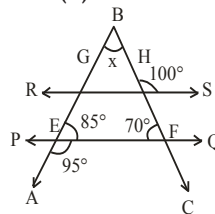
14. Sol. (a)

$$71 = 33^\circ + 180 - x \quad (\text{Corresponding})$$

$$x = 213 - 71$$

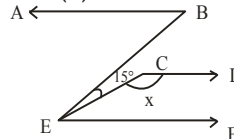
$$= 142^\circ$$

15. Sol. (b)



$$x = 180 - 85 - 70 = 25^\circ$$

16. Sol. (d)



$$\angle ABE = \angle CEF + 15^\circ \quad (\text{Alternate angle})$$

$$\Rightarrow \angle ABE - \angle CEF = 15^\circ$$

$$\Rightarrow \frac{3}{2} \angle CFE - \angle EFE = 15^\circ \quad (\because 2\angle ABE = 3\angle CF)$$

$$\Rightarrow \frac{\angle CEF}{2} = 15^\circ$$

$$\Rightarrow \angle CFE = 30^\circ$$

$$\angle CEF + X = 180^\circ$$

$$\Rightarrow X = 180^\circ - 30^\circ = 150^\circ$$

17. Sol. (c)

$$x + y = 180^\circ$$

$$x + 30^\circ = 180^\circ$$

$$x = 150^\circ$$

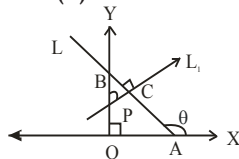
$$y = \frac{1}{2}(90 - y)$$

$$2y = 90 - y$$

$$3y = 90^\circ, y = 30^\circ$$

$$x : y = 150 : 30 = 5 : 1$$

18. Sol. (d)



$$\angle BCP = 180^\circ - \angle BCL_1 = 90^\circ$$

In $\triangle BOA$,

$$\angle O = 90^\circ, \angle A = 180^\circ - \theta$$

$$\therefore \angle OBA = 180^\circ - (90^\circ + 180^\circ - \theta)$$

$$= \theta - 90$$

In $\triangle BPC$,

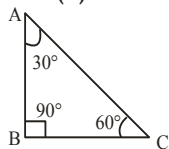
$$\angle BPC = 180^\circ - (90^\circ + \theta - 90^\circ)$$

$$= 180^\circ - \theta$$

$$= \pi - \theta$$

19. Sol. (c)

20. Sol. (b)



Ratio of angles = 1 : 2 : 3

Angles are = $1k, 2k, 3k$

$$1k + 2k + 3k = 180^\circ \Rightarrow k = 30^\circ$$

Angles are : $30^\circ, 60^\circ, 90^\circ$

$$\tan 60^\circ = \sqrt{3} = \frac{AB}{BC}$$

$$AB = \sqrt{3}, BC = 1, AC = 2 \Rightarrow \text{Ratio} : 1 : \sqrt{3} : 2$$

21. Sol. (b)

Three angles are $(60^\circ - d), 60^\circ, (60^\circ + d)$

Difference between largest and smallest angle

$$= 2d \Rightarrow 2d = 50^\circ, d = 25^\circ$$

$$\text{Largest angle} = 60^\circ + 25^\circ = 85^\circ$$

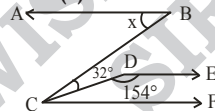
22. Sol. (a)

Angle between the bisector of the other two

interior angle is $= 90^\circ + \frac{1}{2}$ of third angle

$$\Rightarrow 90^\circ + \frac{1}{2} \times 74^\circ = 90^\circ + 37^\circ = 127^\circ$$

23. Sol. (c)



$$\angle 1 + 154^\circ = 180^\circ$$

$$\angle 1 = 26^\circ$$

$$\angle 1 + 32^\circ = x \quad (\text{Alternate angle})$$

$$x = 32^\circ + 26^\circ = 58^\circ$$

24. Sol. (a)

$$180 - A = 2(90 - A) + 40^\circ$$

$$180 - A = 180 - 2A + 40$$

$$A = 40^\circ$$

$$90 - A + 180 - A = 270 - 2A = 270 - 80 = 190^\circ$$

25. Sol. (d)

Interior angle of equilateral triangle = 60°

Exterior angle of equilateral triangle = $180^\circ -$

$$60^\circ = 120^\circ$$

26. Sol. (a)

$$b = a + c + x$$

$$x = b - a - c$$

27. Sol. (b)

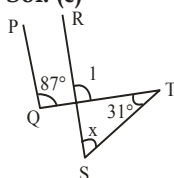
Difference, $A - B = 15^\circ$

$$\text{Sum, } A + B = \frac{5\pi}{12} = 75^\circ.$$

$$\therefore A = 45^\circ \text{ and } B = 30^\circ.$$

$$\therefore \frac{A}{B} = \frac{45^\circ}{30^\circ} = \frac{3}{2}.$$

28. Sol. (c)



$\angle 1 = \angle 87^\circ$ (corresponding angle)

$$\Rightarrow x + 31^\circ = \angle 1$$

$$\Rightarrow x = 87^\circ - 31^\circ$$

$$\Rightarrow x = 56$$

29. Sol. (b)

$\angle PEF = \angle PGH = 80^\circ$ (Corresponding angle)

$$\Rightarrow \angle QGH = 100^\circ, \angle QHD = 120^\circ$$

$$\Rightarrow \angle CHQ = 60^\circ$$

$$\therefore \angle x + 100^\circ + 60^\circ = 180^\circ$$

$$\Rightarrow x = 20^\circ$$

30. Sol. (c)

Angle subtended by the arc at the centre of the circle = θ

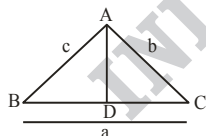
$$\text{Then } \frac{\theta}{360} \cdot 2\pi R = 33$$

$$\Rightarrow \theta = \frac{33 \times 360 \times 7}{2 \times 22 \times 14} = 3 \times 45 = 135^\circ$$

31. Sol. (c)

$BC = a$ cm

Let $BD = x$, $DC = a - x$



We know that, if AD is bisector of $\angle BAC$ then,

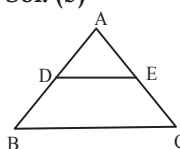
$$\frac{AB}{AC} = \frac{BD}{DC} \Rightarrow \frac{c}{b} = \frac{x}{a-x}$$

$$\Rightarrow ac - cx = bx \Rightarrow x = \frac{ac}{b+c}$$

$$\Rightarrow DC = a - x \Rightarrow DC = a - \frac{ac}{b+c} = \frac{ab}{b+c}$$

$$BD - DC = \frac{ac}{b+c} - \frac{ab}{b+c} = \frac{a(c-b)}{c+b}$$

32. Sol. (b)



Given, $AD \times AC = AB \times AE$ and $\angle ADE$

$$= \angle ACB + 30^\circ \text{ and } \angle ABC = 78^\circ$$

$$\Rightarrow \frac{AD}{AB} = \frac{AE}{AC} \Rightarrow DE \parallel BC$$

$$\angle ADE = \angle ABC = 78^\circ \text{ and } \angle AED = \angle ACB$$

(Corresponding angle)

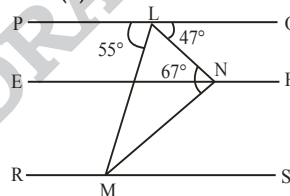
$$\angle ADE = \angle ACB + 30^\circ$$

$$78^\circ = \angle ACB + 30^\circ \Rightarrow \angle ACB = 48^\circ$$

$$\Rightarrow \angle A = 180^\circ - (\angle ABC + \angle ACB)$$

$$= 180^\circ - 78^\circ - 48^\circ = 54^\circ$$

33. Sol. (a)



$$\angle PLM = \angle LMS = 55^\circ \text{ (Alter. angle)}$$

Let draw EF line which is parallel to PQ and bisects by LN.

$$\text{Then, } \angle QLN = \angle LNE = 47^\circ$$

$$\therefore \angle ENL + \angle MNE = 67^\circ$$

$$\Rightarrow 47^\circ + \angle MNE = 67^\circ$$

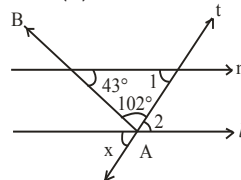
$$\angle MNE = 67^\circ - 47^\circ$$

$$\angle MNE = 20^\circ$$

Similarly, $EF \parallel RS$

$$\text{Then } \angle ENM = \angle NMS = 20^\circ$$

34. Sol. (b)



$$\angle 1 + 43^\circ + 102^\circ = 180^\circ$$

$$\angle 1 = 35^\circ$$

$$\angle 1 = \angle 2 \text{ (alternate angle)}$$

$$\angle 2 = \angle x = 35^\circ \quad (\text{vertical angle})$$

35. Sol. (d)

As $\triangle ABR \sim \triangle PQR$.

$$\therefore \frac{AB}{PQ} = \frac{BR}{QR} = \frac{AR}{PR}$$

$$\Rightarrow \frac{6}{3} = \frac{8.2}{QR} = \frac{AR}{5.2}$$

$$\Rightarrow QR = \frac{8.2}{2} = 4.1 \text{ cm}$$

$$\Rightarrow \text{and } AR = 2 \times 5.2 = 10.4 \text{ cm}$$

36. Sol. (b)

We know

$$\angle A + \angle B + \angle C = 180^\circ \quad \dots(i)$$

$$\angle A - \angle B = 33^\circ \quad \dots(ii)$$

On subtracting eq. (ii) from (i)

$$2\angle B + \angle C = 147^\circ \quad \dots(iii)$$

$$\angle B - \angle C = 18^\circ \quad \dots(iv)$$

On adding eq. (iii) and (iv)

$$3\angle B = 165^\circ \quad \angle B = 55^\circ$$

$$\angle A = 55^\circ + 33^\circ = 88^\circ$$

$$\angle C = 55^\circ - 18^\circ = 37^\circ$$

$$\text{Sum of smallest and largest angle} = 88^\circ + 37^\circ = 125^\circ$$

37. Sol. (d)

$$\angle 1 + \angle 2 = 107^\circ \quad \dots (i)$$

$$\angle 2 + \angle 3 = 108^\circ \quad \dots (ii)$$

Eq. (i) + (ii)

$$\angle 1 + \angle 2 + \angle 3 + \angle 2 = 215^\circ$$

$$= 180^\circ + \angle 2 = 215^\circ \quad (\because \angle 1 + \angle 2 + \angle 3 = 180^\circ)$$

$$\Rightarrow \angle 2 = 35^\circ$$

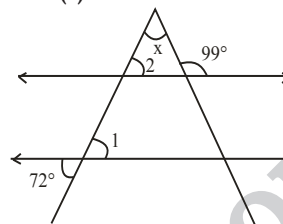
$$\Rightarrow \angle 3 = \angle 6$$

$$\angle 2 + \angle 3 = \angle 6 + \angle 7$$

$$\angle 2 = \angle 7$$

$$\angle A = 35^\circ$$

38. Sol. (c)



$$\angle 1 = 72^\circ \text{ (Vertical angle)}$$

$$\angle 1 = \angle 2 = 72^\circ \text{ (Corresponding angle)}$$

$$\Rightarrow \angle 2 + x = 99^\circ$$

$$\Rightarrow x = 99^\circ - 72^\circ$$

$$\Rightarrow x = 27^\circ$$

(corresponding angle) (alternate angle)

39. Sol. (c)

Let two lines AB and CD intersect each other as

$$\angle AOD = x$$

$$\text{Then, } \angle AOC = 5x$$

$$\text{Now, } \angle AOD + \angle AOC = \angle COD = 180^\circ$$

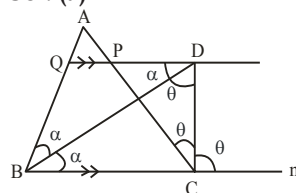
$$x + 5x = 180^\circ = 6x = 180^\circ$$

$$\Rightarrow x = 30^\circ$$

$$\text{Now, } \angle AOD = \angle BOC = x = 30^\circ$$

$$\text{and } \angle AOC = \angle BOD = 5x = 150^\circ$$

40. Sol. (a)



$$PC = 8 \text{ cm, } PQ = 2 \text{ cm}$$

$$\angle PDC = \angle DCM \text{ Alternate Angle}$$

$$\therefore PC = PQ = 8 \text{ cm}$$

$$\angle DBC = \angle QDB \text{ (alternate angle)}$$

$$\therefore BQ = QD = 2 + 8 = 10 \text{ cm}$$

Type-2 (Exterior Property)

1. AB and CD are two chords in a circle with centre O and AD is a diameter. AB and CD produced meet at a point P outside the circle. If $\angle APD = 25^\circ$ and $\angle DAP = 39^\circ$, then the measure of $\angle CBD$ is:
 केंद्र O वाले वृत्त में AB और CD दो जीवाएँ हैं और AD एक व्यास है। AB और CD वृत्त के बाहर एक बिंदु P पर मिलते हैं। यदि $\angle APD = 25^\circ$ और $\angle DAP = 39^\circ$ है, तो $\angle CBD$ का माप है:

SSC CGL Tier -2, 2023

- (a) 29° (b) 26° (c) 32° (d) 27°
2. In $\triangle ABC$, D is a point on BC such that $\angle ADB = 2\angle DAC$, $\angle BAC = 70^\circ$ and $\angle B = 56^\circ$. What is the measure of $\angle ADC$?
 $\triangle ABC$ में, D, BC पर एक बिंदु इस प्रकार है कि $\angle ADB = 2\angle DAC$, $\angle BAC = 70^\circ$ और $\angle B = 56^\circ$ है। $\angle ADC$ का माप क्या है?

SSC CGL Tier II 03/02/2022

- (a) 72° (b) 54° (c) 74° (d) 81°
3. In triangle ABC, D and E are points on BC such that $AD = AE$ and $\angle BAD = \angle CAE$. If $AB = (2p + 3)$, $BD = 2p$, $AC = (3q - 1)$ and $CE = q$, then find the value of $(p + q)$
 त्रिभुज ABC में, D और E BC पर इस प्रकार बिंदु हैं कि $AD = AE$ और $\angle BAD = \angle CAE$ है। यदि $AB = (2p+3)$, $BD = 2p$, $AC = (3q - 1)$ और $CE = q$ है, तो $(p+q)$ का मान ज्ञात कीजिए।

SSC CGL 13/04/2022 (Morning)

- (a) 3 (b) 4.5 (c) 3.6 (d) 2
4. In a triangle ABC, $AB = AC$ and BC is produced to D such that $\angle ACD = x$, then what is $\angle BAC$ equal to?
 त्रिभुज ABC में, $AB = AC$ और BC को D तक इस प्रकार बढ़ाया गया है कि $\angle ACD = x$ है, तो $\angle BAC$ किसके बराबर है?

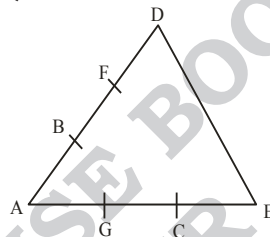
[CDS - 2022-I]

- (a) $2x - 90^\circ$ (b) $2x - 180^\circ$
 (c) $180^\circ - 2x$ (d) $\frac{x}{2}$
5. In a $\triangle ABC$, the side BC is extended from vertex C to point D such that $\angle ACB$ and $\angle ACD$, are in the ratio of 2 : 3. If $\angle A$ is 75° , then what is the value of $\angle B$?
 $\triangle ABC$ में, भुजा BC को शीर्ष C से बिंदु D तक इस प्रकार बढ़ाया गया है कि $\angle ACB$ और $\angle ACD$, 2:3 के अनुपात में हैं। यदि $\angle A = 75^\circ$ है, तो $\angle B$ का मान क्या है?

Higher Secondary 05/08/2022 (Shift - 2)

- (a) 72° (b) 33° (c) 45° (d) 69°

6. In the given diagram $AB = BC = CD = DE = EF = FG = GA$. $\angle CDE = ?$
 दिये गये चित्र में $AB = BC = CD = DE = EF = FG = GA$ है। तो $\angle CDE$ का मान बताओ?

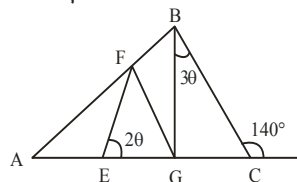


- (a) $180^\circ/7$ (b) 120° (c) 45° (d) 60°

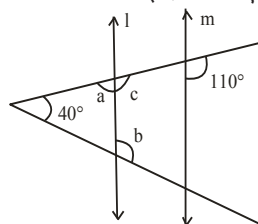
7. In a triangle ABC, CA is produced to P, $\angle BAP = 126^\circ$. If $\angle B : \angle C = 5 : 2$, the degree measures of $\angle B$ and $\angle C$ are respectively:
 एक त्रिभुज ABC में, CA को P तक बढ़ाया गया है, $\angle BAP = 126^\circ$ है। यदि $\angle B : \angle C = 5 : 2$ है, तो $\angle B$ और $\angle C$ की डिग्री माप क्रमशः हैं:

SSC CHSL 30/05/2022 (Evening)

- (a) 90° and 36° (b) 84° and 42°
 (c) 78° and 48° (d) 70° and 56°
8. In the given figure, $AE = EF = FG = GB$, then find the measure of θ .
 दिए गए चित्र में, $AE = EF = FG = GB$, तो θ का माप ज्ञात कीजिए।



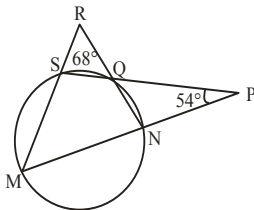
- (a) 10° (b) 20° (c) 30° (d) 40°
9. In the following figure, if $l \parallel m$, then find the measures of angles marked by a and b.
 निम्नलिखित आकृति में, यदि $l \parallel m$ है, तो a और b द्वारा चिह्नित कोणों की माप ज्ञात कीजिए।



- (a) $a = 90^\circ$ and $b = 90^\circ$
 (b) $a = 55^\circ$ and $b = 125^\circ$
 (c) $a = 70^\circ$ and $b = 110^\circ$
 (d) $a = 60^\circ$ and $b = 120^\circ$

10. In the given figure, MNP, SQP, NQR and MSR are straight lines, $\angle NPQ = 54^\circ$ and $\angle QRS = 68^\circ$. What is the degree measure of $\angle SMN$?

दी गई आकृति में, MNP, SQP, NQR और MSR सीधी रेखाएं हैं। $\angle NPQ = 54^\circ$ और $\angle QRS = 68^\circ$ है। $\angle SMN$ का डिग्री माप ज्ञात करें।



SSC CPO 10/11/2022 (Shift- 03)

- (a) 29° (b) 38° (c) 54° (d) 68°

11. In a $\triangle PQR$, $PQ = PR$, and S is a point on PQ , such that $PS = RS = QR$. Then what is the measure of $\angle QPR$?

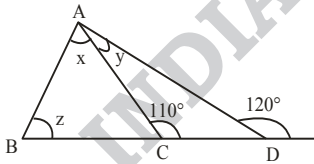
$\triangle PQR$ में $PQ = PR$ और, PQ पर S बिंदु ऐसी स्थिति में है कि $PS = RS = QR$, तो $\angle QPR$ का मान कितना होगा?

DP Head Constable 10/10/2022 (Shift- 01)

- (a) 72° (b) 60° (c) 36° (d) 23°

12. From the following figure find $x + y + z$ निम्नलिखित आकृति से $x + y + z$ ज्ञात कीजिए

SSC CGL 01/12/2022 (3rd Shift)

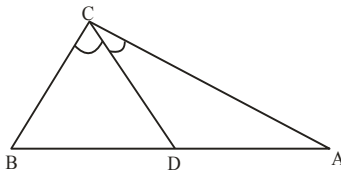


- (a) 100° (b) 130° (c) 120° (d) 110°

13. In the given triangle, CD is the bisector of $\angle BCA$. $CD = DA$. If $\angle BDC = 76^\circ$, what is the degree measure of $\angle CBD$?

दिए गए त्रिभुज में, CD , $\angle BCA$ का समद्विभाजक है। $CD = DA$. यदि $\angle BDC = 76^\circ$ है, तो $\angle CBD$ का डिग्री माप क्या है?

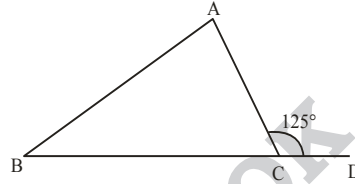
SSC CGL 01/12/2022 (4th Shift)



- (a) 32° (b) 76° (c) 80° (d) 66°

14. If in $\triangle ABC$, $AB = AC$ and $\angle ACD = 125^\circ$, then $\angle BAC$ is:
 यदि $\triangle ABC$ में $AB = AC$ और $\angle ACD = 125^\circ$ है, तो $\angle BAC$ है:

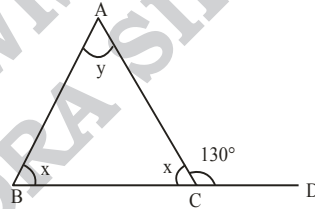
SSC CPO 11/11/2022 (Morning)



- (a) 75° (b) 55° (c) 60° (d) 70°

15. If in a triangle ABC as drawn in the figure, $AB = AC$ and $\angle ACD = 130^\circ$, then $\angle BAC$ is equal to:
 यदि आकृति में खींचे गए त्रिभुज ABC में $AB = AC$ और $\angle ACD = 130^\circ$ है, तो $\angle BAC$ बराबर है:

SSC CGL 07/12/2022 (4th Shift)



- (a) 60° (b) 50° (c) 70° (d) 80°

16. In a $\triangle ABC$, points P , Q and R are taken on AB , BC and CA , respectively, such that $BQ = PQ$ and $QC = QR$. If $\angle BAC = 75^\circ$, what is the measure of $\angle PQR$ (in degrees)?

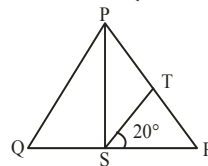
$\triangle ABC$ में, बिंदु P , Q और R को क्रमशः AB , BC और CA पर इस प्रकार लिया जाता है, कि $BQ = PQ$ और $QC = QR$ है। यदि $\angle BAC = 75^\circ$ है, तो $\angle PQR$ का माप (डिग्री में) क्या है?

SSC CGL 11/04/2022 (Morning)

- (a) 40 (b) 30 (c) 50 (d) 75

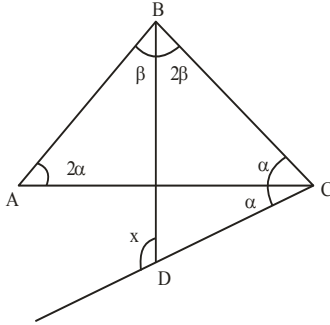
17. In the following figure PQR is isosceles triangle in which $PQ = PR$. if $PS = PT$, and $\angle TSR = 20^\circ$, then find $\angle QPS = ?$

दिये गये चित्र में PQR एक समद्विबाहु त्रिभुज है जिसमें $PQ = PR$, यदि $PS = PT$ और $\angle TSR = 20^\circ$ तो कोण QPS का मान क्या होगा



- (a) 30° (b) 40° (c) 20° (d) 35°

18. In the given figure, find the measure of x .
 दिए गए चित्र में, x का माप ज्ञात कीजिए।



- (a) 130° (b) 160° (c) 90° (d) 120°

19. In $\triangle ABC$, D is a point on BC such that $\angle BAD = \frac{1}{2}\angle ADC$ and $\angle BAC = 77^\circ$ and $\angle C = 45^\circ$, What is the measure of $\angle ADB$?

$\triangle ABC$ में, D BC पर एक बिंदु इस प्रकार है कि $\angle BAD = \frac{1}{2}\angle ADC$ और $\angle BAC = 77^\circ$ और $\angle C = 45^\circ$ है, $\angle ADB$ का माप क्या है?

SSC CGL 23/8/2021 (Afternoon)

- (a) 64° (b) 77° (c) 45° (d) 58°

20. AB is the diameter of a circle with centre O. The tangent at a point C on the circle meets AB produced at Q. If $\angle CAB = 42^\circ$, then what is the measure of $\angle CQA$?

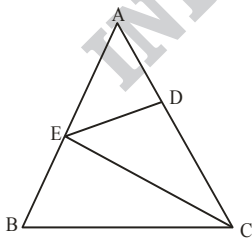
AB केंद्र O वाले एक वृत्त का व्यास है। वृत्त के बिंदु C पर स्पर्शरेखा, Q पर उत्पन्न AB से मिलती है। यदि $\angle CAB = 42^\circ$ है, तो $\angle CQA$ का माप क्या है?

SSC CGL 7/03/2020 (Afternoon)

- (a) 5° (b) 7° (c) 6° (d) 17°

21. In the given $\triangle ABC$, $AD = DE = EC = BC$. Then find $\angle A : \angle B = ?$

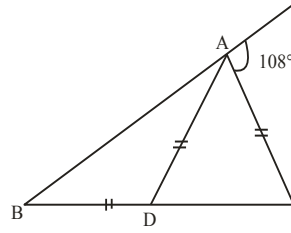
दिए गए $\triangle ABC$ में, $AD = DE = EC = BC$ है। तो $\angle A : \angle B = ?$



- (a) 3:1 (b) 1:3 (c) 1:4 (d) 4:1

22. In the given figure - if $AD = BD = AC$, then the value of angle C will be?.

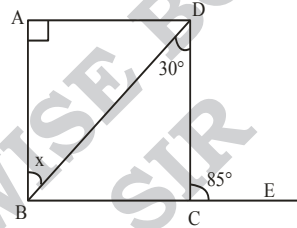
दिये गये चित्र में, यदि $AD = BD = AC$ तो कोण C का मान क्या होगा?



- (a) 72° (b) 90° (c) 54° (d) 64°

23. Given that $D \parallel BE$, $AB \perp AD$, $\angle DCE = 85^\circ$, $\angle BDC = 30^\circ$, What is the value of x?

यह देखते हुए कि $AD \parallel BE$, $AB \perp AD$, $\angle DCE = 85^\circ$, $\angle BDC = 30^\circ$, x का मान क्या है?



- (a) 30° (b) 35° (c) 45° (d) 55°

24. In a circle with centre O, A diameter AB and a chord CD intersect each other at E, AC and AD are joined. If $\angle BOC = 48^\circ$ and $\angle AOD = 100^\circ$, then what is the measure of $\angle CEB$?

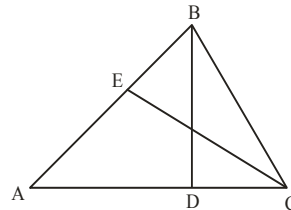
केंद्र O वाले एक वृत्त में, एक व्यास AB और एक जीवा CD एक दूसरे को E पर काटते हैं, AC और AD जुड़े हुए हैं। यदि $\angle BOC = 48^\circ$ और $\angle AOD = 100^\circ$ है, तो $\angle CEB$ का माप क्या है?

SSC CHSL 3/07/2019 (Evening)

- (a) 72° (b) 74° (c) 78° (d) 82°

25. In the given figure, $AD = DB = BC = EC = AE$, then find $\angle A$.

दिए गए चित्र में, $AD = DB = BC = EC = AE$, तो $\angle A$ ज्ञात कीजिए।



- (a) 45° (b) 36° (c) 72° (d) 48°

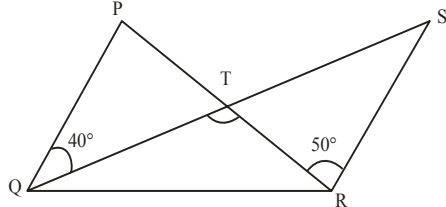
26. In a $\triangle ABC$, $\angle B = \angle C = 78^\circ$. D & E are points on AB and AC respectively. If $\angle CBE = 51^\circ$ & $\angle DCB = 24^\circ$. Then $\angle BED = ?$

एक त्रिभुज ABC में $\angle B = \angle C = 78^\circ$. D तथा E क्रमशः भुजा AB और AC पर स्थित हैं। यदि $\angle CBE = 51^\circ$ तथा $\angle DCB = 24^\circ$ है। तो $\angle BED$ का मान बताओ।

- (a) 12° (b) 20° (c) 15° (d) 22°

27. In the given figure, $PR = QS = QR$. Then find the $\angle QTR$.

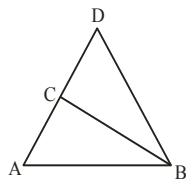
दिये गये चित्र में $PR = QS = QR$ तो $\angle QTR$ का मान बताओ।



- (a) 90° (b) 120° (c) 110° (d) 125°

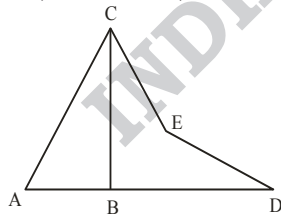
28. In a $\triangle ABD$, $AB = BC = CD$ and $AD = BD$. Find $\angle DAB$, $\angle ADB$ and $\angle DCB$.

$\triangle ABD$ में, $AB = BC = CD$ और $AD = BD$ है। $\angle DAB$, $\angle ADB$ और $\angle DCB$ ज्ञात कीजिए।



- (a) $34^\circ, 16^\circ, 100^\circ$ (b) $12^\circ, 32^\circ, 115^\circ$
(c) $72^\circ, 36^\circ, 108^\circ$ (d) $18^\circ, 38^\circ, 120^\circ$

29. If in the given figure, $\angle ACB + \angle BAC = 80^\circ$; $\angle BDE = 35^\circ$; $\angle BCE = 45^\circ$, then the marked angle $\angle CED$ is: यदि दिए गए चित्र में, $\angle ACB + \angle BAC = 80^\circ$; $\angle BDE = 35^\circ$; $\angle BCE = 45^\circ$, तो अंकित कोण $\angle CED$ है:



SSC CHSL 13/10/2020 (Morning)

- (a) 150° (b) 120° (c) 160° (d) 135°

30. The exterior angle of a triangle is 115° and the corresponding interior opposite angles are in the ratio 2:3. The measure of greatest angle of the triangle is:

एक त्रिभुज का बाहरी कोण 115° है और संगत आंतरिक सममुख कोणों का अनुपात 2:3 है। त्रिभुज के सबसे बड़े कोण का माप है:

SSC CHSL 26/10/2020 (Evening)

- (a) 70° (b) 65° (c) 69° (d) 79°

31. AB is a chord in a circle with centre O. AB is produced to C such that BC is equal to the radius of the circle. C is joined to O and produced to meet the circle at D. If $\angle ACD = 32^\circ$, then the measure of $\angle AOD$ is

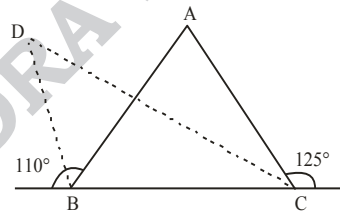
केंद्र O वाले वृत्त में AB एक जीवा है। AB को C तक इस प्रकार बढ़ाया जाता है कि BC वृत्त की त्रिज्या के बराबर हो। C को O से जोड़ा गया है और वृत्त को D पर मिलने के लिए बढ़ाया गया है। यदि $\angle ACD = 32^\circ$ है, तो $\angle AOD$ का माप है

SSC CPO 13/12/2019 (Evening)

- (a) 48° (b) 108° (c) 80° (d) 96°

32. In the given figure internal bisector angle of $\angle ACB$ and external bisector of $\angle ABC$ meet at point D. Find $\angle BDC$?

दिये गये चित्र में, $\angle ACB$ का आंतरिक कोण समद्विभाजक और $\angle ABC$ का बाह्य समद्विभाजक बिन्दु D पर मिलती है। $\angle BDC$ का मान बताओ।



- (a) 25° (b) 27.5° (c) 30° (d) None

33. In $\triangle ABC$, D is a point on BC such that $\angle BAD = 1/2 \angle ADC$, $\angle BAC = 87^\circ$ and $\angle C = 42^\circ$. What is the measure of $\angle ADB$?

$\triangle ABC$ में, D, BC पर एक बिंदु इस प्रकार है कि $\angle BAD = 1/2 \angle ADC$, $\angle BAC = 87^\circ$ और $\angle C = 42^\circ$ है। $\angle ADB$ का माप क्या है?

SSC CHSL 4/07/2019 (Morning)

- (a) 94° (b) 68° (c) 102° (d) 78°

34. In a triangle ABC, the sides AB, AC are produced and the bisectors of exterior angles of $\angle ABC$ and $\angle ACB$ intersect at D. If $\angle BAC = 50^\circ$, then $\angle BDC$ is equal to

त्रिभुज ABC में, भुजाएँ AB, AC बनी हुई हैं और $\angle ABC$ और $\angle ACB$ के बाह्य कोणों के समद्विभाजक D पर प्रतिच्छेद करते हैं। यदि $\angle BAC = 50^\circ$ है, तो $\angle BDC$ बराबर है

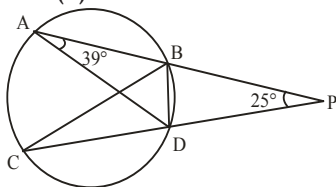
[CDS-2018-II]

- (a) 115° (b) 65° (c) 55° (d) 40°

Type 2 (Exterior Property) Answer key													
1	(b)	2	(a)	3	(a)	4	(b)	5	(b)	6	(a)	7	(a)
8	(b)	9	(c)	10	(a)	11	(c)	12	(c)	13	(d)	14	(d)
15	(d)	16	(b)	17	(b)	18	(d)	19	(a)	20	(c)	21	(b)
22	(a)	23	(b)	24	(b)	25	(b)	26	(a)	27	(b)	28	(c)
29	(c)	30	(c)	31	(d)	32	(b)	33	(d)	34	(b)		

Type-2 (Exterior Property) Solution

1. Sol. (b)



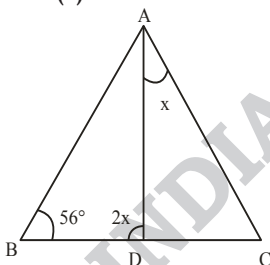
Since AD is diameter, so $\angle ABD = 90^\circ$

$\angle ADC = 39^\circ + 25^\circ = 64^\circ$ (exterior angle)

$\angle ADC = \angle ABC = 64^\circ$ (Angle in the same segment)

$\angle CBD = 90^\circ - \angle ABC = 90^\circ - 64^\circ = 26^\circ$

2. Sol. (a)



In $\triangle ABC$, $\angle BAC + \angle ABC + \angle ACB = 180^\circ$

$70^\circ + 56^\circ + \angle ACB = 180^\circ$

So, $\angle ACB = 180^\circ - 126^\circ = 54^\circ$

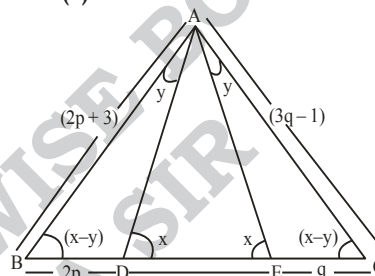
$\angle ADB = \angle DAC + \angle ACB$ (exterior angle is sum of two interior opposite angle)

$\Rightarrow 2x = x + 54^\circ \Rightarrow x = 54^\circ$

So, in $\triangle ADC$, $\angle ADC = 180 - (54 + 54)$

$= 180 - 108 = 72^\circ$

3. Sol. (a)



As, $AD = AE$, $\angle D = \angle E = x$

As $\angle BAD = \angle CAE = y$ (let)

By exterior angle property, $\angle B = \angle C = (x - y)$

By symmetry, $BD = CE$, so, $2p = q$,

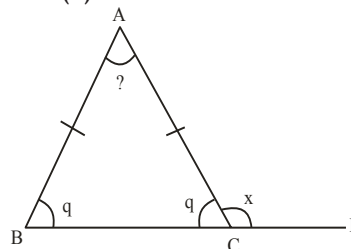
$\Rightarrow$ As, $\angle B = \angle C$, $AB = AC$

$\Rightarrow 2p + 3 = 3q - 1 \Rightarrow 2p + 3 = 3 \times 2p - 1$

$\Rightarrow 4 = 4p \Rightarrow p = 1$

So, $q = 2p = 2 \Rightarrow (p + q) = 2 + 1 = 3$

4. Sol. (b)



$\angle BAC = 180^\circ - 2q$

$\therefore \angle ACD = \angle BAC + \angle ABC$

$\Rightarrow x = 180 - 2q + q$

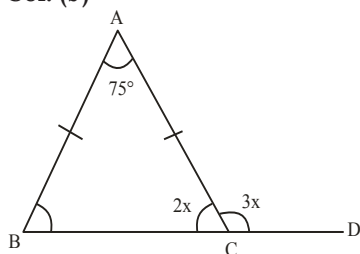
$\Rightarrow x = 180^\circ - q$

$\Rightarrow q = 180^\circ - x$

Hence, $\angle BAC = 180^\circ - 2q$

$= 180^\circ - 2(180^\circ - x) = 2x - 180^\circ$

5. Sol. (b)



From the given figure, we have:

$2x + 3x = 180^\circ$ (linear pairs are always supplementary)

$$5x = 180^\circ, x = \frac{180}{5} = 36^\circ,$$

Using exterior angle property,

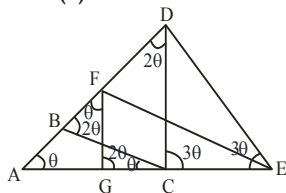
$$\angle ACD = \angle CAB + \angle ABC,$$

$$3 \times 36^\circ = 75^\circ + \angle ABC$$

$$108^\circ = 75^\circ + \angle ABC$$

$$\angle ABC = 108^\circ - 75^\circ = 33^\circ$$

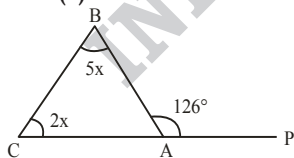
6. Sol. (a)



$$7\theta = 180^\circ$$

$$\theta = \frac{180^\circ}{7}$$

7. Sol. (a)



As we know that exterior angle of a Δ equal to sum of its interior opposite angles

Let the $\angle B$ and $\angle C$ be $5x$ and $2x$

$$5x + 2x = 126^\circ \Rightarrow 7x = 126^\circ$$

$$\Rightarrow x = \frac{126^\circ}{7} = 18^\circ$$

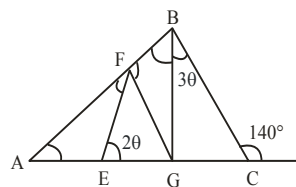
$$\angle B = 18^\circ \times 5 = 90^\circ, \angle C = 18^\circ \times 2 = 36^\circ$$

8. Sol. (b)

$$\angle EAF = \angle EFA = \theta$$

$$(AE = EF \text{ and } \angle FEG = 2\theta)$$

$$\angle FEG = \angle FGE = 2\theta (\because EF = FG)$$



In ΔAFG

$$\Rightarrow \angle GFB = 2\theta + \theta = 3\theta$$

$$\Rightarrow \angle GFB = \angle GBF = 3\theta$$

$$(\because FG = GB)$$

Now In ΔABC

$$\Rightarrow \theta + 6\theta = 140^\circ$$

$$\Rightarrow \theta = 20^\circ$$

9. Sol. (c)

Since, $l \parallel m$. then,

$$\angle C = 110^\circ \text{ (corresponding angles)}$$

$\angle a + \angle c = 180^\circ$ (linear pair of angles is always supplementary)

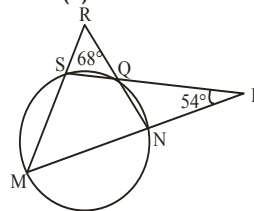
$$\text{So, } \angle a = 180^\circ - 110^\circ = 70^\circ$$

Now, $\angle b$ is the exterior angle of the triangle formed in the given figure :

$$\angle a + 40^\circ = \angle b \text{ (exterior angle property)}$$

$$70^\circ + 40^\circ = \angle b \Rightarrow \angle b = 110^\circ$$

10. Sol. (a)



$$\angle NPQ = 54^\circ$$

$$\angle QRS = 68^\circ$$

$$\text{Let } \angle SMN = \theta$$

$$= \angle RQS = \theta \text{ (cyclic quadrilateral)}$$

$$\angle PSM = 68 + \theta \text{ (exterior angle)}$$

In ΔPSM

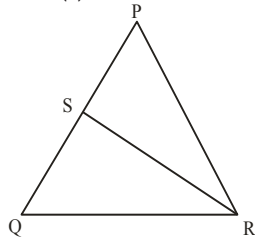
$$\Rightarrow 68 + \theta + \theta + 54^\circ = 180$$

$$2\theta = 180 - 122$$

$$2\theta = 58^\circ$$

$$\theta = 29^\circ$$

11. Sol. (c)



Given, $PQ = PR$

$$\Rightarrow \angle PQR = \angle PRQ = 2\theta$$

Given, $PS = RS = QR$

$$\Rightarrow \angle SPR = \angle SRP = \theta \text{ (let)}$$

$$\Rightarrow \angle QSR = 2\theta \text{ (exterior angle)}$$

$$\angle QSR = \angle RQS = 2\theta \text{ (QR = SR)}$$

So, in $\triangle PQR$

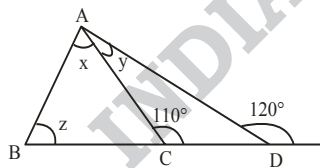
$$2\theta + 2\theta + \theta = 180^\circ$$

$$\theta = 36^\circ$$

$$\angle QPR = \theta = 36^\circ$$

12. Sol. (c)

Exterior angle Property : exterior angle is equal to Sum of two opposite interior angles .



$$x^\circ + z^\circ = 110^\circ \quad \dots (i)$$

$$y^\circ + 110^\circ = 120^\circ \quad \dots (ii)$$

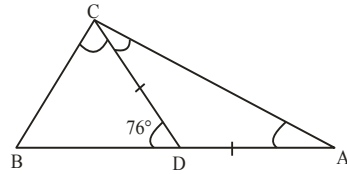
Adding eq. (i) and eq. (ii), we get

$$\Rightarrow x^\circ + y^\circ + z^\circ + 110^\circ = 230^\circ$$

$$\Rightarrow x^\circ + y^\circ + z^\circ = 120^\circ$$

13. Sol. (d)

Exterior angle of a triangle is equal to Sum of two opposite interior angles.



In $\triangle CDA$

$$\angle DCA = \angle DAC \quad \dots (DC = DA)$$

$$\angle DCA + \angle DAC = 76^\circ \quad \text{(exterior angle)}$$

$$x^\circ + x^\circ = 76^\circ \Rightarrow x^\circ = 38^\circ$$

$$\text{Now, } \angle DCA = \angle DCB = 38^\circ$$

(AD is angle bisector of $\angle A$)

Now, in $\triangle CBD$

$$\angle DCB + \angle CBD + \angle BDC = 180^\circ$$

$$\Rightarrow 38^\circ + \angle CBD + 76^\circ = 180^\circ$$

$$\Rightarrow \angle CBD = 66^\circ$$

14. Sol. (d)

Let $\angle ABC = \angle ACB = x$ (ABC is an isosceles $\triangle$)

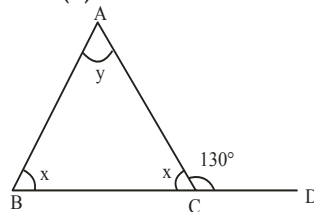
Then, $\angle A = (180^\circ - 2x)$ (using angle sum property)

Now, $\angle ACD = \angle ABC + \angle BAC$ (exterior sum property)

$$125^\circ = x + 180 - 2x \Rightarrow x = 180 - 125 = 55^\circ$$

$$\text{So, } \angle A = (180^\circ - 2x) = 180^\circ - 110^\circ = 70^\circ$$

15. Sol. (d)



$AB = AC$ and $\angle ACD = 130^\circ$,

$$x + y = 130 \quad \dots (i)$$

$$2x + y = 180 \quad \dots (ii)$$

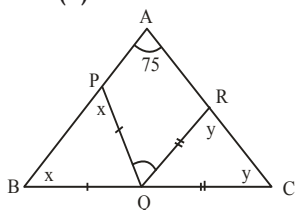
By solving eq. (i) and (ii)

$$\text{we get, } x = 50^\circ$$

$$\text{and } y = 80^\circ$$

$$\text{Then, } \angle BAC = 80^\circ$$

16. Sol. (b)



As $BQ = PQ$, $\angle BPQ = \angle PBQ = x$,

As $QC = QR$, $\angle QRC = \angle QCR = y$,

In triangle ABC, $75 + x + y = 180$.

$$\Rightarrow x + y = 105$$

In $\triangle PQB$ and $\triangle RQC$,

$$x + x + \angle PQB + y + y + \angle RQC = 360$$

$$2(x + y) + \angle PQB + \angle RQC = 360$$

$$210 + \angle PQB + \angle RQC = 360$$

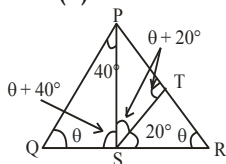
$$\angle PQB + \angle RQC = 150$$

Now as BC is a straight line,

$$\angle PQB + \angle RQC + \angle PQR = 180$$

$$\angle PQR = 180 - 150 = 30^\circ$$

17. Sol. (b)



Let $\angle PQR = \angle PRQ = \theta$

$\therefore$ Exterior angle PTS of $\triangle TSR$

$$= \theta + 20^\circ$$

In $\triangle PTS$, $PS = PT$

$$\angle PST = \angle PTS$$

$$= \theta + 20^\circ$$

$$\angle PSR = \theta + 20 + 20 = \theta + 40^\circ$$

$\angle PSR$ is exterior angle of $\triangle PQS$

$$\therefore Q + \angle QPS = Q + 40^\circ$$

$$\angle QPS = 40^\circ$$

18. Sol. (d)

In $\triangle ABC$

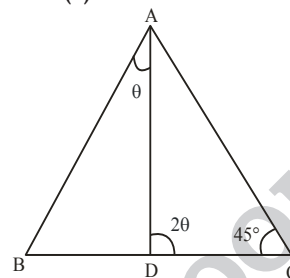
$$3\alpha + 3\beta = 180^\circ$$

$$\alpha + \beta = 60^\circ$$

$$x = 2\alpha + 2\beta$$

$$x = 2(60^\circ) = 120^\circ$$

19. Sol. (a)



Let $\angle BAD = \theta$, $\angle ADC = 20^\circ$

$$\angle C = 45^\circ, \angle BAC = 77^\circ$$

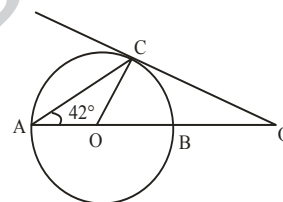
$$\angle ABC = 180^\circ - 77^\circ - 45^\circ = 58^\circ$$

$$58^\circ + \theta = 20^\circ \text{ (By external angle theorem)}$$

$$\theta = 58^\circ, \angle ADB = 180^\circ - 116^\circ = 64^\circ$$

20. Sol. (c)

$\angle CAB = 42^\circ$ and AB is the diameter of a circle. Join OC.



In $\triangle OCA$, $OC = OA = \text{radius}$

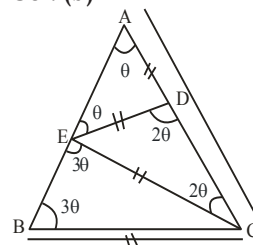
Thus, $\angle CAC = \angle OCA = 42^\circ$

$$\angle COB = \angle CAB + \angle OCA = 84^\circ$$

CQ is a tangent, therefore, OC is perpendicular to CQ.

$$\text{In } \triangle OCQ, \angle CQB = (90 - 84)^\circ = 6^\circ$$

21. Sol. (b)



$\angle EDC: 2\theta$ (by Ext. Prop.)

In $\triangle AEC$

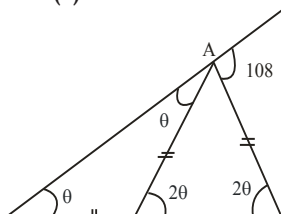
$$\angle BEC = 3\theta \text{ (by Ext. Prop)}$$

$$\angle A : \angle B$$

$$\theta : 3\theta$$

$$1 : 3$$

22. Sol (a)



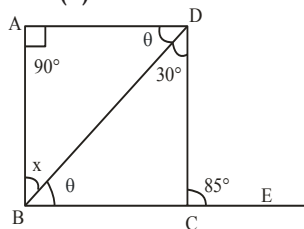
$$2\theta + \theta = 108$$

$$3\theta = 108$$

$$\theta = 36$$

$$\therefore \angle C = 2\theta = 2 \times 36 = 72^\circ$$

23. Sol. (b)



$$\text{Let } \angle ADB = \theta$$

$$\therefore AD \parallel BE$$

$$\therefore \angle CBD = \theta \text{ (alternate angle)}$$

$$\therefore \theta + 30^\circ = 85^\circ \text{ [Sum of interior opposite angle]}$$

$$\Rightarrow \theta = 55^\circ$$

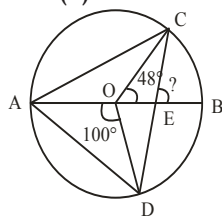
$$\text{In } \triangle ABD,$$

$$90^\circ + \theta + x = 180^\circ$$

$$\text{or, } 90^\circ + 55^\circ + x = 180^\circ$$

$$\therefore x = 35^\circ$$

24. Sol. (b)



$$\angle BOC = 48^\circ \text{ and } \angle AOD = 100^\circ$$

$$\angle BAC = \frac{1}{2} \times \angle BOC$$

$$\angle BAC = \frac{1}{2} \times 48 = 24$$

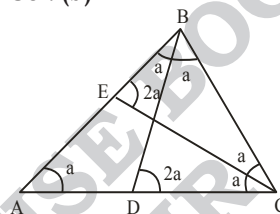
$$\angle ACE = \frac{1}{2} \times \angle AOD$$

$$\angle ACE = \frac{1}{2} \times 100 = 50$$

$$\angle CEB = \angle BAC + \angle ACE \text{ (external opposite angle)}$$

$$= 24^\circ + 50^\circ = 74^\circ$$

25. Sol. (b)



$$\text{Let } \angle BAC = a$$

$$\text{Then}$$

$$\angle DBA = a (\because AD = DB)$$

$$\text{And}$$

$$\angle ECA = a (\because AE = EC)$$

$$\text{In } \triangle ADB$$

$$\angle BDC = 2a$$

$$\Rightarrow \angle BCE = a (\because BD = BC)$$

$$\text{In } \triangle AEC$$

$$\angle CEB = 2a$$

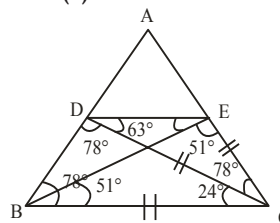
$$\Rightarrow \angle DBC = a (\because CE = BC)$$

$$\text{In } \triangle ABC$$

$$\Rightarrow 5a = 180^\circ$$

$$\Rightarrow a = 36^\circ$$

26. Sol. (a)



$$\angle B = \angle C \text{ (given)}$$

$$\angle BED = ?$$

↓

$$63 - 51 = 12^\circ$$

27. Sol. (b)

PR = QS = QR (given)

$\angle QTR = \theta$ (let)

$\angle QPT = \theta - 40^\circ$ (by Ext. prop.)

$\angle RST = \theta - 50^\circ$ (by ext. prop.)

$\angle QPR = \angle PQR$ (PR = QR)

$\angle PQR = \theta - 40^\circ$

$\angle SQR = \theta - 80^\circ$

Similarly, $\angle PRQ = \theta - 100^\circ$

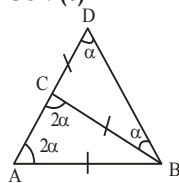
In $\triangle QTR$

$$3\theta - 180 = 180$$

$$3\theta = 360$$

$$\theta = 120^\circ,$$

28. Sol. (c)



Let $\angle ADB = \alpha$

$\angle CDB = \angle CBD = \alpha$ [$\because CD = BC$]

$\angle ACB = 2\alpha$ (Exterior Angle of $\triangle DCB$)

$\angle ACB = \angle CAB = 2\alpha$ [$\because BC = AB$]

Now

$\angle DAB = \angle DBA = 2\alpha$ ($\because AD = BD$)

In $\triangle ABD$

$$5\alpha = 180^\circ$$

$$\angle ADB = \alpha = 36^\circ$$

$$\angle DAB = 2\alpha = 2 \times 36^\circ = 72^\circ$$

$\angle DCB = 3\alpha$ (Exterior angle of $\triangle ABC$)

$$= 3 \times 36^\circ = 108^\circ$$

29. Sol. (c)

$\angle CBD = 80^\circ$ (exterior angle)

In quadrilateral BCED

$$\angle CED = 360^\circ - (80^\circ + 45^\circ + 35^\circ)$$

$$\angle CED = 200^\circ \text{ (it is a reflex angle)}$$

$$\text{Obtuse angle } (\angle CED) = 360^\circ - 200^\circ = 160^\circ$$

30. Sol. (c)

We know the exterior angle is equal to the sum of interior opposite angles.

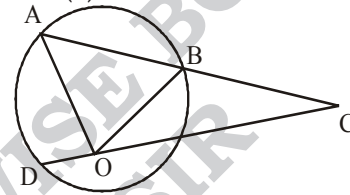
Here, exterior angle = 115° and Corresponding

interior opposite angles = $2:3$ or $2x$ and $3x$

$$115 = 2x + 3x \Rightarrow 5x = 115^\circ \Rightarrow x = 23^\circ$$

$$\text{Greatest angle} = 3x = 3 \times 23^\circ = 69^\circ$$

31. Sol. (d)



$OB = r = BC$

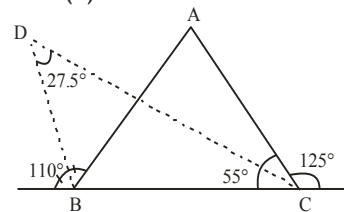
$$\angle ACD = 32^\circ, \angle ACD = \angle BOC = 32^\circ$$

Thus, $\angle ABO = 64^\circ$ (exterior

angle property) $\angle ABO = \angle OAB = 64^\circ$

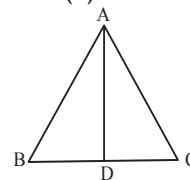
$$\angle AOD = \angle ACO + \angle OAC = 32^\circ + 64^\circ = 96^\circ$$

32. Sol. (b)



$$\angle BDC = 27.5$$

33. Sol. (d)



$$\text{Given, } \angle BAD = \frac{1}{2} \times \angle ADC$$

$$\angle BAC = 87^\circ \text{ and } \angle C = 42^\circ$$

$$\angle B = 180^\circ - \angle BAC - \angle C$$

$$= 180^\circ - 87^\circ - 42^\circ = 51^\circ$$

$$\angle BAD + \angle B = \angle ADC$$

(external opposite angle)

$$\angle BAD + 51^\circ = 102^\circ$$

$$\angle BAD = 51^\circ$$

$$\angle ADB = 180^\circ - \angle BAD - \angle ABD$$

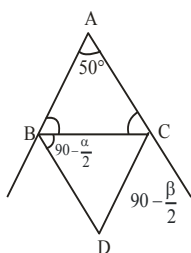
$$= 180^\circ - 51^\circ - 51^\circ = 78^\circ$$

34. (b)

Let In $\triangle ABC$, $\angle B = \alpha$ and $\angle ACB = \beta$ and $\angle A = 50^\circ$

(given) so, in $\triangle ABC$, $\alpha + \beta + 50 = 180^\circ$ $\alpha + \beta = 130^\circ$

As BD and CD bisect exterior angle $\angle B$ and $\angle C$ respectively.



$$\text{then, } \angle DBC = 90^\circ - \frac{\alpha}{2}$$

$$\text{and } \angle DCB = 90^\circ - \frac{\beta}{2}$$

Again, In $\triangle BDC$, sum of angles = 180°

$$\therefore \angle D + 90^\circ - \frac{\alpha}{2} + 90^\circ - \frac{\beta}{2} = 180^\circ$$

$$\angle D - \left(\frac{\alpha + \beta}{2}\right) = 0 \Rightarrow \angle D = \left(\frac{\alpha + \beta}{2}\right)$$

$$\text{From } \triangle ABC, \alpha + \beta + 50^\circ = 180^\circ$$

$$\therefore \alpha + \beta = 130^\circ$$

$$\angle D = \left(\frac{\alpha + \beta}{2}\right) = \frac{130^\circ}{2} = 65^\circ$$

Type-3 (Area of Triangle)

1. If areas of similar triangles $\triangle ABC$ and $\triangle DEF$ are $x^2 \text{ cm}^2$ and $y^2 \text{ cm}^2$ respectively, and $EF = a \text{ cm}$, then BC (in cm) is:

यदि समरूप त्रिभुजों $\triangle ABC$ और $\triangle DEF$ का क्षेत्रफल क्रमशः x^2 सेमी² और y^2 सेमी² है, और $EF = a$ सेमी है, तो BC (सेमी में) है:

SSC CGL 2023 (2nd Shift)

- (a) $\frac{y^2}{a^2 x^2}$ (b) $\frac{y}{ax}$ (c) $\frac{ax}{y}$ (d) $\frac{a^2 x^2}{y^2}$

2. If the ratio of corresponding sides of two similar triangles is $\sqrt{5} : \sqrt{7}$ then what is the ratio of the area of the two triangles?

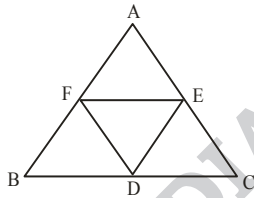
यदि दो समरूप त्रिभुजों की संगत भुजाओं का अनुपात $\sqrt{5} : \sqrt{7}$ है तो दोनों त्रिभुजों के क्षेत्रफल का अनुपात क्या है?

SSC CGL 09/12/2022 (4th Shift)

- (a) $\sqrt[3]{5} : \sqrt{7}$ (b) 25 : 49
(c) $\sqrt{5} : \sqrt{7}$ (d) 5 : 7

3. $AB : BF = 4 : 1$, $AE : EC = 2 : 5$ and $BD : DC = 2 : 3$ If area of $\triangle DEF = 144 \text{ cm}^2$. Find area of $\triangle ABC$?

$AB : BF = 4 : 1$, $AE : EC = 2 : 5$ और $BD : DC = 2 : 3$. यदि $\triangle DEF$ का क्षेत्रफल = 144 cm^2 तब $\triangle ABC$ का क्षेत्रफल ज्ञात करें।



- (a) 420 cm^2 (b) 630 cm^2
(c) 490 cm^2 (d) 560 cm^2

4. If the ratio of corresponding sides of two similar triangles is $\sqrt{3} : \sqrt{2}$ then what is the ratio of the area of the two triangles?

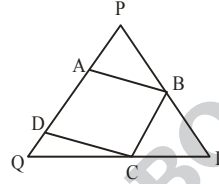
यदि दो समरूप त्रिभुजों की संगत भुजाओं का अनुपात $\sqrt{3} : \sqrt{2}$ है तो दोनों त्रिभुजों के क्षेत्रफल का अनुपात क्या है?

SSC CGL 02/12/2022 (3rd Shift)

- (a) 3 : 2 (b) 9 : 4
(c) $\sqrt{3} : \sqrt{2}$ (d) 27 : 8

- Q.5. In the given figure, PQR is a triangle and Quadrilateral $ABCD$ is inscribed in it. $QD = 2 \text{ cm}$, $QC = 5 \text{ cm}$, $CR = 3 \text{ cm}$, $BR = 4 \text{ cm}$, $PB = 6 \text{ cm}$, $PA = 5 \text{ cm}$ and $AD = 3 \text{ cm}$. What is the area of $\triangle ABCD$?

दिये गये चित्र में, PQR एक त्रिभुज है जिसके अंदर एक चतुर्भुज $ABCD$ बनाया गया है। यदि $QD = 2 \text{ cm}$, $QC = 5 \text{ cm}$, $CR = 3 \text{ cm}$, $BR = 4 \text{ cm}$, $PB = 6 \text{ cm}$, $PA = 5 \text{ cm}$ और $AD = 3 \text{ cm}$ तो चतुर्भुज $ABCD$ का क्षेत्रफल क्या होगा?



- (a) $\frac{(23\sqrt{21})}{4}$ (b) $\frac{(15\sqrt{21})}{4}$
(c) $\frac{(17\sqrt{21})}{5}$ (d) $\frac{(23\sqrt{21})}{5}$

6. In a triangle ABC , $AB = AC$ and BC is produced to D such that $\angle ACD = x$, then what is $\angle BAC$ equal to?

त्रिभुज ABC में, $AB = AC$ और BC को D तक इस प्रकार बढ़ाया गया है कि $\angle ACD = x$ है, तो $\angle BAC$ किसके बराबर है?

[CDS-2022-I]

- (a) $2x - 90^\circ$ (b) $2x - 180^\circ$
(c) $180^\circ - 2x$ (d) $\frac{x}{2}$

7. In a $\triangle ABC$, $\angle A = 60^\circ$, $AB = 3 \text{ cm}$ $AC = 4 \text{ cm}$. Find the length of Angle bisector AD .

$\triangle ABC$ में, $\angle A = 60^\circ$, $AB = 3$ सेमी $AC = 4$ सेमी। कोण के समद्विभाजक AD की लंबाई ज्ञात कीजिए।

- (a) $\frac{12\sqrt{3}}{7} \text{ cm}$ (b) $\frac{13\sqrt{3}}{7} \text{ cm}$
(c) $\frac{9\sqrt{3}}{4} \text{ cm}$ (d) $\frac{23\sqrt{3}}{4} \text{ cm}$

8. The area of similar triangles $\triangle PQR$ and $\triangle MNT$ are 196 cm^2 and 169 cm^2 respectively. If the longest side of the larger $\triangle PQR$ be 28 cm then what is the length (in cm) of the longest side of the smaller $\triangle MNT$?

समरूप त्रिभुजों $\triangle PQR$ और $\triangle MNT$ का क्षेत्रफल क्रमशः 196 सेमी² और 169 सेमी² है। यदि बड़े $\triangle PQR$ की सबसे लंबी भुजा 28 सेमी है तो छोटे $\triangle MNT$ की सबसे लंबी भुजा की लंबाई (सेमी में) क्या है?

SSC CGL 18/4/2022 (Evening)

- (a) 26 (b) 24 (c) 25 (d) 27

9. The area of a right-angled triangle is 42 cm^2 . If the length of one of its two sides containing the right angle is 10 cm , find the length (in cm) of the other side that contain the right angle.

एक समकोण त्रिभुज का क्षेत्रफल 42 सेमी² है। यदि समकोण वाली इसकी दो भुजाओं में से एक की लंबाई 10 सेमी है, तो समकोण वाली दूसरी भुजा की लंबाई (सेमी में) ज्ञात कीजिए।

SSC CHSL 06/06/2022 (Evening)

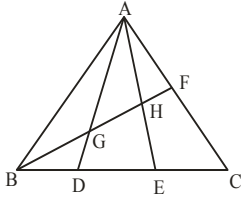
- (a) 4.0 (b) 8.0 (c) 8.4 (d) 4.8

10. Find the area of the triangle whose sides are 5 cm, 12 cm and 13 cm.
उस त्रिभुज का क्षेत्रफल ज्ञात कीजिए जिसकी भुजाएँ 5 सेमी, 12 सेमी और 13 सेमी हैं।

SSC CHSL 26/05/2022 (Afternoon)

- (a) 30 cm² (b) 33 cm²
(c) 15 cm² (d) 25 cm²

11. In the given figure, $BD = DE = EC$ and $AF = FC$ and if area of $\triangle ABC = 60 \text{ cm}^2$, then.
दी गई आकृति, $BD = DE = EC$ और $AF = FC$ और यदि $\triangle ABC$ का क्षेत्रफल = 60 सेमी² है, तो।



Find the area of $\triangle BDG$.

$\triangle BDG$ का क्षेत्रफल ज्ञात कीजिए।

- (a) 3 cm² (b) 5 cm²
(c) 7 cm² (d) 9 cm²

12. Find the area of triangle whose length of all three altitudes are 20 cm, 28 cm and 35 cm ?
उस त्रिभुज का क्षेत्रफल ज्ञात कीजिए जिसके तीनों शीर्षलंबों की लंबाई 20 सेमी, 28 सेमी और 35 सेमी है?

- (a) $\frac{1225}{\sqrt{6}}$ (b) $\frac{1225}{\sqrt{7}}$ (c) $\frac{2025}{\sqrt{11}}$ (d) $\frac{625}{\sqrt{5}}$

13. If the ratio of area of two similar triangles is $\sqrt{3}:\sqrt{2}$ then what is the ratio of the corresponding sides of the two triangles?

यदि दो समरूप त्रिभुजों के क्षेत्रफल का अनुपात $\sqrt{3}:\sqrt{2}$ है तो दोनों त्रिभुजों की संगत भुजाओं का अनुपात क्या है?

SSC CGL 05/12/2022 (2nd Shift)

- (a) 9:4 (b) 3:2
(c) $\sqrt[3]{3}:\sqrt[3]{2}$ (d) $\sqrt[4]{3}:\sqrt[4]{2}$

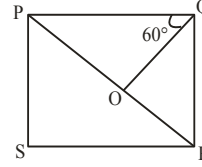
14. If XY and PQ divide the triangle into three equal areas, then find $AX:XP:PB$.

यदि XY और PQ त्रिभुज को तीन बराबर क्षेत्रों में विभाजित करते हैं, तो $AX:XP:PB$ ज्ञात करें।

- (a) 1:1:1 (b) $1:\sqrt{2}:\sqrt{3}$
(c) $1:\sqrt{2}-1:\sqrt{3}-\sqrt{2}$ (d) $1:\sqrt{3}-1:\sqrt{3}-\sqrt{2}$

15. In the given figure. PQRS is a square of sides 8 cm. $\angle PQO = 60^\circ$, what is the area (in cm²) of the triangle POQ. ?

दी गयी आकृति में, 8 सेमी² भुजा वाला एक वर्ग है जिसमें $\angle PQO = 60^\circ$. तो त्रिभुज POQ का क्षेत्रफल क्या है?



- (a) $32\sqrt{3}$ (b) $24(\sqrt{3}-1)$
(c) $48(\sqrt{3}-1)$ (d) $16(3-\sqrt{3})$

16. In a $\triangle PQR$, $\angle PQR = 120^\circ$, S is a point on side PR such that $\angle PQS = 75^\circ$. if $PQ = 16 \text{ cm}$ and $QR = 15 \text{ cm}$, then find the length of QS ?.

त्रिभुज PQR में $\angle PQR = 120^\circ$, भुजा PR पर एक बिंदु S इस प्रकार स्थित है कि $\angle PQS = 75^\circ$ और $PQ = 16$ सेमी², $QR = 15$ सेमी², तब QS की लंबाई ज्ञात करो ?

- (a) $120\sqrt{6}/23 + 8\sqrt{3}$ (b) $124\sqrt{6} \mid 27 + 11\sqrt{3}$
(c) $240\sqrt{2} \mid 31 + 8\sqrt{2}$ (d) $120\sqrt{3}/15.5 + 7\sqrt{3}$

17. In $\triangle ABC$, $AB = AC$ and AL is perpendicular to BC at L . In $\triangle DEF$, $DE = DF$ and DM is perpendicular to EF at M . If (area of $\triangle ABC$) : (area of $\triangle DEF$) = 9:25, then $\frac{DM+AL}{DM-AL}$ is equal to:

$\triangle ABC$ में, $AB = AC$ और AL , L पर BC पर लंबवत है। $\triangle DEF$ में, $DE = DF$ और DM , M पर EF पर लंबवत है। यदि $(\triangle ABC \text{ का क्षेत्रफल}) : (\triangle DEF \text{ का क्षेत्रफल}) = 9:25$, तो $\frac{DM+AL}{DM-AL}$ इसके बराबर है:

SSC CGL 3/03/2020 (Afternoon)

- (a) 6 (b) 4 (c) 3 (d) 5

18. AD is the median of the triangle ABC . If P is any point on AD , then which one of the following is correct?

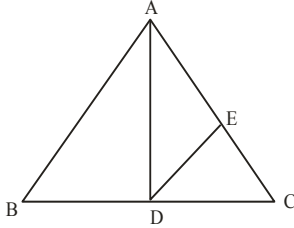
AD त्रिभुज ABC की माधिका है। यदि P , AD पर कोई बिंदु है, तो निम्नलिखित में से कौन सा सही है?

[CDS - 2020-II]

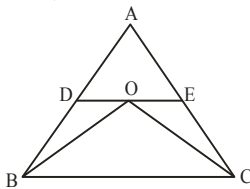
- (a) Area of triangle PAB is greater than the area of triangle PAC त्रिभुज PAB का क्षेत्रफल त्रिभुज PAC के क्षेत्रफल से अधिक है
(b) Area of triangle PAB is equal to area of triangle PAC त्रिभुज PAB का क्षेत्रफल त्रिभुज PAC के क्षेत्रफल के बराबर है
(c) Area of triangle PAB is one-fourth of the area of triangle PAC त्रिभुज PAB का क्षेत्रफल त्रिभुज PAC के क्षेत्रफल का एक-चौथाई है

(d) Area of triangle PAB is half of the area of triangle PAC त्रिभुज PAB का क्षेत्रफल त्रिभुज PAC के क्षेत्रफल का आधा है

19. If $BD:DC = 1:3$ and $AE:EC = 5:2$ $\frac{Ar(\triangle EDC)}{Ar(\triangle ABC)} = ?$
यदि $BD:DC = 1:3$ और $AE:EC = 5:2$ $\frac{Ar(\triangle EDC)}{Ar(\triangle ABC)} = ?$



- (a) $3/14$ (b) $5/14$ (c) $5/12$ (d) $7/15$
20. In $\triangle ABC$, the medians AD, BE and CF meet at O . What is the ratio of the area of $\triangle ABD$ to the area of $\triangle AOE$?
 $\triangle ABC$ में, माधिकाएँ AD, BE और CF O पर मिलती हैं। $\triangle ABD$ के क्षेत्रफल का $\triangle AOE$ के क्षेत्रफल से अनुपात क्या है?
SSE CGL TIER II (12/09/2019)
(a) $2:1$ (b) $3:1$ (c) $5:2$ (d) $3:2$
21. In a Triangle PQR, S and T are the points on PQ and PR respectively. If ST is perpendicular to PR , area of triangle PQR is 320 cm^2 , $PR = 28 \text{ cm}$, $QS:PS = 9:7$, $PT:PR = 2:5$ then find the length of ST ?
त्रिभुज PQR में, S और T दो बिंदु क्रमशः भुजा PQ और भुजा PR पर स्थित हैं तथा भुजा ST भुजा PR पर लम्ब है यदि त्रिभुज PQR का क्षेत्रफल 320 वर्ग सेमी है तथा $PR = 28 \text{ cm}$, $QS:PS = 9:7$, $PT:TR = 2:5$ तब ST की लम्बाई ज्ञात करो ?
(a) 8 cm (b) 10 cm
(c) 12 cm (d) 6 cm
22. In $\triangle ABC, D$ & E are two points on AB and AC such that $AD:DB = 1:3$ & $EC:EA = 1:3$. O is the mid point of DE . Find out ratio of area of $\triangle BOC$ to $\triangle ABC$.
 $\triangle ABC$ में D, E क्रमशः AB तथा AC पर इस प्रकार स्थित हैं की $AD:DB = 1:3$ तथा $EC:EA = 1:3$. O भुजा DE का मध्य बिन्दु है। तो $\triangle BOC$ तथा $\triangle ABC$ के क्षेत्रफलों का अनुपात क्या होगा।



- (a) $1:2$ (b) $2:1$ (c) $5:4$ (d) None

23. $\triangle ABC$ is a right angled triangle $\triangle PBA$, $\triangle QBC$ and $\triangle RAC$ are equilateral triangle. If the area of PAB is 32 cm^2 and area of $\triangle RAC$ is 78 cm^2 . Find the area of $\triangle QBC$.

$\triangle ABC$ एक समकोण त्रिभुज PBA है, $\triangle QBC$ और $\triangle RAC$ समबाहु त्रिभुज हैं। यदि PAB का क्षेत्रफल 32 सेमी² है और $\triangle RAC$ का क्षेत्रफल 78 सेमी² है। $\triangle QBC$ का क्षेत्रफल ज्ञात कीजिए।

- (a) 46 cm^2 (b) 18 cm^2
(c) 27 cm^2 (d) 35 cm^2

24. Let two lines p and q be parallel. Consider two points B and C on the line p and two points D and E on the line q . The line through B and E intersects the line through C and D at A in between the two lines p and q . If $AC:AD = 4:9$, then what is the ratio of area of triangle ABC to that of triangle ADE ?

मान लीजिए दो रेखाएँ p और q समानांतर हैं। रेखा p पर दो बिंदु B और C और रेखा q पर दो बिंदु D और E पर विचार करें। B और E से होकर जाने वाली रेखा C और D से होकर जाने वाली रेखा को दो रेखाओं p और q के बीच A पर काटती है। यदि $AC:AD = 4:9$ है, तो त्रिभुज ABC और त्रिभुज ADE के क्षेत्रफल का अनुपात क्या है?

- (a) $2:3$ (b) $4:9$ (c) $16:81$ (d) $1:2$

25. In $\triangle ABC, AB = 8 \text{ cm}, AC = 12 \text{ cm}, AD$ is angle bisector of $\angle BAC$. If $\angle BAC = 60^\circ$. What is the length of AD .

त्रिभुज ABC में $AD, \angle BAC$ का कोण समद्विभाजक है। $\angle BAC = 60^\circ, AB = 8 \text{ cm}$ और $AC = 12 \text{ cm}$ तो AD की लम्बाई क्या है।

- (a) $\frac{32\sqrt{3}}{5} \text{ cm}$ (b) $\frac{20\sqrt{3}}{3} \text{ cm}$
(c) $\frac{25\sqrt{3}}{7} \text{ cm}$ (d) $\frac{24\sqrt{3}}{5} \text{ cm}$

26. In $\triangle ABC, AD$ is the median and G is a point on AD such that $AG:GD = 2:1$, then $ar(\triangle BDG):(\triangle ABC)$ is equal to :

$\triangle ABC$ में, AD माधिका है और G, AD पर एक बिंदु है जैसे कि $AG:GD = 2:1$, तो $ar(\triangle BDG):(\triangle ABC)$ बराबर है:

- SSC CGL 10/06/2019 (Afternoon)**
(a) $1:4$ (b) $1:9$ (c) $1:6$ (d) $1:3$

Type 3 (Area of Triangle) Answer Key

1	(c)	2	(d)	3	(d)	4	(a)	5	(c)	6	(b)	7	(a)
8	(a)	9	(c)	10	(a)	11	(b)	12	(a)	13	(d)	14	(c)
15	(d)	16	(a)	17	(b)	18	(b)	19	(a)	20	(b)	21	(b)
22	(a)	23	(a)	25	(c)	26	(d)	27	(c)	28	(b)		

Type-3 (Area of Triangle) Solution

1. Sol. (c)

Given that $\triangle ABC$ and $\triangle DEF$ are similar Triangle,

Then,

$$\frac{AB}{DE} = \frac{BC}{EF} = \frac{CA}{FD} = \frac{\sqrt{\text{ar} \cdot \triangle ABC}}{\sqrt{\text{ar} \cdot \triangle DEF}}$$

According to question,

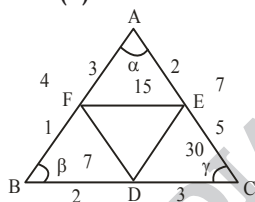
$$\sqrt{\frac{x^2}{y^2}} = \frac{BC}{a} \Rightarrow BC = \frac{ax}{y}$$

2. Sol. (d)

The area of ($\triangle 1$)
The area of ($\triangle 2$)

$$= \left(\frac{\sqrt{5}}{\sqrt{7}}\right)^2 = \frac{5}{7}$$

3. Sol. (d)



Given

$$AB:BF = 4:1$$

$$AE:EC = 2:5$$

$$BD:DC = 2:3$$

$$\text{Ar}(\triangle DEF) = 144 \text{ cm}^2$$

$$\text{Ar}(\triangle ABC) \Rightarrow ?$$

$$18 \xrightarrow{\times 8} 144$$

$$70 \xrightarrow{\times 8} 560 \text{ Ar}(\triangle ABC) = 560 \text{ cm}^2$$

4. Sol. (a)

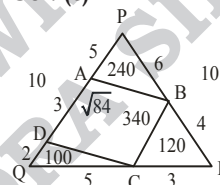
Theorem :- If two triangles are similar, then the ratio of area of both triangles is proportional to the square of the ratio of their corresponding sides.

$$\frac{\text{ar} \cdot \triangle ABC}{\text{ar} \cdot \triangle PQR} = \frac{AB^2}{PQ^2} = \frac{BC^2}{QR^2} = \frac{CA^2}{RP^2}$$

Here,

$$\frac{\text{ar} \cdot \triangle ABC}{\text{ar} \cdot \triangle PQR} = \frac{(\sqrt{3})^2}{(\sqrt{2})^2} = \frac{3}{2}$$

5. Sol. (c)



$$\text{Ar}(ABCD) = ?$$

$$A = \frac{1}{2} \times 8 \times 2\sqrt{21}$$

$$\Delta PQR = 8\sqrt{21} \text{ cm}^2$$

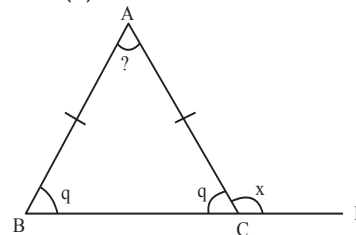
$$800(\text{let}) = 8\sqrt{21}$$

$$1 = \frac{\sqrt{21}}{100}$$

$$340 = \frac{\sqrt{21}}{100} \times 340$$

$$5 = \frac{17}{5} \sqrt{21} \text{ cm}^2$$

6. Sol. (b)



$$\angle BAC = 180^\circ - 2q$$

$$\angle ACD = \angle BAC + \angle ABC$$

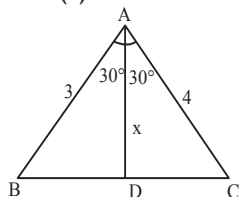
$$\Rightarrow x = 180 - 2q + q$$

$$\Rightarrow x = 180^\circ - q$$

$$\Rightarrow q = 180^\circ - x$$

$$\begin{aligned}\text{Hence, } \angle BAC &= 180^\circ - 2q \\ &= 180^\circ - 2(180^\circ - x) \\ &= 2x - 180^\circ\end{aligned}$$

7. Sol. (a)



$$\text{Area } (\triangle ABC) = \text{Area}(\triangle ABD) + \text{Area}(\triangle ACD)$$

$$\Rightarrow \frac{1}{2} \times 3 \times 4 \sin 60^\circ = \frac{1}{2} \times 3 \times x$$

$$\sin 30^\circ + \frac{1}{2} \times 4 \times x \times \sin 30^\circ$$

$$\Rightarrow 12 \times \frac{\sqrt{3}}{2} = \frac{1}{2} (3x + 4x)$$

$$\Rightarrow x = \frac{12\sqrt{3}}{7} \text{ cm}$$

8. Sol. (a)

According to the question,

$$\frac{\text{area } \triangle PQR}{\text{area } \triangle MNT} = \frac{(\text{longest side of } \triangle PQR)^2}{(\text{longest side of } \triangle MNT)^2}$$

$$\frac{196}{169} = \frac{(\text{longest side of } \triangle PQR)^2}{(\text{longest side of } \triangle MNT)^2}$$

$$\frac{14}{13} = \frac{\text{longest side of } \triangle PQR}{\text{longest side of } \triangle MNT}$$

$$\frac{14}{13} = \frac{28}{\text{longest side of } \triangle MNT}$$

$$\text{So, longest side of } \triangle MNT = 26 \text{ cm}$$

9. Sol. (c)

Let base of right angles triangle = 10 cm

$$\text{Area of triangle} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$42 = \frac{1}{2} \times 10 \times \text{Height}$$

$$\text{Height} = \frac{42 \times 2}{10} = 8.4 \text{ cm}$$

So, the length of other side that contain right angle = 8.4 cm

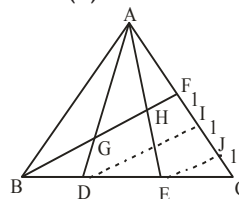
10. Sol. (a)

Sides of the triangle forms triplets i.e. $5^2 + 12^2 = 13^2$

$$\text{Area of triangle} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$= \frac{1}{2} \times 5 \times 12 = 30 \text{ cm}^2$$

11. Sol. (b)



Draw DI and EJ parallel to BF

In $\triangle BFC$

$$FI : IJ : JC = 1 : 1 : 1$$

$$(\because BD = DE = EC)$$

And

$$AF : FI : IJ : JC = 3 : 1 : 1 : 1$$

$$(\because AF = FC)$$

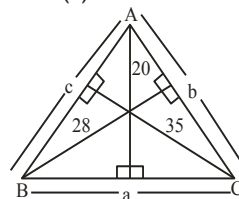
In $\triangle ADI$

$$\frac{AG}{GD} = \frac{AF}{FI} = \frac{3}{1} (\because DI \parallel GF)$$

$$\text{ar}(\triangle BGD) = \frac{1}{4} \text{ar}(\triangle ABD)$$

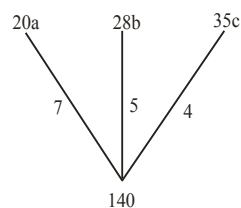
$$\text{ar}(\triangle BGD) = \frac{1}{4} \times \frac{1}{3} \text{ar}(\triangle ABC) = \frac{1}{12} \times 60 = 5 \text{ cm}^2$$

12. Sol. (a)



$$\text{Area of } \triangle ABC = \frac{1}{2} \times 20 \times a = \frac{1}{2} \times 28 \times b = \frac{1}{2} \times$$

$$35 \times c$$



$$a : b : c = 7 : 5 : 4$$

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \frac{1}{2} \times 7x \times 20$$

$$\Rightarrow \sqrt{8x \times x \times 3x \times 4x} = 7x \times 10$$

$$\Rightarrow 4\sqrt{6}x^2 = 7x \times 10$$

$$\Rightarrow x = \frac{70}{4\sqrt{6}}$$

$$\text{Area} = \frac{1}{2} \times 7 \times \frac{70}{4\sqrt{6}} \times 20 = \frac{1225}{\sqrt{6}} \text{ cm}^2$$

13. Sol. (d)

If the ratio of area of two similar triangles is a: b, then their corresponding side will be in the ratio $\sqrt{a} : \sqrt{b}$.

Here, ratio of area $\Rightarrow \sqrt{3} : \sqrt{2}$ Then, ratio of corresponding side $= \sqrt[4]{3} : \sqrt[4]{2}$

14. Sol. (c)

$$\frac{\text{ar}(\triangle AXY)}{\text{ar}(\triangle APQ)} = \left(\frac{AX}{AP}\right)^2$$

$$\Rightarrow \left(\frac{AX}{AP}\right)^2 = \frac{1}{2}$$

$$\Rightarrow \frac{AX}{AP} = \frac{1}{\sqrt{2}}$$

$$\Rightarrow \frac{AX}{XP} = \frac{1}{\sqrt{2}-1} \quad \dots(i)$$

Again

$$\frac{\text{ar}(\triangle APQ)}{\text{ar}(\triangle ABC)} = \left(\frac{AP}{AB}\right)^2$$

$$\Rightarrow \left(\frac{AP}{AB}\right)^2 = \frac{2}{3}$$

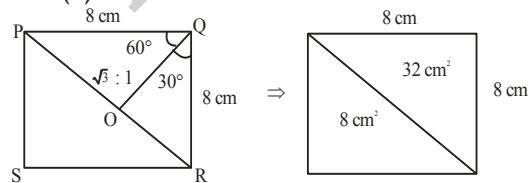
$$\Rightarrow \frac{AP}{AB} = \frac{\sqrt{2}}{\sqrt{3}}$$

$$\Rightarrow \frac{AP}{PB} = \frac{\sqrt{2}}{\sqrt{3}-\sqrt{2}} \quad \dots(ii)$$

From (i) and (ii)

$$AX:XP:PB = 1:\sqrt{2}-1:\sqrt{3}-\sqrt{2}$$

15. Sol. (d)



$$\text{Area} = 64 \text{ cm}^2$$

$$\frac{\text{Area of } \triangle PQO}{\text{Area of } \triangle RQO} = \frac{\frac{1}{2} \times 8 \times OQ \times \sin 60}{\frac{1}{2} \times 8 \times OQ \times \sin 30} = \frac{\sin 60}{\sin 30} = \frac{\sqrt{3}/2}{1/2} = \frac{\sqrt{3}}{1}$$

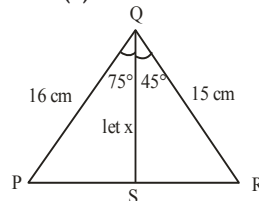
$$(\sqrt{3} + 1) \rightarrow 32$$

$$1 \rightarrow 32/\sqrt{3} + 1$$

$$\sqrt{3} \rightarrow \frac{32\sqrt{3}}{\sqrt{3}+1} \rightarrow \frac{32\sqrt{3}}{\sqrt{3}+1} \times \frac{\sqrt{3}-1}{\sqrt{3}-1} = \frac{32\sqrt{3}(\sqrt{3}-1)}{2}$$

$$= 16(3 - \sqrt{3})$$

16. Sol. (a)



$$\text{Then Area of Triangle PQR} = \frac{1}{2} \times 16 \times 15 \times \sin 120$$

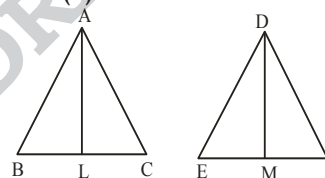
$$= \frac{1}{2} \times 16 \times x \cdot \sin 75 + \frac{1}{2} \times 15 \times x \cdot \sin 45^\circ$$

$$\frac{1}{2} \times 16 \times 15 \times \sin 120 = \frac{1}{2} \times 16 \times x \cdot \sin 75^\circ + \frac{1}{2} \times 15 \times x \cdot \sin 45^\circ$$

$$16 \times 15 \times \frac{\sqrt{3}}{2} = 16 \cdot x \cdot \frac{(\sqrt{3}+1)}{2\sqrt{2}} + 15x \cdot \frac{1}{\sqrt{2}}$$

$$120\sqrt{3} = \frac{x(8\sqrt{3}+8+15)}{\sqrt{2}} \Rightarrow x = \frac{120\sqrt{6}}{23+8\sqrt{3}}$$

17. Sol. (b)



$$\frac{\text{area (ABC)}}{\text{area (DEF)}} = \frac{9}{25} = \left(\frac{AL}{DM}\right)^2$$

$$\frac{AL}{DM} = \frac{3}{5} \text{ Then, } \frac{DM+AL}{DM-AL} = \frac{8}{2} = 4:1$$

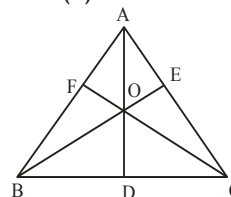
18. Sol. (b)

As median divide the sides into two equal parts.

So, area of $\triangle APB$ = Area of $\triangle APC$

19. Sol. (a)

20. Sol. (b)



$\frac{1}{6}$ of the area of the $\triangle ABC$ = Area of $\triangle ABD$ (O is centroid)

$\frac{1}{6}$ of the area of the $\triangle ABC$ = Area of $\triangle AOE$... (O is centroid)

Area of $\triangle ABD = \text{ar}\triangle ABG + \text{ar}\triangle BDG = 2 + 1 = 3$

unit

Area of $\triangle ABC = 2 \times \text{Area of } \triangle ABD$

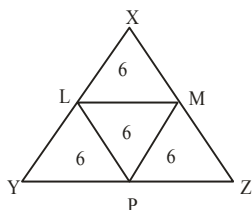
(AD is median)

$= 2 \times 3 = 6$ unit

$\text{ar}(\triangle BDG) : (\triangle ABC) = 1 : 6$

27. Sol. (b)

We know that median divides triangle in two equal parts.

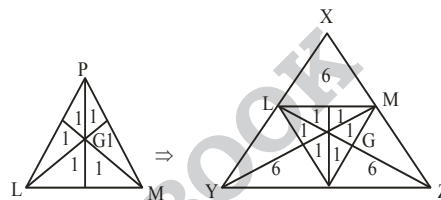


If mid points of sides of a triangle joined. Then the triangle is divided into four equal parts (areas).

Let area of each triangle $\triangle XLM = \triangle YLP = \triangle PMZ =$

$\triangle LMP = 6$ units Total area of $\triangle XYZ = 24$ units

Median divides triangle in two equal parts



Area of $\triangle GLM : \text{Area of } \triangle XYZ = 2 : 24 = 1 : 12$

Type-4 (Similarity, BPT & MPT)

1. Triangle ABC and DEF are similar. If $AB = 92$ cm, $BC = 48$ cm, $AC = 120$ cm, and the length of the smallest side of DEF is 200 cm, then find the length of the longest side of triangle DEF ?

त्रिभुज ABC और DEF समरूप हैं। यदि $AB = 92$ सेमी, $BC = 48$ सेमी, $AC = 120$ सेमी, और DEF की सबसे छोटी भुजा की लंबाई 200 सेमी है, तो त्रिभुज DEF की सबसे लंबी भुजा की लंबाई ज्ञात कीजिए?

SSC CGL/2023 (2nd Shift)

- (a) 400 cm (b) 225 cm
(c) 350 cm (d) 500 cm

2. The area of two similar triangles XYZ and ABC are 361 cm^2 and 225 cm^2 , respectively. If the longest side of the larger $\triangle XYZ$ be 38 cm, then what is the length (in cm) of the longest side of the smaller $\triangle ABC$?

दो समरूप त्रिभुजों XYZ और ABC का क्षेत्रफल क्रमशः 361 सेमी² और 225 सेमी² है। यदि बड़े $\triangle XYZ$ की सबसे लंबी भुजा 38 सेमी है, तो छोटी $\triangle ABC$ की सबसे लंबी भुजा की लंबाई (सेमी में) क्या है?

SSC CHSL 07/06/2022 (Afternoon)

- (a) 35 (b) 28 (c) 32 (d) 30

3. $\triangle ABC$ is similar to $\triangle DEF$. The perimeters of $\triangle ABC$ and $\triangle DEF$ are 40 cm and 30 cm respectively. What is the ratio of $(BC + CA)$ to $(EF + FD)$ equal to?

$\triangle ABC$, $\triangle DEF$ आपस में समरूप है। $\triangle ABC$ और $\triangle DEF$ की परिधि क्रमशः 40 सेमी और 30 सेमी है। $(BC + CA)$ से $(EF + FD)$ का अनुपात किसके बराबर है?

[CDS- 2021-I]

- (a) 5:4 (b) 4:3 (c) 3:2 (d) 2:1

4. In a $\triangle ABC$, $AB = BC$, and P, Q and R are the mid points of the sides AB, BC and AC , respectively. If $PR = 5$ cm, then find the length of QR .

$\triangle ABC$ में, $AB = BC$, और P, Q और R क्रमशः भुजाओं AB, BC और AC के मध्य बिंदु हैं। यदि $PR = 5$ सेमी है, तो QR की लंबाई ज्ञात कीजिए।

SSC CGL 05/12/2022 (4th Shift)

- (a) 5 cm (b) 2 cm (c) 7 cm (d) 4 cm

5. In a triangle ABC , point D lies on AB , and points E and F lie on BC such that DF is parallel to AC and DE is parallel to AF . if $BE = 4$ cm, $CF = 3$ cm, then find the length (in cm) of EF .

त्रिभुज ABC में, बिंदु D , AB पर स्थित है, और बिंदु E और F , BC पर इस प्रकार स्थित हैं कि DF , AC के समानांतर है और DE , AF के समानांतर है। यदि $BE = 4$ सेमी, $CF = 3$ सेमी है, तो EF की लंबाई (सेमी में) ज्ञात कीजिए।

SSC CGL 16/8/2021 (Afternoon)

- (a) 3 (b) 1.5 (c) 5 (d) 2

6. If triangles ABC and PQR are both isosceles with $AB = AC$ and $PQ = PR$, respectively. If also $AB = PQ$ and $BC = QR$ and angle $B = 50^\circ$, then what is the measure of angle R ?

यदि त्रिभुज ABC और PQR दोनों समद्विबाहु हैं, जिनमें क्रमशः $AB = AC$ और $PQ = PR$ है। यदि $AB = PQ$ और $BC = QR$ और कोण $B = 50^\circ$ है, तो कोण R का माप क्या है?

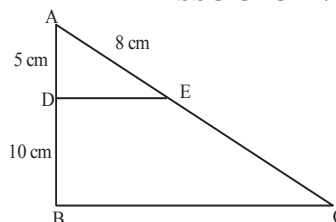
SSC CHSL 26/05/2022 (Morning)

- (a) 50° (b) 80° (c) 90° (d) 60°

7. In the given figure, $DE \parallel BC$. If $AD = 5$ cm, $DB = 10$ cm, and $AE = 8$ cm, then AC is:

दिए गए चित्र में, $DE \parallel BC$ । यदि $AD = 5$ सेमी, $DB = 10$ सेमी, और $AE = 8$ सेमी, तो AC है:

SSC CPO 11/11/2022 (Afternoon)



- (a) 24 cm (b) 32 cm
(c) 8 cm (d) 16 cm

8. The mid point of AB and AC of a $\triangle ABC$ are X and Y , respectively. If $BC + XY = 24$ units, then the value of $BC - XY$ is:

$\triangle ABC$ के AB और AC के मध्य बिंदु क्रमशः X और Y हैं। यदि $BC + XY = 24$ इकाइयाँ, तो $BC - XY$ का मान है:

SSC CGL 06/12/2022 (1st Shift)

- (a) 5 (b) 4 (c) 6 (d) 8

9. If ABC is a triangle in which $DE \parallel BC$ and $AD:DB = 9:8$, then $DE:BC$ is

यदि ABC एक त्रिभुज है जिसमें $DE \parallel BC$ और $AD:DB = 9:8$ है, तो $DE:BC$ है

SSC CHSL 03/06/2022 (Morning)

- (a) 9:17 (b) 9:15 (c) 8:17 (d) 9:13

10. ABC is a triangle in which $DE \parallel BC$ and $AD:DB = 5:4$ Then $DE:BC$ is

ABC एक त्रिभुज है जिसमें $DE \parallel BC$ और $AD:DB = 5:4$ है तो $DE:BC$ है

- (a) 4:5 (c) 4:9 (b) 9:5 (d) 5:9

11. $\triangle XYZ \sim \triangle GST$ and $XY:GS = 2:3$, XV is the median to the side YZ , and GD is the median to the side ST . The value of $\left(\frac{YV}{SD}\right)^2$ is _____

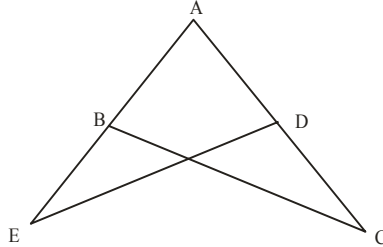
$\triangle XYZ \sim \triangle GST$ और $XY:GS = 2:3$, XV पक्ष YZ का माधिका है, और GD पक्ष ST का माधिका है। $\left(\frac{YV}{SD}\right)^2$ का मान _____ है

SSC CGL 03/12/2022 (2nd Shift)

- (a) $\frac{4}{9}$ (b) $\frac{3}{5}$ (c) $\frac{1}{4}$ (d) $\frac{2}{3}$

12. $AB = 18$ cm, $BE = 6$ cm, $CD = 11$ cm and $\angle AED = \angle ACB$. Find AD in given fig.

$AB = 18$ cm, $BE = 6$ cm, $CD = 11$ cm और $\angle AED = \angle ACB$ दिए गए चित्र में AD ज्ञात कीजिए।



- (a) 16 cm (b) 18 cm
(c) 19 cm (d) 20 cm

13. If $\triangle ABC \sim \triangle DEF$ such that $2AB = DE$ and $DE = 8$ cm, then the length of EF is:

यदि $\triangle ABC \sim \triangle DEF$ इस प्रकार है कि $2AB = DE$ और $BC = 8$ सेमी है, तो EF की लंबाई है:

SSC CGL 07/12/2022 (2nd Shift)

- (a) 16 cm (b) 18 cm
(c) 22 cm (d) 20 cm

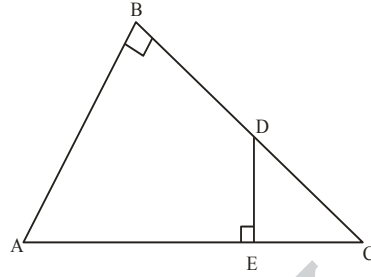
14. For a triangle ABC , D and E are two points on AB and AC such that $AD = \frac{1}{4}AB$, $AE = \frac{1}{4}AC$. If $BC = 12$ cm, then DE is

त्रिभुज ABC के लिए, D और E , AB और AC पर दो बिंदु इस प्रकार हैं कि $AD = \frac{1}{4}AB$, $AE = \frac{1}{4}AC$ है। यदि $BC = 12$ सेमी है, तो DE है

- (a) 5 cm (b) 4 cm (c) 3 cm (d) 6 cm

15. $AB = AE = 5$ cm and $BC = 12$ cm $\cdot DE = ?$

$AB = AE = 5$ cm और $BC = 12$ cm $\cdot DE = ?$



- (a) $\frac{10}{3}$ cm (b) $\frac{5}{3}$ cm
(c) 10 cm (d) 5 cm

16. Triangle BAC is similar to triangle PQR . The area of triangle BAC and triangle PQR is 25 cm^2 and 36 cm^2 respectively. If $BA = 4$ cm, then what is the length of PQ ?

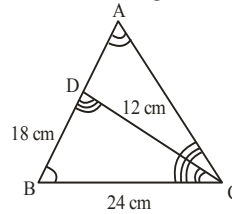
त्रिभुज BAC त्रिभुज PQR के समरूप है। त्रिभुज BAC और त्रिभुज PQR का क्षेत्रफल क्रमशः 25 सेमी^2 और 36 सेमी^2 है। यदि $BA = 4$ सेमी है, तो PQ की लंबाई क्या है?

SSC CGL Tier II 08/08/2022

- (a) 5.8 cm (b) 4.2 cm (c) 4.8 cm (d) 5 cm

17. In the given fig. $BD = 18$, $CD = 12$, $BC = 24$ then find ratio of perimeter of $\triangle ADC$ and perimeter of $\triangle BCD$.? Given that $(\angle BAC = \angle BCD)$.

दिये गये चित्र में, $\angle BAC = \angle BCD$, और $BD = 18$, $CD = 12$, $BC = 24$, तब त्रिभुज ADC और त्रिभुज BCD के परिमापों का अनुपात ज्ञात करें?



- (a) $\frac{7}{9}$ (b) $\frac{6}{7}$ (c) $\frac{13}{18}$ (d) $\frac{2}{3}$

18. In a $\triangle ABC$, D & E is on AB & AC respectively. D is the mid-point of AB , while E is the mid-point of AC . If DE is 5 cm. Find BC .

$\triangle ABC$ में D तथा E क्रमशः AB और AC के मध्य बिन्दु है, यदि $DE = 5$ cm तो BC का मान बताओ।

- (a) 10 cm (b) 12 cm
(c) 15 cm (d) 20 cm

19. $\triangle ABC \sim \triangle PQR$, The areas of $\triangle ABC$ and $\triangle PQR$ are 64 cm^2 and 81 cm^2 , respectively and AD and PT are the medians of $\triangle ABC$ and $\triangle PQR$, respectively. If $PT = 10.8$ cm, then $AD = ?$

$\triangle ABC \sim \triangle PQR$, $\triangle ABC$ और $\triangle PQR$ का क्षेत्रफल क्रमशः 64 सेमी² और 81 सेमी² है और AD और PT क्रमशः $\triangle ABC$ और $\triangle PQR$ की माधिकाएँ हैं। यदि $PT = 10.8$ सेमी, तो $AD = ?$

SSC CGL 13/8/2021 (Morning)

- (a) 8.4 (b) 9 (c) 9.6 (d) 12

20. ABCD is a trapezium in which AB is parallel to CD and $AB = 4(CD)$. The diagonals of the trapezium intersect at O . what is the ratio of area of triangle DCO to the area of the triangle ABO ?

ABCD एक समलंब है जिसमें AB , CD के समानांतर है और $AB = 4(CD)$ है। समलंब के विकर्ण O पर प्रतिच्छेद करते हैं। त्रिभुज DCO के क्षेत्रफल का त्रिभुज ABO के क्षेत्रफल से अनुपात क्या है?

- (a) 1:4 (b) 1:2 (c) 1:8 (d) 1:16

21. If S is a point on side QR of a triangle PQR such that $QS = 10$ cm, $QR = 18$ cm and $\angle PSR = \angle QPR$, then the length of PR (in cm) will be:

यदि त्रिभुज PQR की भुजा QR पर एक बिंदु S इस प्रकार है कि $QS = 10$ सेमी, $QR = 18$ सेमी और $\angle PSR = \angle QPR$ है, तो PR की लंबाई (सेमी में) होगी:

SSC CHSL 10/8/2021 (Afternoon)

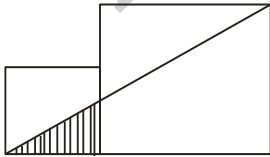
- (a) 16 (b) 12 (c) 15 (d) 14

22. In $\triangle ABC$, $\angle A = 90^\circ$ and $AD \perp BC$ where D lies on BC . If $BC = 8$ cm, $AC = 6$ cm, then area of $\triangle ABC$: area of $\triangle ACD = ?$

$\triangle ABC$ में $\angle A = 90^\circ$ और $AD \perp BC$ जहाँ D , BC पर स्थित है। यदि $BC = 8$ सेमी, $AC = 6$ सेमी, तो $\triangle ABC$ का क्षेत्रफल : $\triangle ACD$ का क्षेत्रफल = ?

- (a) 4:3 (b) 16:9 (c) 25:16 (d) 25:9

23. In given fig two squares of sides 8 cm and 20 cm are given. What is the area (in cm²) of shaded part? दिये गये चित्र में, दो वर्ग हैं, जिनकी भुजाएँ क्रमशः 8 cm तथा 20 cm हैं। छायांकित भाग का क्षेत्रफल क्या होगा।



- (a) $\frac{120}{7}$ (b) $\frac{160}{7}$ (c) $\frac{180}{7}$ (d) $\frac{240}{13}$

24. A straight line parallel to BC of $\triangle ABC$ intersects AB and AC at points P and Q respectively. $AP = QC$, $PB = 4$ units and $AQ = 9$ units, then the length of AP is :

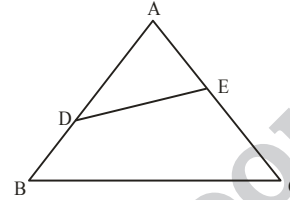
$\triangle ABC$ की BC के समानांतर एक सीधी रेखा AB और AC को क्रमशः बिंदु P और Q पर काटती है। $AP = QC$, $PB = 4$ इकाई और $AQ = 9$ इकाई, तो AP की लंबाई है:

- (a) 25 units (b) 3 units

- (c) 6 units (d) 6.5 units

25. In the given fig. if $AD = 12$ cm, $AE = 8$ cm, and $EC = 14$ cm, then What is the value (in cm) of BD ?

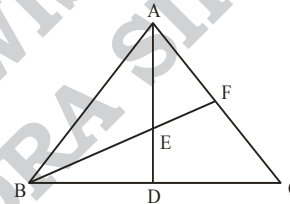
दिए गए चित्र में यदि $AD = 12$ सेमी, $AE = 8$ सेमी, और $EC = 14$ सेमी तो BD का मान (सेमी में) क्या है?



- (a) 50/3 (b) 15 (c) 8/3 (d) 47/3

26. $AE:ED = BD:DC = 3:4$, If $AC = 370$ cm. Find the length of AF .

$AE:ED = BD:DC = 3:4$, यदि $AC = 370$ सेमी. AF की लंबाई ज्ञात कीजिए।



- (a) 90 cm (b) 82 cm
(c) 160 cm (d) 120 cm

27. In $\triangle ABC$, D and E are the points on the sides AB and AC , respectively such that $\angle AED = \angle ABC$. If $AE = 6$ cm, $BD = 2$ cm, $DE = 3$ cm and $BC = 5$ cm, then $(AB + AC)$ (in cm) is equal to :

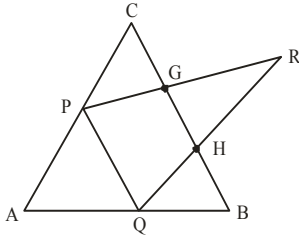
$\triangle ABC$ में, AB और AC भुजाओं पर क्रमशः D और E बिंदु इस प्रकार हैं कि $\angle AED = \angle ABC$ है। यदि $AE = 6$ सेमी, $BD = 2$ सेमी, $DE = 3$ सेमी और $BC = 5$ सेमी, तो $(AB + AC)$ (सेमी में) बराबर है:

SSC CHSL 9/8/2021 (Morning)

- (a) $\frac{86}{3}$ cm (b) $\frac{49}{3}$ cm
(c) $\frac{50}{3}$ cm (d) $\frac{70}{3}$ cm

28. In the given fig. P & Q are the mid-points of AC & AB . $PG = GR$, $HQ = HR$. What is the ratio of $Ar(\triangle PQR):Ar(\triangle ABC)$.

दिये गये चित्र में P तथा Q क्रमशः AC तथा AB के मध्य बिन्दु हैं। $PG = GR$, $HQ = HR$ तो $\triangle PQR$ तथा $\triangle ABC$ के क्षेत्रफलों का अनुपात बताओ।



- (a) 1:2 (b) 2:1 (c) 3:1 (d) 1:3

29. In $\triangle ABC$, $BC = 24$ cm and area of triangle is 120 cm^2 . if $AD \perp BC$ find the distance between mid-point of BD and AC .

त्रिभुज ABC में, $BC = 24$ सेमी० और त्रिभुज का क्षेत्रफल 120 cm^2 । यदि $AD \perp BC$ तब BD के मध्यबिंदु और AC के मध्यबिंदु के बीच की दूरी क्या है?

- (a) 12 cm (b) 13 cm
(c) 11 cm (d) $2\sqrt{30}$ cm

30. D and E are the mid-points of AB and AC of $\triangle ABC$, BC is produced to any point P ; DE , DP and EP are joined. then, area of :

D और E , AB और AC के मध्य-बिंदु हैं। BC को किसी भी बिंदु P तक बढ़ाया जाता है, DE , DP और EP जुड़े हुए हैं। फिर, का क्षेत्रफल:

- (a) $\triangle PED = \frac{1}{4} \triangle ABC$
(b) $\triangle PED = \triangle BEC$
(c) $\triangle ADE = \triangle BEC$
(d) $\triangle BDE = \triangle BEC$

31. In $\triangle ADC$, E and B are the mid points on the sides AD and AC respectively such that $\angle ABE = \angle ADC$, if $AE = 6$ cm, $BC = 2$ cm, $BE = 3$ cm and $= 5$ cm, then $AB + DE$ is equal to?

$\triangle ADC$ में, E और B क्रमशः AD और AC पर स्थित दो बिंदु इस प्रकार हैं कि $\angle ABE = \angle ADC$ यदि $AE = 6$ cm, $BC = 2$ cm, $BE = 3$ cm, और $CD = 5$ cm, तो $AB + DE$ किसके बराबर है?

- (a) 14 cm (b) 16 cm
(c) $49/3$ cm (d) $46/3$ cm

32. In $\triangle ABC$ a line DE is drawn parallel to BC in such a way that $\text{Ar.}(\triangle ADE) : \text{Ar.}(BCED) = 16 : 33$. Find $AD : DB$.

$\triangle ABC$ में एक रेखा DE को BC के समानांतर इस प्रकार खींचा जाता है कि $\text{Ar.}(\triangle ADE) : \text{Ar.}(BCED) = 16 : 33$. $AD : DB$ ज्ञात करें।

- (a) 3:4 (b) 4:3 (c) 5:4 (d) 4:5

33. In $\triangle ABC$, E and D are points on sides AB and AC , respectively, such that $\angle ABC = \angle ADE$, if $AE =$

6 cm, $AD = 4$ cm and $EB = 4$ cm, then the length of DC is:

$\triangle ABC$ में, E और D क्रमशः AB और AC भुजाओं पर इस प्रकार बिंदु हैं कि $\angle ABC = \angle ADE$ है, यदि $AE = 6$ सेमी, $AD = 4$ सेमी और $EB = 4$ सेमी है, तो DC की लंबाई है:

SSC CHSL 20/10/2020 (afternoon shift)

- (a) 11 cm (b) 8 cm (c) 9.5 cm (d) 10 cm

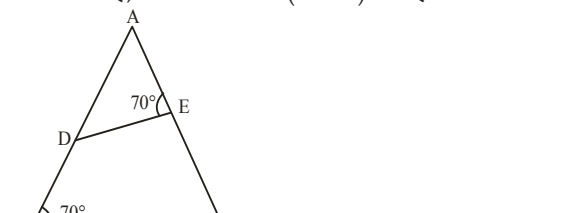
34. The perimeters of two similar triangles ABC and PQR are 75 cm and 50 cm respectively. If the length of one side of the triangle PQR is 20 cm, then what is the length of corresponding side of the triangle ABC ?

दो समरूप त्रिभुजों ABC और PQR का परिमाप क्रमशः 75 सेमी और 50 सेमी है। यदि त्रिभुज PQR की एक भुजा की लंबाई 20 सेमी है, तो त्रिभुज ABC की संगत भुजा की लंबाई क्या है?

[CDS - 2019-II]

- (a) 25 cm (b) 30 cm
(c) 40 cm (d) 45 cm

35. In the given figure, if $AD = 12$ cm, $AE = 8$ cm and $EC = 14$ cm, then what is the value (in cm) of BD ?



- (a) $50/3$ (b) 15 (c) $8/3$ (d) $44/3$

36. In $\triangle ABC$, $AB = AC$ and D is a point on side AC such that $BD = BC$. If $AB = 12.5$ cm and $BC = 5$ cm, then what is the measure of DC ?

$\triangle ABC$ में, $AB = AC$ और D भुजा AC पर एक बिंदु है जैसे कि $BD = BC$ है। यदि $AB = 12.5$ सेमी और $BC = 5$ सेमी है, तो DC का माप क्या है?

SSC CPO 13/12/2019 (Evening)

- (a) 2.5 cm (b) 3 cm
(c) 1.8 cm (d) 2 cm

37. If $\triangle ABC$ is similar to $\triangle DEF$. The area of $\triangle ABC$ is 100 cm^2 and area of $\triangle DEF$ is 49 cm^2 . If the altitude of $\triangle ABC$ is 5 cm then Corresponding altitude of $\triangle DEF$ is:-

यदि त्रिभुज ABC त्रिभुज DEF के समरूप है तथा त्रिभुज ABC का क्षेत्रफल शीर्ष लम्ब की लम्बाई 5 सेमी. है तो उसके संगत $\triangle DEF$ के शीर्ष लम्ब की लम्बाई क्या है?

- (a) 7 cm (b) 4.5 cm

- (c) 6 cm (d) 3.5 cm

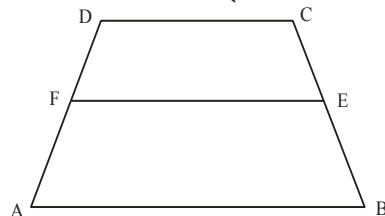
38. In $\triangle ABC$, $\angle A = 90^\circ$, M is the midpoint of BC and D is a point on BC such that $AD \perp BC$. If $AB = 7$ cm and $AC = 24$ cm, then $AD:AM$ is equal to:
 $\triangle ABC$ में, $\angle A = 90^\circ$, M , BC का मध्यबिंदु है और D एक बिंदु है। BC पर इस प्रकार कि $AD \perp BC$ । यदि $AB = 7$ सेमी और $AC = 24$ सेमी है, तो $AD:AM$ बराबर है:

SSC CGL 4/03/2020 (Morning)

- (a) 168:275 (c) 32:43
 (b) 24:25 (d) 336:625

39. In the given figure $AF:FD = 5:3$, $AB = 128$ cm, $DC = 56$ cm. Find length of FE while $AB \parallel DC \parallel FE$.

दिये गये चित्र में $AF:FD = 5:3$, $AB = 128$ cm, $DC = 56$ cm तो FE की लम्बाई निकालो यदि $AB \parallel DC \parallel FE$ है।



- (a) 84 cm (b) 72 cm
 (c) 92 cm (d) 83 cm

40. In $\triangle ABC$, $AC = 8.4$ cm, $BC = 14$ cm. P is a point on AB such that $CP = 11.2$ cm and $\angle ACP = \angle B$. What is the length (in cm) of BP ?

$\triangle ABC$ में, $AC = 8.4$ सेमी, $BC = 14$ सेमी। P , AB पर एक बिंदु इस प्रकार है कि $CP = 11.2$ सेमी और $\angle ACP = \angle B$ है। BP की लंबाई (सेमी में) क्या है?

SSC CGL 4/03/2020 (Evening)

- (a) 4.12 (b) 2.8 (c) 3.78 (d) 3.6

41. In $\triangle ABC$, $\angle A = 90^\circ$, $AD \perp BC$ at D . If $AB = 12$ cm and $AC = 16$ cm, then what is the length (in cm) of BD ?
 $\triangle ABC$ में, $\angle A = 90^\circ$, $AD \perp BC$ D पर है। यदि $AB = 12$ सेमी और $AC = 16$ सेमी है, तो BD की लंबाई (सेमी में) क्या है?

SSC CGL 16/8/2021 (Morning)

- (a) 8.4 (b) 7.8 (c) 7.2 (d) 6.4

42. One-fifth of the area of a triangle ABC is cut off by a line DE drawn parallel to BC such that D is on AB and E is on AC . If $AB = 10$ cm, then what is DE equal to?

त्रिभुज ABC के क्षेत्रफल का पांचवां हिस्सा BC के समानांतर खींची गई रेखा DE द्वारा इस प्रकार काटा जाता है कि D , AB पर है और E , AC पर है। यदि $BC = 10$ सेमी है, तो DE किसके बराबर है?

[CDS - 2017-II]

- (a) $\sqrt{5}$ cm (b) $2\sqrt{5}$ cm
 (c) $3\sqrt{5}$ cm (d) $4\sqrt{5}$ cm

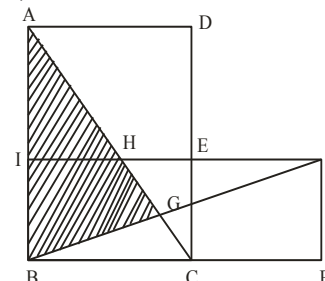
43. In $\triangle ABC$, D and E are midpoint of side AB and BC . P is point on line AC in such a way that R and S are the mid-point of AP & PC find $DR:ES$

$\triangle ABC$ में, D और E भुजा AB और BC के मध्यबिंदु हैं। P रेखा AC पर इस प्रकार बिंदु है कि R और S , AP और PC के मध्य-बिंदु हैं, $DR:ES$ ज्ञात कीजिए

- (a) 1:1 (b) 2:1 (c) 4:1 (d) 3:1

44. If the sides of each square is 10 cm. Find area of shaded region?

प्रत्येक वर्ग की भुजा 10 cm है तो छायांकित भाग का क्षेत्रफल ज्ञात करें।



- (a) 80 cm^2 (b) 60 cm^2
 (c) 100 cm^2 (d) 120 cm^2

Type 4 (Similarity, BPT & MPT) Answer Key

1	(d)	2	(d)	3	(b)	4	(a)	5	(d)	6	(a)	7	(a)
8	(d)	9	(a)	10	(d)	11	(a)	12	(c)	13	(a)	14	(c)
15	(a)	16	(c)	17	(a)	18	(a)	19	(c)	20	(d)	21	(b)
22	(c)	23	(b)	24	(c)	25	(c)	26	(a)	27	(d)	28	(a)
29	(b)	30	(a)	31	(d)	32	(b)	33	(a)	34	(b)	35	(c)
36	(d)	37	(d)	38	(d)	39	(d)	40	(c)	41	(c)	42	(b)
43	(a)	44	(a)										

Type-4 (Similarity, BPT & MPT) Solution

1. Sol. (d)

Since, $\triangle ABC \sim \triangle DEF$ then,

$$\frac{BC}{FE} = \frac{AC}{DF} \Rightarrow \frac{48}{200} = \frac{120}{DF}$$

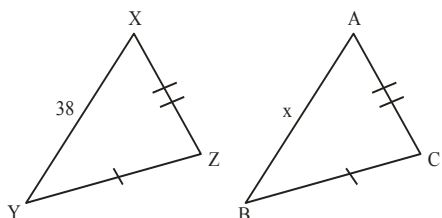
$$\Rightarrow DF = \frac{120 \times 200}{48} = 500 \text{ cm}$$

So, the longest side of $\triangle DEF = 500 \text{ cm}$

2. Sol. (d)

Since $\triangle XYZ \sim \triangle ABC$,

$$\frac{\text{ar}(XYZ)}{\text{ar}(ABC)} = \left(\frac{XY}{AB}\right)^2 = \left(\frac{YZ}{BC}\right)^2 = \left(\frac{ZX}{CA}\right)^2$$



Let the length of the longest side of the smaller

$\triangle ABC$ be $x \text{ cm}$

$$\Rightarrow \frac{361}{225} = \left(\frac{38}{x}\right)^2 \Rightarrow \frac{19}{15} = \frac{38}{x}$$

$$\Rightarrow x = \frac{15 \times 38}{19} = 30 \text{ cm}$$

3. Sol. (b)

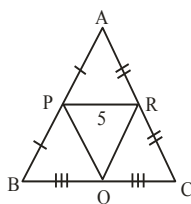
As $\triangle ABC$ and $\triangle DEF$ are similar,

$$\therefore \frac{\text{Perimeter of } \triangle ABC}{\text{Perimeter of } \triangle DEF} = \frac{AB}{DE} = \frac{BC}{EF} = \frac{CA}{DF} = \frac{40}{30} = \frac{4}{3} = \frac{4k}{3k}$$

$$\frac{BC+CA}{EF+DF} = \frac{4k+4k}{3k+3k} = \frac{8k}{6k} = \frac{4}{3}$$

4. Sol. (a)

Given, $AB = BC$



P is the midpoint of AB and R is the midpoint of AC.

Then, $PR \parallel BC$ and $PR = \frac{1}{2} \times BC \dots$ (mid-point theorem)

$$\Rightarrow BC = 10 \text{ cm and } AB = 10 \text{ cm}$$

Again, Q is the midpoint of BC and R is the midpoint of AC.

Then, $QR \parallel AB$ and $QR = \frac{1}{2} \times AB$ (mid-point theorem) $\Rightarrow QR = 5 \text{ cm}$

5. Sol. (d)



From the figure

$\triangle ABC$ is similar to $\triangle DBF$

$$\frac{BC}{BF} = \frac{AB}{BD}$$

$\triangle ABF$ is similar to $\triangle DBE$

$$\frac{BF}{BE} = \frac{AB}{BD}$$

Comparing both the equations

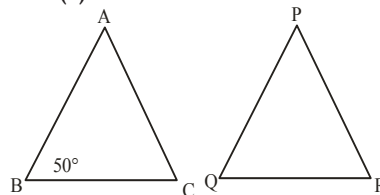
$$\frac{BC}{BF} = \frac{BF}{BE} \text{ (Let } EF = x)$$

$$\Rightarrow \frac{7+x}{4+x} = \frac{4+x}{4}$$

$$\Rightarrow 28 + 4x = 16 + 8x + x^2 \Rightarrow x^2 + 4x - 12 = 0$$

$\Rightarrow x = 2$ or -6 (x is a distance and it can't be negative) $\Rightarrow x = 2$

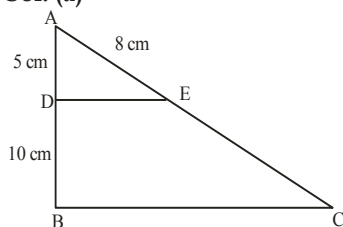
6. Sol. (a)



$$AB = AC, PQ = PR, AB = PQ$$

$$\angle B = \angle Q = 50^\circ = \angle R$$

7. Sol. (a)

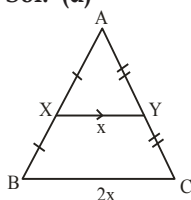


If $AD = 5$ cm, $DB = 10$ cm, and $AE = 8$ cm When

$$DE \parallel BC, \frac{AD}{AB} = \frac{AE}{AC}$$

$$AC = \frac{8 \times 15}{5} = 24 \text{ cm}$$

8. Sol. (d)



Let, the length of BC is ' $2x$ ' then, the length of XY be ' x '(Midpoint theorem) Now, According to the question,

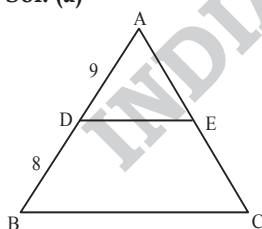
$$BC + XY = 24 \text{ cm}$$

$$\Rightarrow 2x + x = 24 \text{ cm} \Rightarrow x = 8 \text{ cm}$$

$$\Rightarrow BC = 16 \text{ cm and } XY = 8 \text{ cm}$$

$$\text{Then, } BC - XY = 8 \text{ cm}$$

9. Sol. (a)



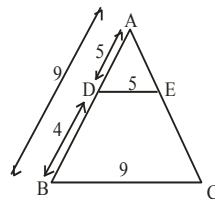
Since $DE \parallel BC$, So $\triangle ADE \sim \triangle ABC$

$$\text{Hence, } \frac{AD}{AB} = \frac{DE}{BC} = \frac{9}{9+8} = \frac{9}{17}$$

So, the ratio of DE and $BC = 9:17$

10. Sol. (d)

In $\triangle ABC$, $DE \parallel BC$



$$\frac{AE}{AC} = \frac{AD}{AB} = \frac{DE}{BC}$$

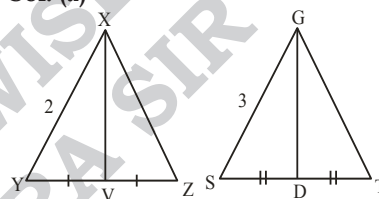
(Basic Prop, theorem)

$$\text{Here, } \frac{AD}{DB} = \frac{5}{4}$$

$$\Rightarrow \frac{AD}{AB} = \frac{DE}{BC} = \frac{5}{9}$$

$$\Rightarrow DE:BC = 5:9$$

11. Sol. (a)



If two triangles are similar then the ratio of their corresponding sides are equal. If, $\triangle XYZ \sim \triangle GST$

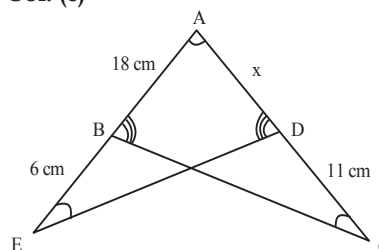
$$\text{Then } \frac{XY}{GS} = \frac{YZ}{ST} \quad \dots (i)$$

$$YV = \frac{YZ}{2} \text{ and } SD = \frac{ST}{2} \quad \dots (ii)$$

Putting the value of eq. (ii) in eq. (i), we get,

$$\frac{XY}{GS} = \frac{YV}{SD} = \frac{2}{3} \Rightarrow \left(\frac{YV}{SD}\right)^2 = \frac{4}{9}$$

12. Sol. (c)



$$AB = 18 \text{ cm}$$

$$BE = 6 \text{ cm}$$

$$CD = 11 \text{ cm}$$

$$\angle AED = \angle ACB.$$

$$AD = ?$$

$$\frac{x}{18} = \frac{24}{x+11}$$

Trick: Check option

Put $x = 16$ (right)

$$\frac{16}{18} = \frac{24}{28}$$

$$\frac{8}{9} = \frac{8}{9}$$

13. Sol. (a)

Since, $\triangle ABC \sim \triangle DEF$,

$$\text{Given, } 2AB = DE \Rightarrow \frac{AB}{DE} = \frac{1}{2}$$

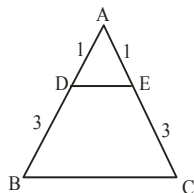
From properties of similarity,

$$\frac{AB}{DE} = \frac{BC}{EF} = \frac{1}{2}$$

When, $BC = 8$ cm then, $EF = 16$ cm

14. Sol. (c)

According to question



By using B.P.T

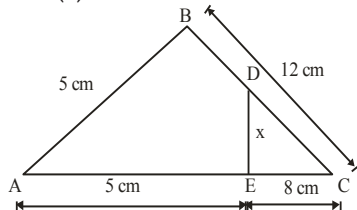
$$\frac{AD}{AB} = \frac{AE}{AC} = \frac{DE}{BC}$$

$$\frac{AD}{AB} = \frac{DE}{BC'}$$

$$\frac{1}{4} = \frac{DE}{12}$$

$$DE = 3 \text{ cm}$$

15. Sol. (a)



$$BC = 12 \text{ cm}$$

$$AB = AE = 5 \text{ cm}$$

$$DE = ?$$

By similarity of $\triangle$.

$$\frac{5}{x} = \frac{12}{8}$$

$$x = \frac{10}{3} \text{ cm}$$

16. Sol. (c)

As $\triangle BAC \sim \triangle PQR$,

$$\frac{\text{Area of } \triangle BAC}{\text{Area of } \triangle PQR} = \frac{BA^2}{PQ^2} \Rightarrow \frac{25}{36} = \frac{4^2}{PQ^2}$$

$$\Rightarrow \frac{25}{36} = \frac{16}{PQ^2} \Rightarrow PQ^2 = \frac{576}{25}$$

$$\Rightarrow PQ = \frac{24}{5} = 4.8 \text{ cm}$$

17. Sol. (a)

$\triangle ABC \sim \triangle BDC$

$$\frac{BD}{BC} = \frac{CD}{AC} = \frac{BC}{AB} \Rightarrow \frac{18}{24} = \frac{12}{AC} = \frac{24}{AB}$$

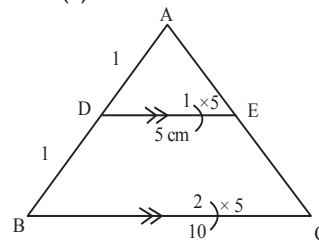
$$\text{Perimeter} = \frac{\triangle ADC}{\triangle BCD}$$

$$\frac{3}{4} = \frac{12}{AC} = \frac{24}{AB}$$

$$\text{Perimeter} = \frac{\triangle ADC}{\triangle BCD}$$

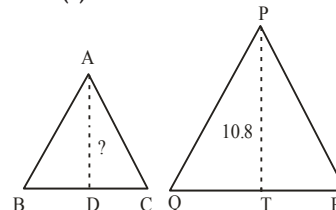
$$= \frac{42}{54} = \frac{7}{9}$$

18. Sol. (a)



$$BC = 5 \times 2 = 10 \text{ cm}$$

19. Sol. (c)



In similar triangles

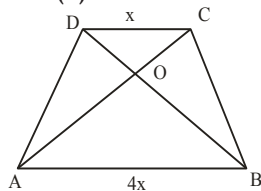
$$\frac{\text{Area of } \triangle ABC}{\text{Area of } \triangle PQR} = \frac{64}{81} = \frac{\text{side}^2}{\text{side}^2}$$

$$\Rightarrow \frac{8}{9} = \frac{\text{altitude of } \triangle ABC}{\text{altitude of } \triangle PQR}$$

$$\Rightarrow \frac{8}{9} = \frac{\text{altitude of } \triangle ABC}{10.8}$$

$$\Rightarrow \text{Altitude of } \triangle ABC = \frac{10.8 \times 8}{9} = 9.6 \text{ cm}$$

20. Sol. (d)



$$\frac{AB}{CD} = \frac{4x}{x} \quad [\text{given}]$$

Now, in $\triangle DOC$ & $\triangle BOA$

$$\angle DOC = \angle AOB$$

[Vertically opposite angles]

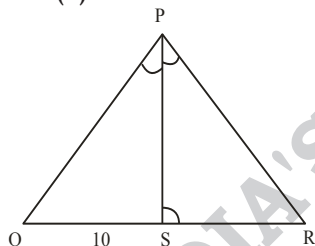
$$\angle OCD = \angle OAB \quad [\text{Alternate angles}]$$

$$\therefore \triangle DOC \sim \triangle BOA$$

$$\frac{\text{Area of } \triangle DOC}{\text{Area of } \triangle AOB} = \left(\frac{DC}{AB}\right)^2$$

$$= \frac{x^2}{(4x)^2} = \frac{x^2}{16x^2} = \frac{1}{16}$$

21. Sol. (b)



$$QS = 10 \text{ cm}, QR = 18 \text{ cm}$$

$$SR = (18 - 10) \text{ cm} = 8 \text{ cm}$$

In $\triangle PQR$ and $\triangle SPR$

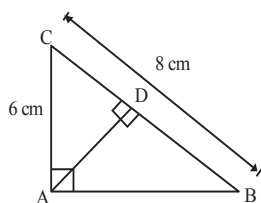
$$\angle QPR = \angle SPR, \angle PRQ = \angle PRS$$

$$\triangle PQR \sim \triangle SPR$$

$$\frac{PR}{QR} = \frac{SR}{PR} \Rightarrow PR^2 = 8 \times 18 \Rightarrow PR = 12$$

22. Sol. (b)

According to question



$$\triangle CAB \sim \triangle CDA$$

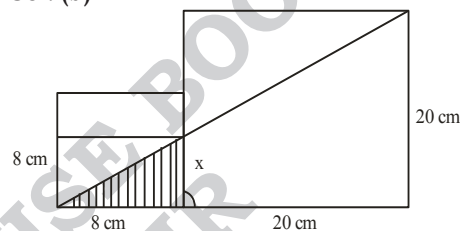
$$\therefore \frac{\text{area of } \triangle CAB}{\text{area of } \triangle CDA} = \frac{BC^2}{AC^2}$$

$$\frac{\text{area of } \triangle CAB}{\text{area of } \triangle CDA} = \frac{8^2}{6^2}$$

$$\frac{\text{area of } \triangle CAB}{\text{area of } \triangle CDA} = \frac{64}{36}$$

$$\frac{\text{area of } \triangle CAB}{\text{area of } \triangle CDA} = \frac{16}{9}$$

23. Sol. (b)



$$\text{Ar(shaded)} = ?$$

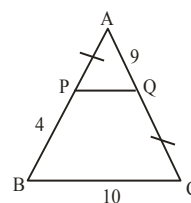
$$\frac{x}{20} = \frac{8}{28} \quad (\text{By BPT})$$

$$x = \frac{40}{7} \text{ cm}$$

$$\text{Area (shaded)}: \frac{1}{2} \times \frac{40}{7} \times 8 = \frac{160}{7} \text{ cm}^2$$

24. Sol. (c)

According to Question Given:



$$AP = QC$$

$$AQ = 9 \text{ cm}$$

$$BP = 4 \text{ cm}$$

$$\text{Let } AP = x \text{ cm}$$

$$\triangle APQ \sim \triangle ABC$$

To apply similarity property

$$\frac{AP}{BP} = \frac{AQ}{QC}$$

$$\frac{x}{4} = \frac{9}{x}$$

$$x^2 = 36$$

$$x = 6$$

$$\therefore AP = 6 \text{ cm}$$

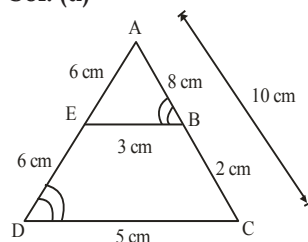
and $\triangle BDE = \triangle PED$

[$\because$ both triangles lie on the same base DE and between two parallel lines DE and BP]

$\therefore \text{ar}(\triangle PED)$

$$= \frac{1}{4} \times \text{ar}(\triangle ABC)$$

31. Sol. (d)

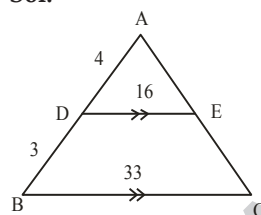


$$\frac{3}{5} = \frac{6}{AC} \Rightarrow AC = 10 \text{ cm.}$$

$$\frac{3}{5} = \frac{8}{AD} \Rightarrow AD = \frac{40}{3} \text{ cm}$$

$$AB + DE = 8 + \frac{22}{3} = \frac{46}{3} \text{ cm}$$

32. Sol.



$$\frac{\text{Ar.}(ADE)}{\text{Ar.}(BDEC)} = \frac{16}{33}$$

$$AD : DB = ?$$

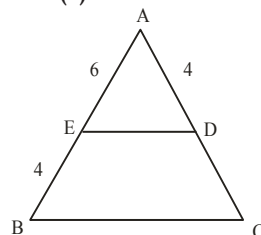
$$AD : AB$$

$$\sqrt{16} : \sqrt{49} = 4 : 7$$

$$AD : DB$$

$$4 : 3$$

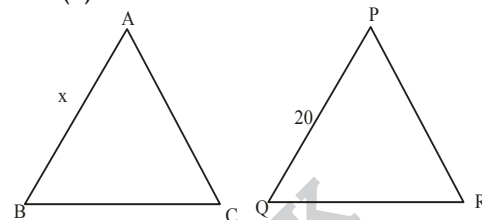
33. Sol. (a)



$$\angle ABC = \angle ADE \Rightarrow \triangle ABC \sim \triangle ADE$$

$$\frac{AB}{AD} = \frac{AC}{AE} \Rightarrow \frac{10}{4} = \frac{4+x}{6}, x = 11$$

34. Sol. (b)



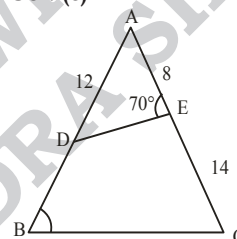
$$\text{Perimeter of } \triangle ABC = 75 \text{ cm}$$

$$\text{Perimeter of } \triangle PQR = 50 \text{ cm}$$

$$\text{So, } \frac{\triangle ABC}{\triangle PQR} = \frac{AB}{PQ} \Rightarrow \frac{75}{50} = \frac{x}{20}$$

$$\therefore x = \frac{75 \times 20}{50} = 30 \text{ cm}$$

35. Sol. (c)



In $\triangle AED$ & $\triangle ABC$

$$\triangle AED \sim \triangle ABC$$

$$\frac{AE}{AB} = \frac{AD}{AC}$$

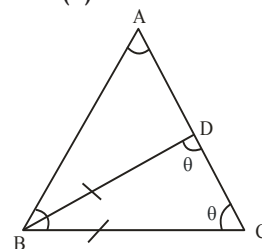
$$\frac{8}{AB} = \frac{12}{22}$$

$$AB = \frac{22 \times 8}{12}$$

$$AB = \frac{44}{3}$$

$$BD = AB - AD = \frac{44}{3} - 12 = \frac{8}{3}$$

36. Sol. (d)



$$\angle C = \angle B = \theta (AB = AC)$$

$$\angle A = 180 - 2\theta$$

$$\angle DBC = 180 - 2\theta$$

Since $\triangle ABC$ and $\triangle BDC$ are similar

$$\frac{BC}{CD} = \frac{AC}{BC} \Rightarrow BC^2 = AC \cdot DC$$

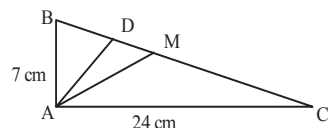
$$\Rightarrow 25 = 12.5 \times CD \Rightarrow CD = 2$$

37. Sol. (d)

$$\sqrt{100} : \sqrt{49} \\ \times \frac{1}{2} \left(\begin{matrix} 10 & : & 7 \\ 5\text{cm} & & 3.5\text{cm} \end{matrix} \right) \times \frac{1}{2}$$

38. Sol. (d)

M is the mid point of BC and $AD \perp BC$.



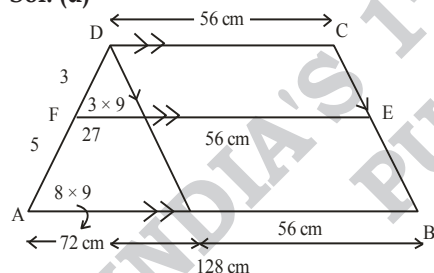
Using pythagoras theorem: $BC = 25$ cm M is the midpoint, $BM = MC = AM = 12.5$ cm

$$\text{In } \triangle BAC; BA \times AC = AD \times BC$$

$$7 \times 24 = AD \times 25 \Rightarrow AD = \frac{168}{25}$$

$$\text{Hence, } \frac{AD}{AM} = \frac{168 \times 2}{25 \times 25} = \frac{336}{625}$$

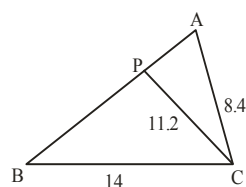
39. Sol. (d)



$$x = 56 + 27 = 83 \text{ cm}$$

40. Sol. (c)

In $\triangle ABC$, $\angle ACP = \angle B$



In $\triangle ABC$ and $\triangle ACP$:

$$\angle ACP = \angle B,$$

$\angle A$ and side AC is common

$$\text{Hence, } \frac{AB}{AC} = \frac{BC}{PC} = \frac{AC}{AP}$$

$$\Rightarrow \frac{BC}{PC} = \frac{AC}{AP} \Rightarrow \frac{14}{11.2} = \frac{8.4}{AP} \Rightarrow AP = 6.72$$

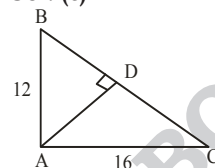
Similarly, in $\triangle ABC$ and $\triangle CBP$:

$$\Rightarrow AB \times PC = AC \times BC$$

$$\Rightarrow AB \times 11.2 = 8.4 \times 14$$

$$\Rightarrow AB = 10.5, BP = 10.5 - 6.72 = 3.78 \text{ cm}$$

41. Sol. (c)



Applying pythagoras in the $\triangle ABC$

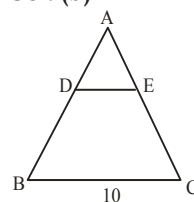
$$BC = \sqrt{16^2 + 12^2} = 20$$

In $\triangle ABC \sim \triangle DBA$ (one angle is 90 and one is common)

$$\frac{AB}{BC} = \frac{DB}{AB} \Rightarrow AB^2 = BC \times BD$$

$$144 = BD \times 20 \Rightarrow BD = 7.2 \text{ cm}$$

42. Sol. (b)



According to the question and by BPT, $\frac{AD}{AB} = \frac{AE}{AC}$ and $\angle A$ is common.

Therefore, $\triangle ADE \sim \triangle ABC$ (by SAS similarity) Since we know that the ratio of areas of two similar triangles is equal to the square of its proportional sides,

$$\text{therefore, } \frac{\text{ar.}(\triangle ADE)}{\text{ar.}(\triangle ABC)} = \frac{(DE)^2}{(BC)^2} \quad \dots (i)$$

Also, we are given that

$$\text{ar}(\triangle ADE) = \frac{1}{5} \text{ar}(\triangle ABC)$$

Thus, (i)

$$\Rightarrow \frac{\text{ar.}(\triangle ABC)}{5 \text{ar.}(\triangle ABC)} = \frac{(DE)^2}{(10)^2} = \frac{(DE)^2}{100}$$

$$\Rightarrow \frac{1}{5} = \frac{(DE)^2}{100} \Rightarrow DE = \sqrt{\frac{100}{5}} = 2\sqrt{5}$$

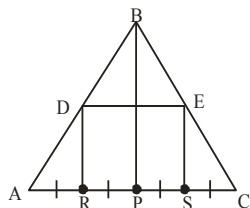
43. Sol. (a)

Let $ES = x$

According to the question,

In $\triangle BPC$,

E is the midpoint of BC and S is the midpoint of PC .



By using midpoint theorem.

$$ES = \frac{1}{2}BP$$

$$BP = 2x$$

In $\triangle BPA$,

D is the midpoint of AB and R is the midpoint of AP

By using midpoint theorem,

$$DR = \frac{1}{2} \times BP$$

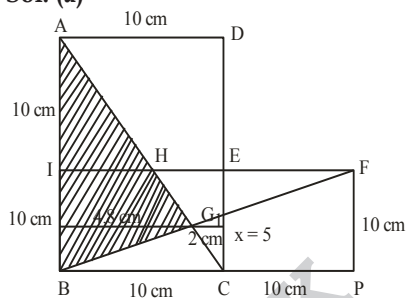
$$DR = \frac{1}{2} \times 2x$$

$$DR = x$$

$$ES = DR$$

$$\frac{ES}{DR} = \frac{x}{x} = \frac{1}{1}$$

44. Sol. (a)



Ar. (shaded) = ?

In $\triangle BPF$

$$\frac{BC}{BP} = \frac{CG}{EP} = \frac{10}{20} = \frac{CG}{10}$$

$$CG = 5$$

$$\triangle AOG \sim \triangle COG$$

$$\frac{h_1}{h_2} = \frac{AG}{CG}$$

$$\frac{h_1}{h_2} = \frac{20}{5}$$

$$\frac{h_1}{h_2} = \frac{20}{5} \Rightarrow 4 : 1 \Rightarrow 5$$

$$\downarrow \times 2 \quad \downarrow \times 2$$

$$8 \quad 10$$

$$h_1 + h_2 = 10$$

$$h_1 = 8$$

$$\text{Ar. (Shaded)} = \frac{1}{2} \times 20 \times 8 = 80 \text{ cm}^2$$

Type-5 (Congruency)

1. In $\triangle ABC$, $DE \parallel BC$ in such a way that $A - D - B$ and $A - E - C$. If $m\angle ACB = 40^\circ$, then $m\angle DAE + m\angle ADE =$
 $\triangle ABC$, $DE \parallel BC$ में इस प्रकार कि $A-D-B$ और $A-E-C$.
 यदि $m\angle ACB = 40^\circ$, तो $m\angle DAE + m\angle ADE =$

SSC CPO 2023 (Morning)

- (a) 240° (b) 120° (c) 140° (d) 230°

2. If $AB = QR$, $BC = PR$ and $CA = PQ$, then
 यदि $AB = QR$, $BC = PR$ और $CA = PQ$ है, तो

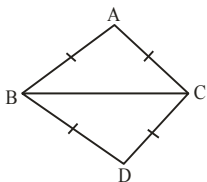
SSC CHSL 30/05/2022 (Morning)

- (a) $\triangle PQR \cong \triangle BCA$ (b) $\triangle ABC \cong \triangle PQR$
 (c) $\triangle CBA \cong \triangle PRQ$ (d) $\triangle BAC \cong \triangle RPQ$

3. In the given figure, $AB = DB$ and $C = DC$. If $\angle ABD = 58^\circ$ and $\angle DBC = (2x - 4)^\circ$, $\angle ACB = (y + 15)^\circ$ and $\angle DCB = 63^\circ$, then the value of $2x + 5y$ is:

दिए गए चित्र में, $AB = DB$ और $AC = DC$ है। यदि $\angle ABD = 58^\circ$ तथा $\angle DBC = (2x - 4)^\circ$, $\angle ACB = (y + 15)^\circ$ तथा $\angle DCB = 63^\circ$, तो $2x + 5y$ का मान है:

SSC CGL 02/12/2022 (4th Shift)



- (a) 325 (b) 273 (c) 259 (d) 268

4. In $\triangle ABC$ and $\triangle PQR$, $AB = PQ$ and $\angle B = \angle Q$. The two triangles are congruent by SAS criteria if:
 $\triangle ABC$ और $\triangle PQR$ में, $AB = PQ$ और $\angle B = \angle Q$ दोनों त्रिभुज SAS मानदंड के अनुरूप हैं यदि:

SSC CGL 08/12/2022 (2nd Shift)

- (a) $BC = QR$ (b) $AC = PR$
 (c) $ACQR$ (d) $BC = PQ$

5. For what angle D is $\triangle ABC$ congruent to $\triangle DEF$, given $AC = 2.5$ cm, $BC = 5$ cm, $\angle C = 75^\circ$, $DE = 2.5$ cm and $DF = 5$ cm?

किस कोण D के लिए $\triangle ABC$, $\triangle DEF$ के सर्वांगसम है, $AC = 2.5$ सेमी, $BC = 5$ सेमी, $\angle C = 75^\circ$, $DE = 2.5$ सेमी और $DF = 5$ सेमी दिया गया है?

SSC CHSL 01/06/2022 (Morning)

- (a) 75° (b) 25° (c) 35° (d) 90°

6. In trapezium $ABCD$, $AB \parallel DC$, $AB = 9$ cm, $DC = 15$ cm and the distance between AB and DC is 4 cm. F and G are the mid-points of AD and BC , respectively. DA and CB are produced to meet at point E . What is the area (in cm^2) of $\triangle EFG$?

समलंब $ABCD$ में, $AB \parallel DC$, $AB = 9$ cm और $DC = 15$ cm है तथा AB और DC के बीच की दूरी 4 cm है। F और G क्रमशः AD और BC के मध्य बिंदु हैं। DA और CB को आगे बढ़ाया जाता है जो E मिलती हैं। $\triangle EFG$ का क्षेत्रफल (cm^2 में) क्या होगा?

ICAR Assistant 29/07/2022 (Shift-03)

- (a) 45 (b) 40 (c) 48 (d) 36

7. If it is given that for two right angled triangles ABC and DFE , $\angle A = 25^\circ$, $\angle E = 25^\circ$, $\angle B = \angle F = 90^\circ$ and $AC = ED$, then which one of the following is TRUE?

यदि यह दिया गया है कि दो समकोण त्रिभुज ABC और DFE के लिए, $\angle A = 25^\circ$, $\angle E = 25^\circ$, $\angle B = \angle F = 90^\circ$ और $AC = ED$, तो निम्नलिखित में से कौन सा सत्य है?

SSC CGL 09/12/2022 (3rd Shift)

- (a) $\triangle ABC \cong \triangle FED$ (b) $\triangle ABC \cong \triangle DFE$
 (c) $\triangle ABC \cong \triangle EFD$ (d) $\triangle ABC \cong \triangle DEF$

8. Given that $\triangle MAN$ and $\triangle CPT$ are congruent to each other such that $\angle M = 75^\circ$, $\angle N = 65^\circ$, $\angle A = 40^\circ$, $\angle C = \frac{x}{2}$, $\angle P = 6y + 16$. Find the value of $(x - 5y)$

दिया गया है कि $\triangle MAN$ और $\triangle CPT$ एक दूसरे के सर्वांगसम हैं जैसे कि $\angle M = 75^\circ$, $\angle N = 65^\circ$, $\angle A = 40^\circ$, $\angle C = x/2$, $\angle P = 6y + 16$ । $(x - 5y)$ का मान ज्ञात कीजिए

Graduate Level 04/08/2022 (Shift - 2)

- (a) 130 (b) 125 (c) 135 (d) 120

9. Given that triangle ABC is congruent to triangle DEF . If $AC = 11$ m, $ED = 6$ m, $EF = 15$ m, $\angle FDE = 85^\circ$ and $\angle ABC = 55^\circ$, then the perimeter of triangle ABC and $\triangle EFD$ are, respectively:

दिया गया है कि त्रिभुज ABC त्रिभुज DEF के सर्वांगसम है। यदि $AC = 11$ m, $ED = 6$ m, $EF = 15$ m, $\angle FDE = 85^\circ$ और $\angle ABC = 55^\circ$, तो त्रिभुज ABC और $\triangle EFD$ की परिधि क्रमशः हैं:

Higher Secondary 01/08/2022 (Shift - 3)

- (a) 32 m, 45° (b) 32 m, 40°
 (c) 30 m, 50° (d) 35 m, 45°

10. ABC and PQR are two triangles. $AB = PQ = 6$ cm, $BC = QR = 10$ cm and $AC = PR = 8$ cm. If angle $ABC = x$ degrees, then what is the value of angle PRQ ?

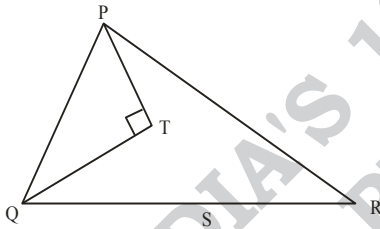
ABC और PQR दो त्रिभुज हैं। $AB = PQ = 6$ सेमी, $BC = QR = 10$ सेमी और $AC = PR = 8$ सेमी। यदि कोण $ABC = x$ डिग्री है, तो कोण PRQ का मान क्या है?

SSC CGL Tier II 08/08/2022

- (a) $(180 - x)$ degree (b) x degree
(c) $(90 - x)$ degree (d) $(90 + x)$ degree
11. In a circle of diameter 20 cm, chords AB and CD are parallel to each other. BC is diameter. If AB is 6 cm from the centre of the circle, what is the length (in cm) of the chord CD?
- 20 सेमी व्यास वाले एक वृत्त में, जीवा AB और CD एक दूसरे के समानांतर हैं। BC व्यास है। यदि AB वृत्त के केंद्र से 6 सेमी दूर है, तो जीवा CD की लंबाई (सेमी में) क्या है?

SSC CGL 13/04/2022 (Morning)

- (a) 8 (b) 12 (c) 20 (d) 16
12. In $\triangle PQR$, $PQ = 13$ cm, $PR = 17$ cm, S is mid point of QR. PT is angle bisector of $\angle QPR$. $\angle PTQ = 90^\circ$ find ST.
- $\triangle PQR$ में, $PQ = 13$ सेमी, $PR = 17$ सेमी, S, QR का मध्य बिंदु है। PT, $\angle QPR$ का कोण समद्विभाजक है। $\angle PTQ = 90^\circ$ ST ज्ञात कीजिए।



- (a) 1 cm (b) 2 cm (c) 3 cm (d) 4 cm
13. The perimeters of two similar triangles are 36 cm and 24 cm, respectively. Find the ratio of their areas.
- दो समान त्रिभुजों की परिधि क्रमशः 36 सेमी और 24 सेमी है। उनके क्षेत्रफलों का अनुपात ज्ञात कीजिए।

SSC CPO 10/11/2022 (Evening)

- (a) 6:13 (b) 2:3 (c) 9:4 (d) 35:24
14. In a $\triangle ABC$, $XY \parallel BC$ and XY divides the triangle into two equal areas, then $AX:XB$ will be
- $\triangle ABC$ में, $XY \parallel BC$ और XY त्रिभुज को दो बराबर क्षेत्रों में विभाजित करते हैं, तो $AX:XB$ होगा

- (a) $1:\sqrt{2}$ (b) $\sqrt{2}:\sqrt{2}-1$
(c) $1:\sqrt{2}-1$ (d) $\sqrt{2}-1$

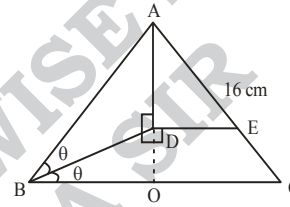
15. In a right angled $\triangle ABC$, $\angle ABC = 90^\circ$, $AB = 3$, $BC = 4$, $CA = 5$; BN is perpendicular to AC, AN:NC is

समकोण $\triangle ABC$ में, $\angle ABC = 90^\circ$, $AB = 3$, $BC = 4$, $CA = 5$; BN, AC पर लंबवत है, AN:NC है

- (a) 3:4 (b) 9:16 (c) 3:16 (d) 1:4

16. AD is perpendicular to the internal bisector of $\angle ABC$ of $\triangle ABC$. DE is drawn through D and parallel to BC to meet AC at E. If the length of AC is 16 cm then the length of AE (in cm) is:-

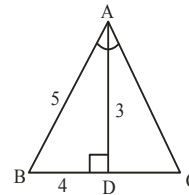
त्रिभुज ABC में, रेखा AD, $\angle ABC$ के अन्तः कोण समद्विभाजक पर लम्ब है रेखा DE, बिंदु D से भुजा BC के समांतर खींची जाती है और AC को बिंदु E पर मिलती है यदि AC की लंबाई 16 सेमी है तो AE की लंबाई क्या है?



- (a) 9 cm (b) 12 cm
(c) 6 cm (d) 8 cm

17. In the adjoining figure the $\angle BAC$ and $\angle ADB$ are right angles. $BA = 5$ cm, $AD = 3$ cm and $BD = 4$ cm, what is the length of DC?

निकटवर्ती चित्र में $\angle BAC$ और $\angle ADB$ समकोण हैं। $BA = 5$ cm, $AD = 3$ cm और $BD = 4$ cm, DC की लंबाई क्या है?



- (a) 2.5 (b) 3 (c) 2.25 (d) 2

18. In $\triangle ABC$, D and E are the points on sides AB and AC, respectively such that $\angle ADE = \angle B$. If $AD = 7$ cm, $BD = 5$ cm and $BC = 9$ cm, then DE (in cm) is

$\triangle ABC$ में, D और E क्रमशः भुजा AB और AC पर इस प्रकार बिंदु हैं कि $\angle ADE = \angle B$ । यदि $AD = 7$ सेमी, $BD = 5$ सेमी और $BC = 9$ सेमी, तो DE (सेमी में)।

SSC CGL 13/8/2021 (Afternoon)

- (a) 6.75 (b) 10 (c) 5.25 (d) 7

19. In $\triangle ABC$, D and E are points on sides AB and BC, respectively, such that $BD:DA = 1:2$ and $CE:EB = 1:4$. If DC and AE intersect at F, then $FD:FC$ is equal to:

$\triangle ABC$ में, D और E क्रमशः भुजाओं AB और BC पर इस प्रकार बिंदु हैं, कि $BD:DA = 1:2$ और $CE:EB = 1:4$ । यदि DC और AE F पर प्रतिच्छेद करते हैं, तो $FD:FC$ बराबर है:

SSC CHSL 19/4/2021 (Morning)

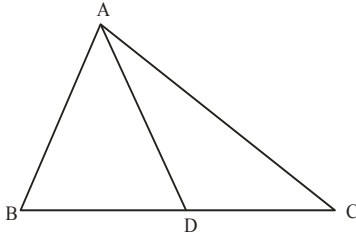
- (a) 3:2 (b) 5:2 (c) 8:3 (d) 4:1

20. In $\triangle ABC$, $AD \perp BC$ and $BE \perp AC$. AD and BE intersect each other at cut F. if $BF = AC$, then the measure of $\angle ABC$ is ?

त्रिभुज ABC में, $AD \perp BC$ और $BE \perp AC$. AD और BE एक दूसरे को F पर काटते हैं यदि $BF = AC$, तो $\angle ABC$ का क्या है?

- (a) 45° (b) 60° (c) 30° (d) 75°

21. In $\triangle ABC$, AD is Angle bisector (कोण समद्विभाजक) $\angle BAC = 111^\circ$
 $AB + BD = AC$
 $\angle ACB = ?$



- (a) 23° (b) $22\frac{1}{2}^\circ$ (c) 24° (d) 25°

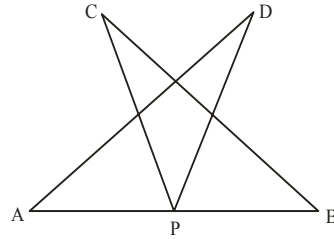
22. In $\triangle ABC$, $DE \parallel AB$, where D and E are points on sides AC and BC respectively. F is a point between C and D such that $EF \parallel BD$. If $AD = 15$ cm, $DC = 10$ cm, then the length of CF is:

$\triangle ABC$, $DE \parallel AB$ में, जहाँ D और E क्रमशः AC और BC पक्षों पर बिंदु हैं। F, C और D के बीच एक बिंदु है जैसे कि $EF \parallel BD$ । यदि $AD = 15$ सेमी, $DC = 10$ सेमी है, तो CF की लंबाई है:

SSC CHSL 13/4/2021 (Morning)

- (a) 3 cm (b) 7.5 cm
 (c) 5 cm (d) 4 cm

23. $AD = 6$ cm, $AP = BP = 3$ cm, $\angle APC = \angle BPD$, $\angle DAP = \angle CBP$, $BC = ?$



- (a) 8 cm (b) 5 cm (c) 6 cm (d) 4 cm

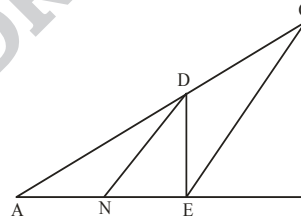
24. ABC is an equilateral triangle with side 12 cm. What is the length of the radius of the circle inscribed in it?

ABC, 12 सेमी. भुजा वाला एक समबाहु त्रिभुज है। इसमें उत्कीर्णित अंतर्वृत्त की त्रिज्या की लंबाई कितनी है?

- (a) $2\sqrt{3}$ cm (b) $8\sqrt{3}$ cm
 (c) $4\sqrt{3}$ cm (d) $6\sqrt{3}$ cm

25. In the given figure, $DE \parallel BC$ and $EC \parallel ND$, $AE:EB = 4:5$, then $EN:EB$ is :

दिए गए चित्र में, $DE \parallel BC$ और $EC \parallel ND$, $AE:EB = 4:5$, तो $EN:EB$ है:



- (a) 5:9 (b) 9:4 (c) 4:5 (d) 4:9

26. In $\triangle PQR$, $\angle Q = 85^\circ$ and $\angle R = 65^\circ$. Points S and T are on the sides PQ and PR, respectively such that $\angle STR = 95^\circ$, then the ratio of QR and ST is 9:5. If $PQ = 21.6$ cm, then the length of PT is:

$\triangle PQR$ में, $\angle Q = 85^\circ$ और $\angle R = 65^\circ$. बिंदु S और T क्रमशः PQ और PR की भुजाओं पर इस प्रकार हैं कि $\angle STR = 95^\circ$ है, तो QR और ST का अनुपात 9:5 है। यदि $PQ = 21.6$ सेमी है, तो PT की लंबाई है:

SSC CGL 4/03/2020 (Afternoon)

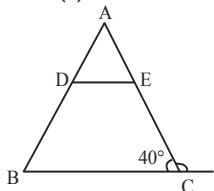
- (a) 10.5 cm (b) 9.6 cm
 (c) 12 cm (d) 9 cm

Type 5 (Congruency) Answer Key

1	C	2	C	3	B	4	A	5	A	6	C	7	C
8	A	9	B	10	C	11	D	12	B	13	C	14	C
15	B	16	D	17	C	18	C	19	C	20	A	21	A
23	C	24	C	25	D	26	C						

Type-5 (Congruency) Solution

1. Sol. (c)


 $\triangle ADE \sim \triangle ABC$ (BY AAA) [ST || CE, DE || BC]

So, $\angle ADE = \angle ABC$, $\angle AED = \angle ACB$ and $\angle DAE = \angle BAC$

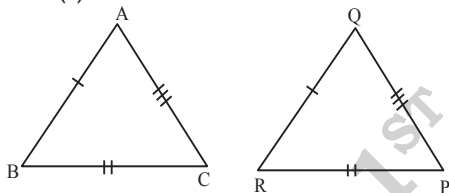
$$\angle DEC = 180^\circ - \angle ECB = 180^\circ - 40^\circ = 140^\circ$$

 $\Rightarrow \triangle ADE$,

$$\Rightarrow m\angle DAE + m\angle ADE = m\angle DEC$$

$$\Rightarrow m\angle DAE + m\angle ADE = 140^\circ$$

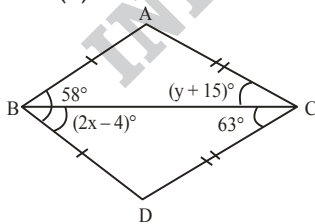
2. Sol. (c)



Since, $AB = QR$, $BC = PR$ and $CA = PQ$

Then $\triangle CBA \cong \triangle PRQ$ (By SSS property)

3. Sol. (b)



In the given figure,

 $\triangle ABC \cong \triangle DBC$

As $AB = BD$, $AC = CD$ and BC is common in both triangles.

$$\text{Then, } \angle ACB = \angle BCD \Rightarrow y + 15^\circ = 63^\circ$$

$$\Rightarrow y = 48^\circ$$

$$\text{And } \angle ABC = \angle CBD = (2x - 4)^\circ$$

$$\angle ABC + \angle CBD = 58^\circ$$

$$(2x - 4)^\circ + (2x - 4)^\circ = 58^\circ \Rightarrow x = 16.5^\circ$$

$$\begin{aligned} \text{Now, } 2x + 5y &= 2x + 16.5^\circ + 5 \times 48^\circ \\ &= 33^\circ + 240^\circ = 273^\circ \end{aligned}$$

4. Sol. (a)

 $\triangle ABC \cong \triangle PQR$ (by SAS)

If, $AB = PQ$, $\angle B = \angle Q$ and $BC = QR$

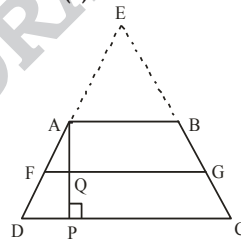
5. Sol. (a)

Since $AC = DE = 2.5$ cm, $BC = DF = 5$ cm, $\angle C =$

$$\angle D = 75^\circ$$

So, $\triangle ACB \cong \triangle EDF$ (by SAS congruence)

6. Sol. (c)



Given $AB \parallel DC$, $AP = 4 \Rightarrow PQ = 2$

Since F and G are mid-point $\Rightarrow AB \parallel DC \parallel FG$

$$\text{Also, } FG = \frac{1}{2}(9 + 15) \Rightarrow 12 \text{ cm}$$

In $\triangle EFG$ and $\triangle EDC$,

These triangles are similar (By AAA)

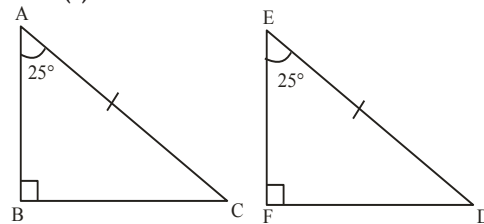
$$\Rightarrow \frac{12}{15} = \frac{h}{h+2} \text{ (Where } h \text{ is the height of triangle)}$$

$$\Rightarrow 4h + 8 = 5h \Rightarrow h = 8$$

$$\therefore \text{Area of } \triangle EFG = \frac{1}{2} \times \text{base} \times \text{height}$$

$$\Rightarrow \frac{1}{2} \times FG \times h = \frac{1}{2} \times 12 \times 8 = 48$$

7. Sol. (c)



From the given figure, we have : $\angle A = \angle E$
 $= 25^\circ, \angle B = \angle F = 90^\circ, AC = ED$
 So, $\triangle ABC \cong \triangle EFD$ (by AAS rule)

8. Sol. (a)

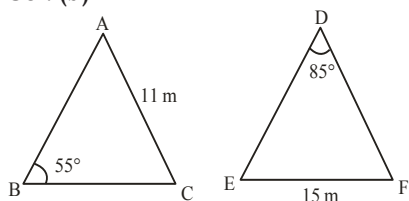
$\triangle MAN \cong \triangle CPT$ (given) $\Rightarrow \angle A = \angle P$

$$40 = 6y + 16, 24 = 6y, y = \frac{24}{6} = 4$$

$$\text{Also, } \angle M = \angle C, 75 = \frac{x}{2}, x = 75 \times 2 = 150$$

$$\text{So, } x - 5y = 150 - 5 \times 4 = 150 - 20 = 130$$

9. Sol. (b)

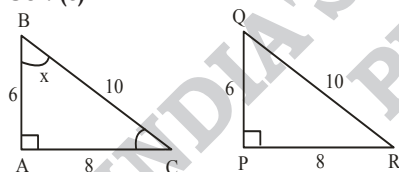


$\triangle ABC$ is congruent to $\triangle DEF$. So, $\angle B = \angle E = 55^\circ, AB = DE = 6 \text{ m}, BC = EF = 15 \text{ m}$,

$$\text{Perimeter of } \triangle ABC = 11 + 6 + 15 = 32 \text{ m}$$

In $\triangle DEF, \angle D + \angle E + \angle F = 180^\circ$ (Sum of angles of a triangle is always 180°) $\Rightarrow 85^\circ + 55^\circ + \angle F = 180^\circ \Rightarrow \angle F = 40^\circ$

10. Sol. (c)

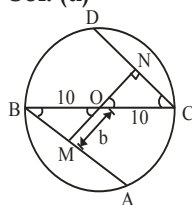


According to the question,

$\triangle BAC$ is congruent to $\triangle QPR$ because $AB = PQ, BC = QR$ and $AC = PR$ (SSS rule) And values 6, 8 and 10 are triplets. So, both triangles are right angled triangles with $\angle A = \angle P = 90^\circ, \angle ACB = 90 - x$

So, value of $\angle PRQ = \angle ACB = (90 - x)$ degree

11. Sol. (d)



$$\text{radius} = \frac{20}{2} = 10 \text{ cm.}$$

As $AB \parallel CD, \angle MBO = \angle NCO$ and

$\angle BOM = \angle CON$ (vertically opposite angles)

$$BO = CO = 10 \text{ (radius)}$$

So, by ASA congruency $\triangle BOM \cong \triangle CON$

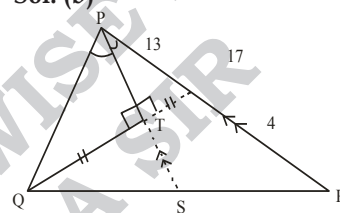
Now, by cpct, $ON = OM = 6 \text{ cm}$

$$\text{And } \angle OMB = \angle ONC = 90^\circ$$

$$NC = \sqrt{10^2 - 6^2} = 8 \text{ cm}$$

$$CD = 2 \times NC = 16 \text{ cm}$$

12. Sol. (b)



$$\triangle AQT \cong \triangle PRT$$

$$ST = 2 \text{ cm}$$

13. Sol. (c)

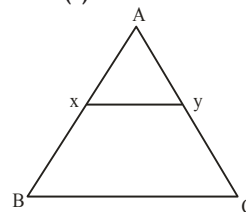
$\triangle ABC \sim \triangle PQR$ (by AAA rule)

$$\text{Then, } \frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR} = \frac{AB + BC + CA}{PQ + QR + PR}$$

$$= \frac{36}{24} = \frac{3}{2} \Rightarrow \frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR} = \frac{3}{2}$$

$$\text{So, the ratio of their areas} = 3^2 : 2^2 = 9 : 4$$

14. Sol. (c)

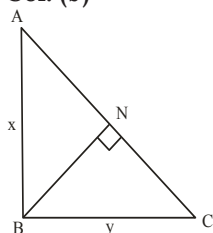


$$\triangle AXY \sim \triangle ABC \frac{\text{ar}(\triangle AXY)}{\text{ar}(\triangle ABC)} = \left(\frac{AX}{AB}\right)^2 \text{ (by A-A)}$$

$$\Rightarrow \left(\frac{AX}{AB}\right)^2 = \frac{1}{2}$$

$$\Rightarrow \frac{AX}{AB} = \frac{1}{\sqrt{2}} \Rightarrow \frac{AX}{XB} = \frac{1}{\sqrt{2}-1}$$

15. Sol. (b)

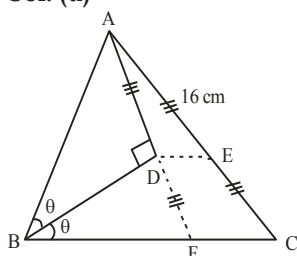


In such cases use the following method to save your valuable time.

$$\frac{AN}{NC} = \frac{x^2}{y^2} = \frac{3^2}{4^2} = \frac{9}{16}$$

$$\Rightarrow AN:NC = 9:16$$

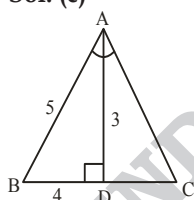
16. Sol. (d)



$$\triangle ADB \sim \triangle FDB$$

$$AE = \frac{16}{2} = 8 \text{ cm}$$

17. Sol. (c)



According to question As we know that,

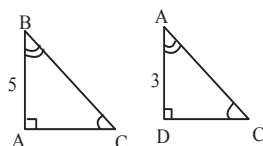
$$\frac{1}{AD^2} = \frac{1}{AB^2} + \frac{1}{AC^2}$$

$$\frac{1}{(3)^2} = \frac{1}{(5)^2} + \frac{1}{(AC)^2}$$

$$\frac{1}{AC^2} = \frac{1}{9} - \frac{1}{25} = \frac{25-9}{225}$$

$$AC = \frac{15}{4}$$

In $\triangle BAC$ and $\triangle ADC$



$$\angle B = \angle A, \angle A = \angle D$$

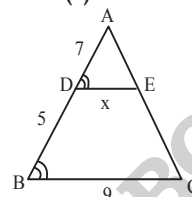
$$\triangle CAB \sim \triangle CDA$$

$$\frac{AC}{DC} = \frac{AB}{AD}$$

$$\frac{15}{4DC} = \frac{5}{3}$$

$$DC = \frac{9}{4} = 2.25$$

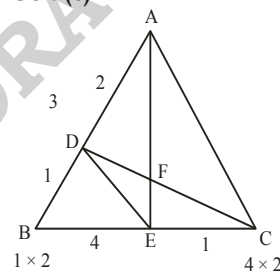
18. Sol. (c)



As, $\triangle ABC \sim \triangle ADE$ (two corresponding angles are same)

$$\frac{AD}{AB} = \frac{DE}{BC} \Rightarrow \frac{7}{12} = \frac{x}{9} \Rightarrow x = 5.25 \text{ cm}$$

19. Sol. (c)

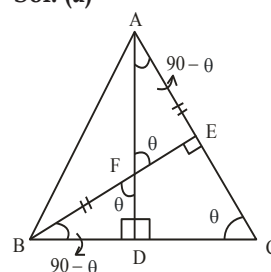


By mass point geometry

$$DF = 8 \text{ unit}, FC = 3 \text{ unit}$$

$$FD:FC = 8:3$$

20. Sol. (a)



In $\triangle BDF$ & $\triangle ADC$

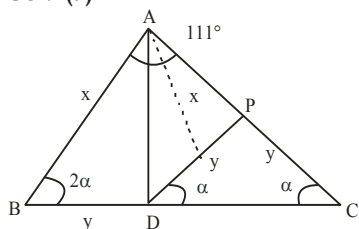
$$\angle BFD = \angle AFE = \theta$$

$$\angle FBD = \angle DAC = 90 - \theta$$

$$\triangle BDF \cong \triangle ADC$$

$$AD = BD \Rightarrow \theta = 45^\circ.$$

21. Sol. (a)



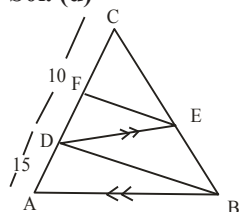
$$\angle BAC = 111^\circ$$

$$AB + BD = AC, \angle ACB = ?$$

$$3\alpha + 111^\circ = 180^\circ$$

$$\alpha = \frac{69}{3} = 23^\circ$$

22. Sol. (d)



$$\text{As } \triangle ABC \sim \triangle DEC$$

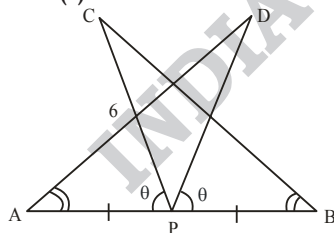
$$\text{With ratio of sides as } 2:5$$

$$\text{And } \triangle FCE \sim \triangle DCB$$

$$\text{With ratio of side as } 2:5 \text{ (as, } CE:CB = 2:5\text{)]}$$

$$\Rightarrow \text{So } CF = \frac{2}{5} \times 10 = 4 \text{ cm}$$

23. Sol. (c)



$$\text{By ASA, } \triangle APD \cong \triangle BPC$$

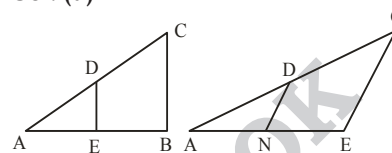
$$AD = 6 \text{ cm}$$

24. Sol. (a)

$$\text{Incircle radius } (r) = \frac{a}{2\sqrt{3}}$$

$$\therefore \frac{12}{2\sqrt{3}} = 2\sqrt{3} \text{ cm}$$

25. Sol. (d)



$$\text{In } \triangle ABC, \because DE \parallel BC$$

$$\therefore \frac{AD}{DC} = \frac{AE}{EB} = \frac{4}{5} = 4:5 \quad \dots (i)$$

$$\text{In } \triangle AEC, EC \parallel ND$$

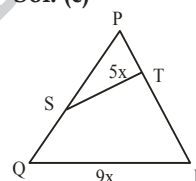
$$\therefore \frac{AN}{NE} = \frac{AD}{DC} = \frac{4}{5} = 4:5 \quad \dots (ii)$$

$$\text{Let } AE = 40 \therefore EB = 50 \text{ and}$$

$$\therefore EN = 40 \times \frac{5}{9} = \frac{200}{9}$$

$$EN:EB = \frac{200}{9}:50 = 4:9$$

26. Sol. (c)



$$\angle STR = 95^\circ \text{ then } \angle STP = 85^\circ$$

$$\text{Given: } \angle Q = 85^\circ \text{ and } \angle R = 65^\circ \text{ and } QR:ST = 9.5$$

$$\text{and } PQ = 21.6 \text{ cm In } \triangle STP \text{ and } \triangle RQP :$$

$$\angle RQP = \angle STP = 85^\circ, \angle P \text{ (common) Hence,}$$

$$\triangle STP \sim \triangle RQP$$

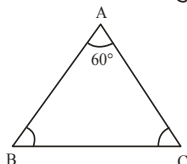
$$\text{Thus, } \Rightarrow \frac{ST}{QR} = \frac{PT}{PQ} \Rightarrow \frac{5}{9} = \frac{PT}{21.6}$$

$$\Rightarrow PT = 12 \text{ cm}$$

Type-6 (Sine & Cosine Rule)

1. In the triangle ABC, AB = 12 cm and AC = 10 cm, and $\angle BAC = 60^\circ$. What is the value of the length of the side BC?

त्रिभुज ABC में, AB = 12 सेमी और AC = 10 सेमी, और $\angle BAC = 60^\circ$ है। भुजा BC की लंबाई का मान क्या है?



SSC CGL 2023 (1st Shift)

- (a) 10 cm (b) 7.13 cm
(c) 13.20 cm (d) 11.13 cm

2. In $\triangle LMN$, $LM = 5\sqrt{2}$ cm, $LN = 13$ cm and $\angle LMN = 135^\circ$. What is the length (in cm) of MN?

$\triangle LMN$ में, $LM = 5\sqrt{2}$ सेमी, $LN = 13$ सेमी और $\angle LMN = 135^\circ$ । MN की लंबाई (सेमी में) क्या है?

SSC CGL Tier II 29/01/2022

- (a) $8\sqrt{2}$ (b) 8 (c) $7\sqrt{2}$ (d) 7

3. ABC is a triangle right angled at B with $AC = 2BC$. If $\angle A = x$, then what is $\angle C$ equal to?

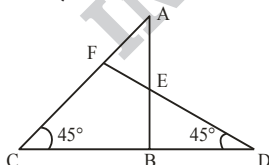
ABC एक त्रिभुज है जिसका कोण B समकोण है और $AC = 2BC$ है। यदि $\angle A = x$ है, तो $\angle C$ किसके बराबर है?

[2022-I]

- (a) $\frac{x}{2}$ (b) $2x$ (c) $\sqrt{2}x$ (d) $\sqrt{3}x$

4. In the given figure, If $CE = 16$ cm, $\angle ABC = 90^\circ$ then find AD = ?

दिये गये चित्र में यदि $CE = 16$ cm, $\angle ABC = 90^\circ$, तब AD की लंबाई क्या होगी?



- (a) $8\sqrt{2}$ cm (b) $16\sqrt{3}$ cm
(c) 16 cm (d) $16\sqrt{2}$ cm

5. In a triangle ABC, if the three sides are $a = 5$, $b = 7$ and $c = 3$, what is angle B?

एक त्रिभुज ABC में, यदि तीन भुजाएँ $a = 5$, $b = 7$ और $c = 3$ हैं, तो कोण B क्या है?

SSC CHSL 24/05/2022 (Morning)

- (a) 1200 (b) 600 (c) 900 (d) 1500

6. Sides of a triangle are $(k^2 + k + 1)$, $(2k + 1)$ and $(k^2 - 1)$ then find the greatest value of angle in triangle?

यदि किसी त्रिभुज की भुजाएँ $(k^2 + k + 1)$, $(2k + 1)$ और $(k^2 - 1)$ हैं तो त्रिभुज के सबसे बड़े कोण का मान क्या है?

- (a) 90 (b) 75 (c) 120 (d) 105

7. In a $\triangle ABC$, AD divides BC in the ratio 2:3. $\angle B = 30^\circ$, $\angle C = 45^\circ$. Find $\frac{\sin \angle BAD}{\sin \angle CAD}$.

$\triangle ABC$ में, AD भुजा BC को 2:3 में विभाजित करता है और $\angle B = 30^\circ$, $\angle C = 45^\circ$ है तो $\frac{\sin \angle BAD}{\sin \angle CAD}$ बताओ।

- (a) $\frac{\sqrt{3}}{2}$ (b) $\frac{\sqrt{2}}{3}$ (c) $\frac{2}{\sqrt{3}}$ (d) $\frac{1}{\sqrt{3}}$

8. Three sides of a triangle are 7 cm, $4\sqrt{3}$ cm and $\sqrt{13}$ cm then the smallest angle is :

एक त्रिभुज की तीन भुजाएँ 7 सेमी, $4\sqrt{3}$ सेमी और $\sqrt{13}$ सेमी हैं तो सबसे छोटा कोण है:

- (a) 15° (b) 30° (c) 45° (d) 60°

9. In a $\triangle ABC$ of area 80 cm^2 . $AC = 20$ cm, $C = 10$ cm. Find out length of AB.

त्रिभुज ABC में, $\triangle ABC$ का क्षेत्रफल 80 cm^2 है। यदि $AC = 20$ cm, $BC = 10$ cm तो AB की लंबाई निकालो?

- (a) $2\sqrt{65}$ (b) $3\sqrt{65}$
(c) $2\sqrt{67}$ (d) None

10. In $\triangle ABC$, $\angle A = 135^\circ$, $CA = 5\sqrt{2}$ cm and $AB = 7$ cm. E and F are the midpoints of sides AC and AB respectively. The length of EF is:

$\triangle ABC$ में, $\angle A = 135^\circ$, $CA = 5\sqrt{2}$ सेमी और $AB = 7$ सेमी। E और F क्रमशः AC और AB भुजाओं के मध्यबिंदु हैं। EF की लंबाई है:

SSC CHSL 12/04/2021 (Morning)

- (a) 6.5 (b) 5.5 (c) 6 (d) 5

11. In a triangle the length of two larger sides are 15 cm and 13 cm. The angles of a triangle are in A.P. The length of remaining side can be- किसी त्रिभुज में दो बड़ी भुजाओं की लंबाई 15 cm और 13 cm है। तथा उसके कोण समांतर श्रेणी है। उसकी बची हुई भुजा की लंबाई हो सकती है-

- (a) 8 cm (b) 4 cm
(c) Either 8 or 7 cm (d) 6 cm

12. Two sides of triangle 50 cm, 24 cm, and its area is 360 cm^2 . find the perimeter of this triangle?

किसी त्रिभुज की दो भुजाएँ 50 सेमी, 24 सेमी और इसका क्षेत्रफल 360 सेमी² है तो इसका परिभाष ज्ञात करो ?

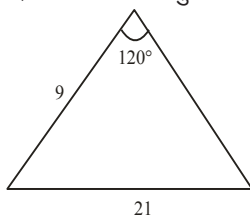
- (a) 102 cm (b) 108 cm
(c) 96 cm (d) 112 cm

13. In a triangle ABC , $\angle B = 30^\circ$, and $\angle C = 45^\circ$. If $BC = 50$ cm then find the length of AB ?

किसी त्रिभुज ABC में $\angle B = 30^\circ$ और $\angle C = 45^\circ$ है। यदि $BC = 50$ सेमी तो AB की लम्बाई ज्ञात करो ?

- (a) $50/\sqrt{3} + 1$ (b) $50(\sqrt{3} - 1)$
(c) $100/(\sqrt{3} - 1)$ (d) $100(\sqrt{3} - 1)$

14. In the given fig. Find out area of Δ .
दिये गये चित्र में त्रिभुज का क्षेत्रफल निकालो।



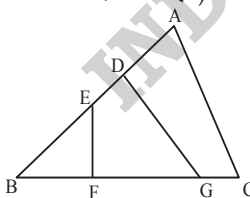
- (a) $\frac{135\sqrt{3}}{4}$ (b) $\frac{145\sqrt{3}}{7}$
(c) $\frac{120\sqrt{3}}{7}$ (d) $\frac{145\sqrt{3}}{4}$

15. In the given figure, if $D = 3$, $DE = 4$, $AB = 12$, $BF = 2$, $FG = 6$, $BC = 10$. then the value of $\frac{M}{N}$ is:

दिए गए चित्र में, यदि $AD = 3$, $DE = 4$, $AB = 12$, $BF = 2$, $FG = 6$, $BC = 10$. तो M/N का मान है:

(Assume: M is the area of the quadrilateral $FGDE$ and N is the area of the triangle ABC .)

(मान लें: M चतुर्भुज $FGDE$ का क्षेत्रफल है और N त्रिभुज ABC का क्षेत्रफल है।)

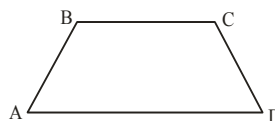


SSC CHSL 14/10/2020 (Afternoon)

- (a) $\frac{31}{60}$ (b) $\frac{1}{2}$ (c) $\frac{25}{49}$ (d) $\frac{1}{3}$

16. $ABCD$ is a Quadrilateral such that $AB = 5$ cm, $CD = 7$ cm, $BC = 17$ cm and $AD = 25$ cm. also $\angle ABC + \angle BCD = 270^\circ$ find the area of Quadrilateral $ABCD$?

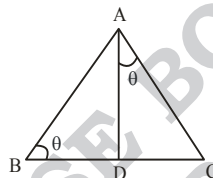
$ABCD$ एक चतुर्भुज है जिसमें $AB = 5$ सेमी, $CD = 7$ सेमी, $BC = 17$ सेमी और $AD = 25$ सेमी. और $\angle ABC + \angle BCD = 270$ तो चतुर्भुज $ABCD$ का क्षेत्रफल ज्ञात करें?



- (a) 80 cm^2 (b) 90 cm^2
(c) 105 cm^2 (d) 100 cm^2

17. In ΔABC area is 300 cm^2 . $BD = 42$ cm, $DC = 8$ cm. Find out AB in given figure.

त्रिभुज ABC का क्षेत्रफल 300 cm^2 है। $BD = 42$ cm, $DC = 8$ cm तो दिये गये चित्र में AB की लम्बाई निकालो?



- (a) $10\sqrt{15} \text{ cm}$ (b) $10\sqrt{10} \text{ cm}$
(c) $10\sqrt{13} \text{ cm}$ (d) None

18. In a ABC , $AB = AC = 17$, D is a point on BC such that $CD = 4$ cm, $AD = 15$ cm. Find BD .

ABC में, $AB = AC = 17$, D BC पर एक बिंदु इस प्रकार है कि $CD = 4$ सेमी, $AD = 15$ सेमी है। BD खोजें।

- (a) 12 cm (b) 16 cm
(c) 25 cm (d) 35 cm

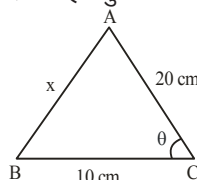
19. If the sides of a triangle are in AP and the largest angle is twice the smallest angle. What is the ratio of sides of triangle?

यदि किसी त्रिभुज की भुजाएँ AP में हैं और सबसे बड़ा कोण सबसे छोटे कोण का दोगुना है। त्रिभुज की भुजाओं का अनुपात क्या है?

- (a) 1:2:3 (b) 6:7:8
(c) 4:5:6 (d) 9:10:11

20. $AC = 20$ cm, $BC = 10$ cm and Area of ABC is 80 cm^2 . Find the length of side AB .

$AC = 20$ सेमी, $BC = 10$ सेमी और ABC का क्षेत्रफल 80 सेमी² है। भुजा AB की लंबाई ज्ञात कीजिए।



- (a) $\sqrt{260} \text{ cm}$ (b) $\sqrt{361} \text{ cm}$
(c) $\sqrt{491} \text{ cm}$ (d) $\sqrt{185} \text{ cm}$

21. Side AB of a triangle ABC is 80 cm long, whose perimeter is 170 cm. If angle $ABC = 60^\circ$, the shortest side of triangle ABC measures _____ cm.

एक त्रिभुज ABC की भुजा AB 80 सेमी लंबी है, जिसका परिमाण 170 सेमी है। यदि कोण $\angle ABC = 60^\circ$ है, तो त्रिभुज ABC की सबसे छोटी भुजा _____ सेमी है।

SSC CPO 16/03/2019 (Evening)

- (a) 17 (b) 15 (c) 25 (d) 21

22. In $\triangle ABC$, $AB = AC$ and D is a point on BC . If $BD = 5$ cm, $AB = 12$ cm and $AD = 8$ cm, then the length of CD is :

$\triangle ABC$ में, $AB = AC$ और D , BC पर एक बिंदु है। यदि $BD = 5$ सेमी, $AB = 12$ सेमी और $AD = 8$ सेमी है, तो CD की लंबाई है:

SSC CGL TIER II (12/09/2019)

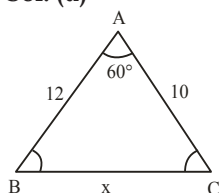
- (a) 14.8 cm (b) 16.2 cm
(c) 16 cm (d) 14 cm

Type 6 (Sine & Cosine Rule) Answer Key

1	(d)	2	(d)	3	(b)	4	(c)	5	(a)	6	(c)	7	(b)
8	(b)	9	(a)	10	(a)	11	(c)	12	(b)	13	(b)	14	(a)
15	(a)	16	(b)	17	(c)	18	(b)	19	(c)	20	(a)	21	(a)
22	(c)												

Type-6 (Sine & Cosine Rule) Solution

1. Sol. (d)

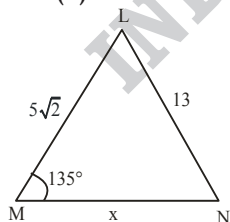


$$\cos A = \frac{AB^2 + AC^2 - BC^2}{2 \times AB \times AC}$$

$$\cos 60^\circ = \frac{12^2 + 10^2 - x^2}{2 \times 12 \times 10} \Rightarrow \frac{1}{2} = \frac{244 - x^2}{240}$$

$$\Rightarrow x^2 = 244 - 120 = 124 \Rightarrow x = 11.13 \text{ cm}$$

2. Sol. (d)



Let, $MN = x$

Applying cosine rule

$$\cos 135^\circ = \frac{(5\sqrt{2})^2 + x^2 - 13^2}{2 \times x \times 5\sqrt{2}}$$

$$-\frac{1}{\sqrt{2}} = \frac{50 + x^2 - 169}{10\sqrt{2}x}$$

$$-10x = x^2 - 119 \Rightarrow x^2 + 10x - 119 = 0$$

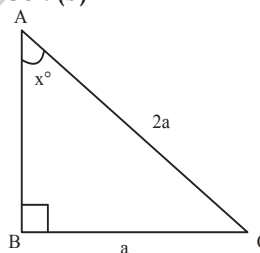
$$\Rightarrow x^2 + 17x - 7x - 119 = 0$$

$$\Rightarrow x(x + 17) - 7(x + 17) = 0$$

$$\Rightarrow (x - 7) = 0 \text{ or } (x + 17) = 0$$

$$x = 7 \Rightarrow MN = 7 \text{ cm}$$

3. Sol. (b)



Let BC is a

$$\therefore AC = 2a$$

$$\therefore AB = \sqrt{(2a)^2 - a^2} = a\sqrt{3}$$

$$\therefore \angle C = 90^\circ - x^\circ$$

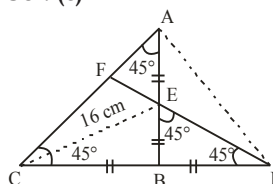
$$\sin x^\circ = \frac{BC}{AC} = \frac{a}{2a} = \frac{1}{2} = \sin 30^\circ$$

$$\Rightarrow x^\circ = 30^\circ$$

$$\therefore \angle C = 90^\circ - 30^\circ = 60^\circ$$

$$\text{Hence, } \angle C = 2 \times 30^\circ = 2x^\circ.$$

4. Sol. (c)



In $\triangle ABC$, $\angle CAB = \angle ACB$

$AB = BC$

In $\triangle BED$, $\angle BDE$

$BC = BD$

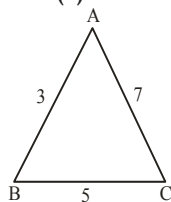
$$CE^2 = CB^2 + BE^2$$

$$AD^2 = AB^2 + BD^2$$

$$AD^2 = CB^2 + BE^2 = CE^2$$

$$CE = AD = 16 \text{ cm.}$$

5. Sol. (a)



Using cosine law,

$$5^2 + 3^2 - 7^2 = 2 \times 3 \times 5 \cos B$$

$$25 + 9 - 49 = 30 \cos B$$

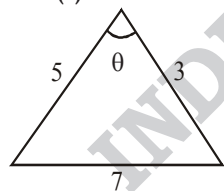
$$-15 = 30 \cos B$$

$$\cos B = -\frac{1}{2} = \cos(180 - 60)$$

$$\text{Angle } B = 120^\circ$$

$$\text{Condition} - (360 \times 3 + 120 = 1200)$$

6. Sol. (c)



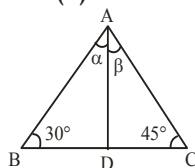
Put $k = 2$

$$\cos \theta = \frac{5^2 + 3^2 - 7^2}{2 \cdot 5 \cdot 3} = \frac{-15}{30} = -\frac{1}{2}$$

$$\cos \theta = \frac{-1}{2} = \cos 120$$

$$\theta = 120^\circ$$

7. Sol. (b)



$$\frac{\sin \alpha}{\sin \beta} = \frac{\frac{2}{3} \times \frac{1}{2}}{\frac{1}{\sqrt{2}}} = \frac{\sqrt{2}}{3}$$

8. Sol. (b)

By using cosine formula,

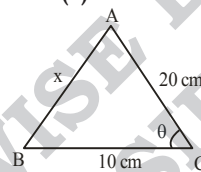
$$\cos \theta = \frac{a^2 + b^2 - c^2}{2ab}$$

$$\Rightarrow \cos \theta = \frac{49 + 48 - 13}{2 \times 7 \times 4\sqrt{3}}$$

$$\Rightarrow \cos \theta = \frac{\sqrt{3}}{2}$$

$$\Rightarrow \theta = 30^\circ$$

9. Sol. (a)



$$\triangle ABC = 80 \text{ cm}^2$$

$$\frac{1}{2} \times 20 \times 10 \sin \theta = 80$$

$$\sin \theta = \frac{4}{5}$$

$$\cos \theta = \frac{3}{5}$$

$$\left(\cos \theta = \frac{a^2 + b^2 - c^2}{2ab} \right)$$

By Cosine Rule,

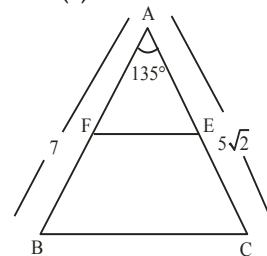
$$\frac{3}{5} = \frac{400 + 100 - x^2}{2 \times 200}$$

$$240 = 500 - x^2$$

$$x^2 = \sqrt{260}$$

$$x = 2\sqrt{65} \text{ cm}$$

10. Sol. (a)



$$\text{Using Cosine rule: } \cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\cos 135^\circ = \frac{7^2 + (5\sqrt{2})^2 - BC^2}{2 \times 7 \times 5\sqrt{2}}$$

$$\Rightarrow \frac{-1}{\sqrt{2}} = \frac{49 + 50 - BC^2}{70\sqrt{2}}$$

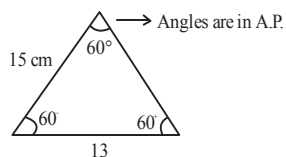
$$BC^2 = 99 + 70 = 169$$

$$BC = 13 \text{ so, } EF = \frac{13}{2} = 6.5$$

11. Sol. (c)

$$\cos 60 = \frac{15^2 + x^2 - 13^2}{2 \cdot 15 \cdot x}$$

$$\frac{1}{2} = \frac{225 + x^2 - 169}{2 \cdot 15 \cdot x}$$



$$15x = x^2 + 56$$

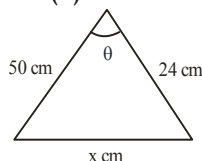
$$x^2 - 15x + 56 = 0$$

$$x^2 - 7x - 8x + 56 = 0$$

$$(x - 7)(x - 8) = 0$$

$$\Rightarrow x = 8 \text{ or } 7$$

12. Sol. (b)



$$\text{ATQ, } \frac{1}{2} \times 50 \times 24 \times \sin \theta = 360$$

$$\sin \theta = \frac{3 \rightarrow P}{5 \rightarrow H} \Rightarrow B = 4$$

$$\cos \theta = \frac{4}{5}$$

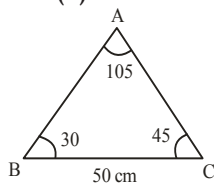
$$\cos \theta = \frac{4}{5} = \frac{50^2 + 24^2 - x^2}{2 \times 50 \times 24}$$

$$1920 = 2500 + 576 - x^2$$

$$x^2 = 1156 \Rightarrow x = 34 \text{ cm}$$

$$\text{Perimeter} = 50 + 24 + 34 = 108 \text{ cm}$$

13. Sol. (b)



Apply SME Rule: -

$$\sin 105 = \sin(180 - 75)$$

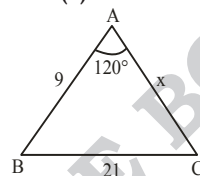
$$= \sin 75 = \frac{\sqrt{3}+1}{2\sqrt{2}}$$

$$\text{Rule: } \frac{AB}{50} = \frac{\sin 45}{\sin 105}$$

$$AB = \frac{50 \times 1/\sqrt{2}}{\frac{\sqrt{3}+1}{2\sqrt{2}}} = \frac{100 \times (\sqrt{3}-1)}{(\sqrt{3}+1)(\sqrt{3}-1)}$$

$$= 50(\sqrt{3} - 1)$$

14. Sol. (a)



$$\text{Ar}(\triangle ABC) = ?$$

$$\cos 120 = \frac{81 + x^2 - 441}{18x}$$

$$-\frac{1}{2} = \frac{81 + x^2 - 441}{18x}$$

$$-9x = 81 + x^2 - 441$$

$$-9x = -360 + x^2$$

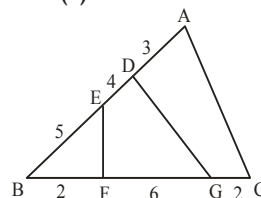
$$x^2 + 9x - 360 = 0$$

$$\begin{array}{cc} +24 & -15 \\ \downarrow & \downarrow \\ -24 & +15 \end{array}$$

$$x = 15$$

$$\text{Ar} = \frac{1}{2} \times 9 \times 15 \times \frac{\sqrt{3}}{2} = \frac{135\sqrt{3}}{4} \text{ cm}^2,$$

15. Sol. (a)



Short trick:

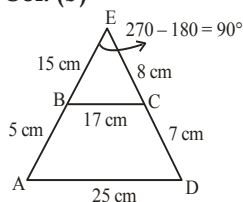
By sin formula,

$$\frac{\text{area of triangle ABC}}{\text{area of quadrilateral DEFG}}$$

$$= \frac{12 \times 10}{(9 \times 8) - (2 \times 5)} = \frac{120}{62} = \frac{N}{M}$$

$$\frac{M}{N} = \frac{62}{120} = \frac{31}{60}$$

16. Sol. (b)

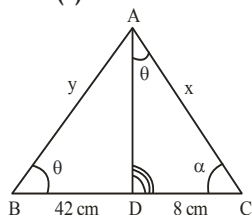


$$\angle AED = 270 - 180 = 90^\circ$$

$$\begin{array}{ccc} 3 & 4 & 5 \\ \downarrow \times 5 & \downarrow \times 5 & \downarrow \times 5 \\ 15 & 20 & 25 \\ ED & AE & AD \end{array}$$

$$\begin{aligned} \text{Area of Quadrilateral} &= \frac{1}{2} \times 20 \times 15 - \frac{1}{2} \times 15 \times 8 \\ &= 150 - 60 = 90 \text{ cm}^2. \end{aligned}$$

17. Sol. (c)



$$\text{Ar}(\triangle ABC) = 300 \text{ cm}^2$$

$$\frac{x}{8} = \frac{50}{x}$$

$$x^2 = 400$$

$$x = 20 \text{ cm}$$

$$\frac{1}{2} \times 50 \times 20 \sin \alpha = 300$$

$$\sin \alpha = \frac{120}{20}$$

$$\sin \alpha = \frac{3 \rightarrow P}{5 \rightarrow H}$$

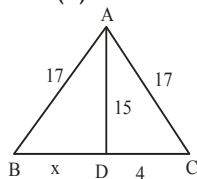
$$\cos \alpha = \frac{4}{5}$$

$$\frac{4}{5} = \frac{2800 + 400 - y^2}{2 \times 50 \times 20}$$

$$\Rightarrow 1600 = 2900 - y^2$$

$$y^2 = 1300 \Rightarrow y = 10\sqrt{13} \text{ cm}$$

18. Sol. (b)



$$AB = AC$$

$$\therefore \angle B = \angle C$$

By using cosine formula,

$$\cos B = \cos C$$

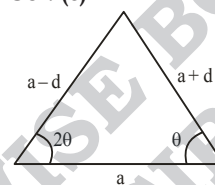
$$\frac{17^2 + (x+4)^2 - 17^2}{2 \times 17 \times (x+4)} = \frac{17^2 + 4^2 - 15^2}{2 \times 17 \times 4}$$

$$x + 4 = \frac{8^2 + 4^2}{4}$$

$$x + 4 = \frac{80}{4} = 20$$

$$BD = x = 16 \text{ cm}$$

19. Sol. (c)

Let sides of triangle be $a-d, a, a+d$, using sine-rule

$$\frac{a+d}{\sin 2\theta} = \frac{a-d}{\sin \theta}$$

$$\frac{a+d}{2\sin \theta \cos \theta} = \frac{a-d}{\sin \theta}$$

$$\cos \theta = \frac{(a+d)}{2(a-d)} \quad \dots (i)$$

using cosine rule

$$\cos \theta = \frac{(a+d)^2 + (a)^2 - (a-d)^2}{2(a+d)(a)} = \frac{4ad + a^2}{2a(a+d)}$$

$$\cos \theta = \frac{4d+a}{2(a+d)} \quad \dots (ii)$$

From (i) & (ii)

$$\frac{a+d}{2(a-d)} = \frac{4d+a}{2(a+d)}$$

$$a^2 + d^2 + 2ad = 4ad + a^2 - 4d^2 - ad$$

$$\Rightarrow 5d^2 = ad$$

$$\frac{a}{d} = \frac{5}{1}$$

$$\text{Ratio will be } \Rightarrow 5 - 1 : 5 : 5 + 1$$

$$\Rightarrow 4 : 5 : 6$$

20. Sol. (a)

$$\frac{1}{2} \times 10 \times 20 \times \sin \theta = 80$$

$$\sin \theta = \frac{4}{5} = \frac{P}{H}$$

$$B = \sqrt{5^2 - 4^2} = 3$$

$$\cos \theta = \frac{3}{5}$$

$$\cos \theta = \frac{3}{5}$$

$$\frac{3}{5} = \frac{20^2 + 10^2 - x^2}{2 \times 20 \times 10}$$

$$240 = 500 - x^2$$

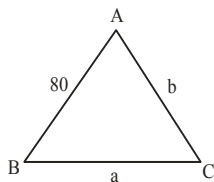
$$x^2 = 260$$

$$AB = x = \sqrt{260} \text{ cm}$$

21. Sol. (a)

$$a + b + 80 = 170$$

$$a + b = 90 \text{ cm}$$



From cosine rule

$$\cos 60^\circ = \frac{a^2 + 80^2 - b^2}{2 \times 80 \times a}$$

$$80(90 - b) = (90 - b)^2 + 80^2 - b^2$$

$$7200 - 80b = 8100 - 180b + 6400$$

$$100b = 7300 \Rightarrow b = 73$$

$$a = 90 - 73 = 17$$

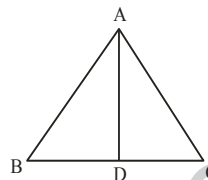
22. Sol. (c)

Given, $AB = AC$, $BD = 5 \text{ cm}$, $AB = 12 \text{ cm}$ and

$AD = 8 \text{ cm}$

$$\Rightarrow \angle ABC = \angle ACB \text{ (AB = BC)}$$

$$\text{Let } \angle ABC = \angle ACB = \theta$$



In $\triangle ABD$

$$AD^2 = AB^2 + BD^2 - 2 \times AB \times BD \times \cos \theta$$

$$8^2 = 12^2 + 5^2 - 2 \times 12 \times 5 \times \cos \theta$$

$$\Rightarrow \cos \theta = \frac{7}{8} \Rightarrow \text{In } \triangle ADC$$

$$AD^2 = AC^2 + CD^2 - 2 \times AC \times CD \times \cos \theta$$

$$8^2 = 12^2 + CD^2 - 2 \times 12 \times CD \times \frac{7}{8}$$

$$\Rightarrow CD^2 - 21CD + 80 = 0$$

$$\Rightarrow CD^2 - 16CD - 5CD + 80 = 0$$

$$\Rightarrow CD(CD - 16) - 5(CD - 16) = 0 \Rightarrow CD = 16 \text{ or } 5$$

Clearly among the given options option, C is the right answer.

Type-7 (Center of Triangle)

1. If O is the orthocentre of a $\triangle ABC$ and $\angle BOC = 140^\circ$, then the measure of $\angle BAC$ is:
यदि O , $\triangle ABC$ का लंबकेंद्र है और $\angle BOC = 140^\circ$ है, तो $\angle BAC$ का माप है:

Higher Secondary 2023 (Shift - 3)

- (a) 45° (b) 40° (c) 30° (d) 60°

2. A chord of a circle is equal to its radius of length 9 cm. Find the angle subtended by it in major segment.

एक वृत्त की एक जीवा उसकी त्रिज्या 9 सेमी के बराबर है। प्रमुख खंड में इसके द्वारा अंतरित कोण ज्ञात कीजिए।

SSC CPO 10/11/2022 (Afternoon)

- (a) 90° (b) 60° (c) 30° (d) 120°

3. In $\triangle LMN$, the bisectors of $\angle L$ and $\angle N$ intersect at an angle of 112° . What is the measure (in degrees) of $\angle M$?

$\triangle LMN$ में, $\angle L$ और $\angle N$ के समद्विभाजक 112° के कोण पर प्रतिच्छेद करते हैं। $\angle M$ का माप (डिग्री में) क्या है?

SSC CGL 11/04/2022 (Evening)

- (a) 62 (b) 60 (c) 44 (d) 72

4. In $\triangle ABC$, if G is the centroid and AD is a median with length 9 cm, then the length of AG (in cm) is:
 $\triangle ABC$ में, यदि G केन्द्रक है और AD एक माधिका है जिसकी लंबाई 9 सेमी है, तो AG की लंबाई (सेमी में) है:

SSC CHSL 10/06/2022 (Evening)

- (a) 8 (b) 5 (c) 7 (d) 6

5. An equilateral triangle of side x is inscribed in a circle of radius y . Which one of the following is correct?

भुजा x का एक समबाहु त्रिभुज त्रिज्या y के एक वृत्त में अंकित है। निम्नलिखित में से कौन सा सही है?

[CDS-2022-I]

- (a) $2y = x$ (b) $2y = \sqrt{3}x$
(c) $\sqrt{3}y = 2x$ (d) $\sqrt{3}y = x$

6. In $\triangle ABC$, $\angle A = 50^\circ$, BE and CF are perpendiculars on AC and AB at E and F , respectively. BE and CF intersect at H . The bisectors of $\angle HBC$ and $\angle HCB$ intersect at P . $\angle BPC$ is equal to:

$\triangle ABC$ में, $\angle A = 50^\circ$, BE और CF क्रमशः AC और AB पर E और F पर लंबवत हैं। BE और CF , H पर प्रतिच्छेद करते हैं। $\angle HBC$ और $\angle HCB$ के समद्विभाजक P पर प्रतिच्छेद करते हैं। $\angle BPC$ बराबर है:

SSC CGL Tier II 03/02/2022

- (a) 155° (b) 100° (c) 115° (d) 120°

7. In $\triangle ABC$, O is the point of intersection of the bisectors of $\angle B$ and $\angle A$. If $\angle BOC = 108^\circ$, then $\angle BAO = ?$

$\triangle ABC$ में, O , $\angle B$ और $\angle A$ के समद्विभाजक का प्रतिच्छेदन बिंदु है। यदि $\angle BOC = 108^\circ$ है, तो $\angle BAO = ?$

SSC CGL Tier II 29/01/2022

- (a) 27° (b) 18° (c) 36° (d) 40°

8. In triangle XYZ , P is the incentre of the triangle XYZ . If angle $XYZ = 50$ degree, then what is the value of angle XPZ ?

त्रिभुज XYZ में, P त्रिभुज XYZ का अंतःकेन्द्र है। यदि कोण $XYZ = 50$ डिग्री है, तो कोण XPZ का मान क्या है?

SSC CGL 07/12/2022 (2nd Shift)

- (a) 100 degree (c) 140 degree

- (b) 115 degree (d) 130 degree

9. In $\triangle ABC$, $\angle A = 88^\circ$. If I is the incentre of the triangle, then the measure of $\angle BIC$ is ;

$\triangle ABC$ में, $\angle A = 88^\circ$. यदि I त्रिभुज का अंतःकेन्द्र है, तो $\angle BIC$ का माप है;

SSC CGL 12/04/2022 (Afternoon)

- (a) 112° (b) 134° (c) 56° (d) 68°

10. In $\triangle ABC$, $\angle A = 66^\circ$ and $\angle B = 50^\circ$. If the bisectors of $\angle B$ and $\angle C$ meet at P , then, $\angle BPC - \angle PCA = ?$

$\triangle ABC$ में, $\angle A = 66^\circ$ और $\angle B = 50^\circ$ । यदि $\angle B$ और $\angle C$ के समद्विभाजक P पर मिलते हैं, तो $\angle BPC - \angle PCA = ?$

SSC CGL Tier II 29/01/2022

- (a) 93° (b) 81° (c) 91° (d) 83°

11. In $\triangle ABC$ in which $AB = 8$ cm, $AC = 6$ cm. I is the incentre. Then find out area of $\triangle ABC$ and $\angle BIC = 135^\circ$.

त्रिभुज ABC में $AB = 8$ cm, $AC = 6$ cm. I त्रिभुज का अन्तःकेन्द्र है। तो $\triangle ABC$ का क्षेत्रफल बताओ। यदि $\angle BIC = 135^\circ$ है।

- (a) 25 cm^2 (b) 24 cm^2

- (c) 26 cm^2 (d) 30 cm^2

12. From the circumcentre L of $\triangle XYZ$, perpendicular LM is drawn on side YZ . If $\angle YXZ = 60^\circ$, then the measure of $\angle YLM$ is:

$\triangle XYZ$ के परिकेंद्र L से, YZ पक्ष पर लम्ब LM खींचा गया है। $\angle YXZ = 60^\circ$, तो $\angle YLM$ का माप है:

SSC CGL 02/12/2022 (4th Shift)

- (a) 60° (b) 120° (c) 180° (d) 90°

13. What is the area (in cm^2) of the circumcircle of a triangle whose sides are 6 cm, 8 cm and 10 cm respectively?

एक त्रिभुज के परिवृत्त का क्षेत्रफल (सेमी² में) क्या है जिसकी भुजाएँ क्रमशः 6 सेमी, 8 सेमी और 10 सेमी हैं?

- (a) 275/7 (b) 550/7
(c) 2200/7 (d) 1100/7

14. The inradius of a triangle is 6 cm and sum of length of its side is 50 cm. find the area of triangle?

एक त्रिभुज के अंत वृत्त की त्रिज्या 6 सेमी⁰ और उसकी भुजाओं का योग 50 सेमी⁰ है तो उसका क्षेत्रफल क्या होगा?

- (a) 150 (b) 50 (c) 300 (d) 100

15. In $\triangle ABC$, AB and AC are produced to points D and E respectively. If the bisectors of angle CBD and angle BCE meet at point O , such that $\angle BOC = 63^\circ$, then $\angle A = ?$

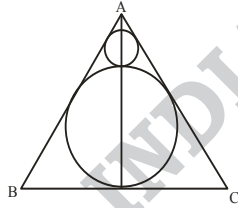
$\triangle ABC$ में, AB और AC को क्रमशः बिंदु D और E तक बढ़ाया जाता है। यदि कोण CBD और कोण BCE के समद्विभाजक बिंदु O पर इस प्रकार मिलते हैं कि $\angle BOC = 63^\circ$ है, तो $\angle A = ?$

SSC CGL 18/08/2021 (Evening)

- (a) 54° (b) 27° (c) 63° (d) 36°

16. ABC is an equilateral triangle if area of larger circle is 1422 cm^2 then area of smaller circle (in cm^2)?

ABC एक समबाहु त्रिभुज है यदि बड़े वृत्त का क्षेत्रफल 1422 cm^2 है तब छोटे वृत्त का क्षेत्रफल ज्ञात करें।



- (a) 154 cm^2 (b) 172 cm^2
(c) 158 cm^2 (d) 166 cm^2

17. D, E and F are the feet of the perpendiculars from the vertices A, B and C respectively, of a triangle ABC . If angle BED and angle BFE (in degrees) are 24 and 110, respectively, what is the measure of angle EBF ? (in degrees)

D, E और F एक त्रिभुज ABC के शीर्षों A, B और C पर क्रमशः डाले गए लंबों के पाद हैं। यदि कोण BED और कोण BFE (डिग्री में) क्रमशः 24 और 110 हैं, तो कोण EBF का माप क्या है? (डिग्री में)

SSC CHSL 6/8/2021 (Morning)

- (a) 55 (b) 67 (c) 86 (d) 46

18. In a $\triangle ABC$, I is a point which is equidistance from all sides of triangle. If $\angle B = 56^\circ$, then find out $\angle AIB + \angle BIC$?

$\triangle ABC$ में, I एक बिंदु है जो त्रिभुज की सभी भुजाओं से समान दूरी पर है। यदि $\angle B = 56^\circ$ है, तो $\angle AIB + \angle BIC$ ज्ञात कीजिए?

- (a) 242° (b) 214° (c) 248° (d) 236°

19. O is the circumcentre of $\triangle ABC$. If $\angle BAC = 85^\circ$, $\angle BCA = 75^\circ$, the $\angle OAC$ is equal to:

O , $\triangle ABC$ का परिकेन्द्र है। यदि $\angle BAC = 85^\circ$, $\angle BCA = 75^\circ$, तो $\angle OAC$ बराबर है:

- (a) 70° (b) 60° (c) 50° (d) 40°

20. Angle between the internal bisectors of two angles $\angle B$ and $\angle C$ of a $\triangle ABC$ is 132° , then the value of $\angle A$ is:

$\triangle ABC$ के दो कोणों $\angle B$ और $\angle C$ के आंतरिक समद्विभाजक के बीच का कोण 132° है, तो $\angle A$ का मान है:

SSC CGL 16/8/2021 (Morning)

- (a) 84° (b) 62° (c) 48° (d) 72°

21. In $\triangle ABC$, medians BE and CF are perpendicular to each other and intersect at M . If $BE = 9 \text{ cm}$ and $CF = 13 \text{ cm}$, then the area of $\triangle ABC$ will be: (in cm^2)

$\triangle ABC$ में, माध्यिकाएँ BE और CF एक दूसरे के लंबवत हैं और M पर प्रतिच्छेद करती हैं। यदि $BE = 9$ सेमी और $CF = 13$ सेमी है, तो $\triangle ABC$ का क्षेत्रफल होगा: (सेमी² में)

SSC CHSL 15/4/2021 (Evening)

- (a) 75 (b) 78 (c) 76 (d) 68

22. What is the radius of incircle of the triangle whose sides are 51 cm, 37 cm, and 20 cm.

उस त्रिभुज के अंतःवृत्त की त्रिज्या ज्ञात करें जिसकी भुजाएँ क्रमशः 51 सेमी⁰, 37 सेमी⁰, और 20 सेमी⁰ हैं?

- (a) 5.66 cm (b) 5.33 cm
(c) 6.66 cm (d) 7.24 cm

23. In $\triangle PQR$, $\angle Q > \angle R$, PS is the bisector of $\angle P$ and $PT \perp RQ$. If $\angle SPT = 28^\circ$ and $\angle R = 23^\circ$. Then find $\angle Q$.

$\triangle PQR$ में $\angle Q > \angle R$, PS , $\angle P$ का द्विभाजक है। और $PT \perp RQ$ यदि $\angle SPT = 28^\circ$ और $\angle R = 23^\circ$ तो $\angle Q$ की माप बताओ।

- (a) 79° (b) 74° (c) 82° (d) 89°

24. In a triangle ABC , I is incenter. AI is produced up to D . Point D is on BC . Find $AI : ID$.

त्रिभुज ABC में I त्रिभुज का अंतकेन्द्र है। AI को बिंदु D तक आगे बढ़ाया जाता है। बिंदु D , BC पर स्थित है। $AI : ID$ बताओ?

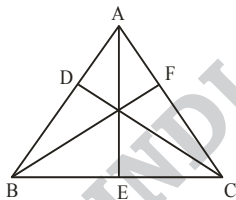
- (a) 15:9 (b) 14:9

- (c) 13:7 (d) 9:14

25. If the side of triangle are 39, 80, 89. then what is the distance between orthocenter and incenter?
यदि किसी त्रिभुज की भुजाएँ क्रमशः 39, 80, 89 है तो उसके अंतर्केन्द्र और लम्ब केन्द्र के बीच में क्या दूरी होगी ?
(a) $14\sqrt{2}$ (b) 15 (c) $15\sqrt{2}$ (d) 16
26. If O be the orthocentre of ABC, $OF \perp AB$ and $OE \perp AC$. If $OE = 2$ cm and $BE = 5$ cm, then find the value of $OF \times OC$.
यदि O, ABC, $OF \perp AB$ और $OE \perp AC$ का लम्बकेन्द्र है। यदि $OE = 2$ सेमी और $BE = 5$ सेमी है, तो $OF \times OC$ का मान ज्ञात कीजिए।
(a) 10 (b) 3 (c) 6 (d) 3
27. Which one of the following is correct in respect of a right angled triangle?
समकोण त्रिभुज के संबंध में निम्नलिखित में से कौन सा सही है?

[CDS-2019-II]

- (a) Its orthocentre lies inside the triangle
(b) Its orthocentre lies outside the triangle
(c) Its orthocentre lies on the triangle
(d) It has no orthocentre
28. In the given fig O is the incenter of $\triangle ABC$. If $AO:OE = 7:5$, $CO:OD = 4:3$ then find $BO:OF$?
दिये गये चित्र में, O त्रिभुज ABC का अंतर्केन्द्र है यदि $AO:OE = 7:5$, $CO:OD = 4:3$ तब $BO:OF$ क्या है?

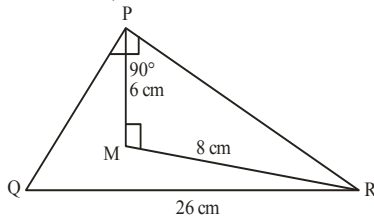


- (a) $\frac{71}{13}$ (b) $\frac{69}{15}$ (c) $\frac{74}{17}$ (d) $\frac{59}{11}$
29. In a $\triangle ABC$, the bisectors of $\angle B$ and $\angle C$ meet at point O inside the triangle. If $\angle BOC = 122^\circ$, then the measure of $\angle A$
 $\triangle ABC$ में, $\angle B$ और $\angle C$ के समद्विभाजक त्रिभुज के अंदर बिंदु O पर मिलते हैं। यदि $\angle BOC = 122^\circ$ है, तो $\angle A$ का माप
SSC CGL 4/06/2019 (Morning)
(a) 64° (b) 62° (c) 72° (d) 68°
30. In a triangle ABC, $\angle A = 72^\circ$, its side AB and AC produced to the point D and E respectively. if the bisector of the $\angle CBD$ and $\angle BCE$ meet at point O, then $\angle BOC$ is equal to ?
त्रिभुज ABC में, $\angle A = 72^\circ$, तथा इसकी भुजा AB और AC को क्रमशः बिंदु D और E तक बढ़ाया जाता है यदि $\angle CBD$

और $\angle BCE$ के अद्विज बिंदु O पर मिलते हैं तो $\angle BOC$ का मान क्या है?

- (a) 16 (b) 54 (c) 32 (d) 106
31. If O and I is the circumcenter and incenter of $\triangle DEF$ respectively. $\angle EOF = 124^\circ$, then $\angle EIF$?
यदि त्रिभुज DEF में O और I क्रमशः परिकेन्द्र और अन्तर्केन्द्र है। $\angle EOF = 124^\circ$ तो $\angle EIF =$?
(a) 118° (b) 124° (c) 106° (d) 121°
32. In triangle PQR, internal bisector of $\angle Q$ and $\angle R$ meet at O. If $\angle QPR = 70^\circ$, then what is the value (in degrees) of $\angle QOR$?
त्रिभुज PQR में, $\angle Q$ और $\angle R$ का आंतरिक समद्विभाजक O पर मिलता है। यदि $\angle QPR = 70^\circ$ है, तो $\angle QOR$ का मान (डिग्री में) क्या है?
(a) 45 (b) 125 (c) 115 (d) 110
33. If the length of three altitude are 10, 12, 15 cm. Find in radius of triangle.
यदि किसी त्रिभुज के तीनों लम्बों की लम्बाइयाँ क्रमशः 10, 12, 15 cm है। तो त्रिभुज अंतःवृत्त की त्रिज्या बताओ।
(a) 1 cm (b) 25 cm
(c) 2 cm (d) None
34. In a $\triangle ABC$, the sides AB and AC are extended to P and Q respectively. The bisectors of $\angle PBC$ and $\angle QCB$ intersect at a point R. If $\angle R = 66^\circ$, then the measure of $\angle A$ is:
 $\triangle ABC$ में, भुजाओं AB और AC को क्रमशः P और Q तक बढ़ाया गया है। $\angle PBC$ और $\angle QCB$ के समद्विभाजक एक बिंदु R पर प्रतिच्छेद करते हैं। यदि $\angle R = 66^\circ$ है, तो $\angle A$ का माप है:
SSC CGL 4/06/2019 (Evening)
(a) 36° (b) 24° (c) 48° (d) 72°
35. If G is the centroid of $\triangle ABC$ and $AG = BC$, then $\angle BGC$ is :
यदि G, $\triangle ABC$ का केन्द्रक है और $AG = BC$ है, तो $\angle BGC$ है:
(a) 75 (b) 45 (c) 90 (d) 60
36. In triangle PQR, C is the centroid. $PQ = 30$ cm, $QR = 36$ cm and $PR = 50$ cm. If D is the midpoint of QR, then what is the length (in cm) of CD ?
त्रिभुज PQR में, C केन्द्रक है। $PQ = 30$ सेमी, $QR = 36$ सेमी और $PR = 50$ सेमी। यदि D, QR का मध्यबिंदु है, तो CD की लंबाई (सेमी में) क्या है?
(a) $(4\sqrt{86})/3$ (b) $(2\sqrt{86})/3$
(c) $(5\sqrt{86})/3$ (d) $(5\sqrt{86})/2$
37. In the given figure $\angle QPR = 90^\circ$, $QR = 26$ cm, $PM = 6$ cm, $MR = 8$ cm and $\angle PMR = 90^\circ$, find the area of $\triangle PQR$.

दो गई आकृति में $\angle QPR = 90^\circ$, $QR = 26$ सेमी, $PM = 6$ सेमी, $MR = 8$ सेमी और $\angle PMR = 90^\circ$, $\triangle PQR$ का क्षेत्रफल ज्ञात कीजिए।



- (a) 180 cm^2 (c) 120 cm^2
(b) 240 cm^2 (d) 150 cm^2

38. The circumcentre, incentre, orthocentre and the centroid of a triangle are one and the same point. The triangle must be:
किसी त्रिभुज का परिकेंद्र, अंतर्केंद्र, लंबकेन्द्र और केन्द्रक एक ही बिंदु होते हैं। त्रिभुज होना चाहिए:

SSC CHSL 9/07/2019 (Evening)

- (a) Isosceles (b) right-angled
(c) right-angled isosceles (d) equilateral

39. In $\triangle ABC$, the medians AD, BE and CF meet at O. What is the ratio of the area of $\triangle ABD$ to the area of $\triangle AOE$?

$\triangle ABC$ में, माध्यिकाएँ AD, BE और CF O पर मिलती हैं। $\triangle ABD$ के क्षेत्रफल का $\triangle AOE$ के क्षेत्रफल से अनुपात क्या है?

SSC CGL TIER II (12/09/2019)

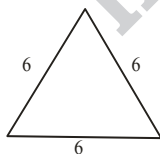
- (a) 2:1 (b) 3:1 (c) 5:2 (d) 3:2

40. An equilateral triangle ABC is inscribed in a circle of radius $20\sqrt{3}$ cm. What is the length of the side of the triangle?

एक समबाहु त्रिभुज ABC त्रिज्या $20\sqrt{3}$ सेमी के एक वृत्त में अंकित है। त्रिभुज की भुजा की लंबाई क्या है?

- (a) 30 cm (b) 40 cm (c) 50 cm (d) 60 cm

41. Find area



- (a) $9\sqrt{3}$ (b) $3\sqrt{3}$ (c) $5\sqrt{3}$ (d) None

42. The perimeter of $\triangle ABC$ is 24 cm and its side, $= 9$ cm. AD is the bisector of $\angle BAC$, while I is the incentre AI : ID is equal to :

$\triangle ABC$ का परिमाप 24 सेमी है और इसकी भुजा, $BC = 9$ सेमी है। AD, $\angle BAC$ का समद्विभाजक है, जबकि I अंतःकेंद्र है AI : ID इसके बराबर है:

SSC CHSL 11/07/2019 (Afternoon)

- (a) 7:5 (b) 5:2 (c) 3:2 (d) 5:3

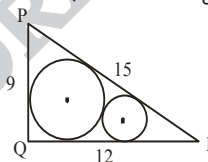
43. In $\triangle ABC$, $\angle A = 52^\circ$ and O is the orthocenter of the triangle (BO and CO meet AC and AB at E and F respectively when produced). If the bisectors of $\angle OBC$ and $\angle OCB$ meet at P, then the measure of $\angle BPC$ is:

$\triangle ABC$ में, $\angle A = 52^\circ$ और O त्रिभुज का लंबकेन्द्र है (बढ़ाने पर O और CO क्रमशः AC और AB से E और F पर मिलते हैं)। यदि $\angle OBC$ और $\angle OCB$ के समद्विभाजक P पर मिलते हैं, तो $\angle BPC$ का माप है:

SSC CGL TIER II (11/09/2019)

- (a) 124° (b) 132 (c) 138 (d) 154

44. In the given fig. find the radius of smaller circle. दिये गए चित्र में छोटे वृत्त की त्रिज्या क्या होगी?



- (a) $11 - 2\sqrt{10}/3$ (b) $11 - \sqrt{10}/3$
(c) $11 - 5\sqrt{10}/3$ (d) $11 - 2\sqrt{5}/3$

45. In a triangle ABC, the sides AB, AC are produced and the bisectors of exterior angles of $\angle ABC$ and $\angle ACB$ intersect at D. If $\angle BAC = 50^\circ$, then $\angle BDC$ is equal to

त्रिभुज ABC में, भुजाएँ AB, AC बनी हुई हैं और $\angle ABC$ और $\angle ACB$ के बाह्य कोणों के समद्विभाजक D पर प्रतिच्छेद करते हैं। यदि $\angle BAC = 50^\circ$ है, तो $\angle BDC$ बराबर है

[CDS-2018-II]

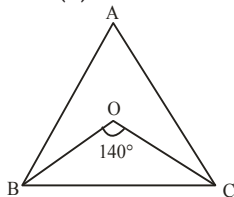
- (a) 115° (b) 65°
(c) 55° (d) 40°

Type 7 (Center of Triangle) Answer Key

1	(b)	2	(c)	3	(c)	4	(d)	5	(d)	6	(a)	7	(b)
8	(b)	9	(b)	10	(c)	11	B	12	(a)	13	(b)	14	(a)
15	(a)	16	(c)	17	(d)	18	(a)	19	(a)	20	(a)	21	(b)
22	(a)	23	(a)	24	(b)	25	(c)	26	(c)	27	(c)	28	(a)
29	(a)	30	(b)	31	(a)	32	(b)	33	(d)	34	(c)	35	(c)
36	(a)	37	(c)	38	(d)	39	(b)	40	(d)	41	(c)	42	(d)
43	(d)	44	(a)	44	(b)								

Type-7 (Center of Triangle) Solution

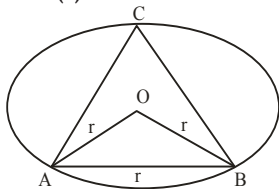
1. Sol. (b)



As we know, $\angle BAC + \angle BOC = 180^\circ$

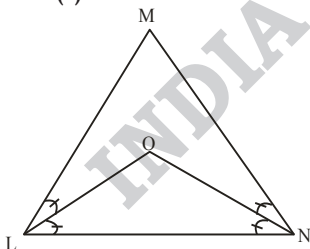
So, $\angle BAC = 180^\circ - 140^\circ = 40^\circ$

2. Sol. (c)



Clearly, we can see that $\triangle AOB$ is an equilateral triangle. $\Rightarrow \angle AOB = 60^\circ$ As we know, the angle subtended by chord at the centre is half the angle subtended by it at any point on the circle. So, Angle subtended by it in major segment $= \frac{60^\circ}{2} = 30^\circ$

3. Sol. (c)

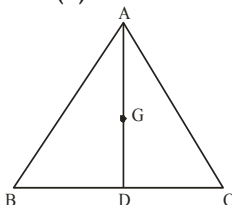


Let bisectors of $\angle L$ and $\angle N$ meet at point O.

$$\angle LON = 90^\circ + \frac{\angle M}{2} \Rightarrow 112^\circ = 90^\circ + \frac{\angle M}{2}$$

$$\frac{\angle M}{2} = 22^\circ \Rightarrow \angle M = 44^\circ$$

4. Sol. (d)

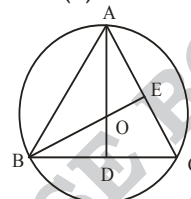


We know,

If G is centroid, then ratio of AG:GD = 2:1

$$\Rightarrow AG = 9 \times \frac{2}{3} = 6$$

5. Sol. (d)



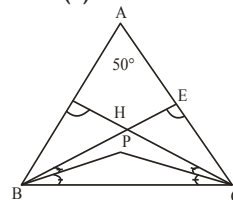
$\triangle ABC$ is an equilateral triangle, such that $AB = BC = CA = x$

$$AD = \sqrt{x^2 - \left(\frac{x}{2}\right)^2} = \frac{\sqrt{3}}{2}x$$

$$\text{Circum radius } AO = \frac{2}{3} \times AD = \frac{2}{3} \times \frac{\sqrt{3}}{2}x = \frac{x}{\sqrt{3}} = y$$

$$x = \sqrt{3} \cdot y$$

6. Sol. (a)



Here point H is orthocentre,

$$\text{so } \angle BHC + \angle BAC = 180^\circ$$

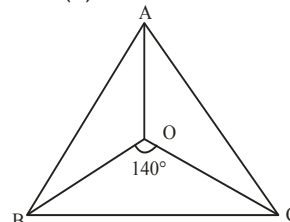
$$\angle BHC + 50^\circ = 180^\circ \Rightarrow \angle BHC = 130^\circ$$

In above figure, point P is incentre,

$$\text{so } \angle BPC = 90^\circ + \frac{\angle BHC}{2}$$

$$= 90^\circ + \frac{130^\circ}{2} = 90^\circ + 65^\circ = 155^\circ$$

7. Sol. (b)

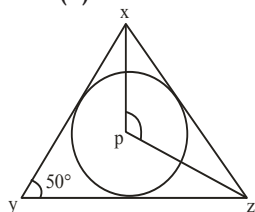


Clearly, O is the incentre of $\triangle ABC$,

$$\angle BAC = 2 \times (\angle BOC - 90) = 2 \times 18 = 36^\circ$$

$$\angle BAO = \frac{1}{2} \angle BAC = \frac{36}{2} = 18^\circ$$

8. Sol. (b)



From incentre property,

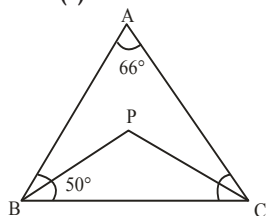
$$\angle XPZ = 90^\circ + \frac{\angle XYZ}{2}$$

$$= 90 + \frac{50}{2} = 115^\circ$$

9. Sol. (b)

$$\angle BIC = 90^\circ + \frac{\angle A}{2} = 90^\circ + \frac{88^\circ}{2} = 90^\circ + 44^\circ = 134^\circ$$

10. Sol. (c)



$$\angle C = 180 - \angle A - \angle B = 180^\circ - 66^\circ - 50^\circ$$

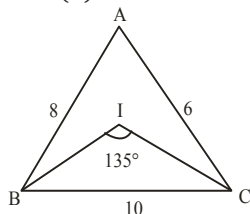
$$= 64^\circ \Rightarrow \text{As P is incentre,}$$

$$\angle BPC = 90^\circ + \frac{\angle A}{2} = 90^\circ + \frac{66^\circ}{2} = 123^\circ$$

$$\angle PCA = \frac{1}{2} \angle C = 32^\circ$$

$$\angle BPC - \angle PCA = 123^\circ - 32^\circ = 91^\circ$$

11. Sol. (b)



$$\text{Ar}(\triangle ABC) = ?$$

$$135 = 90 + \frac{x}{2}$$

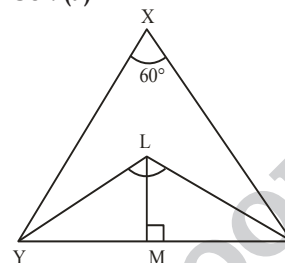
$$45 = \frac{x}{2}$$

$$x = 90^\circ$$

$$\text{Ar}(\triangle ABC) = \frac{1}{2} \times 8 \times 6 \times \sin 90^\circ$$

$$= 24 \text{ cm}^2$$

12. Sol. (a)



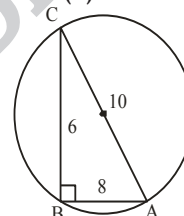
$$\angle YLZ = 2 \times \angle YXZ \quad (\text{circumcenter})$$

$$\angle YLZ = 2 \times 60^\circ = 120^\circ$$

$\triangle YLZ$ is an isosceles triangle in which LM is perpendicular which works as angle bisector, median as well as altitude.

$$\angle YLM = \angle MLZ = \frac{1}{2} \times \angle YLZ = 60^\circ$$

13. Sol. (b)



ABC has sides 6 cm, 8 cm and 10 cm respectively.

ABC is a right angled Δ .

circumradius of this Δ is

$$= \frac{1}{2} \times \text{hypotenuse}$$

$$= \frac{1}{2} \times 10 = 5 \text{ cm}$$

Area of the circum circle =

$$\pi r^2 = \frac{22}{7} \times 5 \times 5$$

$$= \frac{550}{7} \text{ cm}^2$$

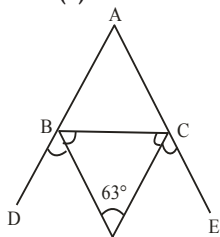
14. Sol. (a)

$$r = 6 \text{ cm}$$

$$s = \frac{50}{2} = 25 \text{ cm}$$

$$\Delta = 25 \times 6 = 150 \text{ cm}^2$$

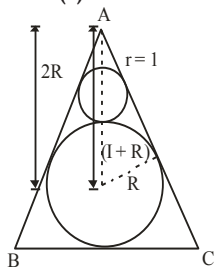
15. Sol. (a)



$$\angle BOC = 90^\circ - \frac{\angle A}{2} \Rightarrow 63^\circ$$

$$= 90^\circ - \frac{\angle A}{2} \Rightarrow \angle A = 54^\circ$$

16. Sol. (c)



Radius 1: 3

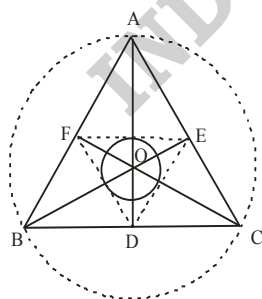
Area 1: 9

$$9 \rightarrow 1422 \text{ cm}^2$$

$$1 \rightarrow 158 \text{ cm}^2$$

17. Sol. (d)

Triangle formed by the joining the altitude has its incenter at the same point as the circumcenter of the bigger triangle.



From the diagram

OE is the bisector of the $\angle FED$

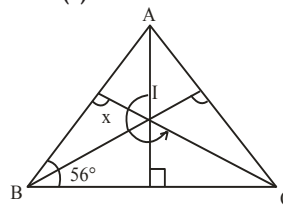
$$\text{So, } \angle FEO = \angle DEO = 24^\circ$$

In Triangle BFE

$$\angle FBE = 180^\circ - (110^\circ + 24^\circ)$$

$$\angle FBE = 180^\circ - 134^\circ = 46^\circ$$

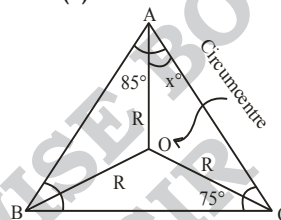
18. Sol. (c)



$$\angle AIC = 2 \times \angle B = 112^\circ$$

$$\angle AIB + \angle BIC = 360 - 112^\circ = 248^\circ$$

19. Sol. (a)



$\therefore O$ is circumcentre

So, $OA = OB = OC = R$ (Radius)

$\therefore \angle BAC = 85^\circ, \angle BCA = 75^\circ$

Then, $[\angle ABC = 180^\circ - (\angle BAC + \angle BCA)]$

$$\angle ABC = 180^\circ - (85^\circ + 75^\circ)$$

$$\Rightarrow \angle ABC = 180^\circ - 160^\circ \Rightarrow \angle ABC = 20^\circ$$

Angle made by same chord at the centre is doubled than that of any other part of the circumference at same sector

$$\text{Then, } \angle AOC = 20^\circ \times 2 = 40^\circ$$

$$OA = OC = R$$

So, $\triangle AOC = \text{Isosceles triangle}$

$$\text{Then, } \angle OCA + \angle OAC + \angle AOC = 180^\circ$$

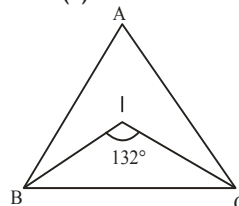
$$x + x + \angle AOC = 180^\circ$$

$$2x + 40^\circ = 180^\circ$$

$$x = 70^\circ$$

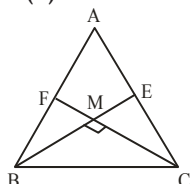
$$\text{Therefore } \angle OAC = 70^\circ$$

20. Sol. (a)



$$\angle BIC = 132 = 90^\circ + \frac{\angle A}{2} \Rightarrow \angle A = 84^\circ$$

21. Sol. (b)



We know,

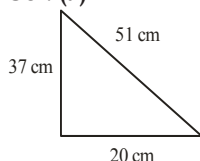
Centroid divides median in 2:1

$$BM = 6 \text{ cm}, ME = 3 \text{ cm}, CM = 26/3, MF = 13/3$$

$$\text{Area of } \triangle ABC = 3 \times \text{Area of } \triangle MBC$$

$$= 3 \times \frac{1}{2} \times 6 \times \frac{26}{3} = 78 \text{ cm}^2$$

22. Sol. (a)



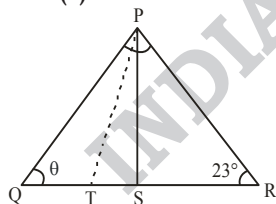
$x \rightarrow$ Not Right Angle $\triangle$

$$S = \frac{51+37+20}{2} = 54$$

$$\Delta = \sqrt{54 \times 3 \times 17 \times 34} = 17 \times 18$$

$$r = \frac{\Delta}{s} = \frac{17 \times 18}{54} = \frac{17}{3} = 5.66 \text{ cm}$$

23. Sol. (a)



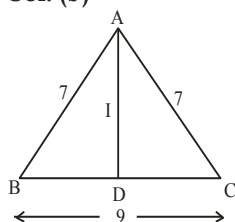
$$\angle TPS = 28^\circ$$

$$28 = \frac{\theta - 23}{2}$$

$$56 = \theta - 23$$

$$\theta = 79^\circ$$

24. Sol. (b)



$$AB = AC = 7 \text{ cm (Given)}$$

$$BC = 9 \text{ cm}$$

$$\frac{AI}{ID} = \frac{7+7}{9} = \frac{14}{9}$$

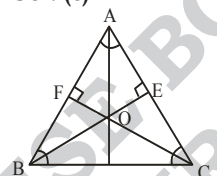
25. Sol. (c)

$$r = \frac{39+80-89}{2} = \frac{30}{2} = 15$$

Distance b/w orthocenter and in center $\rightarrow r\sqrt{2}$

$$= 15\sqrt{2} \text{ ans.}$$

26. Sol. (c)



In $\triangle OBF$ and $\triangle OCE$,

$$\angle OFB = \angle OEC = 90^\circ$$

$$\text{and } \angle BOF = \angle EOC$$

$$\therefore \triangle OBF \sim \triangle OCE$$

$$\text{Hence, } \frac{OB}{OC} = \frac{OF}{OE} \text{ or,}$$

$$\frac{OB}{OF} = \frac{OC}{OE}$$

$$\text{or, } OB \times OE = OF \times OC$$

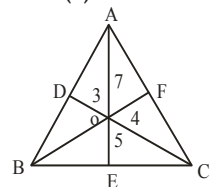
$$OF \times OC = OB \times OE$$

$$= (BE - OE)(OE) \Rightarrow (5 - 2) \times 2 = 6$$

27. Sol. (c)

In a right angle triangle. Its orthocentre lies on the triangle

28. Sol. (a)



$$\frac{AO}{OE} = \frac{b+c}{a} = \frac{7}{5} \times 7$$

$$\frac{CO}{OD} = \frac{a+b}{c} = \frac{4}{3} \times 12$$

$$a + b + c = 12 \times 7$$

$$a + b + c = 7 \times 12$$

$$\{a = 35, b = 13, c = 36\}$$

$$\frac{BO}{OF} = \frac{c+a}{b} = \frac{35+36}{13} = \frac{71}{13}$$

29. Sol. (a)

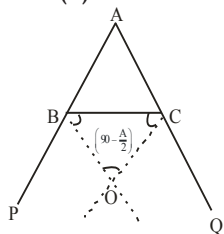
In $\triangle ABC$

$$\angle BOC = 90^\circ + \frac{\angle A}{2} \text{ (Incentre property)}$$

$$122^\circ = 90^\circ + \frac{\angle A}{2}$$

$$32^\circ = \frac{\angle A}{2} \Rightarrow \angle A = 64^\circ$$

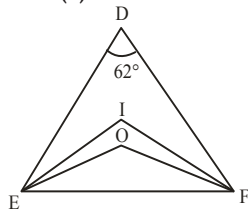
30. Sol. (b)



$$\angle BOC = 90 - \frac{72}{2}$$

$$= 90 - 36 = 54^\circ$$

31. Sol. (a)



$$\angle EOF = 124^\circ$$

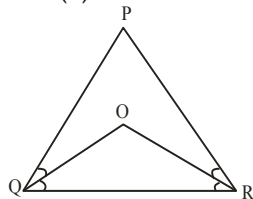
$$\angle EIF = ?$$

$$\angle D = \frac{124}{2} = 62^\circ$$

$$\angle EIF = 90 + \frac{62}{2}$$

$$= 90 + 31 = 121^\circ$$

32. Sol. (b)



$$\angle QPR = 70^\circ$$

$$\angle QOR = 90 + \frac{1}{2} \angle QPR$$

$$= 90 + 35$$

$$= 125^\circ$$

33. Sol. (d)

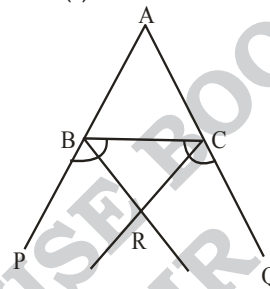
$$\frac{1}{r} = \frac{1}{h_1} + \frac{1}{h_2} + \frac{1}{h_3}$$

$$= \frac{1}{10} + \frac{1}{12} + \frac{1}{15}$$

$$= \frac{1}{4}$$

$$r = 4 \text{ cm}$$

34. Sol. (c)

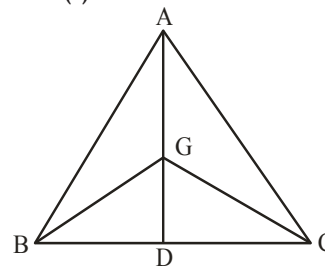


We know that

$$90^\circ - \frac{\angle A}{2} = \angle BRC \Rightarrow 90^\circ - \frac{\angle A}{2} = 66^\circ$$

$$\frac{\angle A}{2} = 24^\circ \Rightarrow \angle A = 48^\circ$$

35. Sol. (c)



$$AG = BC = 2x \text{ (let)}$$

$$\therefore GD = x (\because \text{centroid divides median in } 2:1)$$

$$\text{Now in } \triangle BDG, BD = GD = x$$

$$\therefore \angle DBG = \angle BGD = \theta_1 \text{ (let)}$$

$$\text{Similarly in } \triangle DGC, CD = GD = x$$

$$\therefore \angle DCG = \angle DGC = \theta_2 \text{ (let)}$$

$$\therefore \angle BGC = \theta_1 + \theta_2$$

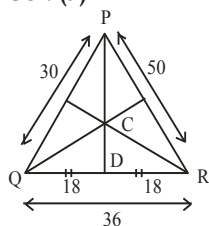
$$\text{Now in } \triangle BGC, \theta_1 + \theta_2 +$$

$$(\theta_1 + \theta_2) = 180^\circ$$

$$\Rightarrow \theta_1 + \theta_2 = 90^\circ$$

$$\Rightarrow \angle BGC = 90^\circ$$

36. Sol. (a)



$$(PQ)^2 + (PR)^2 = 2(QD^2 + PD^2)$$

$$(30)^2 + (50)^2 = 2[(18)^2 + PD^2]$$

$$900 + 2500 = 2[324 + PD^2]$$

$$3400 = 2[324 + PD^2]$$

$$1700 = 324 + PD^2$$

$$PD^2 = 1376$$

$$PD = 4\sqrt{86}$$

$$CD = \frac{1}{3}PD$$

$$CD = \frac{4\sqrt{86}}{3}$$

37. Sol. (c)

$$PR = \sqrt{PM^2 + MR^2}$$

$$= \sqrt{36 + 64} = 10 \text{ cm}$$

$$\Rightarrow PQ = \sqrt{QR^2 - PR^2}$$

$$= \sqrt{26^2 - 10^2} = 24 \text{ cm}$$

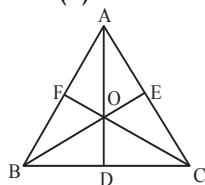
$$\therefore \text{ar}(\triangle PQR) = \frac{1}{2}(PR)(PQ)$$

$$= \frac{1}{2} \times 10 \times 24 = 120 \text{ cm}^2$$

38. Sol. (d)

Equilateral Triangle (only in equilateral triangle all converge at a point)

39. Sol. (b)



$\frac{1}{2}$ of the area of the $\triangle ABC$ = Area of $\triangle ABD$ (O is centroid)

$\frac{1}{6}$ of the area of the $\triangle ABC$ = Area of $\triangle AOE$ (O is centroid)

Required ratio = $\frac{1}{2}$ of the area of the $\triangle ABC$: $\frac{1}{6}$ of the area of the $\triangle ABC$ = 3: 1

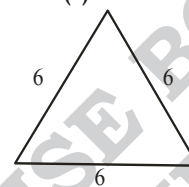
40. Sol. (d)

Here, radius $OA = OB = OC = r = 20\sqrt{3} \text{ cm}$

We know that, side of equilateral triangle = $\sqrt{3} \times$ radius of circumcircle

$$= \sqrt{3} \times 20\sqrt{3} = 60 \text{ cm}$$

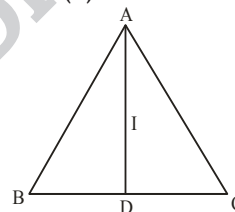
41. Sol. (c)



$$\text{Area} = \frac{\sqrt{3}}{4}(6)^2$$

$$= 9\sqrt{3}$$

42. Sol. (d)



Given, I is the incentre of $\triangle ABC$,

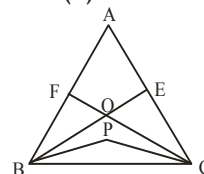
Perimeter of $\triangle ABC$ = 24 cm and $BC = 9$

$$\Rightarrow AB + AC + BC = 24 \text{ cm}$$

$$\Rightarrow AB + AC = 24 - 9 = 15 \text{ cm} \Rightarrow \frac{AB+AC}{BC}$$

$$= \frac{AI}{ID} \Rightarrow \frac{15}{9} = \frac{AI}{ID} \Rightarrow \frac{AI}{ID} = \frac{5}{3}$$

43. Sol. (d)



Given, $\angle A = 52^\circ$

$$\Rightarrow \angle BOC = 180^\circ - 52^\circ = 128^\circ$$

In $\triangle BOC$

$$\angle OBC + \angle OCB = 180^\circ - \angle BOC$$

$$= 180^\circ - 128^\circ = 52^\circ$$

$$\Rightarrow \angle PBC + \angle PCB = \frac{1}{2}(\angle OBC + \angle OCB)$$

$$= \frac{1}{2} \times 52^\circ = 26^\circ$$

$$\text{In } \triangle BPC \angle P = 180^\circ - (\angle PBC + \angle PCB)$$

$$= 180^\circ - 26^\circ = 154^\circ$$

Alternate :-

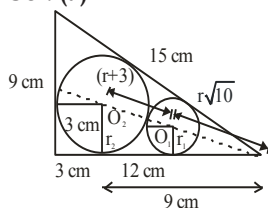
$$\text{Given, } \angle A = 52^\circ$$

$$\Rightarrow \angle BOC = 180^\circ - 52^\circ = 128^\circ$$

$$\angle BPC = 90^\circ + \frac{\angle BOC}{2} = 90^\circ + \frac{128^\circ}{2}$$

$$= 90^\circ + 64^\circ = 154^\circ$$

44. Sol. (a)



$$\frac{r}{3} = \frac{GR}{3\sqrt{10}}$$

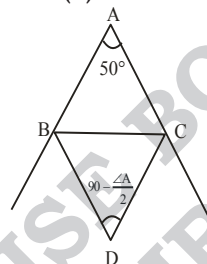
$$GR = r\sqrt{10}$$

$$2\sqrt{10} + r + 3 = 3\sqrt{10}$$

$$r(\pi 0 + 1) = 3(\pi_0 - 1)$$

$$r = \frac{3(\pi_0 - 1)}{\sqrt{10} + 1} = r = \frac{11 - 2\sqrt{10}}{3} \text{ cm}$$

45. Sol. (b)



$$\angle BDC = 90 - \frac{50}{2}$$

$$= 90 - 25 = 65$$

Type-8 (Angle Bisector Theorem)

1. In a $\triangle ABC$, the internal bisectors of the angle B and the angle C intersect at an angle of 105° . What is the value of the angle A?

$\triangle ABC$ में, कोण B और कोण C के आंतरिक समद्विभाजक 105° के कोण पर प्रतिच्छेद करते हैं। कोण A का मान क्या है?

SSC CGL 2023 (3rd Shift)

- (a) 52.5° (b) 75° (c) 15° (d) 30°

2. In a triangle ABC, AD is the bisector of $\angle BAC$. If $AB = 12$ cm, $BD = 10$ cm and $DC = 5$ cm, then what is the perimeter of the triangle?

त्रिभुज ABC में, AD, $\angle BAC$ का समद्विभाजक है। यदि $AB = 12$ cm, $BD = 10$ cm और $DC = 5$ cm है, तो त्रिभुज का परिमाप क्या है?

- (a) 30 cm (b) 31 cm
(c) 33 cm (d) 35 cm

3. In a triangle ABC, the bisector of angle BAC meets BC at point D such that $DC = 2BD$. If $AC - AB = 5$ cm then find the length of AB (in cm).

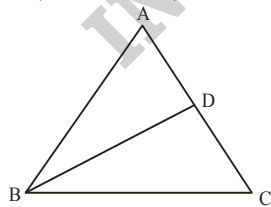
त्रिभुज ABC में, कोण BAC का समद्विभाजक BC से बिंदु D पर इस प्रकार मिलता है कि $DC = 2BD$ है। यदि $AC - AB = 5$ सेमी है तो AB की लंबाई (सेमी में) ज्ञात करें।

SSC CGL 19/4/2022 (Evening)

- (a) 10 (b) 12 (c) 7 (d) 5

4. In the given figure $AB = 60$ cm, $BC = 80$ cm, $AD = 36$ cm, $DC = 48$ cm, $\angle BDA = 92^\circ$ $\angle C = 72^\circ$. Then $\angle A = ?$

दिए गए चित्र में $AB = 60$ cm, $BC = 80$ cm, $AD = 36$ cm, $DC = 48$ cm, $\angle BDA = 92^\circ$ $\angle C = 72^\circ$ । फिर $\angle A = ?$



- (a) 78° (b) 72° (c) 68° (d) None

5. In a triangle ABC, $AB = 16$ cm, $AC = 12$ cm and AD is the bisector of $\angle A$. If $BD = 4$ cm, then what is CD equal to?

एक त्रिभुज ABC में, $AB = 16$ cm, $AC = 12$ cm और AD, $\angle A$ का समद्विभाजक है। यदि $BD = 4$ सेमी, तो CD किसके बराबर है?

- (a) 2 cm (b) 2.5 cm
(c) 3 cm (d) 3.5 cm

6. The bisectors BI and CI of $\angle B$ and $\angle C$ of a $\triangle ABC$ meet in I. If $\angle A = 38^\circ$, then what is $\angle BIC$ equal to? $\angle B$ के समद्विभाजक BI और CI और $\triangle ABC$ के $\angle C$ I में मिलते हैं। यदि $\angle A = 38^\circ$ है, तो $\angle BIC$ किसके बराबर है?

Higher Secondary 02/08/2022 (Shift - 2)

- (a) 125° (b) 120° (c) 105° (d) 109°

7. In triangle ABC, AD is the angle bisector of angle A. If $AB = 8.4$ cm and $AC = 5.6$ cm and $C = 2.8$ cm, then the length of side BC will be:

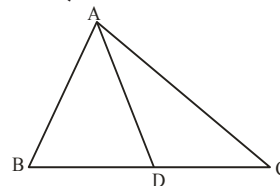
त्रिभुज ABC में, AD कोण A का कोण समद्विभाजक है। यदि $AB = 8.4$ सेमी और $AC = 5.6$ सेमी और $DC = 2.8$ सेमी है, तो भुजा BC की लंबाई होगी:

SSC CGL 05/12/2022 (1st Shift)

- (a) 4.2 cm (b) 5.6 cm
(c) 7 cm (d) 2.8 cm

8. In the given $\triangle ABC$, $AB = 16$ cm, $AC = 12$ cm and $BC = 21$ cm. The find the length of angle bisector AD?

दिये गये $\triangle ABC$ में, $AB = 16$ cm, $AC = 12$ cm और $BC = 21$ cm तो कोण समद्विभाजक AD (सेमी में) की लंबाई ज्ञात करें।



- (a) $\sqrt{78}$ (b) $\sqrt{84}$
(c) $\sqrt{93}$ (d) $\sqrt{80}$

9. In $\triangle PQR$, the bisector of $\angle R$ meets side PQ at S, $PR = 10$ cm, $RQ = 14$ cm and $PQ = 12$ cm. What is the length of SQ?

$\triangle PQR$ में, $\angle R$ का समद्विभाजक भुजा PQ से S, $PR = 10$ सेमी, $RQ = 14$ सेमी और $PQ = 12$ सेमी पर मिलता है। SQ की लंबाई कितनी है?

SSC CGL Tier II 03/02/2022

- (a) 5 cm (b) 6 cm
(c) 7 cm (d) 8 cm

[CDS-2022-I]

10. In $\triangle ABC$, the bisector of $\angle A$ meets BC at D. If $AB = 9.6$ cm, $AC = 11.2$ cm and $BD = 4.8$ cm, the perimeter of $\triangle ABC$ (in cm) is:

$\triangle ABC$ में, $\angle A$ का समद्विभाजक BC से D पर मिलता है। यदि $AB = 9.6$ सेमी, $AC = 11.2$ सेमी और $BD = 4.8$ सेमी है, तो $\triangle ABC$ का परिमाण (सेमी में) है:

SSC CGL 18/04/2022 (Morning)

- (a) 30.4 (b) 28.6 (c) 31.2 (d) 32.8

11. In right angle triangle ABC, $\angle B = 90^\circ$, if $AB = 20$ cm, $BC = 15$ cm. Exterior angle bisector of $\angle BAC$ meets the extended part of CB at point D. Find the length of BD.

समकोण त्रिभुज ABC में, $\angle B = 90^\circ$ यदि $AB = 20$ cm, $BC = 15$ cm, $\angle BAC$ का बाह्यकोण समद्विभाजक बिंदु D पर CB के विस्तारित भाग से मिलता है। BD की लम्बाई ज्ञात करो।

- (a) 80 cm (b) 60 cm
(c) 48 cm (d) 75 cm

12. In $\triangle LMN$, the bisectors of $\angle L$ and $\angle N$ intersect at an angle of 112° . What is the measure (in degrees) of $\angle M$?

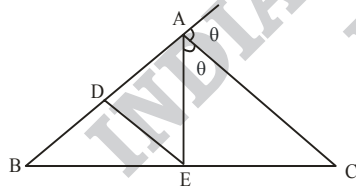
$\triangle LMN$ में, $\angle L$ और $\angle N$ के समद्विभाजक 112° के कोण पर प्रतिच्छेद करते हैं। $\angle M$ का माप (डिग्री में) क्या है?

SSC CGL 11/04/2022 (Evening)

- (a) 62 (b) 60 (c) 44 (d) 72

13. If AC and ED angle bisector, $AE = 4$ cm, $BE = EC = 6$ cm. Find AD = ?

यदि AC और ED कोण समद्विभाजक हैं, तो $AE = 4$ सेमी, $BE = EC = 6$ सेमी। AD = ज्ञात कीजिए?



- (a) $16/5$ cm (b) $13/5$ cm
(c) 4 cm (d) 3 cm

14. In triangle ABC, the bisector of angle BAC cuts the side BC at D. If $AB = 10$ cm, and $AC = 14$ cm then what is $BD : DC$?

त्रिभुज ABC में, कोण BAC का समद्विभाजक भुजा BC को D पर काटता है। यदि $AB = 10$ सेमी, और $AC = 14$ सेमी है, तो $BD : DC$ क्या है?

SSC CGL 05/12/2022 (1st Shift)

- (a) 5:3 (b) 7:5 (c) 5:2 (d) 5:7

15. The bisector of $\angle B$ in $\triangle ABC$ meets AC at D. If $AB = 12$ cm, $BC = 18$ cm and $C = 15$ cm, then the length of AD (in cm) is:

$\angle ABC$ में $\angle B$ का समद्विभाजक AC को D पर मिलता है। यदि $AB = 12$ सेमी, $BC = 18$ सेमी और $AC = 15$ सेमी, तो AD की लंबाई (सेमी में) है:

SSC CGL 12/04/2022 (Morning)

- (a) 6 (b) 5 (c) 12 (d) 9

16. In triangle ABC, the bisector of angle BAC cuts the line BC at D. If $BD = 6$ and $BC = 14$, then what is the value of $AB : AC$?

त्रिभुज ABC में, कोण BAC का समद्विभाजक रेखा BC को D पर काटता है। यदि $BD = 6$ और $BC = 14$ है, तो $AB : AC$ का मान क्या है?

SSC CGL 01/12/2022 (3rd Shift)

- (a) 3:4 (b) 7:3 (c) 3:10 (d) 3:7

17. In triangle ABC, the bisector of angle BAC cuts the side BC at D. If $B = 10$ cm, and $C = 14$ cm, then what is $BD : DC$?

त्रिभुज ABC में, कोण BAC का समद्विभाजक भुजा BC को D पर काटता है। यदि $AB = 10$ सेमी, और $C = 14$ सेमी, तो $BD : DC$ क्या है?

SSC CGL 03/12/2022 (1st Shift)

- (a) 10:7 (b) 5:7 (c) 7:5 (d) 7:10

18. In a triangle ABC, "I" is the incentre located on the bisector BM, such that $3(IE) = 2(BM)$, find the length of AC if $AB + BC = 23$ cm.

त्रिभुज ABC में, "I" समद्विभाजक BM पर स्थित अंतःकेंद्र है, जैसे कि $3(IE) = 2(BM)$, यदि $AB + BC = 23$ सेमी है तो AC की लंबाई ज्ञात करें।

- (a) $\frac{23}{5}$ cm (b) $\frac{23}{4}$ cm
(c) 11.5 cm (d) $\frac{23}{3}$ cm.

19. The bisector of $\angle A$ in $\triangle ABC$ meets side BC at D. If $AB = 12$ cm, $AC = 15$ cm and $BC = 18$ cm, then the length of DC is:

$\triangle ABC$ में $\angle A$ का समद्विभाजक भुजा BC से D पर मिलता है। यदि $AB = 12$ सेमी, $AC = 15$ सेमी और $BC = 18$ सेमी है, तो DC की लंबाई है:

SSC CGL 23/8/2021 (Evening)

- (a) 9 cm (b) 6 cm (c) 10 cm (d) 8 cm

20. In triangle ABC, AD is the bisector of $\angle A$. If $AB = 5$ cm, $AC = 7.5$ cm and $C = 10$ cm, then what is the distance of D from the mid-point of BC (in cm)?

त्रिभुज ABC में, AD, $\angle A$ का समद्विभाजक है। यदि $AB = 5$ cm, $AC = 7.5$ cm और $BC = 10$ cm है, तो BC के मध्य-बिंदु से D की दूरी (सेमी में) क्या है?

SSC CGL 23/8/2021 (Morning)

- (a) 2 (b) 1.5 (c) 2.2 (d) 1

21. A triangle ABC is right-angled at B, if BD is the angle bisector of $\angle ABC$, then $\frac{1}{AB} + \frac{1}{BC} = ?$

एक त्रिभुज ABC, B पर समकोण है, यदि BD, $\angle ABC$ का कोण समद्विभाजक है, तो $1/AB + 1/BC = ?$

- (a) BD (b) $\frac{1}{BD}$ (c) $\frac{\sqrt{2}}{BD}$ (d) $\frac{2}{BD}$

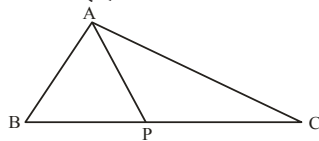
22. Calculate the angle formed by the perpendiculars drawn from the vertex B of a triangle ABC to the interior angle bisectors of A and C, if the measure of $\angle B$ is 110° .

यदि $\angle B$ का माप 110° है, तो त्रिभुज ABC के शीर्ष B से A और C के आंतरिक कोण के समद्विभाजक पर खींचे गए लंबों द्वारा बनाए गए कोण की गणना करें।

- (a) 55° (b) 145° (c) 35° (d) 65°

23. In the given figure, AP bisects $\angle BAC$. If $AB = 4$ cm, $AC = 6$ cm and $BP = 3$ cm, then the length of CP is:

दिए गए चित्र में, AP, $\angle BAC$ को समद्विभाजित करता है। यदि $AB = 4$ सेमी, $AC = 6$ सेमी और $BP = 3$ पर, तो CP की लंबाई है:



SSC CGL 3/03/2020 (Evening)

- (a) 3 cm (b) 7 cm

- (c) 5 cm (d) 4.5 cm

24. In $\triangle ABC$, $\angle A = 90^\circ$, AD is the bisector of $\angle A$ meeting BC at D and $DE \perp AC$ at E. If $AB = 10$ cm and $AC = 15$ cm, then the length of DE, in cm is: $\triangle ABC$ में, $\angle A = 90^\circ$, AD, $\angle A$ का समद्विभाजक है जो BC को D पर और $DE \perp AC$ को E पर मिलता है। यदि $AB = 10$ सेमी और $AC = 15$ सेमी है, तो DE की लंबाई, सेमी में है:

SSC CGL Tier II (15/11/2020)

- (a) 7.5 (b) 6.25 (c) 6 (d) 8

25. In $\triangle ABC$, $AB = 7$ cm, $BC = 10$ cm, and $AC = 8$ cm. If AD is the angle bisector of $\angle BAC$, where D is a point on BC, then BD is equal to (in cm): $\triangle ABC$ में, $AB = 7$ सेमी, $BC = 10$ सेमी, और $AC = 8$ सेमी। यदि AD, $\angle BAC$ का कोण समद्विभाजक है, जहाँ D, BC पर एक बिंदु है, तो BD बराबर (सेमी में) है:

SSC CGL TIER II (11/09/2019)

- (a) $\frac{16}{3}$ (b) $\frac{15}{4}$ (c) $\frac{14}{3}$ (d) $\frac{17}{4}$

26. In a triangle ABC, the sides AB, AC are produced and the bisectors of exterior angles of $\angle ABC$ and $\angle ACB$ intersect at D. If $\angle BAC = 50^\circ$, then $\angle BDC$ is equal to

एक त्रिभुज ABC में, भुजाएँ AB, AC बनी हुई हैं और $\angle ABC$ और $\angle ACB$ के बाह्य कोणों के समद्विभाजक D पर प्रतिच्छेद करते हैं। यदि $\angle BAC = 50^\circ$, तो $\angle BDC$ बराबर है

[CDS-2018-II]

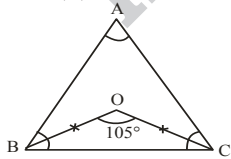
- (a) 115° (b) 65° (c) 55° (d) 40°

Type 8 (Angle Bisector Theorem) Answer key

1	D	2	C	3	D	4	C	5	C	6	D	7	C
8	B	9	C	10	C	11	B	12	C	13	A	14	D
15	A	16	A	17	B	18	C	19	C	20	D	21	C
22	C	23	D	24	C	25	C	26	B				

Type-8 (Angle Bisector Theorem) Solution

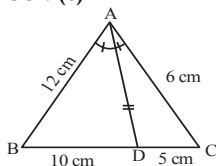
1. Sol. (d)



$$\angle BOC = 90^\circ + \frac{\angle BAC}{2} \text{ (angle bisector property)}$$

$$\Rightarrow \angle BAC = 30^\circ$$

2. Sol. (c)



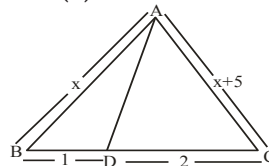
By bisector theorem.

$$\frac{AB}{AC} = \frac{BD}{DC}$$

$$\frac{12}{6} = \frac{10}{5} = AC = 6 \text{ cm}$$

$$P = 12 - 6 + 15 = 33 \text{ cm}$$

3. Sol. (d)



$$\text{Given } DC = 2BD$$

$$\Rightarrow \frac{BD}{DC} = \frac{1}{2}$$

$$AC - AB = 5 \text{ cm}$$

AD is angle bisector of B

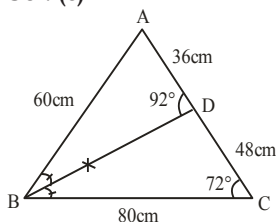
$$\text{Let } AB = x \text{ cm}$$

Then, $AC - x = 5 \text{ cm} \Rightarrow AC = (5 + x) \frac{AB}{AC} = \frac{x}{x+5} =$

$\frac{BD}{DC} \dots \dots \dots$ (angle bisector theorem)

$\Rightarrow \frac{x}{x+5} = \frac{1}{2} \Rightarrow 2x = x + 5 \Rightarrow x = 5 \text{ cm}$

4. Sol. (c)



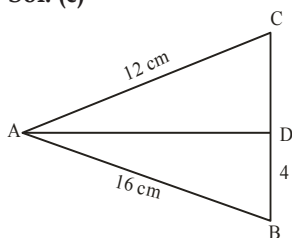
$\angle A = ?$

$\angle DBC = 20$ (by Exterior prop.)

$\angle ABD = 20^\circ$ (by Angle bisector theorem)

$\angle A = 180 - 40 + 72 = 68^\circ$

5. Sol. (c)

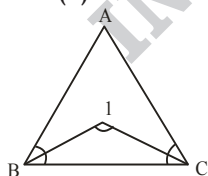


As AD, bisect $\angle A$

$\therefore \frac{AB}{AC} = \frac{BD}{CD} \Rightarrow \frac{16}{12} = \frac{4}{CD}$

$\Rightarrow CD = \frac{4 \times 12}{16} = 3 \text{ cm}$

6. Sol. (d)



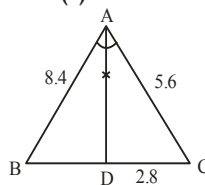
When bisector of BI and CI of $\angle B$ and $\angle C$ meets inside the triangle then

$\angle BIC = 90^\circ + \frac{\angle A}{2}$

$\angle A = 38^\circ$ (given)

$\angle BIC = 90^\circ + \frac{38^\circ}{2} = 90^\circ + 19^\circ = 109^\circ$

7. Sol. (c)

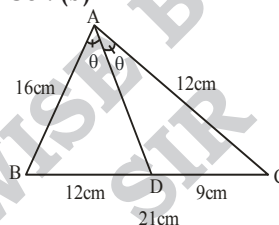


$\frac{AB}{AC} = \frac{BD}{DC}$ (angle bisector theorem)

$\frac{8.4}{5.6} = \frac{BD}{2.8} \Rightarrow BD = 4.2 \text{ cm}$

$BC = BD + DC = 4.2 + 2.8 = 7 \text{ cm}$

8. Sol. (b)

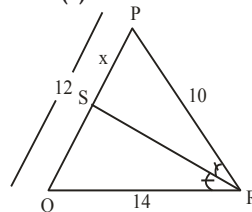


$AD^2 = 16 \times 12 - 12 \times 9$

$AD^2 = 12(7)$

$AD = \sqrt{84} \text{ cm}$

9. Sol. (c)



According to the question,

Let $PS = x$, so $SQ = 12 - x$

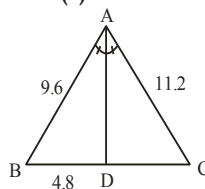
Applying angle bisector theorem, we get

$\frac{PR}{QR} = \frac{PS}{SQ} \Rightarrow \frac{10}{14} = \frac{x}{12-x}$

$\Rightarrow 120 - 10x = 14x \Rightarrow 120 = 24x \Rightarrow x = 5$

So, $SQ = 12 - x = 12 - 5 = 7 \text{ cm}$

10. Sol. (c)

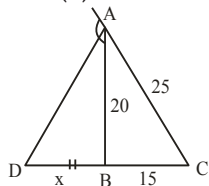


According to the angle bisector theorem,

$$\frac{AB}{AC} = \frac{BD}{DC} \Rightarrow \frac{9.6}{11.2} = \frac{4.8}{DC} \Rightarrow DC = 5.6$$

$$\begin{aligned}\text{So, perimeter} &= AB + BC + AC \\ &= 9.6 + (4.8 + 5.6) + 11.2 = 31.2 \text{ cm}\end{aligned}$$

11. Sol. (b)

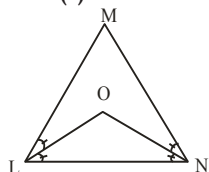


$$\frac{25}{20} = \frac{15+x}{x}$$

$$5x = 60 + 4x$$

$$x = 60 \text{ cm}$$

12. Sol. (c)

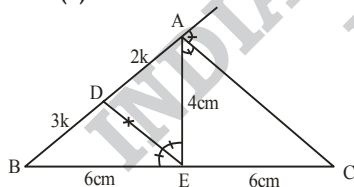


Let bisectors of $\angle L$ and $\angle N$ meet at point O.

$$\angle LON = 90^\circ + \frac{\angle M}{2} \Rightarrow 112^\circ = 90^\circ + \frac{\angle M}{2}$$

$$\frac{\angle M}{2} = 22^\circ \Rightarrow \angle M = 44^\circ$$

13. Sol. (a)



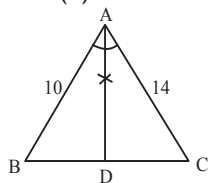
$$AD = ?$$

$$\frac{5k}{4} = \frac{12}{6} \text{ (by External Bisector)}$$

$$k = \frac{8}{5}$$

$$AD = 2x = \frac{8}{5} \times 2 = \frac{16}{5} \text{ cm}$$

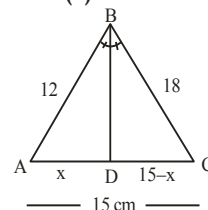
14. Sol. (d)



$$\frac{AB}{AC} = \frac{BD}{DC} \dots \dots \text{(angle bisector theorem)}$$

$$\Rightarrow \frac{10}{14} = \frac{BD}{DC} \Rightarrow \frac{BD}{DC} = \frac{5}{7}$$

15. Sol. (a)



$$\text{Let } AD = x$$

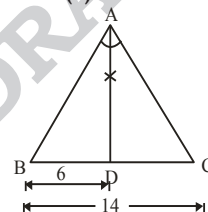
According to the angle bisector theorem,

$$\frac{AB}{BC} = \frac{AD}{DC} \Rightarrow \frac{12}{18} = \frac{x}{15-x} \Rightarrow \frac{2}{3}$$

$$= \frac{x}{15-x} \Rightarrow 30 - 2x = 3x \Rightarrow 5x = 30$$

$$\Rightarrow x = 6 \text{ cm}$$

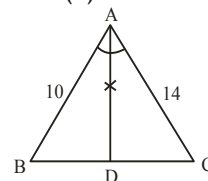
16. Sol. (a)



Using Angle bisector Property :-

$$\frac{AB}{AC} = \frac{BD}{DC} \Rightarrow \frac{AB}{AC} = \frac{6}{8} \Rightarrow \frac{AB}{AC} = \frac{3}{4}$$

17. Sol. (b)



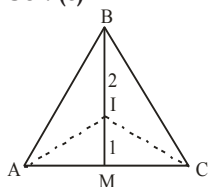
Theorem:-

In a triangle, the angle bisector of any angle will divide the opposite side in the ratio of the sides containing the angle.

$$\frac{AB}{AC} = \frac{BD}{DC} \text{ (angle bisector property) Here,}$$

$$\frac{10}{14} = \frac{BD}{DC} \Rightarrow BD:DC = 5:7$$

18. Sol. (c)



Join AI and CI

$$\frac{AM}{AB} = \frac{MI}{IB} = \frac{1}{2}$$

(AI is angle bisector)

$$\Rightarrow AM = \frac{AB}{2}$$

(CI is angle bisector)

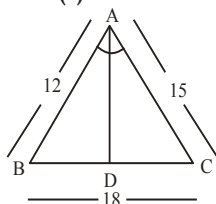
$$\Rightarrow \frac{CM}{BC} = \frac{MI}{IB} = \frac{1}{2}$$

Similarly

$$\Rightarrow CM = \frac{BC}{2}$$

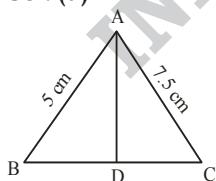
$$AM + CM = \frac{AB+BC}{2} = \frac{23}{2} = 11.5$$

19. Sol. (c)



In $\triangle ABC \Rightarrow DC = \frac{15}{27} \times 18 = 10$ cm (angle bisector theorem,)

20. Sol. (d)



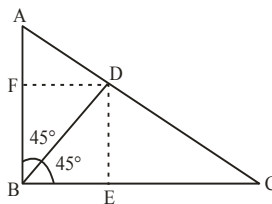
Ratio of BD:DC = 2:3

$$BD = \frac{2}{5} \times 10 = 4 \text{ (Angle bisector theorem)}$$

Midpoint of BC = 5 cm

Required Difference = 5 - 4 = 1 cm

21. Sol. (c)

Draw $DE \perp BC$ Let $BE = x$

$$\frac{AD}{DC} = \frac{AB}{BC} \text{ (i) (BD is angle bisector)}$$

Again

$$\frac{BE}{EC} = \frac{AD}{DC}$$

(ii) ($\because DE \parallel AB$)

From (i) and (ii)

$$\Rightarrow \frac{x}{BC-x} = \frac{AB}{BC}$$

$$\Rightarrow x(AB + BC) = AB \times BC$$

$$\Rightarrow \frac{1}{x} = \frac{1}{AB} + \frac{1}{BC}$$

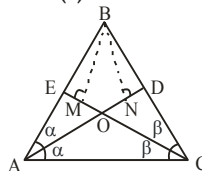
$$\angle DBE = 45^\circ \text{ and } \angle DEB = 90^\circ$$

$$\Rightarrow \sqrt{2}x = BD \Rightarrow x = \frac{BD}{\sqrt{2}}$$

From (iii) and (iv)

$$\Rightarrow \frac{1}{AB} + \frac{1}{BC} = \frac{\sqrt{2}}{BD}$$

22. Sol. (c)

Let $BM \perp CE$ and $BN \perp AD$ Where AD and CE are angle Bisectors In $\triangle ABC$

$$\angle AOC = 90^\circ + \frac{\angle B}{2}$$

(see imp point 3)

$$\Rightarrow \angle AOC = 90^\circ + 55^\circ = 145^\circ$$

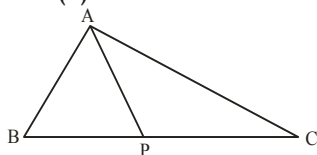
And

$$\angle MBN + \angle EOD = 180^\circ$$

$$\Rightarrow \angle MBN = 180^\circ - 145^\circ (\because \angle EOD = \angle AOC)$$

$$\Rightarrow \angle MBN = 35^\circ$$

23. Sol. (d)

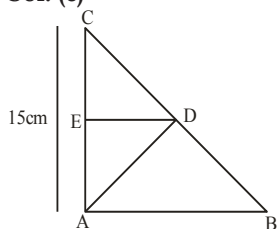


AP is the angle bisector of $\angle BAC$ in $\triangle ABC$

ACC. to angle bisector theorem,

$$\frac{AB}{AC} = \frac{BP}{CP} \Rightarrow \frac{4}{6} = \frac{3}{CP} \Rightarrow CP = 4.5 \text{ cm}$$

24. Sol. (c)



In triangle ABC

$$BC^2 = AB^2 + AC^2]$$

$$BC^2 = 10^2 + 15^2 \Rightarrow BC = 5\sqrt{13}$$

AD is the angle bisector of angle A, so D divides BC

in ratio of AC/AB

$$AC/AB = 3:2$$

$$DC = 3\sqrt{13} \Rightarrow \text{Let } DE = x$$

$$\angle EAD = \angle ADE = 45^\circ$$

$$AE = DE = x \Rightarrow EC = 15 - x$$

In right angles triangle DEC

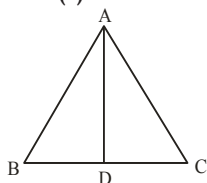
$$DC^2 = ED^2 + EC^2 \Rightarrow (3\sqrt{13})^2 = (15 - x)^2 + x^2$$

$$117 = 225 + x^2 - 30x + x^2$$

Solving the quadratic equation

we get $x = 6 \text{ cm}$ or 9 cm . $\Rightarrow x = 9, 6 \text{ cm}$

25. Sol. (c)



Given, $AB = 7 \text{ cm}$, $BC = 10 \text{ cm}$, and $AC = 8 \text{ cm}$

In $\triangle ABC$

$$\frac{AB}{AC} = \frac{BD}{DC}$$

(AD is angle bisector)

Let $BD = x$

$$\Rightarrow \frac{7}{8} = \frac{x}{10-x} \Rightarrow 70 - 7x = 8x \Rightarrow x = \frac{14}{3}$$

26. Sol. (b)

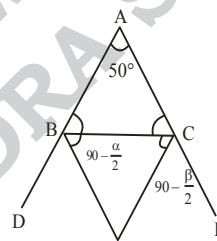
Let In $\triangle ABC = \alpha$ and $\angle ACB = \beta$ and $\angle A = 50^\circ$

(given)

so, in $\triangle ABC$, $\alpha + \beta + 50 = 180^\circ$

$$\alpha + \beta = 130^\circ$$

As BD and CD bisect exterior angle $\angle B$ and $\angle C$ respectively.



$$\text{then, } \angle DBC = 90^\circ - \frac{\alpha}{2}$$

$$\text{and } \angle DCB = 90^\circ - \frac{\beta}{2}$$

Again, In $\triangle BDC$, sum of angles = 180°

$$\therefore \angle D + 90^\circ - \frac{\alpha}{2} + 90^\circ - \frac{\beta}{2} = 180^\circ$$

$$\angle D - \left(\frac{\alpha+\beta}{2}\right) = 0 \Rightarrow \angle D = \left(\frac{\alpha+\beta}{2}\right)$$

From $\triangle ABC$, $\alpha + \beta + 50^\circ = 180^\circ$

$$\therefore \alpha + \beta = 130^\circ$$

$$\angle D = \left(\frac{\alpha+\beta}{2}\right) = \frac{130^\circ}{2} = 65^\circ$$

Type-9 (Right angled Triangle)

1. In triangle ABC , $\angle B = 90^\circ$, and $\angle C = 45^\circ$. If $AB = 2\sqrt{2}$ cm, then the length of BC is:
 त्रिभुज ABC में, $\angle B = 90^\circ$, और $\angle C = 45^\circ$ । यदि $AB = 2\sqrt{2}$ सेमी, तो BC की लंबाई है:

SSC CGL 2023 (1st Shift)

- (a) 3 (b) 2 (c) 1 (d) 4

2. ABC is a triangle right angled at B with $AC = 2BC$. If $\angle A = x$, then what is $\angle C$ equal to?
 ABC एक त्रिभुज है जिसका कोण B समकोण है और $AC = 2BC$ है। यदि $\angle A = x$ है, तो $\angle C$ किसके बराबर है?

[CDS-2022-I]

- (a) $\frac{x}{2}$ (b) $2x$ (c) $\sqrt{2}x$ (d) $\sqrt{3}x$

3. If the perimeter of a right angle triangle is 90 cm. And its circumradius 20.5 cm. Find area of triangle.

समकोण त्रिभुज का परिमाप 90 cm है। यदि इसकी परित्रिज्या 20.5 cm है तो त्रिभुज का क्षेत्रफल निकालो।

- (a) 180 cm^2 (b) 100 cm^2
 (c) 120 cm^2 (d) None

4. $\triangle PQR$ is right-angled at Q . The length of PQ is 5 cm and $\angle PRQ = 30^\circ$. Determine the length of side QR .

$\triangle PQR$, Q पर समकोण है, PQ की लंबाई 5 सेमी है और $\angle PRQ = 30^\circ$ है। भुजा QR की लंबाई ज्ञात कीजिए।

SSC CGL 13/12/2022 (4th Shift)

- (a) $5\sqrt{3}$ cm (b) $3\sqrt{3}$ cm
 (c) $\frac{1}{\sqrt{3}}$ cm (d) $\frac{5}{\sqrt{3}}$ cm

5. In a right triangle ABC , BD is perpendicular on hypotenuse AC . If $AC = 9$ cm and $AD = 4$ cm, then what is $AB + BC$ approximately equal to?

एक समकोण त्रिभुज ABC में, BD कर्ण AC पर लंबवत है। यदि $AC = 9$ सेमी और $AD = 4$ सेमी है, तो $AB + BC$ लगभग किसके बराबर है?

[CDS-2022-I]

- (a) 12 cm (b) 12.2 cm
 (c) 12.4 cm (d) 12.6 cm

6. The difference between the two perpendiculars sides of a right angled triangle is 17 cm and its area is 84 cm^2 . What is the perimeter (in cm) of the triangle?

एक समकोण त्रिभुज की दो लंबवत भुजाओं के बीच का अंतर 17 सेमी है और इसका क्षेत्रफल 84 cm^2 है। त्रिभुज का परिमाप (सेमी में) क्या है?

SSC CGL 12/04/2022 (Morning)

- (a) 40 (b) 49 (c) 36 (d) 56

7. The lengths of the three sides of a right-angled triangle are $(x-1)$ cm, $(x+1)$ and $(x+3)$ cm, respectively. The hypotenuse of the right-angled triangle (in cm) is:

एक समकोण त्रिभुज की तीन भुजाओं की लंबाई क्रमशः $(x-1)$ सेमी, $(x+1)$ और $(x+3)$ सेमी है। समकोण त्रिभुज का कर्ण (सेमी में) है:

SSC CGL 11/04/2022 (Morning)

- (a) 6 (b) 10 (c) 12 (d) 7

8. ABC is a right angle triangle and angle $ABC = 90$ degrees. BD is a perpendicular on the side AC . What is the value of BD^2 ?

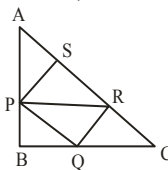
ABC एक समकोण त्रिभुज है और कोण $ABC = 90$ डिग्री है। BD , AC की भुजा पर लंब है। BD^2 का मान क्या है?

SSC CGL Tier II 08/08/2022

- (a) $AD \times DC$ (b) $BC \times AB$
 (c) $BC \times CD$ (d) $AD \times AC$

9. Triangle ABC is right angled at B its side $AB = 24$ cm, $BC = 32$ cm. A square $PQRS$ is made on hypotenuse AC as shown in fig find the diagonal of square $PQRS$?

त्रिभुज ABC , बिंदु B पर समकोण है। यदि भुजा $AB = 24$ सेमी, $BC = 32$ सेमी है। जैसा चित्र में दिया गया है एक वर्ग $PQRS$ भुजा AC पर बनाया गया है, वर्ग $PQRS$ का विकर्ण ज्ञात करो?



- (a) $475\sqrt{2}/37$ (b) $480\sqrt{2}/37$
 (c) $512\sqrt{2}/49$ (d) $225\sqrt{2}/27$

10. ABC is right angle triangle in which $\angle B = 90^\circ$, $AD = 18$ cm & $CD = 32$ cm, then find area of $\triangle ABC$. $BD \perp AC$.

$\triangle ABC$ में $\angle B = 90^\circ$, $AD = 18$ cm, $CD = 32$ cm त्रिभुज का क्षेत्रफल निकालो। $BD \perp AC$

- (a) 480 (b) 600 (c) 400 (d) 540

11. The difference between the two perpendiculars sides of a right angled triangle is 17 cm and its area is 84 cm^2 . What is the perimeter (in cm) of the triangle?

एक समकोण त्रिभुज की दो लंबवत भुजाओं के बीच का अंतर 17 सेमी है और इसका क्षेत्रफल 84 सेमी^2 है। त्रिभुज का परिमाप (सेमी में) क्या है?

SSC CGL 12/04/2022 (Morning)

- (a) 40 (b) 49 (c) 36 (d) 56

12. In a right angled triangle, the length of the median from the vertices of acute angle are 7 cm and $4\sqrt{6}$ cm. What is the length of the hypotenuse of the triangle (in cm)?

एक समकोण त्रिभुज में न्यून कोण के शीर्षों से माधिका की लंबाई 7 सेमी और $4\sqrt{6}$ सेमी है। त्रिभुज के कर्ण की लंबाई (सेमी में) क्या है?

SSC CGL 19/4/2022 (Evening)

- (a) $3.5 + 2\sqrt{6}$ (b) $\frac{5}{2}\sqrt{29}$
(c) $\sqrt{29}$ (d) $2\sqrt{29}$

13. If the hypotenuse of an isosceles right-angled triangle is 10 cm, then the other two sides (in cm) are _____

यदि एक समद्विबाहु समकोण त्रिभुज का कर्ण 10 सेमी है, तो अन्य दो भुजाएँ (सेमी में) _____ हैं

SSC CPO 11/11/2022 (Evening)

- (a) $10\sqrt{2}$ and $10\sqrt{2}$ (c) $6\sqrt{2}$ and $6\sqrt{2}$
(b) $8\sqrt{2}$ and $8\sqrt{2}$ (d) $5\sqrt{2}$ and $5\sqrt{2}$

14. The lengths (in cm) of three sides of a triangle are, respectively, 48, 55 and 73. What is the length (in cm) of the median joining the mid-point of the longest side to its opposite vertex?

एक त्रिभुज की तीन भुजाओं की लंबाई (सेमी में) क्रमशः 48, 55 और 73 है। सबसे लंबी भुजा के मध्य बिंदु को इसके विपरीत शीर्ष से जोड़ने वाली माधिका की लंबाई (सेमी में) क्या है?

SSC CGL 05/12/2022 (3rd Shift)

- (a) 27.5 (b) 73 (c) 24 (d) 36.5

15. In a triangle ABC , $\angle BAC = 90^\circ$ and AD is perpendicular to BC . If $AD = 8.4$ cm and $BD = 4.8$ cm, then the length of BC (in cm) is : / त्रिभुज ABC में, $\angle BAC = 90^\circ$ और AD , BC पर लंबवत है। यदि $AD = 8.4$ सेमी और $BD = 4.8$ सेमी है, तो BC की लंबाई (सेमी में) है:

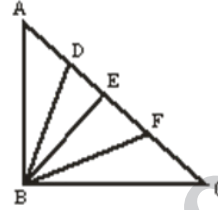
SSC CHSL 4/8/2021 (Morning)

- (a) 19.5 (b) 15 (c) 18 (d) 18.5

16. In the given fig below. ABC is a right angled triangle with Hypotenuse $AC = 100$ cm, AC is divided into four segment AD, DE, EF and FC such

that $AD = DE = EF = FC$. What is the value of $BD^2 + BE^2 + BF^2$.

निचे दिये गये चित्र में, ABC एक समकोण त्रिभुज है जहाँ $AC = 100$ सेमी। AC को चार बराबर भागों AD, DE, EF, FC में बांटा गया है तब $BD = DE = EF = FC$ है तो $BD^2 + BE^2 + BF^2$ का मान ज्ञात कीजिये?



- (a) 8000 (b) 8750
(c) 10000 (d) 9250

17. $\triangle ABC$ is right-angled at B and D is a point on AC such that BD is perpendicular to AC . If $BD = 6$ cm, and $AD = 3$ cm, then what will be the length of AC ? $\triangle ABC$, B पर समकोण है और D , AC पर एक बिंदु है, जिससे BD , AC पर लंबवत है। यदि $BD = 6$ सेमी, और $AD = 3$ सेमी, तो AC की लंबाई क्या होगी?

SSC CHSL 16/4/2021 (Evening)

- (a) 12 (b) 18 (c) 15 (d) 9

18. What is the length (in cm) of the smallest altitude of the triangle whose sides are 5 cm, 12 cm and 13 cm? (correct to one decimal place)

उस त्रिभुज की सबसे छोटी ऊँचाई की लंबाई (सेमी में) क्या है जिसकी भुजाएँ 5 सेमी, 12 सेमी और 13 सेमी हैं? (दशमलव के एक स्थान तक सही)

SSC CGL 18/08/2021 (Evening)

- (a) 5.1 (b) 12.0 (c) 4.6 (d) 2.6

19. In a triangle ABC , $\angle A = 90^\circ$, M is the mid-point of BC and D is a point on BC such that $AD \perp BC$. If $AD = 7$ cm, and $AC = 24$ cm, then $AD : AM$ is equal to- त्रिभुज ABC में, $\angle A = 90^\circ$, M , भुजा BC का मध्य बिंदु है और D भुजा BC पर एक बिंदु है तथा $AD \perp BC$ यदि $AD = 7$ सेमी, और $AC = 24$ सेमी, तब $AD : AM$ का मान क्या है?

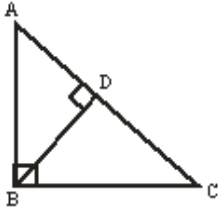
- (a) 168:275 (b) 24:25
(c) 32:43 (d) 336:625

20. In a $\triangle ABC$, $\angle B = 90^\circ$, $\angle A = 75^\circ$. Find out the ratio of its circumradius and inradius.

यदि किसी त्रिभुज ABC में $\angle B = 90^\circ$, $\angle A = 75^\circ$ तो इसके परित्रिज्या तथा अन्तत्रिज्या का अनुपात बताओ।

- (a) $\sqrt{3} + \sqrt{2}$ (b) $\sqrt{6} + 2$
(c) $2 + \sqrt{3}$ (d) $\sqrt{3} + 5$

21. In the given figure, $AC : BD = 4 : 1$. Find DC . दिए गए चित्र में, $AC : BD = 4 : 1$. DC की लंबाई ज्ञात कीजिये।



- (a) $\sqrt{3} + 2$ (b) $\sqrt{2} + 3$
 (c) $2 + \sqrt{5}$ (d) None

22. In a triangle A, B, C, right angles at B, $AB + BC = 10(1 + \sqrt{3})$ and length of the hypotenuse is 20 cm. What is the value of $\tan A + \tan C$?

एक त्रिभुज A, B, C में, B पर समकोण, $AB + BC = 10(1 + \sqrt{3})$ और कर्ण की लंबाई 20 सेमी है। $\tan A + \tan C$ का मान क्या है?

[CDS-2021-II]

- (a) $\frac{4}{\sqrt{3}}$ (b) $\frac{2}{\sqrt{3}}$ (c) $\sqrt{3}$ (d) $2\sqrt{3}$

23. ABC is a triangle right angled at A and AD is perpendicular to BC. If $BD = 8$ cm and $DC = 12.5$ cm, then what is AD equal to?

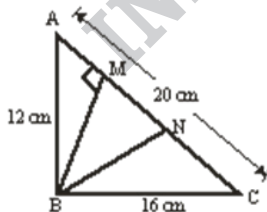
ABC एक त्रिभुज है जिसका कोण A समकोण है और AD, BC पर लंबवत है। यदि $BD = 8$ सेमी और $DC = 12.5$ सेमी है, तो AD किसके बराबर है?

[CDS-2021-I]

- (a) 7.5 cm (b) 8.5 cm
 (c) 9 cm (d) 10 cm

24. In Right Angle Triangle ABC, $\angle ABC = 90^\circ$, $AB = 12$ cm, $BC = 16$ cm, and $AC = 20$ cm. $BM \perp AC$ and BN is the bisector of $\angle ABC$ then find MN.

समकोण त्रिभुज ABC में, $\angle ABC = 90^\circ$, $AB = 12$ सेमी, $BC = 16$ सेमी, और $AC = 20$ सेमी। $BM \perp AC$ और BN, $\angle ABC$ का समद्विभाजक है तो MN ज्ञात करें?



- (a) 96/75 (b) 48/35
 (c) 72/49 (d) 36/25

25. In $\triangle ABC$, $\angle C = 90^\circ$ and Q is the midpoint of BC. If $AB = 10$ cm and $AC = 2\sqrt{10}$ cm, then the length of AQ is:

$\triangle ABC$ में, $\angle C = 90^\circ$ और Q, BC का मध्यबिंदु है। यदि $AB = 10$ सेमी और $AC = 2\sqrt{10}$ सेमी है, तो AQ की लंबाई है:

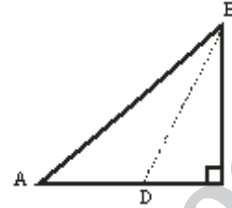
SSC CGL 13/8/2021 (Evening)

- (a) $\sqrt{55}$ cm (b) $5\sqrt{3}$ cm

- (c) $5\sqrt{2}$ cm (d) $3\sqrt{5}$ cm

26. If $\angle BAC = 2\angle DBC$. Then find area of $\triangle ABC$. Given that $AD = 1$ cm, $DC = 2$ cm.

यदि $\angle BAC = 2\angle DBC$ है। फिर $\triangle ABC$ का क्षेत्रफल ज्ञात करें। दिया गया है कि $AD = 1$ सेमी, $DC = 2$ सेमी।



- (a) 6 cm^2 (b) 12 cm^2
 (c) 4 cm^2 (d) 9 cm^2

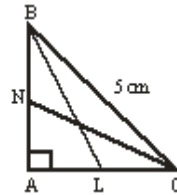
27. If the circumradius of a right angle triangle is 25 cm and its perimeter is 112 cm. Find out its area.

यदि एक समकोण त्रिभुज के परिवृत्त की त्रिज्या 25 cm है जबकि इसका परिमाप 112 cm है तो त्रिभुज का क्षेत्रफल बताओ?

- (a) 300 cm^2 (b) 336 cm^2
 (c) 340 cm^2 (d) None

28. In a $\triangle ABC$, $\angle A = 90^\circ$, BL and CN are two medians. $BC = 5$ cm, $BL = \frac{3\sqrt{5}}{2}$ cm. Find CN.

त्रिभुज ABC में $\angle A = 90^\circ$, BL तथा CN त्रिभुज की दो माधिकाएँ हैं। $BC = 5$ cm, $BL = \frac{3\sqrt{5}}{2}$ cm तो CN का मान बताओ।



- (a) $3\sqrt{5}$ (b) $2\sqrt{5}$ (c) $5\sqrt{3}$ (d) None

29. In $\triangle ABC$, $\angle BAC = 90^\circ$, AD is drawn perpendicular from A on BC. Which among the following is the mean proportional between BD and BC?

$\triangle ABC$ में, $\angle BAC = 90^\circ$, AD को A से BC पर लंबवत खींचा गया है। निम्नलिखित में से कौन सा BD और BC के बीच औसत अनुपातिक है?

SSC MTS 5/10/2021 (Morning)

- (a) AD (b) AB (c) CD (d) AC

30. In $\triangle ABC$, $\angle A = 90^\circ$, $AB = 16$ cm and $AC = 12$ cm. D is the mid point of AC and $DE \perp CB$ at E. What is the area of $\triangle CDE$?

$\triangle ABC$ में, $\angle A = 90^\circ$, $AB = 16$ cm और $AC = 12$ cm है। AC का मध्य बिन्दु D है। $DE \perp CB$, $\triangle CDE$ का क्षेत्रफल बताओ।

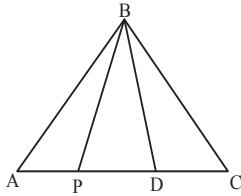
- (a) 8 cm^2 (b) 8.46 cm^2
(c) 8.64 cm^2 (d) 8.97 cm^2

31. In $\triangle ABC$, $\angle C = 90^\circ$, Points P and Q are on the sides AC and BC , respectively, such that $AP:PC = BQ:QC = 1:2$ Then $\frac{AQ^2 + BP^2}{AB^2}$ is equal:
 $\triangle ABC$ में, $\angle C = 90^\circ$, बिंदु P , Q क्रमशः AC और BC की भुजाओं पर इस प्रकार हैं कि $AP:PC = BQ:QC = 1:2$ फिर $\frac{AQ^2 + BP^2}{AB^2}$ बराबर है:

SSC CGL Tier II (15/11/2020)

- (a) $\frac{4}{7}$ (b) $\frac{4}{3}$ (c) $\frac{13}{9}$ (d) $\frac{8}{3}$

32. In the given fig. ABC is a right angle triangle at B , D is a point on AC such that $DC = 11$, $AD = 31$ and $BD = 17$, find the area of shaded region?
दिये गये चित्र में, ABC एक समकोण त्रिभुज है जहाँ B समकोण है AC भुजा पर एक बिंदु D इस प्रकार है कि $DC = 11$ सेमी, $AD = 31$ सेमी, और $BD = 17$ सेमी है तो छायांकित भाग का क्षेत्रफल ज्ञात करें ?



- (a) 84 cm^2 (b) 96.8 cm^2
(c) 92.4 cm^2 (d) 88 cm^2

33. In $\triangle ABC$, $\angle A$ is a right angle. The lengths of AC and BC are 6 cm and 10 cm respectively. Point D is on AB such that $BD = 4$ cm. What is the length of CD in (cm)?
 $\triangle ABC$ में, $\angle A$ एक समकोण है। AC और BC की लंबाई क्रमशः 6 सेमी और 10 सेमी है। बिंदु D , AB पर इस प्रकार है कि $BD = 4$ सेमी। CD की लंबाई (सेमी) क्या है?

SSC CGL 7/06/2019 (Afternoon)

- (a) $2\sqrt{13}$ (b) $3\sqrt{10}$
(c) $2\sqrt{10}$ (d) $3\sqrt{13}$

34. In a $\triangle ABC$, right angled at B , $AB = 7$ cm and $(AC - BC) = 1$ cm. The value of $(\sec C + \cot A)$ is :
 $\triangle ABC$ में, B पर समकोण है, $AB = 7$ सेमी और $(AC - BC) = 1$ सेमी। $(\sec C + \cot A)$ का मान है:

SSC CGL 10/06/2019 (Morning)

- (a) $\frac{19}{24}$ (b) $\frac{4}{3}$ (c) $\frac{3}{4}$ (d) 1

35. ABC is a triangle right angled at B . If $AB = 5$ cm and $BC = 10$ cm, then what is the length of the

perpendicular drawn from the vertex B to the hypotenuse ?

ABC एक त्रिभुज है जिसका कोण B समकोण है। यदि $AB = 5$ सेमी और $BC = 10$ सेमी है, तो शीर्ष B से कर्ण पर खींचे गए लंब की लंबाई क्या है?

[CDS-2019-II]

- (a) 4 cm (b) $2\sqrt{5}$ cm
(c) $\frac{4}{\sqrt{5}}$ cm (d) 8 cm

36. In $\triangle PQR$, $\angle P = 90^\circ$, S and T are the mid points of the sides PR and PQ , respectively. What is the value of $RQ^2 / (QS^2 + RT^2)$?

$\triangle PQR$ में, $\angle P = 90^\circ$, S और T क्रमशः भुजाओं PR और PQ के मध्य बिंदु हैं। $RQ^2 / (QS^2 + RT^2)$ का मान क्या है?

SSC CGL Tier II (16/11/2020)

- (a) $\frac{3}{4}$ (b) $\frac{1}{2}$ (c) $\frac{2}{3}$ (d) $\frac{4}{5}$

37. ABC is a triangle right-angled at C . Let P be any point on AC and Q be any point on BC . Which of the following statements is/are correct?

ABC एक त्रिभुज है जिसका कोण C समकोण है। माना P , AC पर कोई बिंदु है और Q , BC पर कोई बिंदु है। निम्नलिखित में से कौन सा/से कथन सही है/हैं?

[CDS-2020-II]

1. $AQ^2 + BP^2 = AB^2 + PQ^2$
2. $AB = 2PQ$

Select the correct answer using the code given below :

नीचे दिए गए कोड का उपयोग करके सही उत्तर चुनें:

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

38. The perimeter of a right-angled triangle is k times the shortest side. If the ratio of the other side to hypotenuse is 4:5, then what is the value of k ?
एक समकोण त्रिभुज का परिमाप उसकी सबसे छोटी भुजा का k गुना है। यदि दूसरी भुजा का कर्ण से अनुपात 4:5 है, तो k का मान क्या है?

[CDS-2019-I]

- (a) 2 (b) 3 (c) 4 (d) 5

39. In a $\triangle ABC$, $\angle A = 90^\circ$, if BM and CN are two medians, $\frac{BM^2 + CN^2}{BC^2}$ is equal

$\triangle ABC$ में, $\angle A = 90^\circ$, यदि BM और CN दो माधिकाएँ हैं, $\frac{BM^2 + CN^2}{BC^2}$ बराबर है

SSC CHSL 21/10/2020 (Evening)

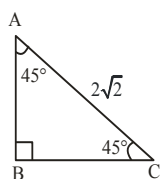
- (a) $\frac{3}{5}$ (b) $\frac{4}{5}$ (c) $\frac{5}{4}$ (d) $\frac{3}{4}$

Type 9 (Right Angled Triangle) Answer Key

1	(b)	2	(b)	3	(a)	4	(a)	5	(d)	6	(d)	7	(b)
8	(a)	9	(b)	10	(b)	11	(d)	12	(d)	13	(d)	14	(d)
15	(a)	16	(b)	17	(c)	18	(c)	19	(d)	20	(b)	21	(a)
22	(a)	2	(d)	24	(b)	25	(a)	26	(a)	27	(b)	28	(b)
29	(b)	30	(c)	31	(c)	32	(c)	3	(a)	34	(b)	35	(b)
36	(d)	37	(a)	38	(c)	39	(c)						

Type-9 (Right angled Triangle) Solution

1. Sol. (b)

In $\triangle ABC$, we have

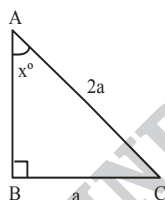
$$\cos 45^\circ = \frac{BC}{2\sqrt{2}}$$

$$\frac{1}{\sqrt{2}} = \frac{BC}{2\sqrt{2}} \Rightarrow BC = 2 \text{ cm}$$

2. Sol. (b)

Let BC is a

$$\therefore AC = 2a$$



$$\therefore AB = \sqrt{(2a)^2 - a^2} = a\sqrt{3}$$

$$\therefore \angle C = 90^\circ - x^\circ$$

$$\sin x^\circ = \frac{BC}{AC} = \frac{a}{2a} = \frac{1}{2} = \sin 30^\circ$$

$$\Rightarrow x^\circ = 30^\circ \therefore \angle C = 90^\circ - 30^\circ = 60^\circ$$

$$\text{Hence, } \angle C = 2 \times 30^\circ = 2x^\circ.$$

3. Sol. (a)

$$S = 45 \text{ cm}$$

$$R = 20.5 (\because \Delta = S(S - 2R))$$

$$\Delta = 45(45 - 41) = 45 \times 4 = 180 \text{ cm}^2$$

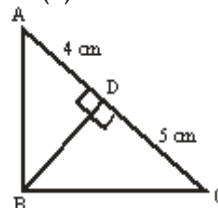
4. Sol. (a)



$$\text{In } \triangle PQR, \tan 30^\circ = \frac{5}{QR}$$

$$\frac{1}{\sqrt{3}} = \frac{5}{QR} \Rightarrow QR = 5\sqrt{3} \text{ cm}$$

5. Sol. (d)



$$BD = \sqrt{AD \times CD} = \sqrt{4 \times 5} = \sqrt{20} \text{ cm}$$

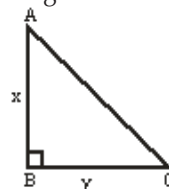
$$AB = \sqrt{(BD)^2 + (AD)^2} = \sqrt{20 + 16} = 6 \text{ cm}$$

$$BC = \sqrt{(BD)^2 + (CD)^2} = \sqrt{20 + 25} = \sqrt{45}$$

$$\therefore AB + BC = 6 + 6.6 = 12.6 \text{ cm}$$

6. Sol. (d)

Let two perpendicular sides of a right angled triangle be x and y .



According to the question,

$$x - y = 17 \quad \dots\dots(1)$$

$$\text{Area} = \frac{1}{2} \times x \times y$$

$$84 = \frac{1}{2} \times x \times y \Rightarrow xy = 168 \quad \dots (ii)$$

Putting $x = 17 + y$ in equation (ii), we get $(17 + y)y = 168$

$$\Rightarrow 17y + y^2 = 168 \Rightarrow y^2 + 17y - 168 = 0$$

$$\Rightarrow y^2 + 24y - 7y - 168 = 0$$

$$\Rightarrow y(y + 24) - 7(y + 24) = 0$$

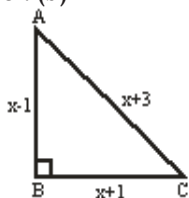
$$y = -24 \text{ not possible, so } y = 7 \text{ cm}$$

$$\text{So, } x = 17 + y = 17 + 7 = 24 \text{ cm}$$

$$\text{Hypotenuse } AC = \sqrt{24^2 + 7^2} = \sqrt{25} = 25 \text{ cm}$$

$$\text{So, Perimeter } AB + BC + AC = 24 + 7 + 25 = 56 \text{ cm}$$

7. Sol. (b)



Applying pythagoras theorem, we get

$$(x - 1)^2 + (x + 1)^2 = (x + 3)^2$$

$$x^2 - 2x + 1 + x^2 + 2x + 1 = x^2 + 6x + 9 \Rightarrow x^2 - 6x - 7 = 0$$

$$\Rightarrow x^2 - 7x + x - 7 = 0$$

$$\Rightarrow x(x - 7) + 1(x - 7) = 0$$

$$\Rightarrow (x - 7)(x + 1) = 0$$

$$\Rightarrow x = -1 \text{ [not possible]}$$

$$\text{so } x = 7$$

Putting $x = 7$ in hypotenuse, we get

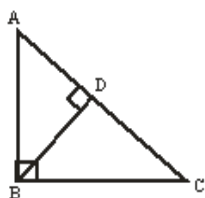
$$AC = x + 3 = 7 + 3 = 10 \text{ cm}$$

Alternate :- Triplet of 6,8,10 follows the above condition.

10 is the hypotenuse.

8. Sol. (a)

According to the question,



When in a right angled $\triangle ABC$, $BD \perp AC$, then

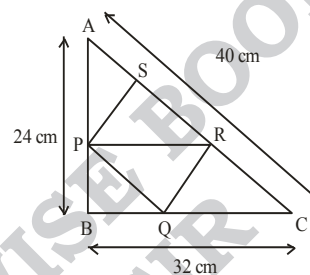
$$BD^2 = AD \times DC$$

9. Sol. (b)

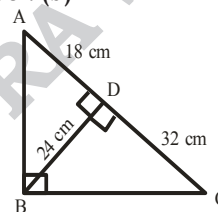
$$p = \frac{24 \times 32}{40} = \frac{96}{5}$$

$$\text{Side} = \frac{40 \times \frac{96}{5}}{40 + \frac{96}{5}} = \frac{40 \times 96}{296} = \frac{480}{37}$$

$$\text{diagonal} = \frac{480\sqrt{2}}{37}$$



10. Sol. (b)



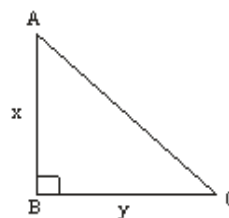
$$BD \perp AC$$

$$\begin{aligned} BD &= \sqrt{18 \times 32} \\ &= \sqrt{9 \times 2 \times 16 \times 2} \\ &= 24 \text{ cm} \end{aligned}$$

$$\Delta = \frac{1}{2} \times 50 \times 24 = 600 \text{ cm}^2,$$

11. Sol. (d)

Let , two perpendicular sides of a right angled triangle be x and y .



According to the question,

$$x - y = 17 \dots (1)$$

$$\text{Area} = \frac{1}{2} \times (x) \times (y)$$

$$84 = \frac{1}{2} \times (x) \times (y) \Rightarrow xy = 168$$

Putting $x = 17 + y$ in equation (2), we get

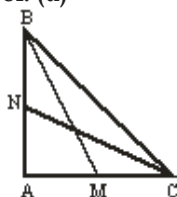
$$\begin{aligned} \Rightarrow (17 + y)y &= 168 \Rightarrow 17y + y^2 = 168 \\ \Rightarrow y^2 + 17y - 168 &= 0 \\ \Rightarrow y^2 + 24y - 7y - 168 &= 0 \\ \Rightarrow y(y + 24) - 7(y + 24) &= 0 \\ \Rightarrow (y + 24)(y - 7) &= 0 \\ y &= -24 \text{ not possible, so } y = 7 \text{ cm} \\ \text{So, } x = 17 + y &= 17 + 7 = 24 \text{ cm} \end{aligned}$$

So, $x = 17 + y = 17 + 7 = 24$ cm

Hypotenuse $AC = \sqrt{24^2 + 7^2} = \sqrt{25^2} = 25$ cm $\Rightarrow$ So, perimeter

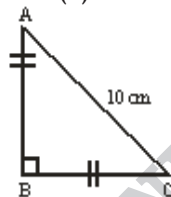
$$= AB + BC + AC = 24 + 7 + 25 = 56 \text{ cm}$$

12. Sol. (d)



$$\begin{aligned} 4(BM^2 + CN^2) &= 5BC^2 \\ 4[(4.6)^2 + 7^2] &= 5 \times BC^2 \Rightarrow 4 \times [96 + 49] \\ &= 5 \times BC^2 \Rightarrow 4 \times [145] = 5 \times BC^2 \\ BC^2 &= 116 \Rightarrow BC = 2\sqrt{29} \end{aligned}$$

13. Sol. (d)



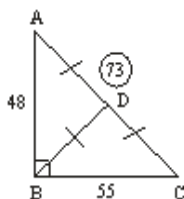
Let the same sides of the isosceles triangle be x cm.

By pythagoras theorem, $x^2 + x^2 = 10^2$

$$\Rightarrow 2x^2 = 100 \Rightarrow x = \sqrt{50} = 5\sqrt{2}$$

Hence, the other two sides of the triangle are $5\sqrt{2}$ and $5\sqrt{2}$.

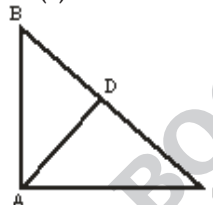
14. Sol. (d) Pythagoras triplets
(48, 55, 73)



Length of median joining the midpoint of longest side to its opposite vertex is equal to half of the longest side.

$$AD = DC = BD = \frac{AC}{2} = 36.5 \text{ cm}$$

15. Sol. (a) Short-Trick:

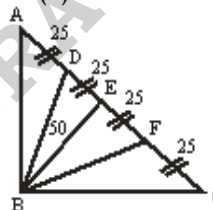


$AD = 8.4$ cm and $BD = 4.8$ cm

$$\Rightarrow AD^2 = BD \times DC \Rightarrow DC = 14.7$$

$$\text{and } BC = 14.7 + 4.8 = 19.5$$

16. Sol. (b)

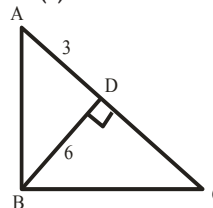


$AC = 100$ cm

$$\begin{aligned} BD^2 + BF^2 &= 2(50^2 + 25^2) \\ &= 5000 + 1250 \\ &= 6250 \end{aligned}$$

$$\begin{aligned} BD^2 + BE^2 + BF^2 &= 6250 + 2500 \\ &= 8750 \end{aligned}$$

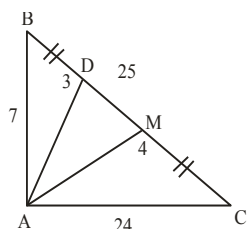
17. Sol. (c)



$$\begin{aligned} CD &= \frac{BD^2}{AD} = \frac{36}{3} = 12 \text{ cm} \\ AC &= 3 + 12 = 15 \text{ cm} \end{aligned}$$

18. Sol. (c)

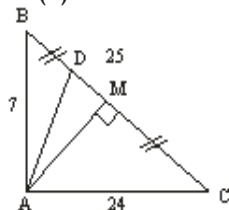
5, 12, 13 is a Pythagorean triplet. So, the smallest altitude of the



$$\frac{1}{2} \times AB \times BC = \frac{1}{2} \times BD \times AC$$

$$5 \times 12 = BD \times 13 \Rightarrow BD = 4.6$$

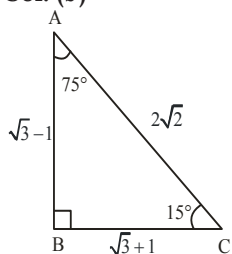
19. Sol. (d)



$$AD : AM = \frac{7 \times 24}{25} : \frac{25}{2}$$

$$= 336 : 625$$

20. Sol. (b)



Circumradius : inradius = ?

$$\tan 15 = \frac{\sqrt{3} - 1}{\sqrt{3} + 1}$$

AC = $2\sqrt{2}$ (by phythagores)

$$\text{Circumradius } R = \frac{H}{2}$$

$$\text{Inradius} = \frac{P+B-H}{2}$$

R : r

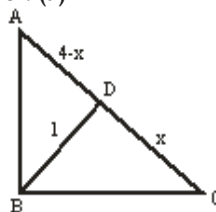
$$\Rightarrow \frac{2\sqrt{2}}{2} : \frac{\sqrt{3}-1+\sqrt{3}+1-2\sqrt{2}}{2}$$

$$\Rightarrow 2\sqrt{2} : \sqrt{3} - 2\sqrt{2}$$

$$\Rightarrow \sqrt{2} : \sqrt{3} - \sqrt{2}$$

$$\Rightarrow \sqrt{6} + 2 : 1$$

21. Sol. (a)



$$AC = 4 \text{ cm}$$

$$BD = 1 \text{ cm}$$

$$DC = ?$$

$$1 = \sqrt{(4-x)x}$$

$$1 = 4x - x^2$$

$$x^2 - 4x + 1 = 0$$

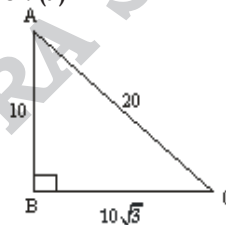
$$x^2 - 4x + 4 - 4 + 1 = 0$$

$$(x-2)^2 = 3$$

$$x-2 = \sqrt{3}$$

$$x = \sqrt{3} + 2 \text{ cm}$$

22. Sol. (a)

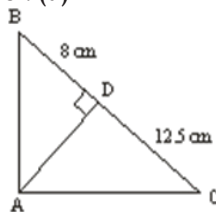


$$\tan A = \frac{10\sqrt{3}}{10} = \sqrt{3}$$

$$\tan C = \frac{10}{10\sqrt{3}} = \frac{1}{\sqrt{3}}$$

$$\tan A + \tan C = \sqrt{3} + \frac{1}{\sqrt{3}} = \frac{4}{\sqrt{3}}$$

23. Sol. (d)

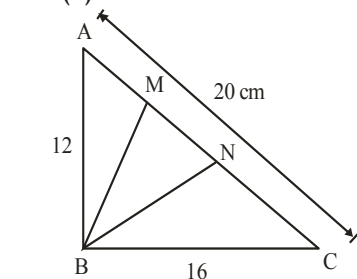


From triangle properties.

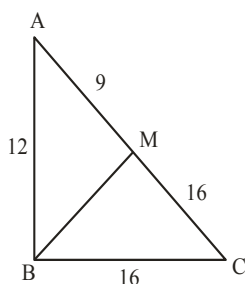
$$\frac{BD}{AD} = \frac{AD}{CD}$$

$$\therefore AD = \sqrt{BD \times CD} = \sqrt{8 \times 12.5} = 10 \text{ cm.}$$

24. Sol. (b)



$$AM = \frac{20 \times 9}{25} = \frac{180}{25} = \frac{36}{5}$$



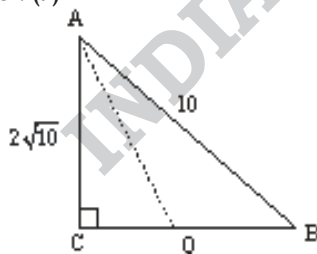
By Angle bisector theorem

$$AN : NC = 3 : 4$$

$$AN = 20 \times \frac{3}{7} = \frac{60}{7} \text{ cm}$$

$$\begin{aligned} MN &= AN - AM \\ &= \frac{60}{7} - \frac{36}{5} \\ &= \frac{300 - 252}{35} = \frac{48}{35} \end{aligned}$$

25. Sol. (a)



Applying pythagoras in $\triangle ABC$,

$$AB^2 - AC^2 = CB^2$$

$$CB = \sqrt{100 - 40} = 2\sqrt{15}$$

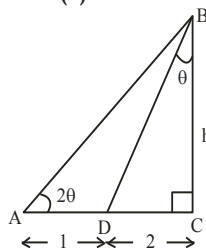
$$CQ = \frac{1}{2} CB = \sqrt{15}$$

Applying pythagoras in $\triangle ACQ$

$$AQ^2 = AC^2 + CQ^2$$

$$AQ^2 = 40 + 15 \Rightarrow AQ = \sqrt{55} \text{ cm}$$

26. Sol. (a)



$$\tan 2\theta = \frac{2 \tan \theta}{1 - \tan^2 \theta}$$

$$\frac{h}{3} = \frac{2 \times \frac{2}{h}}{1 - \frac{4}{h^2}}$$

$$\frac{h}{3} = \frac{4}{h^2 - 4}$$

$$\frac{h}{3} = \frac{4h}{h^2 - 4}$$

$$\frac{h}{3} = \frac{4}{h^2 - 4}$$

$$h = 4$$

$$\text{Area}(\triangle ABC) = \frac{1}{2} \times 3 \times 4$$

$$\text{Area}(\triangle ABC) = 6 \text{ cm}$$

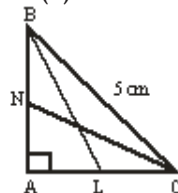
27. Sol. (b)

$$R = 25 \text{ cm}$$

$$S = \frac{112}{2} = 56 \text{ cm}$$

$$\begin{aligned} \Delta &= S(S - 2R) \\ &= 56(56 - 50) \\ &= 56 \times 6 \\ &= 336 \text{ cm}^2 \end{aligned}$$

28. Sol. (b)



$$BL = \frac{3\sqrt{5}}{2} \text{ cm (given)}$$

$$CN = ?$$

$$4(BL^2 + CN^2) = 5BC^2$$

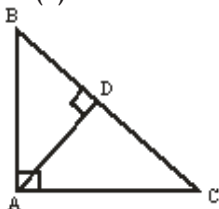
$$4\left(\frac{45}{4} + CN^2\right) = 5 \times 25$$

$$45 + 4CN^2 = 125$$

$$4CN^2 = 80 \Rightarrow CN^2 = 20$$

$$CN = 2\sqrt{5} \text{ cm.}$$

29. Sol. (b)



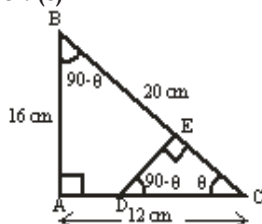
In right angle $\triangle BAC$, where $\angle A = 90^\circ$ and line AD perpendicular to line BC then $AB^2 = BD \times BC$

$$AB = \sqrt{BD \times BC}$$

So mean proportional between BD and

$$BC = \sqrt{BD \times BC} = AB$$

30. Sol. (c)



$$\text{Ar}(\triangle CDE) = ?$$

$$\triangle ABC \sim \triangle CDE$$

$$\text{Side} \rightarrow 20 : 6 \Rightarrow 10 : 3$$

$$\text{Area} \rightarrow 100 : 9$$

$$\text{Area}(\triangle ABC) = \frac{1}{2} \times 16 \times 12 = 96 \text{ cm}^2$$

$$100 \rightarrow 96$$

$$9 \rightarrow \frac{96}{100} \times 9 = 8.64 \text{ cm}^2$$

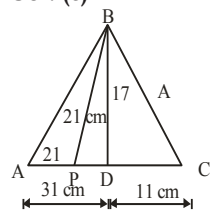
31. Sol. (c)

$$\Rightarrow BA = 3\sqrt{2}$$

$$AQ = \sqrt{AC^2 \times QC^2} = \sqrt{13} \Rightarrow BP = \sqrt{13}$$

$$\Rightarrow \frac{AQ^2 + BP^2}{AB^2} = \frac{13+13}{18} = \frac{13}{9}$$

32. Sol. (c)



$$AC = 31 + 11 = 42$$

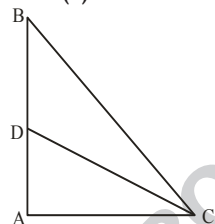
$$AP = PC = 21 = BP$$

$$\Delta = \sqrt{24 \times 3 \times 7 \times 14} = 84$$

$$10 \rightarrow 8.4$$

$$11 \rightarrow 11 \times 8.4 = 92.4 \text{ cm}^2$$

33. Sol. (a)



In $\triangle ABC$

$$AB^2 + AC^2 = BC^2 \text{ (Pythagoras Theorem)}$$

$$\Rightarrow AB^2 + 6^2 = 10^2$$

$$\Rightarrow AB = \sqrt{10^2 - 6^2} = 8$$

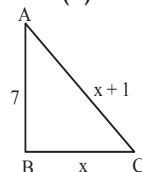
$$AD = AB - BD = 8 - 4 = 4 \text{ cm}$$

In $\triangle ADC$

$$AD^2 + AC^2 = DC^2$$

$$\Rightarrow 4^2 + 6^2 = DC^2 \Rightarrow DC = \sqrt{52} = 2\sqrt{13}$$

34. Sol. (b)



$$\Rightarrow 7^2 + x^2 = (x + 1)^2$$

$$\Rightarrow 49 + x^2 = (x^2 + 1 + 2x) \Rightarrow x = 24$$

$$\sec C = \frac{AC}{BC} = \frac{25}{24} \Rightarrow \cot A = \frac{AB}{BC} = \frac{7}{24}$$

$$(\sec C + \cot A) = \frac{25}{24} + \frac{7}{24} = \frac{32}{24} = \frac{4}{3}$$

Alternate

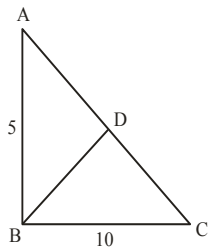
Triplet 7,24,25 satisfies the given condition.

So, $BC = 24 \text{ cm}$

$$(\sec C + \cot A) = \frac{25}{24} + \frac{7}{24} = \frac{32}{24} = \frac{4}{3}$$

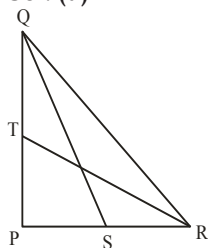
35. Sol. (b)

From properties of perpendicular in a right angled triangle



$$\begin{aligned}\frac{1}{BD^2} &= \frac{1}{BC^2} + \frac{1}{AB^2} \\ &= \frac{1}{25} + \frac{1}{100} = \frac{1}{20} \\ BD &= \sqrt{20} = 2\sqrt{5} \text{ cm}\end{aligned}$$

36. Sol. (d)



Add eq. (1) and (2)

$$\Rightarrow QS^2 = PQ^2 + PS^2$$

$$4QS^2 = 4PQ^2 + PR^2 \text{ --- eq(1)}$$

$$\Rightarrow RT^2 = PT^2 + PR^2$$

$$4RT^2 = PQ^2 + 4PR^2 \text{ --- eq(2)}$$

$$\Rightarrow 4(QS^2 + RT^2) = 5(PQ^2 + PR^2)$$

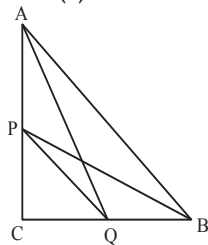
$$\Rightarrow 4(QS^2 + RT^2) = 5QR^2$$

$$\Rightarrow \frac{RQ^2}{QS^2 + RT^2} = \frac{4}{5}$$

Alternate :-

$$4(QS^2 + RT^2) = 5RQ^2 \Rightarrow \frac{RQ^2}{QS^2 + RT^2} = \frac{4}{5}$$

37. Sol. (a)



$\triangle ACB$ and $\triangle PCQ$ are right triangle.

Now, $\triangle ACQ$ and $\triangle BCP$ is a right angle triangle.

$$AB^2 = AC^2 + BC^2 \text{ and } PQ^2 = PC^2 + CQ^2$$

Now, $\triangle ACQ$ and $\triangle BCP$ is a right angle triangle

$$AQ^2 = AC^2 + CQ^2 \text{ --- (i)}$$

$$\text{and } BP^2 = BC^2 + PC^2 \text{ --- (ii)}$$

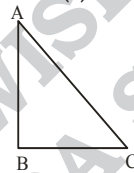
$$AQ^2 + BP^2 = AC^2 + BC^2 + CQ^2 + PC^2$$

$$= AB^2 + PQ^2$$

As point P and Q are not mid point of side AC and BC.

$$\therefore AB \neq 2PQ.$$

38. Sol. (c)



Let BC is shortest side in right angle triangle $\triangle ABC$, such that $AB:AC = 4:5$.

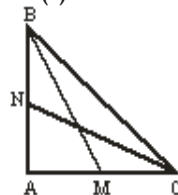
$$\begin{aligned}\therefore BC &= \sqrt{(AC)^2 - (AB)^2} \\ &= \sqrt{(5x)^2 - (4x)^2} = 3x\end{aligned}$$

$$\text{Perimeter} = AB + BC + AC = 4x + 3x + 5x = 12x$$

According to the question $12x = k(3x)$

$$\therefore k = \frac{12x}{3x} = 4$$

39. Sol. (c)



$$\text{We know, } 4(BM^2 + CN^2) = 5BC^2$$

$$\frac{BM^2 + CN^2}{BC^2} = \frac{5}{4}$$

Type-10 (Types of Triangle)

1. The length of the altitude of an equilateral triangle is $6\sqrt{3}$ m. The perimeter of the equilateral triangle (in m) is:
एक समबाहु त्रिभुज की ऊँचाई की लंबाई $6\sqrt{3}$ मीटर है। समबाहु त्रिभुज का परिमाण (मीटर में) है:

SSC CGL 2023 (3rd Shift)

- (a) $12\sqrt{2}$ (b) $36\sqrt{2}$
(c) 36 (d) $24\sqrt{3}$

2. If the hypotenuse of an isosceles right-angled triangle is 10 cm, then the other two sides (in cm) are ____
यदि एक समद्विबाहु समकोण त्रिभुज का कर्ण 10 सेमी है, तो अन्य दो भुजाएँ (सेमी में) ____ हैं

SSC CPO 11/11/2022 (Evening)

- (a) $10\sqrt{2}$ and $10\sqrt{2}$ (b) $8\sqrt{2}$ and $8\sqrt{2}$
(c) $6\sqrt{2}$ and $6\sqrt{2}$ (d) $5\sqrt{2}$ and $5\sqrt{2}$

3. In $\triangle PQR$, S is a point on the side QR such that $\angle QPS = \frac{1}{2}\angle PSR$, $\angle QPR = 78^\circ$ and $\angle PRS = 44^\circ$. What is the measure of $\angle PSQ$?
 $\triangle PQR$ में, S भुजा QR पर इस प्रकार एक बिंदु है कि $\angle QPS = \frac{1}{2}\angle PSR$, $\angle QPR = 78^\circ$ और $\angle PRS = 44^\circ$ है। $\angle PSQ$ का माप क्या है?

SSC CGL Tier II 29/01/2022

- (a) 56° (b) 64°
(c) 58° (d) 68°

4. An isosceles $\triangle MNP$ is inscribed in a circle. If $MN = MP = 16\sqrt{5}$ cm, and $NP = 32$ cm what is the radius (in cm) of the circle?
एक समद्विबाहु $\triangle MNP$ एक वृत्त में अंकित है। यदि $MN = MP = 16\sqrt{5}$ सेमी, और $NP = 32$ सेमी है तो वृत्त की त्रिज्या (सेमी में) क्या है?

SSC CGL 13/04/2022 (Evening)

- (a) 20 (b) $18\sqrt{5}$
(c) 18 (d) $20\sqrt{5}$

5. A triangle ABC is equilateral triangle and $AD \perp BC$, where D lies on BC. If $AD = 4\sqrt{3}$ cm. then what is the perimeter of a triangle ABC.
त्रिभुज ABC एक समबाहु त्रिभुज है और $AD \perp BC$, जहाँ D भुजा BC पर है यदि $AD = 4\sqrt{3}$ सेमी, तो त्रिभुज ABC का परिमाण क्या है?

- (a) 24 cm (b) 30 cm
(c) 21 cm (d) 27 cm

6. In $\triangle PQR$, $PQ = PR = 30$ cm. $QR = 16$ cm. T is a point on QR such that $TR = 5$ cm. Find PT.

त्रिभुज PQR में $PQ = PR = 30$ cm. $QR = 16$ cm बिन्दु T भुजा QR पर इस प्रकार स्थित है की $TR = 5$ cm तो PT का मान निकालें।

- (a) $12\sqrt{5}$ (b) $13\sqrt{5}$
(c) $6\sqrt{5}$ (d) None

7. $\triangle ABC$ is an isosceles with $AB = AC$. Side BA is produced to D such that $AB = AD$. Find $\angle BCD$.

$\triangle ABC$ एक समद्विबाहु त्रिभुज है जिसमें $AB = AC$ है। भुजा BA को बिन्दु D तक इस प्रकार आगे बढ़ाया जाता है की $AB = AD$ तो $\angle BCD$ का मान बताओ।

- (a) 75° (b) 80°
(c) 90° (d) 45°

8. ABC is an equilateral triangle. If the area of the triangle is $36\sqrt{3}$, then what is the radius of the circle circumscribing the triangle ABC?

ABC एक समबाहु त्रिभुज है। यदि त्रिभुज का क्षेत्रफल $36\sqrt{3}$ है, तो त्रिभुज ABC के परिगत वृत्त की त्रिज्या क्या है?

SSC CGL Tier II 08/08/2022

- (a) $2\sqrt{3}$ (b) $3\sqrt{3}$
(c) $4\sqrt{3}$ (d) $6\sqrt{3}$

9. $\triangle ABC$ is an equilateral triangle in which $BD:DC = 3:5$ then $AD:DC = ?$

$\triangle ABC$ एक समबाहु त्रिभुज है जहाँ $BD:DC = 3:5$ तब $AD:DC = ?$ ज्ञात करें?

- (a) 7:8 (b) 3:4
(c) 5:6 (d) 15:16

10. In $\triangle ABC$, $AB = AC$, O is a point on BC such that $BO = CO$ and OD is perpendicular to AB and OE is perpendicular to AC. If $\angle BOD = 60^\circ$, then measure of $\angle AOE$ is:

$\triangle ABC$ में, $AB = AC$, O BC पर एक बिंदु इस प्रकार है कि $BO = CO$ और OD, AB पर लंबवत है और OE, AC पर लंबवत है। यदि $\angle BOD = 60^\circ$ है, तो $\angle AOE$ का माप है:

SSC CGL 02/12/2022 (2nd Shift)

- (a) 120° (b) 60°
(c) 30° (d) 90°

11. An equilateral triangle of side x is inscribed in a circle of radius y. Which one of the following is correct?

भुजा x का एक समबाहु त्रिभुज त्रिज्या y के एक वृत्त में अंकित है। निम्नलिखित में से कौन सा सही है?

[CDS-2022-I]

- (a) $2y = x$ (b) $2y = \sqrt{3}x$
(c) $\sqrt{3}y = 2x$ (d) $\sqrt{3}y = x$

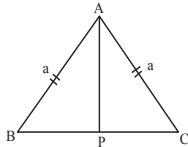
12. In an isosceles $\triangle ABC$, side are 10, 10, 16 cm. Find circumradius and in radius.

$\triangle ABC$ एक समद्विबाहु त्रिभुज है, जिसकी भुजाएँ क्रमशः 10, 10, 16 cm हैं। तो त्रिभुज का क्षेत्रफल, परिवृत्त की त्रिज्या तथा अन्तःवृत्त की त्रिज्या बताइये।

- (a) 8, 25 (b) $\frac{25}{3}, \frac{9}{2}$
(c) $\frac{25}{3}, \frac{8}{3}$ (d) None

13. In the given fig. $\triangle ABC$ is isosceles triangle in which $\angle DAC = 90^\circ$, $AB = AC$, $BD = 5$ cm, & $CD = 12$ cm, then find AD?

दिये गये चित्र में, त्रिभुज ABC में $\angle DAC = 90^\circ$ । जो कि समद्विबाहु त्रिभुज है यदि $AB = AC$, $BD = 5$ सेमी और $CD = 12$ सेमी, तो AD का मान ज्ञात करो?



- (a) $\sqrt{67}$ (b) $\sqrt{39}$
(c) 6.5 (d) $\sqrt{42}$

14. The side of an equilateral $\triangle ABC$ is $3\sqrt{7}$ cm. P is a point on side BC such that $BP:PC = 1:2$. The length (in cm) of AP is:

एक समबाहु $\triangle ABC$ की भुजा $3\sqrt{7}$ सेमी है। P भुजा BC पर एक बिंदु है जैसे कि $BP:PC = 1:2$ है। AP की लंबाई (सेमी में) है:

SSC CGL 20/8/2021 (Evening)

- (a) $6\sqrt{3}$ (b) $7\sqrt{3}$
(c) 6 (d) 7

15. If height of an isosceles triangle is 20 cm and perimeter is 100 cm. Find area of triangle.

एक समद्विबाहु त्रिभुज की ऊँचाई 20 सेमी है तथा परिमाप 100 सेमी है। त्रिभुज का क्षेत्रफल बताओ।

- (a) 420 cm^2 (b) 220 cm^2
(c) 180 cm^2 (d) 200 cm^2

16. If the perimeter of an isosceles right triangle is $15(\sqrt{2} + 1)$ cm, then the area of the triangle (in cm^2) will be:

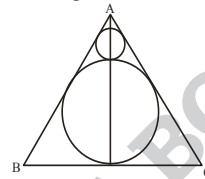
यदि एक समद्विबाहु समकोण त्रिभुज का परिमाप $15(\sqrt{2} + 1)$ सेमी है, तो त्रिभुज का क्षेत्रफल (सेमी² में) होगा:

SSC CHSL 9/8/2021 ((Afternoon)

- (a) 46.5 (b) 45
(c) 56.25 (d) 55

17. $\triangle ABC$ is an isosceles triangle in which $AB = AC$. Two circles are the radius 1 cm and 2 cm are inscribed in figure. Find area of isosceles triangle.

$\triangle ABC$ एक समद्विबाहु त्रिभुज है, जिसमें $AB = AC$ दो वृत्त जिनकी त्रिज्याएँ 1 सेमी तथा 2 सेमी हैं को चित्र में दर्शाया गया है। त्रिभुज का क्षेत्रफल निकालो।



- (a) $13\sqrt{2}$ cm (b) $14\sqrt{2}$ cm
(c) $15\sqrt{2}$ cm (d) $16\sqrt{2}$ cm

18. In an isosceles triangle ABC , $AB = AC$ and AD is perpendicular to BC . If $AD = 12$ cm and the perimeter of $\triangle ABC$ is 36 cm, then the length of BC (in cm) is:

एक समद्विबाहु त्रिभुज ABC में, $AB = AC$ और AD , BC पर लंबवत है। यदि $AD = 12$ सेमी और $\triangle ABC$ का परिमाप 36 सेमी है, तो BC की लंबाई (सेमी में) है:

SSC CHSL 5/8/2021 (Morning)

- (a) 5 (b) 12
(c) 10 (d) 13

19. Triangle ABC is an equilateral triangle. D and E are points on AB and AC respectively such that DE is parallel to BC and is equal to half the length of BC . If $D + CE + BC = 30$ cm, then find the perimeter (in cm) of the quadrilateral $BCED$.

त्रिभुज ABC एक समबाहु त्रिभुज है। D और E क्रमशः AB और AC पर इस प्रकार बिंदु हैं कि DE , BC के समानांतर है और BC की आधी लंबाई के बराबर है। यदि $AD + CE + BC = 30$ सेमी है, तो चतुर्भुज $BCED$ का परिमाप (सेमी में) ज्ञात कीजिए।

SSC CGL 20/8/2021 (Morning)

- (a) 45 (b) 25
(c) 37.5 (d) 35

20. $\triangle ABC$ is an equilateral triangle with side 18 cm, D is a point on BC such that $BD = \frac{1}{3}BC$. Then length (in cm) of AD is:

$\triangle ABC$ एक समबाहु त्रिभुज है जिसकी भुजा 18 सेमी है, D BC पर एक बिंदु है जैसे कि $BD = \frac{1}{3}BC$ है। तो AD की लंबाई (सेमी में) है:

SSC CGL 23/8/2021 (Evening)

- (a) $6\sqrt{3}$ (b) $6\sqrt{7}$
(c) $7\sqrt{6}$ (d) $8\sqrt{3}$

21. $\triangle ABC$ is an isosceles right angle triangle, such that $\angle C = 90^\circ$. D is a point on AB such that $CD = 2\sqrt{5}$ cm, $BD = 6$ cm. Find AD.

$\triangle ABC$ एक समद्विबाहु समकोण त्रिभुज है जिसमें $\angle C = 90^\circ$ बिन्दु D भुजा AB पर इस प्रकार स्थित है की $CD = 2\sqrt{5}$ cm, $BD = 6$ cm तो AD का मान बताओ।

- (a) 3 cm (b) 4 cm
(c) 5 cm (d) 6 cm

22. The centroid of an equilateral triangle $\triangle ABC$ is O. If $AB = 27$ cm, then the length of AO (in cm) is:

एक समबाहु त्रिभुज $\triangle ABC$ का केन्द्रक O है। यदि $AB = 27$ सेमी है, तो AO की लंबाई (सेमी में) है:

SSC CHSL 12/04/2021 (Afternoon)

- (a) $9\sqrt{3}$ (b) $7\sqrt{3}$
(c) $8\sqrt{3}$ (d) $6\sqrt{3}$

23. ABC is an equilateral triangle. The side BC is trisected at D such that $BC = 3BD$. What is the ratio of AD^2 to AB^2 ?

ABC एक समबाहु त्रिभुज है। भुजा BC को D पर इस प्रकार विभाजित किया गया है कि $BC = 3BD$ है। AD^2 से AB^2 का अनुपात क्या है?

[CDS-2020-II]

- (a) 7:9 (b) 1:3
(c) 5:7 (d) 1:2

24. ABC is equilateral triangle circle is drawn Whose diameter is equal to height AD of equilateral triangle if the circle intersect AB and AC at point P and Q respectively then find PQ:BCP.

ABC एक समबाहु त्रिभुज है एक वृत्त जिसका व्यास त्रिभुज की ऊँचाई AD के बराबर है वृत्त भुजा AB और AC को क्रमशः बिन्दु P और Q पर काटता है तब PQ:BC का मान ज्ञात करें।

- (a) 1:2 (b) 2:3
(c) 3:4 (d) 4:5

25. The difference between the area of the circumscribed circle and the area of the inscribed circle of an equilateral triangle is 2156 cm^2 . What is the area in sq cm of the equilateral triangle.

समबाहु त्रिभुज के परिवृत्त और अन्तः वृत्त के क्षेत्रफल का अंतर 2156 वर्ग सेमी² है तो समबाहु त्रिभुज का क्षेत्रफल क्या है?

- (a) $686\sqrt{3}$ (b) 1000
(c) $961\sqrt{3}$ (d) $650\sqrt{3}$

26. The length of each equal side of an isosceles triangle is 15 cm and the included angle between those two sides is 90° . Find the area of the triangle.

एक समद्विबाहु त्रिभुज की प्रत्येक बराबर भुजा की लंबाई 15 सेमी है और उन दोनों भुजाओं के बीच का सम्मिलित कोण 90° है। त्रिभुज का क्षेत्रफल ज्ञात कीजिए।

SSC CGL 7/03/2020 (Evening)

- (a) $\frac{225}{2} \text{ cm}^2$ (b) 225 cm^2
(c) $\frac{255}{2} \text{ cm}^2$ (d) $\frac{125}{2} \text{ cm}^2$

27. In an isosceles right angle triangle whose perimeter is $2p$ cm then find the area of triangle?

किसी समकोण समद्विबाहु त्रिभुज का परिमाप $2p$ सेमी⁰ है तब त्रिभुज का क्षेत्रफल होगा-

- (a) $(3 + 2\sqrt{2})p^2 \text{ cm}^2$ (b) $(3 - 2\sqrt{2})p^2 \text{ cm}^2$
(c) $(2 - \sqrt{2})p \text{ cm}^2$ (d) $(2 + \sqrt{2})p^2 \text{ cm}^2$

28. D and E are two point on the side AC and BC respectively of $\triangle ABC$ such that $DE = 18$ cm, $CE = 5$ cm, and $\angle DEC = 90^\circ$ if $\tan \angle ABC = 3.6$ then $AC:CD = ?$

$\triangle ABC$ की भुजाओं AC तथा BC पर दो बिंदु D तथा E इस प्रकार है कि $DE = 18$ cm $CE = 5$ सेमी⁰, तथा $\angle DEC = 90^\circ$ हो यदि $\tan \angle ABC = 3.6$ तब $AC:CD = ?$

- (a) BC:2CE (b) 2CE:BC
(c) 2BC:CE (d) CE:2BC

29. In $\triangle ABC$, $AB = AC$. If $\angle A$ is twice the sum of other two angles of the triangle, then the measure of $\frac{1}{2}\angle A$ is: $\triangle ABC$ में, $AB = AC$ है। यदि $\angle A$ त्रिभुज के अन्य दो कोणों के योग का दोगुना है, तो $\frac{1}{2}\angle A$ का माप है:

SSC CHSL 21/10/2020 (Evening)

- (a) 70° (b) 60°
(c) 30° (d) 80°

30. What is the percentage decrease in the area of a triangle if its each side is halved?

यदि किसी त्रिभुज की प्रत्येक भुजा आधी कर दी जाए तो उसके क्षेत्रफल में कितने प्रतिशत की कमी होगी?

[CDS-2019-I]

- (a) 75% (b) 50%
(c) 25% (d) No change

31. If $\triangle ABC$ is an equilateral triangle in which D, E and F are the points on sides BC, AC, and AB respectively such that $AD \perp BC$, $BE \perp AC$ and $CF \perp AB$, which of the following is true?

यदि $\triangle ABC$ एक समबाहु त्रिभुज है जिसमें D, E और F क्रमशः BC, AC और AB पर बिंदु इस प्रकार हैं कि $AD \perp BC$, $BE \perp AC$ और $CF \perp AB$ हैं, तो निम्नलिखित में से कौन सा सत्य है?

SSC CPO 11/12/19 (Morning)

- (a) $7AB^2 = 9AD^2$ (b) $2AB^2 = 3AD^2$

- (c) $4AC^2 = 5BE^2$ (d) $3AC^2 = 4BE^2$
32. If l is the length of the median of an equilateral triangle, then what is its area ?
यदि एक समबाहु त्रिभुज की माधिका की लंबाई l है, तो इसका क्षेत्रफल क्या है?

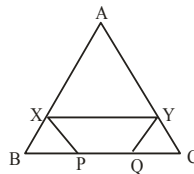
[CDS-2019-II]

- (a) $\frac{\sqrt{3}l^2}{3}$ (b) $\frac{\sqrt{3}l^2}{2}$
- (c) $\sqrt{3}l^2$ (d) $2l^2$

33. In the figure given below, ABC is an equilateral triangle with each side of length 30 cm. XY is parallel to BC , XP is parallel to AC and YQ is parallel to AB . If $XY + XP + YQ$ is 40 cm, then the value of PQ is

नीचे दिए गए चित्र में, ABC एक समबाहु त्रिभुज है जिसकी प्रत्येक भुजा की लंबाई 30 सेमी है। XY , BC के समानांतर है, XP , AC के समानांतर है और YQ , AB के समानांतर है। यदि $XY + XP + YQ$ 40 सेमी है, तो PQ का मान है

[CDS-2018-II]



- (a) 5 cm (b) 12 cm
- (c) 15 cm (d) 10 cm

Type 10 (Types of Triangle) Answer Key

1	(c)	2	(d)	3	(b)	4	(a)	5	(a)	6	(b)	7	(c)
8	(c)	9	(a)	10	(c)	11	(d)	12	(c)	13	(d)	14	(d)
15	(a)	16	(c)	17	(d)	18	(c)	19	(c)	20	(b)	21	(a)
22	(a)	23	(a)	24	(c)	25	(a)	26	(a)	27	(a)	28	(a)
29	(b)	30	(a)	31	(d)	32	(a)	33	(d)				

Type-10 (Types of Triangle) Solution

1. Sol. (c)

Height of the equilateral triangle

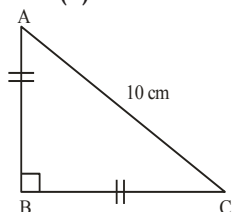
$$= \frac{\sqrt{3}}{2} \times \text{side} \Rightarrow \frac{\sqrt{3}}{2} \times \text{side} = 6\sqrt{3}$$

$$\Rightarrow \text{side} = 12 \text{ m}$$

So, perimeter of equilateral triangle = $3 \times 12 =$

$$36 \text{ m}$$

2. Sol. (d)



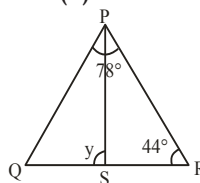
Let the same sides of the isosceles triangle be x cm.

By pythagoras theorem, $x^2 + x^2 = 10^2$

$$\Rightarrow 2x^2 = 100 \Rightarrow x = \sqrt{50} = 5\sqrt{2}$$

Hence, the other two sides of the triangle are $5\sqrt{2}$ and $5\sqrt{2}$.

3. Sol. (b)



$$\angle PQR + \angle PRQ + \angle QPR = 180^\circ$$

According to the question,

$$\angle PQR + 44^\circ + 78^\circ = 180^\circ$$

$$\angle PQR = 180^\circ - 122^\circ = 58^\circ$$

$$\angle PQS + \angle QPS = \angle PSR$$

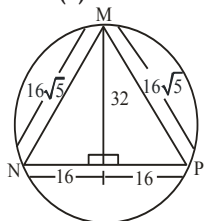
$$58^\circ + \frac{1}{2} \angle PSR = \angle PSR$$

$$\frac{1}{2} \angle PSR = 58^\circ \Rightarrow \angle PSR = 116^\circ$$

$$\Rightarrow \angle PSR + \angle PSQ = 180^\circ$$

$$\Rightarrow 116^\circ + \angle PSQ = 180^\circ \Rightarrow \angle PSQ = 64^\circ$$

4. Sol. (a)

Given, $MN = MP = 16\sqrt{5}$,In right $\triangle NIM$, $MI = \sqrt{(16\sqrt{5})^2 - 16^2} = 32$ cm.

$$\begin{aligned} \text{Circumradius (R)} &= \frac{a \times b \times c}{4 \times \text{ar.} \Delta} \\ &= \frac{16\sqrt{5} \times 16\sqrt{5} \times 32}{4 \times \frac{1}{2} \times 32 \times 32} = 4 \times \sqrt{5} \times \sqrt{5} \\ &= 20 \text{ cm.} \end{aligned}$$

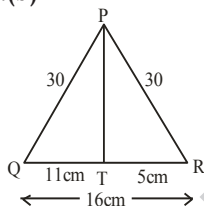
5. Sol. (a)

$$H = \frac{\sqrt{3}}{2} a$$

$$4\sqrt{3} = \frac{\sqrt{3}}{2} a \Rightarrow a = 8 \text{ cm}$$

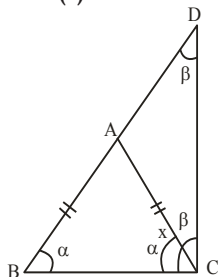
$$\text{perimeter} = 3 \times 8 = 24 \text{ cm}$$

6. Sol. (b)



$$\begin{aligned} PT^2 &= 900 - 55 \\ PT &= \sqrt{845} \\ &= 13\sqrt{5} \text{ cm} \end{aligned}$$

7. Sol. (c)



$$\angle BCD = x \text{ (let)} \quad x = \alpha + \beta, \quad 2(\alpha + \beta) = 180^\circ \quad \alpha + \beta = 90^\circ$$

8. Sol. (c)

Area of an equilateral triangle $= 36\sqrt{3}$

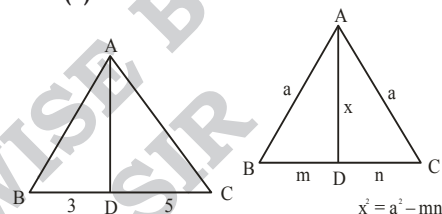
$$\frac{\sqrt{3}}{4} \times a^2 = 36\sqrt{3}$$

$$a^2 = \frac{36\sqrt{3} \times 4}{\sqrt{3}} = 144 \Rightarrow a = \sqrt{144} = 12 \text{ cm}$$

Radius of circle circumscribing the triangle

$$ABC = \frac{12}{\sqrt{3}} = \frac{12}{\sqrt{3}} = 4\sqrt{3} \text{ cm}$$

9. Sol. (a)

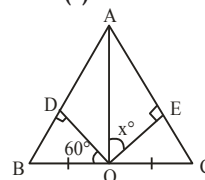


Stewart theorem:-

$$AD^2 = 8^2 - 3 \times 5 = 49$$

$$AD = 7. \quad AD:AC = 7:8$$

10. Sol. (c)



$\triangle ABC$ is isosceles triangle having side $AB =$ Side AC , and AO is median then, $\angle AOB = \angle AOC = 90^\circ$

$$\text{In } \triangle BDO, \angle DBO = 180^\circ - 90^\circ - 60^\circ = 30^\circ$$

$$\angle DBO = \angle ECO = 30^\circ \text{ (Isosceles triangle)}$$

$$\text{In } \triangle ECO, \angle EOC = 180^\circ - 90^\circ - 30^\circ = 60^\circ$$

$$\angle AOE = \angle AOC - \angle EOC. \dots \dots \dots (\angle AOC = 90^\circ)$$

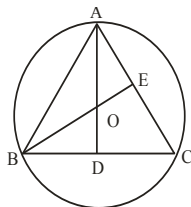
$$= 90^\circ - 60^\circ = 30^\circ$$

11. Sol. (d)

 $\triangle ABC$ is an equilateral triangle, such that

$$AB = BC = CA = x$$

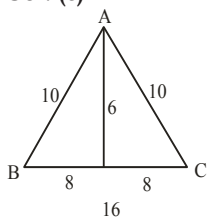
$$OA = \frac{2}{3}, \quad AD = \frac{2}{3} \times \frac{\sqrt{3}x}{x}$$



$$OA = \frac{1}{3}x$$

$$y = \frac{x}{\sqrt{3}} (\sqrt{3}y = x)$$

12. Sol. (c)



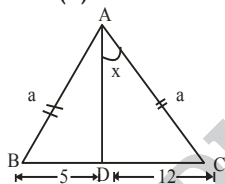
$$\Delta = \frac{1}{2} \times 16 \times 6$$

$$= 48 \text{ cm}^2$$

$$r = \frac{\Delta}{s} = \frac{48}{18} = \frac{8}{3} \text{ cm}$$

$$R = \frac{abc}{4\Delta} = \frac{1600}{4 \times 48} = \frac{25}{3} \text{ cm}$$

13. Sol. (d)



$$x^2 = a^2 - 5 \times 12$$

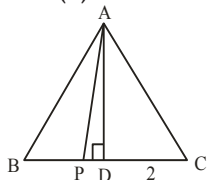
$$a^2 = 12^2 - x^2$$

$$x^2 + 60 = 144 - x^2$$

$$2x^2 = 84 \Rightarrow x^2 = 42$$

$$x = \sqrt{42}$$

14. Sol. (d)



$$PC = \frac{3\sqrt{7}}{2} \times 2 = 3\sqrt{7}$$

AD is the altitude and median of triangle

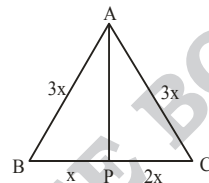
$$DC = \frac{3\sqrt{7}}{2}$$

$$PD = 2\sqrt{7} - \frac{3\sqrt{7}}{2} = \frac{\sqrt{7}}{2}$$

$$AD = \frac{\sqrt{3}a}{2} = \frac{\sqrt{3} \cdot 3 \cdot \sqrt{7}}{2} = \frac{3\sqrt{21}}{2}$$

$$AP = \sqrt{AD^2 + DP^2} = 7$$

Short Trick:



$$\text{Let } BC = 3x, BP = x, PC = 2x$$

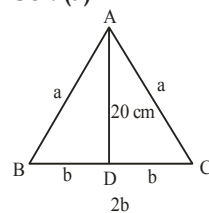
In an equilateral triangle.

$$\text{As we know, } AP^2 = BC^2 - BP \times PC$$

$$AP^2 = 63 - 14 = 7^2$$

$$AP = 7 \text{ cm}$$

15. Sol. (a)



$$2(a + b) = 100$$

$$a + b = 50 \quad \dots (i)$$

$$a^2 - b^2 = 400$$

$$(a + b)(a - b) = 400$$

$$a - b = 80 \quad \dots (ii)$$

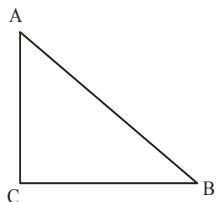
from eq. (i) & (ii)

$$a = 29, b = 21$$

$$\Delta = \frac{1}{2} \times 42 \times 20$$

$$= 420 \text{ cm}^2$$

16. Sol. (c)



We know that a right angled isosceles triangle has

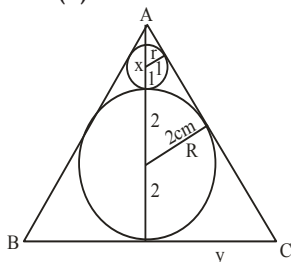
ratio of its side as $1:1:\sqrt{2}$

So perimeter $= a(2 + \sqrt{2}) = 15(\sqrt{2} + 1)$

$$\Rightarrow a\sqrt{2}(\sqrt{2} + 1) = 15(\sqrt{2} + 1) \Rightarrow a = \frac{15}{\sqrt{2}}$$

$$\text{So, Area} = \frac{1}{2} \times a \times a \Rightarrow \frac{1}{2} \times \frac{15}{\sqrt{2}} \times \frac{15}{\sqrt{2}} = \frac{225}{4} = 56.25$$

17. Sol. (d)



$r = 1$ cm given)

$R = 2$ cm

$$\frac{2}{1} = \frac{3+x}{x}$$

$x = 3$

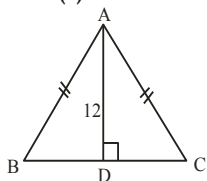
$$\frac{b}{1} = \frac{8}{\sqrt{8}}$$

$b = \sqrt{8}$

$$\Delta = \frac{1}{2} \times 2\sqrt{2} \times 8$$

$16\sqrt{2}$ cm

18. Sol. (c)



Let $AB = AC = x$

We know, In an isosceles triangle, perpendicular, median and angle bisector are the same line. And

AD is median also.

Let, $BD = DC = a$

$$a + a + x + x = 36$$

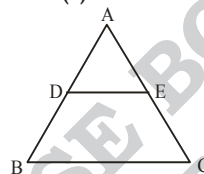
$$2(x + a) = 36 \Rightarrow x + a = 18$$

Triangle ADC is a right angled triangle, $AD =$

12 cm (given)

Go through hit and trial $x = 13$ and $a = 5$ (because it makes a triplet) $BD = DC = 5$ cm and $BC = 10$ cm

19. Sol. (c)



$$\triangle ADE \sim \triangle ABC$$

$$DE \parallel BC$$

$$\frac{AD}{AB} = \frac{AE}{AC} = \frac{DE}{BC} = \frac{1}{2}$$

$$AD = AE = DE = 1 \text{ unit}$$

$$AB = AC = BC = 2 \text{ unit}$$

$$CE = AC - AE = 1 \text{ unit}$$

$$AD + CE + BC = 30 \text{ cm}$$

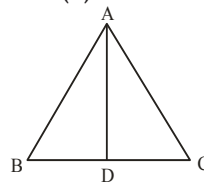
$$4 \text{ unit} = 300 \text{ m}$$

$$1 \text{ unit} = 7.5 \text{ cm}$$

$$\text{Perimeter of BCED} = DB + DE + EC + BC$$

$$= 5 \text{ unit} = 37.5 \text{ cm}$$

20. Sol. (b)



$$BC = 18 - (\text{given})$$

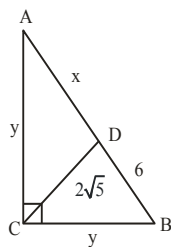
$$BD = \frac{1}{3} BC, \frac{BD}{BC} = \frac{1}{3}, BD = 6, DC = 12$$

$$\text{Direct formula : } -AD^2 = BC^2 - BD \times DC$$

$$\Rightarrow (18)^2 - 6 \times 12 = 324 - 72 = 252$$

$$AD = \sqrt{252} = 6\sqrt{7}$$

21. Sol. (a)



$$2y^2 = (x + 6)^2 \dots \text{(i)}$$

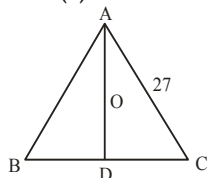
$$20 = y^2 - 6x$$

$$2y^2 = 40 + 12x \dots (\text{ii})$$

Put eq. (ii) in qⁿ (i)

$$\begin{aligned} 40 + 12x &= x^2 + 36 + 12x \\ x &= 2 \end{aligned}$$

22. Sol. (a)



Height of the triangle = $\frac{\sqrt{3}}{2}a$, where a is the side of the equilateral triangle

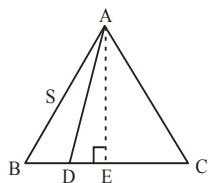
$$H = 27 \frac{\sqrt{3}}{2} \text{ Ratio of circumcentre : Height} =$$

$$AO:AD = 2:3$$

$$AO = 27 \frac{\sqrt{3}}{2} \times \frac{2}{3} = \frac{27}{\sqrt{3}} = 9\sqrt{3}$$

23. Sol. (a)

Let $\triangle ABC$ is an equilateral triangle of side S and

 $AE \perp BC.$ 

Then, $BD = \frac{S}{3}$ and $BE = \frac{S}{2}$

$$DE = BE - BD = \frac{S}{2} - \frac{S}{3} = \frac{S}{6}$$

From $\triangle ABE$,

$$\frac{AE}{AB} = \sin 60^\circ$$

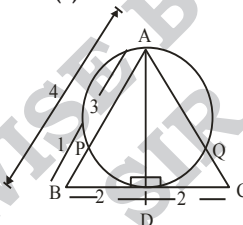
$$\Rightarrow AE = \frac{S\sqrt{3}}{2}$$

Now, $AD^2 = (AE)^2 + (DE)^2$

$$= \left(\frac{S\sqrt{3}}{2}\right)^2 + \left(\frac{S}{6}\right)^2 = \frac{7}{9}S^2.$$

Now, $\frac{AD^2}{AB^2} = \frac{\frac{7}{9}S^2}{S^2} = \frac{7}{9}$.

24. Sol. (c)



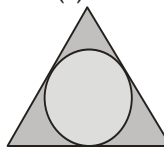
$$BD^2 = BP \times BA$$

$$4 = \text{BP} \times 4$$

$$\text{BP: BA} = 3:4$$

$$PQ:BC = 3:4$$

25. Sol. (a)



$$\frac{\pi a^2}{3} - \frac{\pi a^2}{12} = 2156$$

$$\pi \left(\frac{a^2}{3} - \frac{a^2}{12} \right) = 2156$$

$$\pi \cdot \frac{3a^2}{12} = 2156$$

$$a^2 = \frac{2156 \times 12 \times 7}{3 \times 22}$$

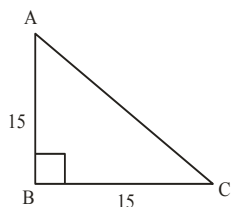
$$\frac{\sqrt{3}}{4}a^2 = \frac{\sqrt{3}}{4} \times \frac{2156 \times 12 \times 7}{3 \times 22}$$

$$\frac{\sqrt{3}}{4}a^2 = 686\sqrt{3}$$

$$\frac{\sqrt{3}}{4}a^2 = 686\sqrt{3}$$

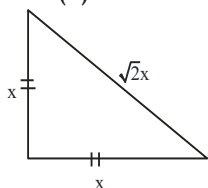
26. Sol. (a)

ABC is an isosceles right angle triangle.



$$\text{Area of } \triangle ABC = \frac{1}{2} \times 15 \times 15 = \frac{225}{2} \text{ cm}^2$$

27. Sol. (b)



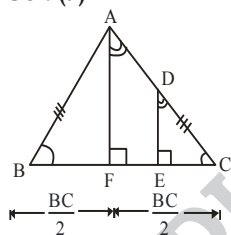
$$\text{perimeter} = 2x + \sqrt{2}x = 2p$$

$$x = \frac{\sqrt{2}p}{\sqrt{2} + 1}$$

$$\text{Area} = \frac{1}{2} \times \frac{\sqrt{2}p}{\sqrt{2} + 1} \times \frac{\sqrt{2}p}{\sqrt{2} + 1} = \frac{2p^2}{2(3 + 2\sqrt{2})}$$

$$= \frac{p^2}{3 + 2\sqrt{2}} \times \frac{(3 - 2\sqrt{2})}{(3 - 2\sqrt{2})} = p^2(3 - 2\sqrt{2}) \text{ cm}^2$$

28. Sol. (a)



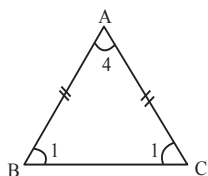
By Thales Theorem:-

$$\frac{AC}{DC} = \frac{BC/2}{CE} = \frac{BC}{2CE}$$

29. Sol. (b)

As $AB = AC$, so $\angle B = \angle C$ Let $\angle B = 1$ unit

Then $\angle A = 4$ units



Sum of all angles = 180°

$$(1 + 1 + 4) = 6 \text{ units} = 180^\circ \quad 1 \text{ unit} = 30^\circ$$

$$\angle A = 4 \times 30^\circ = 120^\circ$$

$$\frac{1}{2} \angle A = 120^\circ / 2 = 60^\circ$$

30. Sol. (a)

Let $\triangle ABC$ is an equilateral triangle with side l .

$$\text{Then, Area (A)} = \frac{\sqrt{3}}{4} (l)^2$$

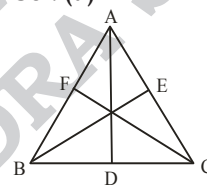
$$\text{When, } l' = \frac{l}{2}$$

$$\text{Then area (A')} = \frac{\sqrt{3}}{4} (l')^2 = \frac{\sqrt{3}}{4} \left(\frac{l}{2}\right)^2$$

$$\text{Percent decrease in area} = \left(\frac{A - A'}{A}\right) \times 100$$

$$= \left\{ \frac{\frac{\sqrt{3}}{4} l^2 - \frac{\sqrt{3}}{4} \left(\frac{l}{2}\right)^2}{\frac{\sqrt{3}}{4} l^2} \right\} \times 100 = \left(1 - \frac{1}{4}\right) \times 100 = 75\%$$

31. Sol. (d)



Since, ABC is an equilateral triangle Altitude =

Angle bisector = Median We know that the

following relation satisfies in case of an equilateral triangle.

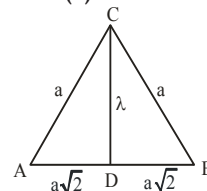
$$3[AB^2 + BC^2 + AC^2] = 4[AD^2 + BE^2 + CF^2] \dots \text{eq. (1)}$$

$$\Rightarrow AB = BC = AC (\triangle ABC \text{ is an equilateral triangle})$$

Putting the values in eq.(1)

$$3[3AC^2] = 4[3BE^2] \Rightarrow 3AC^2 = 4BE^2$$

32. Sol. (a)

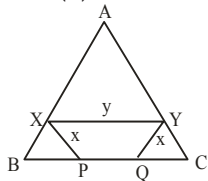


$$\text{Area of eq. triangles} = \frac{\sqrt{3}}{4} a^2$$

$$l = \sqrt{a^2 - (a/2)^2} = \frac{\sqrt{3}}{2} a$$

$$\begin{aligned}\therefore a &= \frac{2}{\sqrt{3}}\ell \\ &= \frac{\sqrt{3}}{4}a^2 = \frac{\sqrt{3}}{4}\left(\frac{2}{\sqrt{3}}\ell\right)^2 \\ &= \frac{\sqrt{3}}{4} \times \frac{4}{3}\ell^2 = \frac{\sqrt{3}\ell^2}{3}\end{aligned}$$

33. Sol. (d)



Let $XP = x$ and $XY = y$

$$\Rightarrow 2x + y = 40 \quad \dots (i)$$

$\therefore XP \parallel AC$.

In $\triangle XBP$

$$\Rightarrow \angle X = \angle P = \angle B = 60^\circ$$

$$\left(\begin{array}{l} \because \angle BXP = \angle BAC \\ \text{and } \angle BPX = \angle BCA \end{array} \right)$$

$\Rightarrow \triangle XBP$ is an equilateral triangle $\Rightarrow BX = XP = X$

Similarly, $\triangle XAY$ is an equilateral triangle.

$$\Rightarrow AX = XY = y$$

$$\text{Given } AB = AX + XB = 30$$

$$x + y = 30$$

Solving (i) & (ii), we get $x = 10$

$$\text{Given } BC = BP + PQ + QC = 30$$

$$\Rightarrow PQ = 10 \text{ cm}$$

* * * * *

Type-11 (Shape)

1. What is the ratio of interior angle to exterior angle of a regular polygon of n sides?
 n भुजाओं वाले एक नियमित बहुभुज के आंतरिक कोण और बाह्य कोण का अनुपात क्या है?

[CDS-2023-I]

- (a) n (b) $\frac{n-1}{2}$ (c) $\frac{n-2}{2}$ (d) $\frac{2(n-2)}{3}$
2. The sum of the interior angles of a regular polygon A is 1260 degrees and each interior angle of a regular polygon B is $128\frac{4}{7}$ degrees. The sum of the number of sides of polygon A and B is:
 एक नियमित बहुभुज A के आंतरिक कोणों का योग 1260 डिग्री है और एक नियमित बहुभुज B का प्रत्येक आंतरिक कोण $128\frac{4}{7}$ डिग्री है। बहुभुज A और B की भुजाओं की संख्या का योग है:

SSC CGL Tier II, 2023

- (a) 18 (b) 19 (c) 16 (d) 17
3. A_1 and A_2 are two regular polygons. The sum of all the interior angles of A_1 is 1080° . Each interior angle of A_2 exceeds its exterior angle by 132° . The sum of the number of sides A_1 and A_2 is:
 A_1 और A_2 दो नियमित बहुभुज हैं। A_1 के सभी आंतरिक कोणों का योग 1080° है। A_2 का प्रत्येक आंतरिक कोण इसके बाहरी कोण से 132° अधिक है। A_1 और A_2 भुजाओं की संख्या का योग है:

SSC CGL Tier II 03/02/2022

- (a) 21 (b) 22 (c) 23 (d) 24
4. If the sum of all interior angles of a regular polygon is 14 right angles, then its number of sides is
 यदि एक नियमित बहुभुज के सभी आंतरिक कोणों का योग 14 समकोण है, तो इसकी भुजाओं की संख्या है
- (a) 6 (b) 8 (c) 9 (d) 7
5. The difference between an exterior angle of $(n-1)$ sided regular polygon and an exterior angle of $(n+2)$ sided regular polygon is 6° , then the value of n is :
 $(n-1)$ भुजा वाले नियमित बहुभुज के बाहरी कोण और $(n+2)$ भुजा वाले नियमित बहुभुज के बाहरी कोण के बीच का अंतर 6° है, तो n का मान है:
- (a) 15 (b) 14 (c) 12 (d) 13
6. If a regular polygon has 16 sides, then what is the measure (in degrees) of its each interior angle?

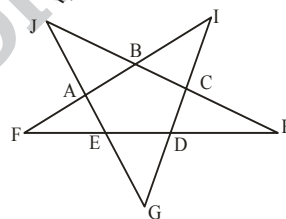
यदि एक नियमित बहुभुज में 16 भुजाएँ हैं, तो इसके प्रत्येक आंतरिक कोण का माप (डिग्री में) क्या है?

SSC CGL Tier II (16/11/2020)

- (a) 155 (b) $157\frac{1}{2}$ (c) $159\frac{1}{2}$ (d) 154
7. If a regular polygon has each of its angles equal to $\frac{3}{5}$ times of two right angles, then the number of sides is
 यदि एक नियमित बहुभुज का प्रत्येक कोण दो समकोणों के $\frac{3}{5}$ गुना के बराबर है, तो भुजाओं की संख्या है
- (a) 3 (b) 5 (c) 6 (d) 8

8. ABCDE is a regular pentagon. Its sides are extended as shown in the figure. The value of $\frac{\angle ABC + 2\angle EGD + 3\angle BAJ}{6}$ is:

ABCDE एक नियमित पंचभुज है। जैसा कि चित्र में दिखाया गया है, इसकी भुजाएँ फैली हुई हैं। $\frac{\angle ABC + 2\angle EGD + 3\angle BAJ}{6}$ का मान है:



SSC CHSL 14/10/2020 (Afternoon)

- (a) 45° (b) 30° (c) 75° (d) 66°
9. If the sum of all interior angles of a regular polygon is twice the sum of all its exterior angles, then the polygon is
 यदि एक नियमित बहुभुज के सभी आंतरिक कोणों का योग उसके सभी बाह्य कोणों के योग का दोगुना है, तो बहुभुज है
- [2020-II]
- (a) Hexagon (b) Octagon
 (c) Nonagon (d) Decagon
10. If angles of a pentagon are in A.P., then the largest possible angle of the pentagon will be if all angle measure are integers.
 यदि किसी पंचभुज के कोण A.P. में हैं, तो पंचभुज का सबसे बड़ा संभावित कोण होगा यदि सभी कोण माप पूर्णांक हों।
- (a) 201° (b) 213° (c) 215° (d) 223°
11. The sides BA and DE of a regular pentagon are produced to meet at F. What is the measure of $\angle EFA$?

एक नियमित पंचभुज की भुजाएँ BA और DE को F पर मिलने के लिए बढ़ाया जाता है। $\angle EFA$ का माप क्या है?

SSC CGL Tier II (15/11/2020)

- (a) 72° (b) 36° (c) 60° (d) 54°

12. What is the magnitude (in radian) of the interior angle of a regular pentagon?

एक नियमित पंचभुज के आंतरिक कोण का परिमाण (रेडियन में) क्या है?

[CDS - 2020-II]

- (a) $\frac{\pi}{5}$ (b) $\frac{2\pi}{5}$ (c) $\frac{3\pi}{5}$ (d) $\frac{4\pi}{5}$

13. If each interior angle of a regular polygon is $(128\frac{4}{7})^\circ$ then what is the sum of the number of its diagonal and the number of its sides?

यदि एक नियमित बहुभुज का प्रत्येक आंतरिक कोण $(128\frac{4}{7})^\circ$ है तो इसके विकर्णों की संख्या और भुजाओं की संख्या का योग क्या है?

SSC CGL TIER II (11/09/2019)

- (a) 15 (b) 19 (c) 17 (d) 21

14. If the measure of each exterior angle of a regular polygon is $(51\frac{3}{7})^\circ$, then the ratio of the number of its diagonals to the number of its sides is

यदि एक नियमित बहुभुज के प्रत्येक बाह्य कोण का माप $(51\frac{3}{7})^\circ$ है तो इसके विकर्णों की संख्या और इसकी भुजाओं की संख्या का अनुपात है

SSC CGL TIER II (13/09/2019)

- (a) 5:2 (b) 13:6 (c) 3:1 (d) 2:1

15. The sum of the interior angles of a regular polygon is 1260° . What is the difference between an exterior angle and an interior angle of the polygon?

एक नियमित बहुभुज के आंतरिक कोणों का योग 1260° होता है। बहुभुज के बाह्य कोण और आंतरिक कोण के बीच क्या अंतर है?

SSC CGL TIER II (12/09/2019)

- (a) 105° (b) 100° (c) 120° (d) 110°

16. If the ratio of an external angle and an internal angle of a regular polygon is 1:17, then the number of sides of the regular polygon is

यदि किसी नियमित बहुभुज के बाहरी कोण और आंतरिक कोण का अनुपात 1:17 है, तो नियमित बहुभुज की भुजाओं की संख्या है

- (a) 20 (b) 18 (c) 36 (d) 12

17. The corners of a square of side 'a' are cut away so as to form a regular octagon. What is the side of the octagon?

'a' भुजा वाले एक वर्ग के कोनों को इस प्रकार काटा जाता है कि एक नियमित अष्टभुज बन जाए। अष्टभुज की भुजा क्या है?

[CDS - 2019-I]

- (a) $a(\sqrt{2} - 1)$ (b) $a(\sqrt{3} - 1)$

- (c) $\frac{a}{\sqrt{2}+2}$ (d) $\frac{a}{3}$

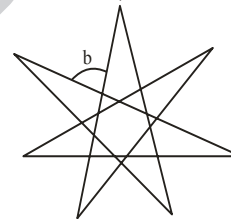
18. If the ratio of interior and exterior angles of n-sided regular polygon is 11:2, then find n.

यदि n-भुजा वाले नियमित बहुभुज के आंतरिक और बाहरी कोणों का अनुपात 11:2 है, तो n ज्ञात करें।

- (a) 15 (b) 13 (c) 11 (d) 17

19. In the given seven-pointed regular star figure. Find the measure of 'b'.

दिए गए सात-बिंदु वाले नियमित तारा चित्र में 'b' का माप ज्ञात कीजिए।



- (a) 36° (b) 72° (c) $74\frac{1}{7}^\circ$ (d) $77\frac{1}{7}^\circ$

20. A closed polygon has six sides and one of its angles is 30° greater than each of the other five equal angles. What is the value of one of the equal angles?

एक बंद बहुभुज की छह भुजाएँ हैं और इसका एक कोण अन्य पाँच समान कोणों में से प्रत्येक से 30° बड़ा है। समान कोणों में से एक का मान क्या है?

[CDS-2017-II]

- (a) 55° (b) 115° (c) 150° (d) 175°

Type 11 (Shape) Answer Key

1	(c)	2	(c)	3	(c)	4	(c)	5	(d)	6	(d)	7	(b)
8	(b)	9	(d)	10	(a)	11	(c)	12	(b)	13	(c)	14	(d)
15	(d)	16	(b)	17	(c)	18	(a)	19	(b)	20	(d)	21	(b)

Type- 11 (Shape) Solution

1. Sol. (c)

$$\text{Interior angle} = \frac{(\pi-2) \times 180}{\pi}$$

$$\text{Exterior angle} = \frac{360}{\pi}$$

$$\text{Ratio} = \frac{\frac{(\pi-2) \times 180}{\pi}}{\frac{360}{\pi}}$$

$$= \frac{\pi-2}{2}$$

2. Sol. (c)

Let number of sides of polygon A = n

$$\text{So, } (n-2) \times 180 = 1260 \Rightarrow n = 9$$

In polygon B,

$$\text{Each interior angle} + \text{Each exterior angle} = 180^\circ$$

$$\left(128\frac{4}{7}\right)^\circ + \text{Each exterior angle} = 180^\circ$$

$$\text{Each exterior angle} = \left(\frac{360}{7}\right)^\circ$$

So, number of sides of polygon B

$$= \frac{360}{\text{Each exterior angle}} = \frac{360}{\frac{360}{7}} = 7$$

$$\text{Total sides} = 9 + 7 = 16$$

3. Sol. (c)

Let number of sides of polygon A₁ = n

$$\text{So, } (n-2) \times 180 = 1080$$

$$\Rightarrow n = 8 \text{ In polygon A}_2,$$

$$\text{Each interior angle} + \text{Each exterior angle} = 180^\circ;$$

$$(\text{Each exterior angle} + 132^\circ) + \text{Each exterior angle}$$

$$= 180^\circ; 2 (\text{Each exterior angle}) = 48^\circ; \text{Each exterior}$$

$$\text{angle} = 24^\circ \text{ So, number of sides of polygon A}_2$$

$$= \frac{360}{\text{Each exterior angle}} = \frac{360}{24} = 15$$

$$\text{So, total sides} = 8 + 15 = 23$$

4. Sol. (c)

$$\text{Sum of Interior angles} = (n-2) \times 180$$

$$\text{Hence, } (n-2) \times 180$$

$$= 14 \times \text{Right angle triangle } (90^\circ)$$

$$n-2 = \frac{14 \times 90}{180}$$

$$n = 7 + 2 = 9$$

5. Sol. (d)

$$\frac{360^\circ}{n-1} - \frac{360^\circ}{n+2} = 6$$

$$\Rightarrow 60 \left(\frac{1}{n-1} - \frac{1}{n+2} \right) = 1$$

$$\Rightarrow 60(n+2 - n+1) = (n-1)(n+2)$$

$$\Rightarrow 60 \times 3 = n^2 + n - 2$$

$$\Rightarrow n^2 + n - 182 = 0$$

$$\Rightarrow (n+14)(n-13) = 0$$

$$\Rightarrow n = -14 \text{ or } n = 13$$

$$\Rightarrow n = 13$$

(∵ n can not be negative)

6. Sol. (b)

$$\text{Sum of all exterior angle} = \frac{360}{16} = 22.5 \text{ Interior angle}$$

$$= 180^\circ - 22.5^\circ = 157.5^\circ$$

7. Sol. (b)

Each interior angle of a regular polygon

$$= 180 \times \frac{3}{5} = 108^\circ$$

$$\therefore \text{Each exterior angle}$$

$$= 180^\circ - 108^\circ = 72^\circ$$

$$\therefore \text{No. of sides} = \frac{360}{72} = 5$$

8. Sol. (d)

ABCDE is a pentagon, and each pentagon has 108° angle

$$\angle DEG = 180^\circ - 108^\circ = 72^\circ$$

$$\angle EDG = 180^\circ - 108^\circ = 72^\circ$$

$$\angle DGE = 180^\circ - 72^\circ - 72^\circ = 36^\circ$$

$$\angle BAJ = 180^\circ - 108^\circ = 72^\circ$$

$$\angle ABC = 108^\circ$$

$$\angle ABC + 2\angle EGD + 3\angle BAJ$$

$$= \frac{108^\circ + 72^\circ + 216^\circ}{6} = 66^\circ$$

9. Sol. (a)

Sum of interior angles of polygon of n sides

$$= (n - 2) \times 180^\circ$$

Sum of exterior angles of any polygon = 360°

ATQ,

$$(n - 2) \times 180^\circ = 2 \times (360^\circ)$$

$$\therefore (n - 2) = 4 \Rightarrow n = 6.$$

Hence, polygon is hexagon.

10. Sol. (c)

Sum of interior angles of a pentagon = $(n - 2) \times$

$$180^\circ = (5 - 2) \times 180^\circ = 540^\circ$$

Let angles of the pentagon be $a - 2d, a - d, a, a + d, a + 2d$

According to question

$$(a - 2d) + (a - d) + a + (a + d) + a + 2d = 540^\circ$$

$$\Rightarrow 5a = 540 \Rightarrow a = 108^\circ$$

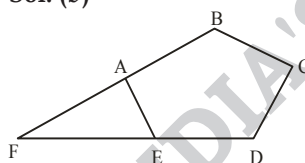
Now smallest possible interior angle can be 1°

$$\Rightarrow 108 - 2d = 1^\circ \Rightarrow 2d = 107^\circ$$

largest angle of the given pentagon = $a + 2d =$

$$108^\circ + 107^\circ = 215^\circ$$

11. Sol. (b)



Total interior angle of pentagon

$$= (2n - 4) \times 90^\circ = 540^\circ$$

Interior angle = 108°

$$\text{Exterior angle} = \frac{360}{5} = 72^\circ$$

$$\Rightarrow \angle AFE = 72^\circ \Rightarrow \angle EAF = 180^\circ - 108^\circ = 72^\circ$$

$$\text{In } \triangle AEF \angle EFA = 180^\circ - (72^\circ + 72^\circ)$$

$$\Rightarrow \angle EFA = 36^\circ$$

12. Sol. (c)

Interior angle of polygon of n sides

$$= \frac{(n-2) \times \pi}{n}$$

Here, $n = 5$.

$$\therefore \text{Interior angle} = \frac{(5-2)\pi}{5} = \frac{3\pi}{5}$$

13. Sol. (d)

interior angle of a regular polygon

$$= \frac{(n-2) \times 180}{n}$$

Where n is the number of sides

$$\Rightarrow \left(128 \frac{4}{7}\right) = \frac{(n-2) \times 180}{n}$$

$$\Rightarrow \frac{900}{7} = \frac{(n-2) \times 180}{n}$$

$$\Rightarrow 5n = 7n - 14 \Rightarrow n = 7$$

$$\text{Number of diagonals} = \frac{n(n-3)}{2}$$

$$= \frac{7(7-3)}{2} = 14$$

$$\text{Desired sum} = 7 + 14 = 21$$

14. Sol. (d)

$$\text{Exterior angle} = \frac{360^\circ}{n}$$

Where n is the number of sides

$$\Rightarrow \left(51 \frac{3}{7}\right)^\circ = \frac{360}{n} \Rightarrow n = \frac{360 \times 7}{360}$$

$$\text{Number of diagonals} = \frac{n(n-3)}{2}$$

$$= \frac{7(7-3)}{2} = 14$$

$$\text{Desired ratio} = 14:7 = 2:1$$

15. Sol. (b)

sum of the interior angles of a

regular polygon = $(n - 2) \times 180$

$$1260 = (n - 2) \times 180 \Rightarrow n = 9$$

$$\Rightarrow \text{Interior angle} = \frac{1260}{9} = 140^\circ$$

$$\Rightarrow \text{Exterior angle} = \frac{360}{9} = 40^\circ$$

$$\text{Required difference} = 140^\circ - 40^\circ = 100^\circ$$

16. Sol. (c)

According to question

$$\frac{\text{External angle}}{\text{Internal angle}} = \frac{1}{17}$$

As we know that

$$\text{External angle} + \text{Internal angle} = 180^\circ$$

$$\therefore 18 \text{ units} = 180^\circ$$

$$1 \text{ unit} = \frac{180^\circ}{18} = 10^\circ$$

$$\therefore \text{ External angle} = 10^\circ \times 1 = 10^\circ$$

$\therefore$ no. of sides

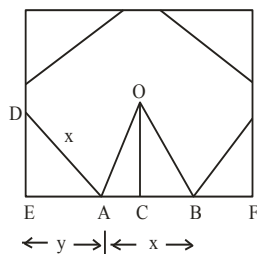
$$= \frac{360^\circ}{\text{External angle}}$$

$$\text{no. of sides} = \frac{360^\circ}{10^\circ} = 36$$

17. Sol. (a)

Let side of octagon = x cm.

For regular octagon, each internal angle



$$= \frac{2(8-2) \times 90^\circ}{8} = \frac{6 \times 90^\circ}{4} = 135^\circ$$

$$\therefore \angle BAD = 135^\circ$$

then, $\angle DAE = 45^\circ$

In $\triangle AED$, $AE = DE$

$$\therefore x^2 = (AE)^2 + (DE)^2 \Rightarrow AE = \frac{x}{\sqrt{2}}$$

$$\Rightarrow y = \frac{x}{\sqrt{2}}$$

By symmetry $AE = BF = y$

Now, $EA + AB + BF = a$

(Side of square)

$$y + x + y = a$$

$$2y + x = a$$

$$2\left(\frac{x}{\sqrt{2}}\right) + x = a$$

$$(\sqrt{2} + 1)x = a$$

$$x = \frac{a}{(\sqrt{2}+1)} = a(\sqrt{2}-1)$$

18. Sol. (b)

Let the interior and exterior angles be $11x$ and $2x$ respectively Then,

$$\Rightarrow 11x + 2x = 180^\circ$$

$$\Rightarrow x = \frac{180^\circ}{13}$$

$$\text{Exterior angle} = 2x = 2 \left[\frac{180^\circ}{13} \right] = \frac{360^\circ}{13}$$

$$\text{Number of sides} = \frac{360^\circ}{\text{Exterior angle}} = \frac{360^\circ}{\frac{360^\circ}{13}} = 13$$

19. Sol. (d)

$$b = \frac{(n-4)}{n} \times 180^\circ$$

$$\Rightarrow b = \frac{3}{7} \times 180^\circ \Rightarrow b = 77\frac{1}{7}^\circ$$

20. Sol. (b)

For finding the sum of the interior angles of a polygon is the same, whether the polygon is regular or irregular. So, we would use the formula $(n - 2) \times 180^\circ$, where n is the number of sides in the polygon.

Let one angle be of the polygon be x and other 5 equal angles be y .

So, according to the question,

$$x = y + 30$$

$$x + 5y = (n - 2) \times 180^\circ$$

$$y + 30 + 5y = (6 - 2) \times 180$$

$$6y + 30 = 720$$

$$6y = 690$$

$$y = 115^\circ$$

Type-12 (Circle)

1. Let O be the center of a circle and P be a point outside the circle. If PAB is a secant of the circle which cuts the circle at A and B and PT is the tangent drawn from P , then find the length of PT if $PA = 3$ cm and $AB = 9$ cm.

मान लीजिए O एक वृत्त का केंद्र है और P वृत्त के बाहर एक बिंदु है। यदि PAB वृत्त का एक छेदक है जो वृत्त को A और B पर काटता है और PT , P से खींची गई स्पर्शरेखा है, तो PT की लंबाई ज्ञात करें यदि $PA=3$ सेमी और $AB=9$ सेमी है।

[SSC CGL 2023 (3rd Shift)]

- (a) $3\sqrt{3}$ cm (b) $4\sqrt{3}$ cm
(c) 6 cm (d) 8 cm

2. If two tangents to a circle of radius 3 cm are inclined to each other at angle of 60° , then the length of each tangent is:

यदि 3 सेमी त्रिज्या वाले एक वृत्त की दो स्पर्शरेखाएँ एक दूसरे पर 60° के कोण पर झुकी हुई हैं, तो प्रत्येक स्पर्शरेखा की लंबाई है:

[SSC CPO 09/11/2022 (Afternoon)]

- (a) $\frac{3\sqrt{3}}{4}$ cm (b) $3\sqrt{3}$ cm
(c) 3 cm (d) 6 cm

3. Radius of a circle is 10 cm. Angle made by chord AB at the centre of this circle is 60 degrees. What is the length of this chord?

एक वृत्त की त्रिज्या 10 सेमी है। इस वृत्त के केंद्र पर जीवा AB द्वारा बनाया गया कोण 60° डिग्री है। इस राग की लंबाई क्या है?

[SSC CGL 01/12/2022 (1st Shift)]

- (a) 40 cm (b) 20 cm
(c) 30 cm (d) 10 cm

4. RA and RB are two tangents from a common point ' R ' outside the circle with centre ' O ', having a radius of 6 cm. If $\angle ARB = 70^\circ$, find the measure of the angle AOB .

RA और RB केंद्र ' O ' वाले वृत्त के बाहर एक उभयनिष्ठ बिंदु ' R ' से दो स्पर्श रेखाएँ हैं, जिनकी त्रिज्या 6 सेमी है। यदि $\angle ARB=70^\circ$, तो कोण AOB का माप ज्ञात कीजिए।

[SSC CHSL 25/05/2022 (Afternoon)]

- (a) 130° (b) 110°
(c) 120° (d) 80°

5. $ABCD$ is a cyclic quadrilateral and BC is a diameter of the circle. If $\angle DBC = 29^\circ$, then $\angle BAD = ?$

$ABCD$ एक चक्रीय चतुर्भुज है और BC वृत्त का व्यास है। यदि $\angle DBC=29^\circ$, तो $\angle BAD = ?$

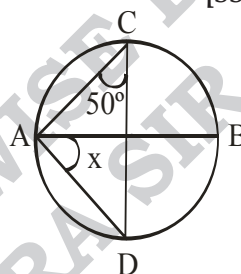
[SSC CGL Tier II 29/01/2022]

- (a) 119° (b) 122°
(c) 129° (d) 111°

6. In the given circle with diameter AB , find the value of x .

दिए गए वृत्त में जिसका व्यास AB है, x का मान ज्ञात कीजिए।

[SSC CPO 10/11/2022 (1st Shift)]

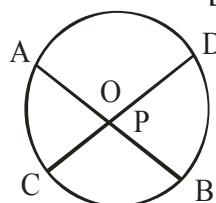


- (a) 40° (b) 20° (c) 30° (d) 50°

7. In the figure, O is the centre of the circle. Its two chords AB and CD intersect each other at the point P within the circle. If $AB = 20$ cm, $PB = 12$ cm and $CP = 8$ cm, then find the measure of PD .

चित्र में, O वृत्त का केंद्र है। इसकी दो जीवाएँ AB और CD वृत्त के भीतर बिंदु P पर एक दूसरे को प्रतिच्छेद करती हैं। यदि $AB=20$ cm, $PB=12$ cm और $CP=8$ सेमी है, तो PD का माप ज्ञात कीजिए।

[SSC CGL 06/12/2022 (3rd Shift)]



- (a) 12 cm (b) 11 cm
(c) 22 cm (d) 14 cm

8. Two circles touch each other externally at T , RS is a direct common tangent to the two circles touching the circles at P and Q . $\angle TPQ = 42^\circ$, $\angle PQT$ (in degrees) is:

दो वृत्त T पर एक दूसरे को बाह्य रूप से स्पर्श करते हैं, RS , P और Q पर वृत्तों को स्पर्श करने वाले दो वृत्तों की सीधी उभयनिष्ठ स्पर्शरेखा है। $\angle TPQ=42^\circ$, $\angle PQT$ (डिग्री में) है:

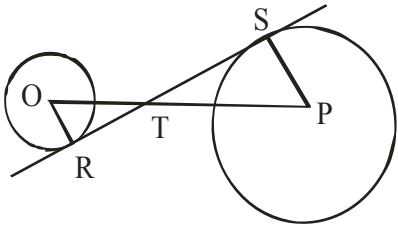
[SSC CGL 11/04/2022 (Evening)]

- (a) 48 (b) 45 (c) 42 (d) 60

9. In the given figure, the circle with centre O has radius 10 cm. The radius of the circle with centre P is x . STR is a common tangent to the two circles at points R and S as shown in the figure. $RT = 16$ cm and $TS = 24$ cm. What is the value of x (in cm)?

दी गई आकृति में, O केंद्र वाले वृत्त की त्रिज्या 10 सेमी है। केंद्र P वाले वृत्त की त्रिज्या x है। STR , चित्र में दिखाए अनुसार दो वृत्तों के बिंदु R और S पर एक उभयनिष्ठ स्पर्श रेखा है। $RT = 16$ सेमी और $TS = 24$ सेमी है। x का मान (सेमी में) क्या है?

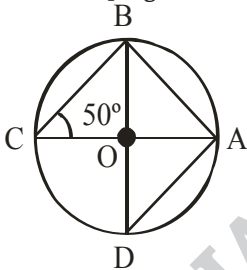
[SSC CPO 09/11/2022 (3rd Shift)]



- (a) 15 (b) 16 (c) 12 (d) 18

10. In the given figure 'O' is the centre of the circle and $\angle BCA = 50^\circ$. The value of $\angle BDA$ is:
दिए गए चित्र में 'O' वृत्त का केंद्र है और $\angle BCA = 50^\circ$ है। $\angle BDA$ का मान है:

[Higher Secondary 01/08/2022 (3rd Shift)]



- (a) 60° (b) 90° (c) 40° (d) 50°

11. If a chord of length 16 cm is at a distance of 15 cm from the centre of the circle, then the length of the chord of the same circle which is at distance of 8 cm from the centre is equal to:

यदि 16 सेमी लंबाई की एक जीवा वृत्त के केंद्र से 15 सेमी की दूरी पर है, तो उसी वृत्त की जीवा की लंबाई जो केंद्र से 8 सेमी की दूरी पर है, बराबर है:

- (a) 10 cm (b) 20 cm
(c) 30 cm (d) 40 cm

12. AB is the chord of a circle such that $AB = 10$ cm. If the diameter of the circle is 20 cm, then the angle subtended by the chord at the centre is _____:

AB एक वृत्त की जीवा इस प्रकार है कि $AB = 10$ सेमी. यदि वृत्त का व्यास 20 सेमी है, तो जीवा द्वारा केंद्र पर बनाया गया कोण _____ है:

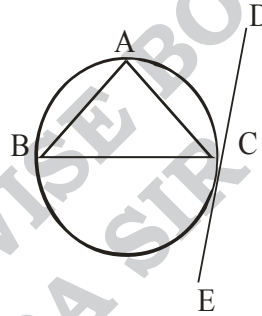
[SSC CGL Tier II 08/08/2022]

- (a) 45 degree (b) 60 degree
(c) 30 degree (d) 90 degree

13. In the following figure, $\triangle ABC$ is an inscribed triangle as shown and DE is a tangent to the circle at C . Which of the angles from the given options is necessarily equal to $\angle ACD$?

निम्नलिखित चित्र में, $\triangle ABC$ एक अन्तः त्रिभुज है जैसा कि दिखाया गया है और DE वृत्त की C पर स्पर्श रेखा है। दिए गए विकल्पों में से कौन सा कोण आवश्यक रूप से $\angle ACD$ के बराबर है?

[SSC CHSL 25/05/2022 (Morning)]



- (a) $\angle BAC$ (b) $\angle BCE$
(c) $\angle ABC$ (d) $\angle BCA$

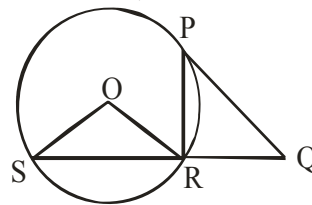
14. The radius of two concentric circles are 17 cm and 25 cm. a straight line PQRS intersects the larger circle at the points P and S and intersects the smaller circle at the points Q and R . If $QR = 16$ cm, then the length (in cm.) of PS is

दो संकेंद्रित वृत्तों की त्रिज्या 17 सेमी और 25 सेमी है। एक सीधी रेखा PQRS बड़े वृत्त को बिंदु P और S पर और छोटे वृत्त को बिंदु Q और R पर प्रतिच्छेद करती है। यदि $QR = 16$ सेमी, तो PS की लंबाई (सेमी में) है

- (a) 41 (b) 33 (c) 32 (d) 40

15. In the given figure, O is the centre of the circle and PQ is tangent to the circle. Find $\angle SOR$ if $\angle RPQ = 37^\circ$ and $\angle PQR = 39^\circ$.

दी गई आकृति में, O वृत्त का केंद्र है और PQ वृत्त की स्पर्श रेखा है। $\angle SOR$ ज्ञात करें यदि $\angle RPQ = 37^\circ$ और $\angle PQR = 39^\circ$ है।



- (a) 132° (b) 137° (c) 134° (d) 138°

16. In a circle of radius 5 m, AB and CD are two equal and parallel chords of length 8 m each. What is the distance between the chords?

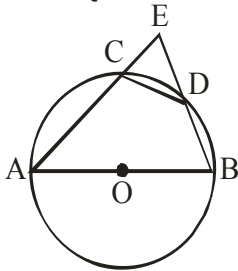
त्रिज्या 5 m के एक वृत्त में, AB और CD दो बराबर और समानांतर जीवाएँ हैं जिनकी लंबाई 8 m है। जीवाओं के बीच की दूरी क्या है?

[SSC CPO 11/11/2022 (Evening)]

- (a) 5 m (b) 6 m
(c) 3 m (d) 8 m

17. In the given figure, CD is a chord equal to the radius of the circle and AB is diameter of the circle, then find $\angle AEB$.

दी गई आकृति में, CD वृत्त की त्रिज्या के बराबर एक जीवा है और AB वृत्त का व्यास है, तो $\angle AEB$ ज्ञात कीजिए।



- (a) 30° (b) 60° (c) 45° (d) 15°

18. A chord of length 42 cm is drawn in a circle having diameter 58 cm. What is the minimum distance of another parallel chord of length 40 cm in the same circle from a 42 cm long chord?

58 सेमी व्यास वाले एक वृत्त में 42 सेमी लंबाई की एक जीवा खींची गई है। 42 सेमी लंबी जीवा से उसी वृत्त में 40 सेमी लंबाई की एक अन्य समानांतर जीवा की न्यूनतम दूरी क्या है?

[SSC CGL 01/12/2022 (4th Shift)]

- (a) 4 cm (b) 1 cm (c) 3 cm (d) 2 cm

19. PQ and RS are two parallel chords of a circle such that PQ is 48 cm and RS is 40 cm. If the chords are on the opposite sides of the centre and the distance between them is 22 cm, what is the radius (in cm) of the circle?

PQ और RS एक वृत्त की दो समान्तर जीवाएँ हैं जैसे कि PQ 48 सेमी है और RS 40 सेमी है। यदि जीवाएँ केंद्र के विपरीत दिशा में हैं और उनके बीच की दूरी 22 सेमी है, तो वृत्त की त्रिज्या (सेमी में) क्या है?

[SSC CPO 09/11/2022 (Afternoon)]

- (a) 25 (b) 24 (c) 35 (d) 22

20. The pair of tangents AP and AQ drawn from external point A to a circle with centre O are perpendicular to each other and the lengths of tangents are 5 cm, then the radius of the circle is बाह्य बिंदु A से केंद्र O वाले वृत्त पर खींची गई स्पर्श रेखाओं AP और AQ का युग्म एक दूसरे पर लंबवत है और स्पर्श रेखाओं की लंबाई 5 सेमी है, तो वृत्त की त्रिज्या है

- (a) 5 cm (b) $5\sqrt{2}$ cm

- (c) 3 cm (d) 4 cm

21. A tangent is drawn from an external point 'A' to a circle of radius 12 cm. If the length of the tangent is 5 cm, then the distance from the centre of the circle to point 'A' is:

12 सेमी त्रिज्या वाले एक वृत्त पर बाह्य बिंदु 'A' से एक स्पर्श रेखा खींची गई है। यदि स्पर्श रेखा की लंबाई 5 सेमी है, तो वृत्त के केंद्र से बिंदु 'A' की दूरी है:

[SSC CPO 10/11/2022 (Afternoon)]

- (a) 17 cm (b) 9 cm (c) 7 cm (d) 13 cm

22. Consider the following statements:

निम्नलिखित कथनों पर विचार करें:

1. If two chords AB and AC of a circle are equal, then the centre of the circle lies on the angle bisector of angle CAB .

यदि किसी वृत्त की दो जीवाएँ AB और AC बराबर हैं, तो वृत्त का केंद्र कोण CAB के कोण समद्विभाजक पर स्थित होता है।

2. If two concentric circles are intersected by a line at A, B, C and D respectively, then $AC = BD$.

यदि दो संकेन्द्रित वृत्तों को एक रेखा क्रमशः A, B, C और D पर प्रतिच्छेद करती है, तो $AC = BD$ ।

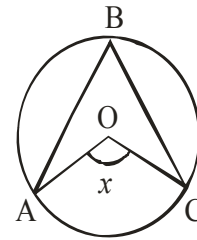
Which of the above statements is/are correct?

उपरोक्त में से कौन सा/से कथन सही है/हैं?

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

23. Find the measure of ' x ', if O is the centre, $\angle OCB = 33^\circ$ and $\angle OAB = 39^\circ$.

' x ' का माप ज्ञात करें, यदि O केंद्र है, $\angle OCB = 33^\circ$ और $\angle OAB = 39^\circ$.



- (a) 71° (b) 144° (c) 142° (d) 145°

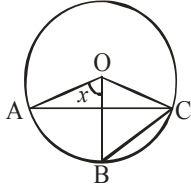
24. Two parallel chords of a circle whose diameter is 20 cm are 16 cm and 12 cm, respectively. If both chords are on the same side of the diameter, then the distance between these chords is:

एक 20 सेमी व्यास के वृत्त की दो समानांतर जीवाएँ क्रमशः 16 सेमी और 12 सेमी हैं। यदि दोनों जीवाएँ व्यास के एक ही ओर हों, तो इन जीवाओं के बीच की दूरी क्या है?

[DP Head Constable 13/10/2022 (1st Shift)]

- (a) 3 cm (b) 1 cm
(c) 2 cm (d) 1.5 cm

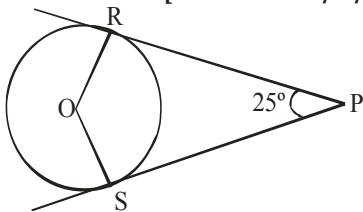
25. Find the measure of 'x', if O is the centre, $\angle OAC = 31^\circ$ and $\angle OBC = 35^\circ$.
'x' का माप ज्ञात करें, यदि O केंद्र है, $\angle OAC = 31^\circ$ और $\angle OBC = 35^\circ$.



- (a) 31° (b) 35° (c) 8° (d) 16°

26. In the given figure, if $\angle RPS = 25^\circ$, the value of $\angle ROS$ is _____

दिए गए चित्र में, यदि $\angle RPS = 25^\circ$, $\angle ROS$ का मान है
[SSC CHSL 27/05/2022 (Afternoon)]



- (a) 155° (b) 145° (c) 135° (d) 165°

27. ABCD is a cyclic quadrilateral. Sides AB and DC, when produced, meet at E and sides AD and BC when produced, meet at F. If $\angle ADC = 76^\circ$ and $\angle AED = 55^\circ$, then $\angle AFB$ is equal to:
ABCD एक चक्रीय चतुर्भुज है। भुजाएँ AB और DC, बढ़ाने पर E पर मिलती हैं और भुजाएँ AD और BC बढ़ाने पर, F पर मिलती हैं। यदि $\angle ADC = 76^\circ$ और $\angle AED = 55^\circ$, तो $\angle AFB$ बराबर है:

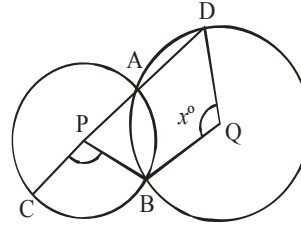
[SSC CGL Tier II 03/02/2022]

- (a) 34° (b) 26° (c) 29° (d) 27°

28. In the following figure, P and Q are centers of two circles. The circles are intersecting at points A and B. PA produced on both the sides meets the circles at C and D. If $\angle CPB = 100^\circ$, then find the value of x.

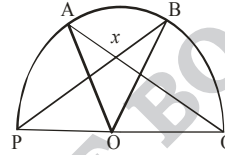
निम्नलिखित आकृति में, P और Q दो वृत्तों के केंद्र हैं। वृत्त बिंदु A और B पर प्रतिच्छेद कर रहे हैं। दोनों तरफ बना PA वृत्त को C और D पर मिलता है। यदि $\angle CPB = 100^\circ$, तो x का मान ज्ञात कीजिए।

[SSC CGL 18/04/2022 (Morning)]



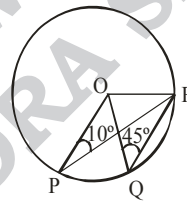
- (a) 115 (b) 120 (c) 110 (d) 100

29. If $\angle AXP = 56^\circ$, then find $\angle AOB = ?$
यदि $\angle AXP = 56^\circ$ तब $\angle AOB$ का मान ज्ञात करो



- (a) 79 (b) 62 (c) 56 (d) 68

30. In the given fig., find the $\angle POQ$?
दिये गये चित्र $\angle POQ$ का मान ज्ञात करो?



- (a) 55 (b) 65 (c) 70 (d) 60

31. The radius of two concentric circles, with centre O, are 29 cm and 21 cm. Chord AB of the larger circle is tangent to the smaller circle at point C and AD is the diameter of the larger circle. What is the length of CD? (Correct to one decimal place)
O केंद्र वाले दो संकेंद्री वृत्तों की त्रिज्याएँ 29 cm और 21 cm हैं। बड़े वृत्त की जीवा AB, छोटे वृत्त की C पर स्पर्श रेखा है और AD बड़े वृत्त का व्यास है। CD के लंबाई क्या है? (दशमलव के स्थान तक सही उत्तर दीजिए।)

[CAR Assistant 29/07/2022 (2nd Shift)]

- (a) 45.8 (b) 46.5 (c) 46.2 (d) 45.6

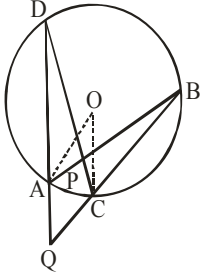
32. Two concentric circles are drawn with radii 20 cm and 16 cm. What will be the length of a chord of the larger circle which is tangent to the smaller circle?

त्रिज्या 20 सेमी और 16 सेमी वाले दो संकेंद्रित वृत्त खींचे गए हैं। बड़े वृत्त की उस जीवा की लंबाई क्या होगी जो छोटे वृत्त की स्पर्शरेखा है?

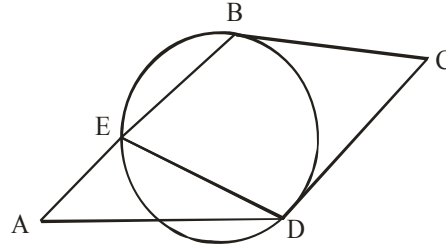
[SSC CGL 07/12/2022 (2nd Shift)]

- (a) 34 cm (b) 24 cm
(c) 48 cm (d) 12 cm

33. In the given fig. if $\angle APC = 110^\circ$ and $\angle BQD = 50^\circ$ then find $\angle AOC = ?$ / दिये गये चित्र में, यदि वृत्त का केन्द्र O है, $\angle APC = 110^\circ$, $\angle BQD = 50^\circ$ तब $\angle AOC$ क्ता मान क्या है ?



- (a) 60 (b) 50 (c) 75 (d) 55
34. Two circles of equal radii pass through centres of each other, then find the length of the common chord if the radii of the circles are 'a'.
समान त्रिज्या वाले दो वृत्त एक-दूसरे के केंद्रों से होकर गुजरते हैं, तो उभयनिष्ठ जीवा की लंबाई ज्ञात कीजिए यदि वृत्तों की त्रिज्या 'a' है।
(a) $2a$ (b) a (c) $\sqrt{3}a$ (d) $\sqrt{2}a$
35. A, B, C and D are points on a circle such that ABC is an equilateral triangle and D is a point on the minor arc BC such that AD and BC intersect at P and $\angle APC = 98^\circ$, then find $\angle CBD$.
 A, B, C और D एक वृत्त पर बिंदु इस प्रकार हैं कि ABC एक समबाहु त्रिभुज है और D लघु चाप (BC) पर एक बिंदु है इस प्रकार कि AD और BC P पर प्रतिच्छेद करते हैं और $\angle APC = 98^\circ$, तो $\angle CBD$ ज्ञात कीजिए।
(a) 38° (b) 28° (c) 22° (d) 32°
36. If AB is a chord of a circle with radius 5 units and C is a point on the circle such that $\angle ACB = \frac{\pi}{2}$, then the length of chord AB is:
यदि 5 इकाई त्रिज्या वाले वृत्त की एक जीवा AB है और C वृत्त पर एक बिंदु इस प्रकार है कि $\angle ACB = \frac{\pi}{2}$ है, तो जीवा AB की लंबाई है:
[Graduate Level 02/08/2022 (3rd Shift)]
(a) 10 units (b) 2.5 units
(c) 7.5 units (d) 5 units
37. In the given figure, $ABCD$ is a parallelogram such that B and D are points of tangency if $\angle EDA = 15^\circ$, then find $\angle BAD$.
दिए गए चित्र में, $ABCD$ एक समांतर चतुर्भुज है जैसे कि B और D स्पर्शरेखा के बिंदु हैं यदि $\angle EDA = 15^\circ$, तो $\angle BAD$ ज्ञात करें।



- (a) 30° (b) 60° (c) 50° (d) 75°
38. AB is a chord in the minor segment of a circle with center O . C is a point on the minor arc (between A and B). The tangents to the circle at A and B meet at a point P . If $\angle ACB = 108^\circ$, then $\angle APB$ is equal to:
केंद्र O वाले वृत्त के लघु खंड में AB एक जीवा है। C लघु चाप (A और B के बीच) पर एक बिंदु है। A और B पर वृत्त की स्पर्शरेखाएँ एक बिंदु P पर मिलती हैं। यदि $\angle ACB = 108^\circ$, तो $\angle APB$ बराबर है:
[SSC CGL Tier II 03/02/2022]
(a) 36° (b) 54° (c) 27° (d) 18°
39. Two concentric circles of radii 10 cm and 8 cm are given, the length of the chord of the larger circle which touches the smaller circle is:
10 सेमी और 8 सेमी त्रिज्या के दो संकेन्द्रित वृत्त दिए गए हैं, बड़े वृत्त की जीवा की लंबाई ज्ञात कीजिए। जो छोटे वृत्त को स्पर्श करती है।
[DP Head Constable 20/10/2022 (2nd Shift)]
(a) 10 cm (c) 14 cm
(b) 8 cm (d) 12 cm
40. PQ and RS are two parallel chords of a circle of length 10 cm and 24 cm, respectively, and lie on the same side of the centre O . If the distance between the chords is 7 cm, what is the radius (in cm) of the circle?
 PQ और RS क्रमशः 10" सेमी और 24 सेमी लंबाई वाले एक वृत्त की दो समानांतर जीवाएँ हैं, और केंद्र O के एक ही तरफ स्थित हैं। यदि जीवाओं के बीच की दूरी 7 सेमी है, तो क्या है वृत्त की त्रिज्या (सेमी में)?
[SSC CHSL 03/06/2022 (Afternoon)]
(a) 11 (b) 9 (c) 13 (d) 7
41. A circle of radius 25 cm has a chord of length 48 cm. What is the length of the perpendicular drawn from the centre of the circle to the chord?
25 सेमी त्रिज्या वाले एक वृत्त की एक जीवा की लंबाई 48 सेमी है। वृत्त के केंद्र से जीवा पर खींचे गए लंब की लंबाई क्या है?
(a) 5 cm (b) 5.5 cm
(c) 6.5 cm (d) 7 cm

42. Chords AB and CD of a circle are produced to meet at the point P , outside the circle, and AD is the diameter of the circle. If $\angle DAP = 36^\circ$ and $\angle APC = 30^\circ$, then what will be the measure of $\angle CBD$?

एक वृत्त की जीवाएँ AB और CD , वृत्त के बाहर, बिंदु P पर मिलती हैं, और AD वृत्त का व्यास है। यदि $\angle DAP = 36^\circ$ और $\angle APC = 30^\circ$ हो, तो $\angle CBD$ का माप क्या होगा?

[SSC CHSL 19/04/2021 (Afternoon)]

- (a) 34° (b) 26° (c) 24° (d) 16°

43. Two circles of radius 4 cm and 6 cm touch each other internally what is the length (in cm) of the longest chord of the outer circle, which is also a tangent to inner circle?

त्रिज्या 4 सेमी और 6 सेमी के दो वृत्त एक दूसरे को आंतरिक रूप से स्पर्श करते हैं, बाहरी वृत्त की सबसे लंबी जीवा की लंबाई (सेमी में) क्या है, जो आंतरिक वृत्त की स्पर्श रेखा भी है?

- (a) $12\sqrt{2}$ (b) $8\sqrt{2}$ (c) $6\sqrt{2}$ (d) $4\sqrt{2}$

44. A chord 21 cm long is drawn in a circle of diameter 25 cm. The perpendicular distance of the chord from the centre is:

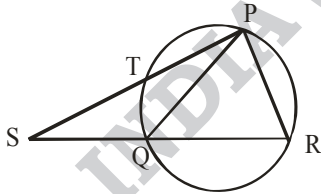
21 सेमी लंबी एक जीवा 25 सेमी व्यास वाले एक वृत्त में खींची गई है। केंद्र से जीवा की लंबवत दूरी है:

[SSC CGL 13/08/2021 (Morning)]

- (a) $\sqrt{41}$ (b) $\sqrt{23}$ (c) $\sqrt{56}$ (d) $\sqrt{46}$

45. In the fig. $\triangle PQR$ is equilateral. $ST = 4$ cm, and $ST = 6$ cm, then find area of $\triangle PQR$?

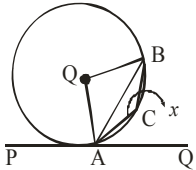
दिये गये चित्र में PQR एक समबाहु त्रिभुज है $ST = 4$ सेमी, और $TP = 6$ सेमी, तब $\triangle PQR$ का क्षेत्रफल ज्ञात करो?



- (a) $10\sqrt{3}$ (b) $15\sqrt{3}$
(c) $12\sqrt{3}$ (d) $16\sqrt{3}$

46. In the given figure, PQ is tangent to the circle at A and O is the centre of the circle. Find the measures of 'x' if $\angle BAQ = 63^\circ$.

दी गई आकृति में, PQ वृत्त की A पर स्पर्शरेखा है और O वृत्त का केंद्र है। 'x' का माप ज्ञात करें यदि $\angle BAQ = 63^\circ$ ।



- (a) 63° (b) 113° (c) 117° (d) 112°

47. In a circle with centre O , Chord AB and diameter CD intersect each other at point E , inside the circle. If $\angle AOD = 42^\circ$ and $\angle BOC = 104^\circ$ then what is the measure (in degrees) of $\angle AED$?

केंद्र O वाले एक वृत्त में जीवा AB और व्यास CD वृत्त के अंदर बिंदु E पर एक दूसरे को काटते हैं। यदि $\angle AOD = 42^\circ$ और $\angle BOC = 104^\circ$ तो $\angle AED$ का माप (डिग्री में) क्या है?

[SSC CHSL 04/08/2021 (Evening)]

- (a) 73° (b) 62° (c) 58° (d) 84°

48. $ABCD$ is a cyclic Quadrilateral. The tangent to the circle at the point A and C on it. intersect at P . If $\angle ABC = 98^\circ$. then what is the measure of $\angle APC$?

$ABCD$ एक चक्रीय चतुर्भुज है वृत्त पर बिंदु A और C पर स्पर्श रेखाएँ एक दूसरे को P पर काटती हैं यदि $\angle ABC = 98^\circ$, तब $\angle APC$ का मान क्या है?

- (a) 22 (b) 26 (c) 16 (d) 14

49. Each of the circles of equal radii with centres A and B pass through the centre of one another circle they cut at C and D then $\angle DBC$ is equal to

केंद्र A और B वाले समान त्रिज्या वाले प्रत्येक वृत्त एक दूसरे वृत्त के केंद्र से होकर गुजरते हैं जिन्हें वे C और D पर काटते हैं तो $\angle DBC$ बराबर होता है

- (a) 60° (b) 100° (c) 120° (d) 140°

50. AB is the diameter of a circle. C and D are points on the opposite sides of the diameter AB , such that $\angle ACD = 25^\circ$, E is a point on the minor arc BD . Find the measure of $\angle BED$ (in degrees).

AB एक वृत्त का व्यास है। C और D व्यास AB के विपरीत पक्षों पर बिंदु हैं, जैसे कि $\angle ACD = 25^\circ$, E लघु चाप BD पर एक बिंदु है। $\angle BED$ का माप (डिग्री में) ज्ञात कीजिए।

[SSC CGL 16/08/2021 (Afternoon)]

- (a) 115 (b) 105 (c) 130 (d) 125

51. O is the centre of the circle to which PAX and PBY are tangent from a point P at point A and B . Q is a point on the circle, such that $\angle QAX = 49^\circ$, and $\angle QBY = 62^\circ$. What is the measure of $\angle AQB$?

O उस वृत्त का केंद्र है जिसमें PAX और PBY बिंदु P से A और B बिंदुओं पर स्पर्श रेखाएँ हैं। Q वृत्त पर एक बिंदु है यदि $\angle QAX = 49^\circ$, और $\angle QBY = 62^\circ$ तो $\angle AQB$ का माप क्या है?

- (a) 67 (b) 59 (c) 69 (d) 63

52. If two concentric circles are of radii 5 cm and 3 cm, then the length of the chord of the larger circle which touches the smaller circle is:

यदि दो संकेंद्रित वृत्तों की त्रिज्या 5 सेमी और 3 सेमी है, तो बड़े वृत्त की जीवा की लंबाई जो छोटे वृत्त को छूती है, है:

- (a) 6 cm (b) 7 cm
(c) 10 cm (d) 8 cm

53. Two circles of radii 18 cm and 16 cm intersect each other and the length of their common chord is 20 cm. What is the distance (in cm) between their centres?

18 सेमी और 16 सेमी त्रिज्या वाले दो वृत्त एक दूसरे को प्रतिच्छेद करते हैं और उनकी उभयनिष्ठ जीवा की लंबाई 20 सेमी है। उनके केन्द्रों के बीच की दूरी (सेमी में) क्या है?

[SSC CGL 20/08/2021 (Afternoon)]

- (a) $4\sqrt{14} + 2\sqrt{39}$ (b) $4\sqrt{10} + 2\sqrt{39}$
(c) $4\sqrt{14} - 2\sqrt{39}$ (d) $4\sqrt{10} - 2\sqrt{39}$

54. In a circle, two chords AB and CD intersect at P . If AB and CD respectively subtend angles 113° and 119° at the centre. Find $\angle APC$ if the minor arc $\widehat{BC}$ subtends 32° at the centre.

एक वृत्त में, दो जीवाएँ AB और CD P पर प्रतिच्छेद करती हैं। यदि AB और CD क्रमशः केंद्र पर 113° और 119° कोण बनाते हैं। यदि लघु चाप (BC) केंद्र पर 32° अंतरित करता है तो $\angle APC$ ज्ञात करें।

- (a) 20° (b) 40° (c) 50° (d) 60°

55. In a circle with centre O , $ABCD$ is a cyclic quadrilateral and AC is the diameter. Chords AB and DC are produced to meet E . If $\angle CAE = 34^\circ$, and $\angle E = 30^\circ$, then $\angle CBD$ is equal to -

केन्द्र O वाले एक वृत्त में, $ABCD$ एक चक्रीय चतुर्भुज है और AC व्यास है जीवा AB और DC आगे बढ़ाने पर बिंदु E पर मिलती है यदि $\angle CAE = 34^\circ$, और $\angle E = 30^\circ$, $\angle CBD$ का मान क्या है?

- (a) 36 (b) 24 (c) 26 (d) 34

56. PA and PB are tangent to a circle with centre O from a point P outside the circle. A and B are points on the circle. C is a point on the minor arc AB if $\angle ACB = 115^\circ$ then $\angle APB$ is equal to:

PA और PB केन्द्र O वाले वृत्त की दो स्पर्श रेखा बाह्य बिंदु P वृत्त के बाहर है तथा A और B वृत्त पर स्थित हैं, C लघु चाप पर स्थित एक बिंदु है यदि $\angle ACB = 115^\circ$ है तो $\angle APB$ का मान क्या है?

- (a) 50 (b) 40 (c) 65 (d) 60

57. Two circles cut each other at A and B , and if a line tangent to both the circles at P and Q , then find $\angle PAQ + \angle PBQ$.

दो वृत्त एक दूसरे को A और B पर काटते हैं, और यदि एक रेखा दोनों वृत्तों को P और Q पर स्पर्श करती है, तो $\angle PAQ + \angle PBQ$ ज्ञात कीजिए।

- (a) 30° (b) 60° (c) 90° (d) 180°

58. AB and CD are two chords of a circle which intersect at E inside the circle. If $\angle BEC = 125^\circ$ and $\angle EBD = 28^\circ$, then what is the measure of $\angle BAC$?

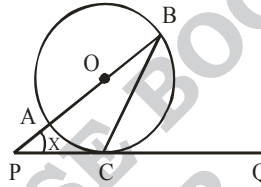
AB और CD एक वृत्त की दो जीवाएँ हैं जो वृत्त के अंदर E पर प्रतिच्छेद करती हैं। यदि $\angle BEC = 125^\circ$ और $\angle EBD = 28^\circ$ है, तो $\angle BAC$ का माप क्या है?

[SSC CHSL 13/04/2021 (Morning)]

- (a) 55° (b) 87° (c) 56° (d) 97°

59. In the given figure, AB is the diameter, and PQ is tangent to the circle at C . Find the measure of ' x ', if $\angle ABC = 34^\circ$.

दिए गए चित्र में, AB व्यास है, और PQ C पर वृत्त की स्पर्श रेखा है। ' x ' का माप ज्ञात कीजिए, यदि $\angle ABC = 34^\circ$ ।



- (a) 11° (b) 23° (c) 22° (d) 24°

60. Two circles with centres A and B of radii 5 cm and 3 cm respectively touch each other internally. If the perpendicular bisector of AB meets the bigger circle in P and Q , then the value of PQ is

क्रमशः 5 सेमी और 3 सेमी त्रिज्या वाले केंद्र A और B वाले दो वृत्त एक दूसरे को आंतरिक रूप से स्पर्श करते हैं। यदि AB का लंब समद्विभाजक P और Q में बड़े वृत्त से मिलता है, तो PQ का मान है

- (a) $\sqrt{6}$ cm (b) $2\sqrt{6}$ cm
(c) $3\sqrt{6}$ cm (d) $4\sqrt{6}$ cm

61. In a circle with centre O , AD is a diameter and AC is a chord. Point B is on AC such that $OB = 7$ cm and $\angle OBA = 60^\circ$. If $\angle DOC = 60^\circ$, then what is the length of BC (in cm)?

केंद्र O वाले वृत्त में, AD व्यास है और AC जीवा है। बिंदु B AC पर इस प्रकार है कि $OB = 7$ cm और $\angle OBA = 60^\circ$ है। यदि $\angle DOC = 60^\circ$, तो BC की लंबाई (सेमी में) क्या है?

[SSC CGL 13/08/2021 (Afternoon)]

- (a) 7 (b) 9
(c) 5 (d) 3.5

62. AB and AC are tangents to a circle with centre O . A is the external point of the circle. The line AO intersects the chord BC at D . The measure of $\angle BDO$ is:

AB और AC केंद्र O वाले वृत्त की स्पर्श रेखाएँ हैं। A वृत्त का बाहरी बिंदु है। रेखा AO जीवा BC को D पर काटती है। $\angle BDO$ का माप है:

- (a) 45° (b) 75°
(c) 90° (d) 60°

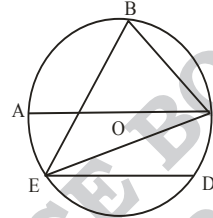
63. $ABCD$ is a cyclic quadrilateral with $\angle ABD = 63^\circ$ and $\angle ADB = 39^\circ$, then find $\angle BCD$
 $ABCD$ एक चक्रीय चतुर्भुज है जिसमें $\angle ABD = 63^\circ$ और $\angle ADB = 39^\circ$ है, तो $\angle BCD$ ज्ञात कीजिए।
 (a) 78° (b) 102° (c) 76° (d) 107°
64. AB is a 12 cm long chord of a circle with centre O and radius 10 cm. The tangents at A and B intersect at P . What is the length of OP (in cm)?
 केंद्र O और त्रिज्या 10 सेमी वाले एक वृत्त की AB एक 12 सेमी लंबी जीवा है। A और B पर स्पर्शरेखाएँ P पर प्रतिच्छेद करती हैं। OP की लंबाई (सेमी में) क्या है?
 [SSC CHSL 09/08/2021 (Afternoon)]
 (a) 12.5 (b) 12 (c) 10 (d) 14
65. Two parallel chords are one side of centre of circle the length 24 cm, 32 cm. If the distance between them is 8 cm then find area of the circle?
 दो समान्तर जीवाएँ जिनकी लंबाई क्रमशः 24 सेमी और 32 सेमी है, केन्द्र के एक ही तरफ है यदि दोनों जीवाओं के बीच की दूरी 8 सेमी है तब वृत्त का क्षेत्रफल क्या है?
 (a) 724.14 (b) 832.86
 (c) 924.12 (d) 988.32
66. AB and AC are two chords of a circle of radius ' r ' such that $AB = 2AC$ if ' p ' and ' q ' are the distances of AB and AC from the centre, then $4q^2 - p^2$ will be equal to
 AB और AC त्रिज्या ' r ' वाले एक वृत्त की दो जीवाएँ हैं जैसे $AB = 2AC$ यदि ' p ' और ' q ' AB और AC की केंद्र से दूरियाँ हैं, तो $4q^2 - p^2$ बराबर होगा
 (a) r^2 (b) $2r^2$ (c) $3r^2$ (d) $4r^2$
67. A Quadrilateral $ABCD$ is inscribed in a circle with centre O . If $\angle BOC = 92^\circ$ and $\angle ADC = 112^\circ$, then $\angle ABO$ is equal to:-
 एक चतुर्भुज $ABCD$ केन्द्र O वाले एक वृत्त में निहित है यदि $\angle BOC = 92^\circ$, $\angle AOC = 112^\circ$ तो $\angle ABO$ का मान क्या है?
 (a) 22 (b) 24 (c) 28 (d) 26
68. The length of two parallel chords of a circle of radius 5 cm are 6 cm and 8 cm in the same side of the centre. The distance between them is
 5 सेमी त्रिज्या वाले एक वृत्त की दो समानांतर जीवाओं की लंबाई केंद्र की एक ही दिशा में 6 सेमी और 8 सेमी है। उनके बीच की दूरी है
 (a) 1 cm (b) 2 cm
 (c) 3 cm (d) 1.5 cm
69. AB is the diameter of a circle of radius 9 cm. PQ is a chord (not a diameter) that intersects AB at M perpendicularly. If $AM:BM = 5:4$, then the length of chord PQ will be:

AB , 9 सेमी त्रिज्या वाले एक वृत्त का व्यास है। PQ एक जीवा है (व्यास नहीं) जो AB को M पर लंबवत काटती है। यदि $AM:BM = 5:4$, तो जीवा PQ की लंबाई होगी:

[SSC CHSL 09/08/2021 (Afternoon)]

- (a) $5\sqrt{5}$ (b) $6\sqrt{5}$ (c) $6\sqrt{3}$ (d) $8\sqrt{5}$

70. In the given fig. O is centre of circle. If $ED \parallel AC$, $\angle CBE = 65^\circ$ then find $\angle DEC = ?$
 दिये चित्र में, O वृत्त का केन्द्र है यदि $ED \parallel AC$, $\angle CBE = 65^\circ$ तब $\angle DEC$ का मान होगा ?



- (a) 29 (b) 25 (c) 35 (d) 30

71. The radius of circum-circle of a right angled triangle is 10 cm and the altitude drawn to the hypotenuse is 8 cm. What is the area of the triangle?

एक समकोण त्रिभुज के परिवृत्त की त्रिज्या 10 सेमी है और कर्ण तक खींची गई ऊंचाई 8 सेमी है। त्रिभुज का क्षेत्रफल कितना है?

- (a) 60 cm^2 (b) 80 cm^2
 (c) 100 cm^2 (d) 120 cm^2

72. Find the length of the common chord of two circles of radius 15 cm and 20 cm if their centres are 25 cm apart?

15 सेमी और 20 सेमी त्रिज्या वाले दो वृत्तों की उभयनिष्ठ जीवा की लंबाई ज्ञात कीजिए यदि उनके केंद्र 25 सेमी दूर हैं?

- (a) 12 cm (b) 20 cm
 (c) 18 cm (d) 24 cm

73. From a point P , which is at a distance of 13 cm from the centre O of a circle, a pair of tangents PQ and PR of length 12 cm are drawn to the circle. The area of the quadrilateral $PQOR$ is:

एक बिंदु P से, जो एक वृत्त के केंद्र O से 13 सेमी की दूरी पर है, स्पर्शरेखा PQ और PR की लंबाई 12 सेमी की एक जोड़ी वृत्त पर खींची जाती है। चतुर्भुज $PQOR$ का क्षेत्रफल है:

[SSC CHSL 11/08/2021 (Morning)]

- (a) 50 (b) 76 (c) 80 (d) 60

74. The distance between two parallel chords of length 8 cm each in a circle of diameter 10 cm is?

10 सेमी व्यास वाले एक वृत्त में 8 सेमी लंबाई वाली दो समानांतर जीवाओं के बीच की दूरी कितनी है?

- (a) 6 cm (b) 7 cm

- (c) 8 cm (d) 5.5 cm

75. Two intersecting circle have a common chord of length 24 cm. the radii of the circle are 20 cm and 37 cm. find the distance between the centre of circle?

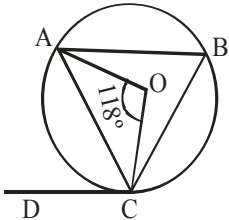
दो वृत्त जिनकी त्रिज्याएं क्रमशः 20 सेमी० और 37 सेमी० है, की उभयनिष्ठ जीवा की लंबाई 24 सेमी० है तब वृत्तों के केन्द्रों के बीच की दूरी ज्ञात करे ?

- (a) 51 cm (b) 49 cm
(c) 48 cm (d) 52 cm

76. In the given figure, BC is a chord and CD is a tangent at the point C If $\angle AOC = 118^\circ$, then find the $\angle ACD$.

दिए गए चित्र में, BC एक जीवा है और CD बिंदु C से होकर जाने वाली स्पर्श रेखा है यदि $\angle AOC = 118^\circ$ है, तो $\angle ACD$ ज्ञात कीजिए।

[SSC CHSL 12/10/2020 (Morning)]



- (a) 63° (b) 56° (c) 65° (d) 59°

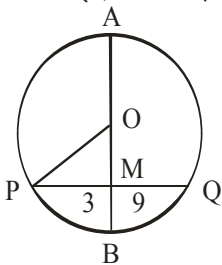
77. If the radii of two circles be 6 cm and 3 cm and the length the transverse common tangent be 8 cm, then the distance between the two centres is

यदि दो वृत्तों की त्रिज्याएँ 6 सेमी और 3 सेमी हैं और अनुप्रस्थ उभयनिष्ठ स्पर्शरेखा की लंबाई 8 सेमी है, तो दोनों केन्द्रों के बीच की दूरी है

- (a) $\sqrt{145}$ cm (b) $\sqrt{140}$ cm
(c) $\sqrt{150}$ cm (d) $\sqrt{135}$ cm

78. In a given circle, the chord PQ is of length 18 cm. AB is the perpendicular bisector of PQ at M . If $MB = 3$. Find the length of AB

किसी दिए गए वृत्त में, जीवा PQ की लंबाई 18 सेमी है। AB , M पर PQ का लंबवत समद्विभाजक है। यदि $MB = 3$ है। AB की लंबाई ज्ञात कीजिए



- (a) 25 cm (b) 30 cm

- (c) 28 cm (d) 27 cm

79. Two tangents AP and AQ are drawn to a circle with centre O from an external point A , where P and Q are points on the circle. If $AP = 12$ cm and $\angle PAQ = 60^\circ$, then the length of chord PQ is:

केंद्र O वाले एक वृत्त पर बाहरी बिंदु A से दो स्पर्श रेखाएँ AP और AQ खींची जाती हैं, जहाँ P और Q वृत्त पर बिंदु हैं। यदि $AP = 12$ cm और $\angle PAQ = 60^\circ$ है, तो जीवा PQ की लंबाई है:

[SSC CHSL 14/10/2020 (Morning Shift)]

- (a) 12 cm (b) 10 cm
(c) 24 cm (d) 16 cm

80. A, B and C are three points on a circle such that the angles subtended by the chord AB and AC at the centre O are 110° and 130° respectively. Then the value of $\angle BAC$ is:

A, B और C एक वृत्त पर तीन बिंदु हैं। जीवा AB और AC केंद्र O क्रमशः 110° और 130° है। $\angle BAC$ का मान ज्ञात कीजिए।

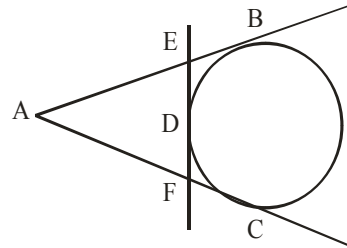
[SSC CGL 03/03/2020 (Morning)]

- (a) 70° (b) 75° (c) 60° (d) 65°

81. In the given figure, AB, AC and EF are tangents to a circle. If $AC = 15$ cm and $DE = 3$ cm, then the length of AE is:

दिए गए चित्र में, AB, AC और EF एक वृत्त की स्पर्श रेखाएँ हैं। यदि $AC = 15$ cm और $DE = 3$ cm है, तो AE की लंबाई है:

[SSC CHSL 19/10/2020 (Evening shift)]



- (a) 24 cm (b) 9 cm
(c) 18 cm (d) 12 cm

82. Two circles of equal radii 4 cm intersect each other at points A and B if $AB = 6$ cm, then the distance between centres will be

समान त्रिज्या 4 सेमी वाले दो वृत्त एक दूसरे को बिंदु A और B पर प्रतिच्छेद करते हैं यदि $AB = 6$ सेमी है, तो केंद्रों के बीच की दूरी होगी

- (a) 5 cm (b) $\sqrt{7}$ cm
(c) $2\sqrt{5}$ cm (d) $2\sqrt{7}$ cm

83. In a circle with centre O , a diameter AB is produced to a point P lying outside the circle and

PT is a tangent to the circle at the point C on it, If $\angle BPT = 36^\circ$, then what is the measure of $\angle BCP$?
 केंद्र O वाले एक वृत्त में, वृत्त के बाहर स्थित बिंदु P पर एक व्यास AB बनाया जाता है और PT उस पर बिंदु C पर वृत्त की एक स्पर्शरेखा है, यदि $\angle BPT = 36^\circ$ है, तो माप क्या है $\angle BCP$ का ?

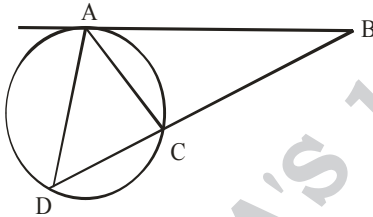
[SSC CGL Tier II 15/11/2020]

- (a) 24° (b) 18° (c) 27° (d) 36°

84. In a circle of radius 17 cm, two parallel chords are drawn on opposite sides of the centre. The distance between the chords is 23 cm if the length of one chord is 16 cm then the length of the other is
 17 सेमी त्रिज्या वाले एक वृत्त में, केंद्र के विपरीत दिशाओं में दो समानांतर जीवाएँ खींची जाती हैं। जीवाओं के बीच की दूरी 23 सेमी है यदि एक तार की लंबाई 16 सेमी है तो दूसरे की लंबाई है

- (a) 30 cm (b) 24 cm
 (c) 28 cm (d) 26 cm

85. In the given fig. AB is tangent to circle if $AC = BC = 9$ cm, and $CD = 7$ cm. then $AD = ?$
 दिये गये चित्र में, रेखा AB वृत्त को स्पर्श करती है यदि $AC = BC = 9$ सेमी और $CD = 7$ सेमी है तब AD की लंबाई क्या है ?



- (a) 12 cm (b) 8 cm
 (c) 16 cm (d) 10 cm

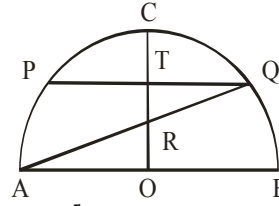
86. A road curve is to be laid out of a circle. What radius should be used if the track is to change direction by 42° in distance of 44 m?
 एक वृत्त के बाहर एक सड़क वक्र बनाना है। यदि ट्रैक को 44 मीटर की दूरी में 42° द्वारा दिशा बदलनी है तो किस त्रिज्या का उपयोग किया जाना चाहिए?

(Assume $= \frac{22}{7}$) / (मान लीजिए $= \frac{22}{7}$)

- (a) 60 m (b) 66 m
 (c) 75 m (d) 80 m

87. In the given figure, O and AB are the centre and diameter of the semicircle, PQ is parallel to AB and $CO \perp AB$. If $AO = 8$ cm and $CT:TO = 1:3$, then find the length of OR .

दिए गए चित्र में, O और AB अर्धवृत्त का केंद्र और व्यास हैं, $PQ \parallel AB$ और $CO \perp AB$ यदि $AO = 8$ cm और $CT:TO=1:3$, तो OR की लंबाई ज्ञात कीजिए।

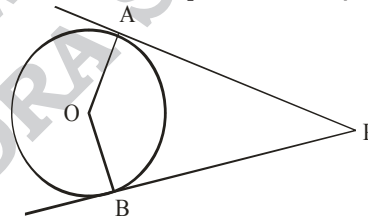


- (a) $\frac{5}{2}(3 - \sqrt{5})$ (b) $\frac{8}{3}(4 - \sqrt{3})$
 (c) $\frac{8}{3}(4 - \sqrt{7})$ (d) $\frac{5}{3}(3 - \sqrt{3})$

88. PA and PB are tangents to the circle and O is the centre of the circle. The radius is 5 cm and PO is 13 cm. If the area of the triangle PAB is M , then the value of $\sqrt{\frac{M}{15}}$ is:

PA और PB वृत्त की स्पर्श रेखाएँ हैं और O वृत्त का केंद्र है। त्रिज्या 5 सेमी है और PO 13 सेमी है। यदि त्रिभुज PAB का क्षेत्रफल M है, तो $\sqrt{\frac{M}{15}}$ का मान है:

[SSC CHSL 18/03/2020 (Morning)]



- (a) $\sqrt{\frac{24}{13}}$ (b) $\frac{24}{13}$ (c) $\frac{12}{13}$ (d) $\sqrt{\frac{12}{13}}$

89. In a circle of radius 5 cm, AB and AC are two chords such that $AC = 8$ cm. What is the length of chord BC ?

5 सेमी त्रिज्या वाले एक वृत्त में, AB और AC दो जीवाएँ इस प्रकार हैं कि $AB = AC = 8$ सेमी। BC की लंबाई क्या है?

[CDS-2020-I]

- (a) 9 cm (b) 9.2 cm
 (c) 9.6 cm (d) 9.8 cm

90. AB and CD are two parallel chords of lengths 40 cm and 48 cm respectively on the same side of the centre. If the distance between these two parallel chords is 8 cm, then find the radius of the circle.

एबी और सीडी केंद्र के एक ही तरफ क्रमशः 40 सेमी और 48 सेमी लंबाई की दो समानांतर जीवाएँ हैं। यदि इन दोनों समान्तर जीवाओं के बीच की दूरी 8 सेमी है, तो वृत्त की त्रिज्या ज्ञात कीजिए।

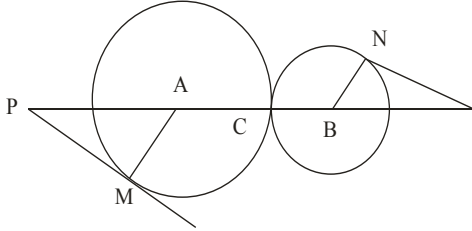
- (a) 21 cm (b) 22 cm
 (c) 24 cm (d) 25 cm

91. In the given figure, MP is the tangent to a circle with centre A and NQ is a tangent to a circle with

centre B . If $MP = 15$ cm, $NQ = 8$ cm, $PA = 17$ cm and $AB = 10$ cm, then AB is:

दिए गए चित्र में, MP केंद्र A वाले वृत्त की स्पर्श रेखा है और NQ केंद्र B वाले वृत्त की स्पर्श रेखा है। यदि $MP=15$ सेमी, $NQ=8$ सेमी, $PA=17$ सेमी और $BQ = 10$ सेमी है, तो AB है:

[SSC CGL 07/03/2020 (Morning)]



- (a) 13.5 cm (b) 23 cm
(c) 14 cm (d) 28 cm

92. A, B and C are three points on a circle such that the angles subtended by the chords AB and AC at the centre O are 80° and 120° , respectively. The value of $\angle BAC$ is:

A, B और C एक वृत्त पर तीन बिंदु इस प्रकार हैं कि जीवा AB और AC द्वारा केंद्र O पर अंतरित कोण क्रमशः 80° और 120° हैं। $\angle BAC$ का मान है:

[SSC CGL 06/06/2020 (Evening)]

- (a) 75° (b) 80° (c) 85° (d) 70°

93. What is the area of segment of a circle of radius r subtending an angle θ at the centre ?
केंद्र पर कोण θ अंतरित करने वाले r त्रिज्या वाले वृत्त के खंड का क्षेत्रफल क्या है?

[CDS-2020-II]

- (a) $\frac{1}{2}r^2\theta$
(b) $\frac{1}{2}r^2\left(\theta - 2\sin\frac{\theta}{2}\cos\frac{\theta}{2}\right)$
(c) $\frac{1}{2}r^2\left(\theta - \sin\frac{\theta}{2}\cos\frac{\theta}{2}\right)$
(d) $\frac{1}{2}r^2\sin\frac{\theta}{2}\cos\frac{\theta}{2}$

94. P is a point outside the circle at a distance of 6.5 cm from centre of the circle. PQR be a secant such that it intersects the circle at Q and R . If $PQ = 4.5$ cm and $QR = 3.5$ cm, then what is the radius of circle?

वृत्त के केन्द्र O से 6.5 सेमी की दूरी पर एक बिंदु P है PQR एक छेदक रेखा है जो वृत्त को क्रमशः बिंदु Q और R पर काटती है यदि $PQ = 4.5$ सेमी और $QR = 3.5$ cm है तब वृत्त की त्रिज्या क्या होगी?

- (a) 2.5 (b) 2 (c) 1.5 (d) 3

95. Chords AB and CD of a circle, when produced, meet at point P outside the circle. If $AB = 6$ cm, $CD = 3$ cm and $PD = 5$ cm, then PB is equal to :

एक वृत्त की जीवाएँ AB और CD , जब बढ़ाई जाती हैं, तो वृत्त के बाहर बिंदु P पर मिलती हैं। यदि $AB = 6$ cm, $CD = 3$ cm और $PD = 5$ सेमी, तो PB बराबर है:

[SSC CGL 11/06/2019 (Morning)]

- (a) 6 cm (b) 6.25 cm
(c) 5 cm (d) 4 cm

96. In a circle with centre O , $ABCD$ is a cyclic quadrilateral and AC is the diameter. Chords AB and DC are produced to meet at E . If $\angle CAE = 34^\circ$ and $\angle E = 30^\circ$, then $\angle CBD$ is equal to :

केंद्र O वाले वृत्त में, $ABCD$ एक चक्रीय चतुर्भुज है और AC इसका व्यास है। जीवा AB और DC को E पर मिलाने के लिए उत्पादित किया जाता है। यदि $\angle CAE=34^\circ$ और $\angle E=30^\circ$, तो $\angle CBD$ बराबर है:

[SSC CGL Tier II (13/09/2019)]

- (a) 36° (b) 26° (c) 24° (d) 34°

97. In a circle with centre O , AD is a diameter and AC is a chord. B is a point on AC , such that $OB = 5$ cm and $\angle OBA = 60^\circ$. If $\angle DOC = 60^\circ$, then what is the length of BC (in cm) ?

केंद्र O वाले वृत्त में, AD एक व्यास है और AC एक जीवा है। B , AC पर एक बिंदु है, इस प्रकार कि $OB=5$ cm और $\angle OBA=60^\circ$ है। यदि $\angle DOC=60^\circ$, तो BC की लंबाई (सेमी में) क्या है?

[SSC CHSL 01/07/2019 (Evening)]

- (a) 4 (b) $3\sqrt{5}$ (c) $5\sqrt{3}$ (d) 5

98. ABC is an equilateral triangle with side length ' a ' is inscribed in a quarter circle of radius ' r ' such a way that two of its vertices lie on the two radii while one vertex lies on the circular arc, if one side of the triangle is parallel to the radius, then find $a:r$.

ABC एक समबाहु त्रिभुज है जिसकी भुजा की लंबाई ' a ' त्रिज्या ' r ' के एक चौथाई वृत्त में इस प्रकार अंकित है कि इसके दो शीर्ष दो त्रिज्याओं पर स्थित हैं जबकि एक शीर्ष वृत्ताकार चाप पर स्थित है, यदि त्रिभुज की एक भुजा है त्रिज्या के समांतर है, तो $a:r$ ज्ञात कीजिए।

- (a) 3:5 (b) $2:\sqrt{5}$
(c) 2:7 (d) $2:\sqrt{7}$

99. PA and PB are tangents to a circle with centre O , from a point P outside the circle, and A and B are points on the circle. If $\angle APB = 40^\circ$, then $\angle OAB$ is equal to:

PA और PB केंद्र O वाले एक वृत्त पर, वृत्त के बाहर एक बिंदु P से स्पर्श रेखाएं हैं, और A और B वृत्त पर बिंदु हैं। यदि $\angle APB=40^\circ$, तो $\angle OAB$ बराबर है:

[SSC CGL 13/06/2019 (Evening)]

- (a) 50° (b) 20°

- (c) 25° (d) 40°

100. In a circle with centre O , $ACBO$ is a parallelogram where C is a point on the minor arc AB . What is the measure of $\angle AOB$?

केंद्र O वाले वृत्त में, $ACBO$ एक समांतर चतुर्भुज है जहाँ C लघु चाप AB पर एक बिंदु है। $\angle AOB$ का माप क्या है?

[SSC CGL 06/06/2019 (Afternoon)]

- (a) 150° (b) 100° (c) 110° (d) 120°

101. AB and CD are two parallel chords of a circle such that $AB = 6$ cm and $CD = 2AB$. Both chords are on the same side of the centre of the circle. If the distance between them is equal to one-fourth of the length of CD , then the radius of the circle (in cm) is:

AB और CD एक वृत्त की दो समान्तर जीवाएँ इस प्रकार हैं कि $AB = 6$ cm और $CD = 2AB$ है। दोनों जीवाएँ वृत्त के केंद्र के एक ही तरफ हैं। यदि उनके बीच की दूरी CD की लंबाई के एक-चौथाई के बराबर है, तो वृत्त की त्रिज्या (सेमी में) है:

[SSC CGL 04/06/2019 (Evening)]

- (a) $3\sqrt{5}$ (b) $4\sqrt{3}$

- (c) $4\sqrt{5}$ (d) $5\sqrt{3}$

102. What is the ratio of the area of a square inscribed in a semicircle of radius r to the area of square inscribed in a circle of radius r ?

त्रिज्या r के अर्धवृत्त में अंकित वर्ग के क्षेत्रफल का त्रिज्या के वृत्त में अंकित वर्ग के क्षेत्रफल से अनुपात क्या है?

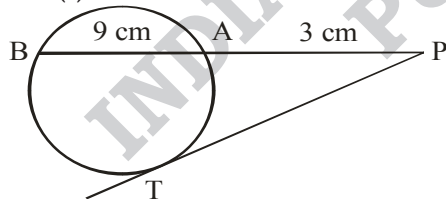
- (a) 1:2 (b) 2:5 (c) 2:3 (d) 3:5

Type 12 (Circle) Answer Key

1	(c)	2	(b)	3	(d)	4	(b)	5	(a)	6	(a)	7	(a)
8	(a)	9	(a)	10	(d)	11	(d)	12	(b)	13	(c)	14	(d)
15	(c)	16	(b)	17	(b)	18	(b)	19	(a)	20	(a)	21	(d)
22	(c)	23	(b)	24	(c)	26	(a)	27	(d)	28	(d)	29	(d)
30	(c)	31	(b)	32	(b)	33	(a)	34	(c)	35	(c)	36	(a)
37	(c)	38	(a)	39	(d)	40	(c)	41	(d)	42	(c)	43	(b)
44	(d)	45	(b)	46	(c)	47	(a)	48	(c)	49	(c)	50	(a)
51	(c)	52	(d)	53	(a)	54	(c)	55	(c)	56	(a)	57	(d)
58	(d)	59	(c)	60	(d)	61	(a)	62	(c)	63	(b)	64	(a)
65	(b)	66	(c)	67	(b)	68	(a)	69	(d)	70	(b)	71	(b)
72	(d)	73	(d)	74	(a)	75	(a)	76	(d)	77	(a)	78	(b)
79	(a)	80	(c)	81	(d)	82	(c)	83	(c)	84	(a)	85	(a)
86	(a)	87	(c)	88	(b)	89	(c)	90	(d)	91	(c)	92	(b)
93	(b)	94	(a)	95	(d)	96	(b)	97	(d)	98	(a)	99	(b)
100	(d)	101	(a)	102	(b)								

Type-12 (Circle) Solution

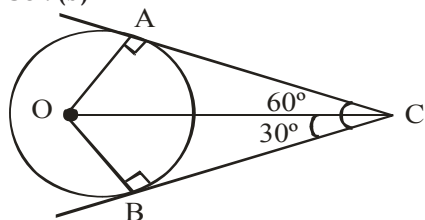
1. Sol. (c)



$$PT^2 = PA \times PB \dots (\text{secant - tangent property})$$

$$PT^2 = 3 \times 12 = 36 \text{ cm} \Rightarrow PT = 6 \text{ cm}$$

2. Sol. (b)



$$\triangle AOC \cong \triangle BOC \text{ (by RHS)}$$

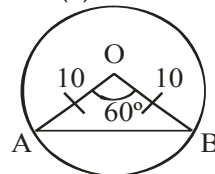
In $\triangle AOC$, we have:

$$\tan 30^\circ = \frac{AO}{AC} = \frac{3}{AC}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{3}{AC} \Rightarrow AC = 3\sqrt{3} \text{ cm}$$

So, the length of each tangent = $3\sqrt{3}$ cm

3. Sol. (d)



In $\triangle OAB$, side $OA = OB$ (radius of circle)

$$\text{Therefore } \angle OBA = \angle BAO = x^\circ$$

$$\angle AOB + \angle OBA + \angle BAO = 180^\circ$$

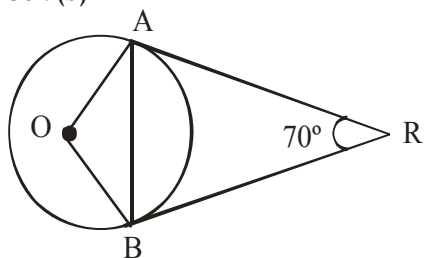
(sum of angles of a triangle)

$$60^\circ + x^\circ + x^\circ = 180^\circ \Rightarrow x^\circ = 60^\circ$$

This means $\triangle OAB$ is an equilateral triangle.

Hence, $AB = 10$ cm

4. Sol. (b)

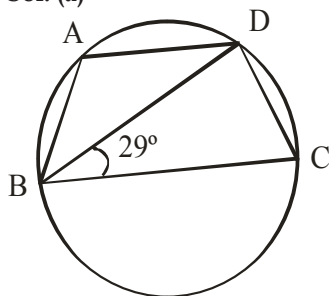


$$\angle ARB = 70^\circ, \angle OAB = \frac{70}{2} = 35^\circ$$

$\angle OAB = \angle OBA = 35^\circ$ (Radius of circle)

$$\begin{aligned} \text{in } \triangle OAB, \angle BOA &= 180^\circ - (35^\circ + 35^\circ) \\ &= 180^\circ - 70^\circ = 110^\circ \end{aligned}$$

5. Sol. (a)



Since BC is diameter, so $\angle BDC = 90^\circ$

$$\angle BCD = 180^\circ - (90^\circ + 29^\circ)$$

$$= 180^\circ - (119^\circ) = 61^\circ$$

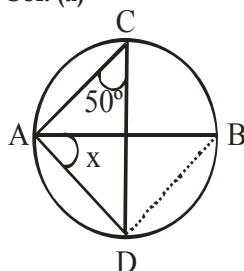
As, $\square ABCD$ is cyclic quadrilateral,

$$\angle A + \angle C = 180^\circ$$

$$\Rightarrow \angle BAD + \angle BCD = 180^\circ$$

$$\Rightarrow \angle BAD = 180^\circ - 61^\circ = 119^\circ$$

6. Sol. (a)



$$\angle ACD = \angle ABD = 50^\circ$$

(Angle made by same arc on circumference)

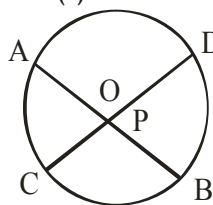
$$\angle ADB = 90^\circ \text{ (Angle made in semi-circle)}$$

In $\triangle ABD$

$$x + 50 + 90 = 180^\circ$$

$$x = 40^\circ$$

7. Sol. (a)

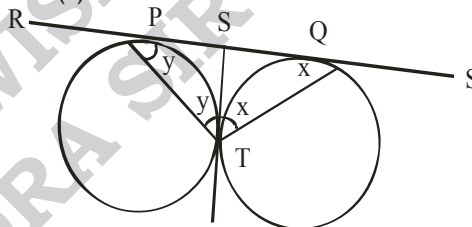


Concepts:-

$PA \times PB = PC \times PD$ (intersecting chord theorem)

$$\Rightarrow 8 \times 12 = 8 \times PD \Rightarrow PD = 12 \text{ cm}$$

8. Sol. (a)



Construction : we join ST such that it is tangent to both circles.

$$ST = SQ, \angle SQT = \angle STQ = x$$

$$ST = SP, \angle SPT = \angle STP = y$$

$$\text{In } \triangle PQT, x + x + y + y = 180^\circ$$

$$x + y = 90^\circ$$

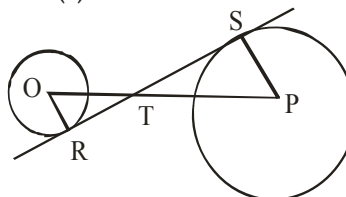
$$\angle TPQ = y = 42^\circ \text{ (given)}$$

$$\angle PQT = x = 90^\circ - y = 48^\circ$$

TRICK

Remember in such cases, $\angle PTQ = 90^\circ$

9. Sol. (a)



In $\triangle ORT$ and $\triangle PTS$

$$\angle ORT = \angle PST = 90^\circ$$

$$\angle OTR = \angle PTS \text{ (vertically opposite)}$$

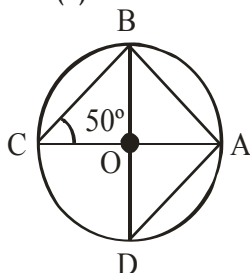
$$\Rightarrow \triangle ORT \sim \triangle PST$$

$$\Rightarrow \frac{OR}{PS} = \frac{RT}{ST}$$

$$\Rightarrow \frac{10}{x} = \frac{16}{24}$$

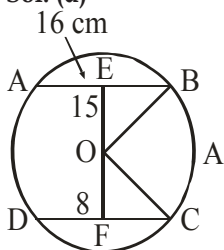
$$\Rightarrow x = 15 \text{ cm}$$

10. Sol. (d)



Angles made by the same arc on the circumference of a circle are always equal. In this figure, arc AB made $\angle BCA$ and $\angle BDA$. So, $\angle BCA = \angle BDA = 50^\circ$

11. Sol. (d)



In $\triangle BEO$

$$OB^2 = BE^2 + OE^2$$

$$OB^2 = 15^2 + 8^2$$

$$OB = 17 \text{ cm}$$

In $\triangle OFC$

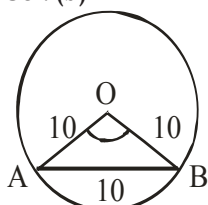
$$OC^2 = OF^2 + FC^2$$

$$(17)^2 = 8^2 + FC^2$$

$$FC = 15 \text{ cm}$$

$$DC = 2 \times FC = 30 \text{ cm}$$

12. Sol. (b)



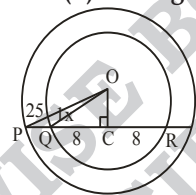
Since, $OB = AB = 10 \text{ cm}$. Then, $\triangle AOB$ is an equilateral triangle.

So, the angle (θ) subtended by circle at the centre $= 60^\circ$

13. Sol. (c) Using the alternate segment theorem, the angle between tangent and chord through the point of contact of the tangent is equal to the alternate segment angle.

$$\text{So, } \angle ACD = \angle ABC$$

14. Sol. (d) In right $\triangle COQ$,



$$QC^2 = OQ^2 + OC^2 \text{ (By pt)}$$

$$17^2 = 8^2 + OC^2$$

$$OC = 15 \text{ cm}$$

In right angle $\triangle COP$

$$OP^2 = CP^2 + CO^2$$

$$25^2 = CP^2 + 15^2$$

$$CP = 20 \text{ cm}$$

$$PS = 2 \times CP$$

$$= 2 \times 20$$

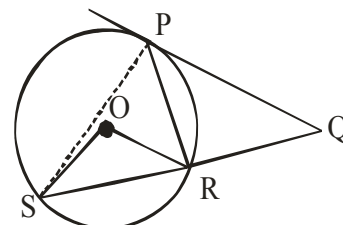
$$= 40 \text{ cm}$$

15. Sol. (c)

Join SP

$$\angle PSR = \angle RPQ = 37^\circ$$

(see theorem 'R')



For $\triangle PRQ$

$$\angle PRS = \angle RPQ + \angle RQP$$

$$\angle PRS = 37^\circ + 39^\circ = 76^\circ$$

In $\triangle SPR$

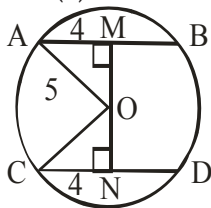
$$\angle PSR + \angle PRS + \angle SPR = 180^\circ$$

$$\angle SPR = 180^\circ - 76^\circ - 37^\circ = 67^\circ$$

$$\angle SOR = 2\angle SPR$$

$$= 2(67^\circ) = 134^\circ$$

16. Sol. (b)



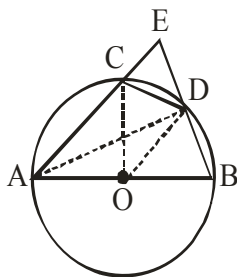
Length of OM = 3 m (by pythagoras theorem)

Length of ON = 3 m (by pythagoras theorem)

so distance between the chords = 3 + 3 = 6 m

17. Sol. (b)

Join CO, AD and OD



Then,

$\triangle ODC$ will be an equilateral triangle

$$\Rightarrow \angle COD = 60^\circ$$

$$\angle CAD = \frac{1}{2} \angle COD$$

(see theorem 'H')

$$\Rightarrow \angle CAD = \frac{1}{2} (60^\circ) = 30^\circ$$

$$\angle ADB = \angle ADE = 90^\circ \text{ (AB is diameter)}$$

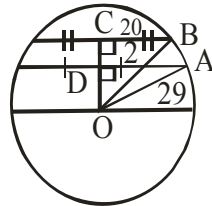
In $\triangle ADE$

$$\angle EAD + \angle ADE + \angle AED = 180^\circ$$

$$\Rightarrow \angle AED = 180^\circ - 90^\circ - 30^\circ = 60^\circ$$

18. Sol. (b)

A line drawn from center to the chord it perpendicularly bisects the chord.



Here, triplets (20,21,29) are used.

In $\triangle ADO$

$$AD^2 + DO^2 = AO^2 \Rightarrow 21^2 + DO^2 = 29^2$$

$$DO = 20 \text{ cm}$$

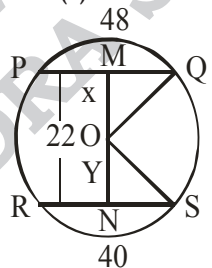
In $\triangle BCO \Rightarrow BC^2 + CO^2 = BO^2$

$$\Rightarrow 20^2 + CO^2 = 29^2 \Rightarrow CO = 21 \text{ cm}$$

Minimum distance between chord = CO

$$DO = 21 - 20 = 1 \text{ cm}$$

19. Sol. (a)



From the given figure, we can clearly conclude that

$$MQ = \frac{48}{2} = 24 \text{ and}$$

$$NS = \frac{40}{2} = 20$$

$$x + y = 22 \quad \text{---(1)}$$

In $\triangle MOQ$, we have :

$$r^2 = x^2 + 24^2 \quad \text{---(2)}$$

In $\triangle NOS$, we have :

$$r^2 = y^2 + 20^2 \quad \text{---(3)}$$

From equation (2) and (3) we have :

$$x^2 + 24^2 = y^2 + 20^2$$

$$\Rightarrow x^2 + 576 = y^2 + 400 \Rightarrow x^2 - y^2 = -176$$

$$(x - y)22 = -176 \text{ (from eqn(1))}$$

$$x - y = -8 \text{ ---(4)}$$

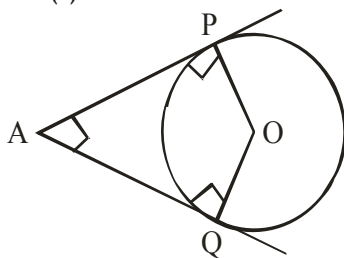
Solving eqn.(1) and (4) we have :

$$x = 7 \text{ and } y = 15$$

Now putting $x = 7$ in eqn(2), we get :

$$r = \sqrt{49 + 576} = 25 \text{ cm}$$

20. Sol.(a)



Since $\angle APO = \angle OQA$
 $= \angle PAQ = 90^\circ$

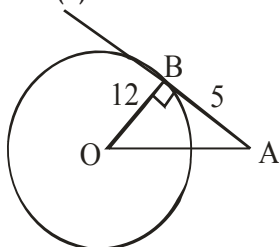
And $PO = OQ$

And $PO = OQ$

$POQA$ is a square

So $AP = OQ = 5 \text{ cm}$

21. Sol. (d)



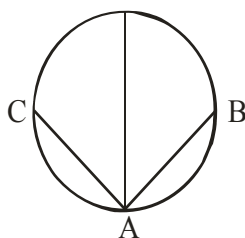
In $\triangle AOB$, we have :

$$AO = \sqrt{BO^2 + AB^2} = \sqrt{12^2 + 5^2}$$

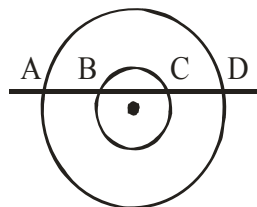
$$= \sqrt{144 + 25} = \sqrt{169} = 13 \text{ cm}$$

22. Sol. (c)

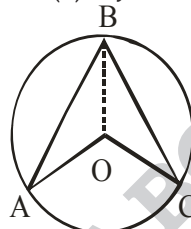
1. Angle bisector of $\angle BAC$ passes through the centre of the circle.



2. $AC = BD$



23. Sol.(b) Join BO



In $\triangle OBD$

$OB = OC = \text{radius}$

$$\Rightarrow \angle OCB = \angle OBC = 33^\circ$$

And

In $\triangle OBC$

$OB = OA = \text{radius}$

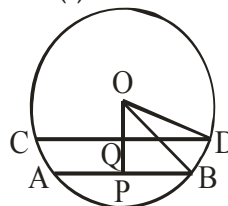
$$\Rightarrow \angle ABO = \angle OAB = 39^\circ$$

$$\angle ABC = \angle ABO + \angle OBC = 33^\circ + 39^\circ = 72^\circ$$

$$\angle AOC = 2\angle ABC$$

$$= 2(72^\circ) = 144^\circ$$

24. Sol. (c)



Let AB & CD are the chords with lengths 12 cm & 16 cm respectively.

$\Rightarrow$ In $\triangle OPB$:-

$OB = \text{radius} = 10 \text{ m}$, $PB = 6 \text{ cm}$

$$\Rightarrow (OP)^2 = (10)^2 - (6)^2$$

$$\Rightarrow OP = 8 \text{ cm}$$

In $\triangle OQD$:-

$OD = \text{radius} = 10 \text{ cm}$, $QD = 8 \text{ cm}$

$$\Rightarrow (OQ)^2 = (10)^2 - (8)^2$$

$$\Rightarrow OQ = 6 \text{ cm}$$

Distance between these chords = $OP - OQ$

$$\Rightarrow (8 - 6)\text{cm}$$

$$\Rightarrow 2\text{ cm.}$$

Smart Approach:-

When both the chords are same side then the diff.

b/w both chord = $\frac{1}{2}$ (difference of both chord)

$$PQ = \frac{1}{2}(16 - 12) = \frac{1}{2} \times 4 = 2$$

25. Sol. (c)

In $\triangle OBC$

$$\angle OBC = \angle OCB = 35^\circ \quad (\because OB = OC)$$

In $\triangle AOC$

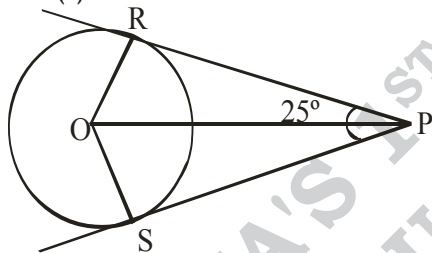
$$\angle OAC = \angle OCA = 31^\circ (\because OA = OC)$$

$$\angle ACB = \angle OCB - \angle OCA = 35^\circ - 31^\circ = 4^\circ$$

$$\angle AOB = 2\angle ACB$$

$$= 2(4^\circ) = 8^\circ$$

26. Sol. (a)



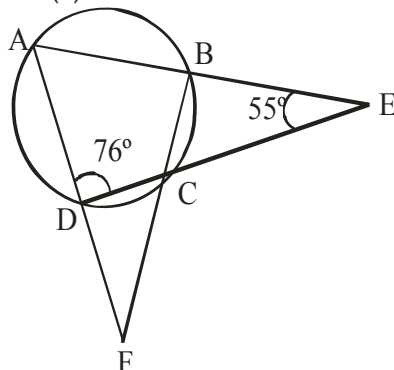
$$\angle ORS = \angle OSR = \frac{25^\circ}{2}$$

In $\triangle ORS$,

$$\angle ROS = 180^\circ - \left(\frac{25^\circ}{2} + \frac{25^\circ}{2}\right)$$

$$= 180^\circ - 25^\circ = 155^\circ$$

27. Sol. (d)



In $\triangle ADE$,

$$\angle EAD = 180^\circ - (55^\circ + 76^\circ) = 180^\circ - 131^\circ$$

$$= 49^\circ \text{ As } \square ABCD \text{ is cyclic quadrilateral,}$$

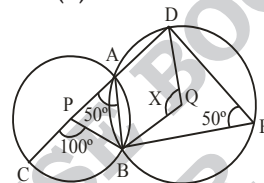
$$\text{so } \angle ABC = 180^\circ - \angle ADC = 180^\circ - 76^\circ$$

$$= 104^\circ \text{ So, in } \triangle ABF$$

$$\angle AFB = 180^\circ - (49^\circ + 104^\circ)$$

$$= 180^\circ - 153^\circ = 27^\circ$$

28. Sol. (d)



Construction : we take a point E on the arc such that $ABED$ is a cyclic quadrilateral.

$\angle PAB = \frac{1}{2}\angle BPC$ (angle subtended at arc is half the angle subtended at the centre.)

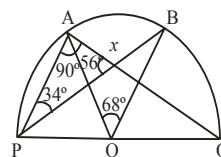
$$\angle PAB = \frac{1}{2} \times 100^\circ = 50^\circ$$

$\angle BED = \angle PAB = 50^\circ$ (external angle property of cyclic quadrilateral) $\angle BQD = 2\angle BED$ (angle subtended at centre)

$$\angle BQD = 2 \times 50^\circ = 100^\circ$$

29. Sol. (d)

Given



In $\triangle APX$,

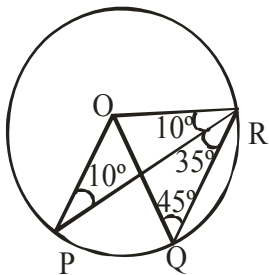
$$\angle PAX = 90^\circ \text{ (angle in semicircle)}$$

$$\angle APX = 34^\circ$$

$$\angle AOB = 2(\angle APB)$$

$$\angle AOB = 2 \times 34 = 68^\circ$$

30. Sol. (c)



$$\begin{aligned}\angle POQ &= 2 \times \angle PRQ \\ &= 2 \times 35 = 70^\circ\end{aligned}$$

31. Sol. (b)

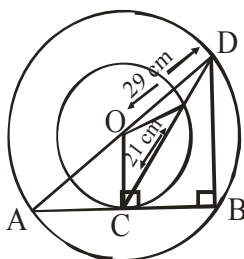
Given,

Two concentric circles

A.T.Q.

$$OA = OD = 29 \text{ cm}$$

$$OC = 21 \text{ cm}$$



If a line divides any two circle in the same ratio

$\left(\frac{AO}{OD} = \frac{AC}{CB}\right)$ then the line is parallel to The third line.

$$\Rightarrow BD \parallel OC$$

$$\Rightarrow BD = 2OC$$

$$\Rightarrow BD = 2 \times 21 \Rightarrow 42 \text{ cm}$$

$$\Rightarrow \text{In } \triangle AOC,$$

$$\Rightarrow (AO)^2 = (OC)^2 + (AC)^2$$

$$\Rightarrow (29)^2 = (21)^2 + (AC)^2$$

$$\Rightarrow 841 - 441 = (AC)^2$$

$$\Rightarrow 20 = AC$$

In $\triangle BCD$, $\angle B = 90^\circ$ (angle in semi-circle)

$$\Rightarrow CD^2 = BD^2 + BC^2$$

$$\Rightarrow CD^2 = (42)^2 + (20)^2$$

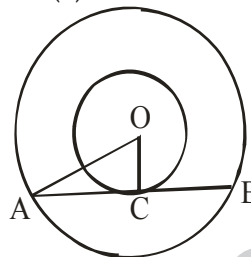
$$\Rightarrow CD^2 = 1764 + 400$$

$$\Rightarrow CD^2 = 2164$$

$$\Rightarrow CD = \sqrt{2164}$$

$$\approx 46.5 \text{ cm}$$

32. Sol. (b)



Given, $AO = 20 \text{ cm}$ and $OC = 16 \text{ cm}$

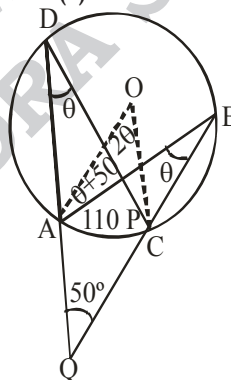
From pythagoras theorem,

$$AC^2 = AO^2 - OC^2$$

$$\Rightarrow AC = \sqrt{400 - 256} = 12$$

So, length of the larger chord is 24 cm

33. Sol. (a)



$\angle APD$ में, $\angle ADC = \angle ABC = \theta$ (angle on same arc)

In $\triangle AQB$,

$$\angle DAB = \theta + 50 \text{ (exterior angle)}$$

In $\triangle ADM$,

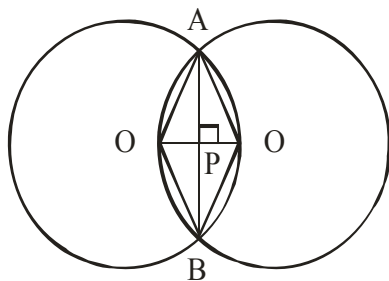
$$\theta + \theta + 50 = 110^\circ$$

$$2\theta = 60^\circ$$

34. Sol. (c)

AOO' is an equilateral triangle, as $OA = AO' =$

$OO' = \text{radius}$



$$AP = \frac{\sqrt{3}}{2}a$$

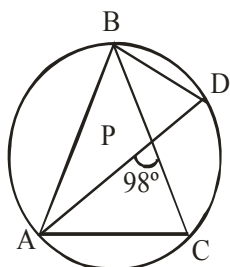
$$AB = 2AP$$

$$AB = \sqrt{3}a$$

35. Sol.(c) $\angle BDA = \angle BCA = 60^\circ$
(see theorem 'I')

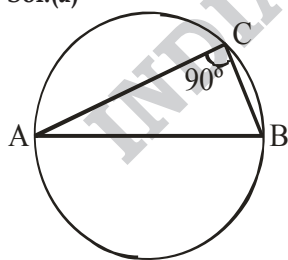
$$\angle BPD = \angle APC = 98^\circ$$

In $\triangle PBD$



$$\begin{aligned}\angle PBD + \angle BPD + \angle BDP &= 180^\circ \\ \Rightarrow \angle PBD &= 180^\circ - 98^\circ - 60^\circ = 22^\circ\end{aligned}$$

36. Sol.(a)

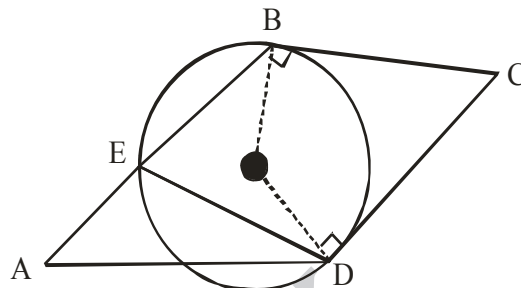


Given, radius of the circle = 5 units

Theorem used: When angles subtended at the circumference of a circle from the two end points of a chord is 90° , then that chord is act as the diameter of the circle.

Length of the chord $AB = 2 \times 5 = 10$ units

37. Sol. (c)
Let OBE the centre of the circle Then,



$$\angle BOD = 180^\circ - \angle BCD$$

And

$$\begin{aligned}\angle BED &= \frac{1}{2} \angle BOD \\ &= \frac{1}{2} (180^\circ - \angle BCD) = 90^\circ - \frac{\angle BCD}{2}\end{aligned}$$

For Δ AED

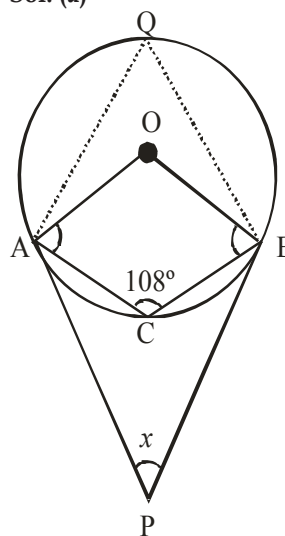
$$\angle EAD + \angle ADE = \angle BED$$

$$\Rightarrow \angle EAD + 15^\circ = 90^\circ - \frac{\angle BCD}{2}$$

$$\Rightarrow \frac{3\angle BAD}{2} = 75^\circ$$

$$\Rightarrow \angle BAD = 50^\circ$$

38. Sol. (a)



Let Q be the point on the major arc, and O be the centre of the circle.

So, $\square APBQ$ becomes cyclic quadrilateral.

So, $\angle AQB = 180^\circ - \angle ACB = 180^\circ - 108^\circ = 72^\circ$ and $\angle AOB = 2(\angle AQB) = 2(72^\circ) = 144^\circ$

In $\square AOBP$, $\angle OAP = \angle OBP =$

90° ($\because$ radius from centre is perpendicular to the tangent)

So, in $\square AOBP$,

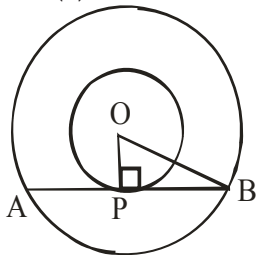
$$144^\circ + 90^\circ + 90^\circ + x = 360^\circ$$

$$x = 360^\circ - 324^\circ = 36^\circ$$

$$x = 36^\circ$$

So, $\angle APB = x = 36^\circ$

39. Sol. (d)



In $\triangle OPB$

$$OB^2 = OP^2 + PB^2$$

$$(10)^2 = (8)^2 + PB^2$$

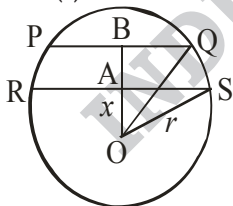
$$PB^2 = 100 - 64$$

$$PB^2 = 36$$

$$PB = 6 \text{ cm}$$

$$AB = 2 PB = 2 \times 6 = 12 \text{ cm}$$

40. Sol. (c)



$$BQ = \frac{PQ}{2} = \frac{10}{2} = 5 \text{ cm}, AS = \frac{RS}{2} = \frac{24}{2}$$

$$= 12 \text{ cm}, AB = 7 \text{ cm}, OQ = OS = r$$

In $\triangle BOQ$, $OB^2 + BQ^2 = OQ^2$

$$(7 + x)^2 + 5^2 = r^2 - (1)$$

In $\triangle OAS$,

$$OA^2 + AS^2 = OS^2 \Rightarrow x^2 + 12^2 = r^2 - (2)$$

From equation (1) and (2) We get,

$$(7 + x)^2 + 5^2 = x^2 + 12^2$$

$$49 + x^2 + 14x + 25 = x^2 + 144$$

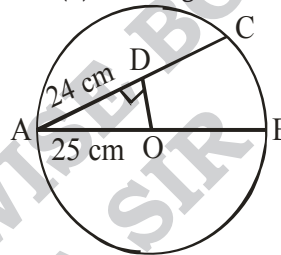
$$74 + 14x = 144 \Rightarrow 14x = 70 \Rightarrow x = 5 \text{ cm}$$

Now putting $x = 5$

Now putting $x = 5$ in equation (2)

$$r^2 = 5^2 + 12^2 = 169 \Rightarrow r = 13 \text{ cm}$$

41. Sol. (d) In triangle ADO,



$$AO^2 - AD^2 = OD^2$$

$$(25)^2 - (24)^2 = OD^2$$

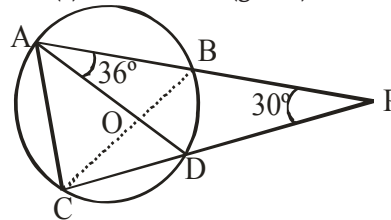
$$625 - 576 = OD^2$$

$$49 = OD^2$$

$$OD = 7 \text{ cm.}$$

So, the length of the perpendicular drawn from the centre of the circle to the chord is 7 cm.

42. Sol (c) $\angle DAP = 36^\circ$ (given), $\angle APC = 30^\circ$ (given)



$$\angle ADC = \angle DAP + \angle DPA \text{ (exterior angle property)}$$

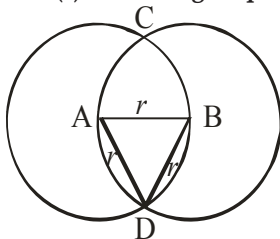
$$\angle ADC = 66^\circ$$

$\angle ACD = 90^\circ$ (Angle subtended by the diameter at the circumference of the circle is 90°) $\Rightarrow$ In triangle ACD

$$\angle CAD = 180^\circ - (90^\circ + 66^\circ) = 24^\circ$$

$\angle CBD = \angle CAD = 24^\circ$ (Angle at the circumference of the circle by same chord are equal)

49. Sol. (c) According to question



$$AB = AD = DB = r$$

$\therefore \triangle ADB$ is an equilateral triangle

$$\angle DBA = 60^\circ$$

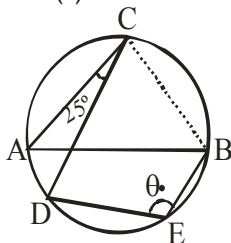
Similarly in $\triangle ABC$

$$\angle ABC = 60^\circ$$

$$\angle DBC = 60^\circ + 60^\circ$$

$$\therefore \angle DBC = 120^\circ$$

50. Sol. (a)



Construct CB

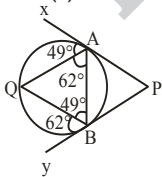
In $\triangle ACB$, $\angle C = 90^\circ$, So $\angle DCB = 65^\circ$

As, BCDE is a cyclic quadrilateral

$$\text{so } \angle C + \angle E = 180^\circ$$

$$\angle BED = 180^\circ - 65^\circ = 115^\circ$$

51. Sol. (c)



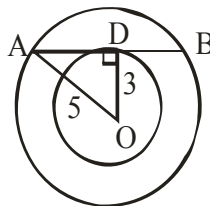
$$\angle YBQ - \angle QAB = 62^\circ \text{ (alternate segment th.)}$$

$$\angle XAQ - \angle QBA = 49^\circ \text{ (alternate segment th.)}$$

$$\angle AQB = 180 - (62 + 49) = 69$$

52. Sol. (d)

According to question



$$\text{Let } AD = DB = x$$

$$OA = 5 \text{ cm}$$

$$OD = 3 \text{ cm}$$

In $\triangle ODA$

$$OA^2 = OD^2 + AD^2$$

$$(5)^2 = (3)^2 + (AD)^2$$

$$25 = 9 + (AD)^2$$

$$(AD)^2 = 25 - 9$$

$$(AD)^2 = 16$$

$$AD = 4$$

$$\therefore AB = 2 \times AD$$

$$\therefore AB = 2 \times 4 = 8 \text{ cm}$$

Alternate:-

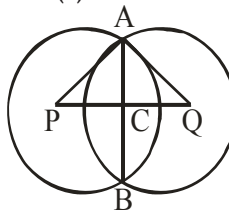
In $\triangle AOD$ 3, 4, 5 (triplet)

$$AD = 4 \text{ cm}$$

$$AB = 2AD$$

$$= 2 \times 4 = 8 \text{ cm}$$

53. Sol. (a)



$$AB = 20 \text{ cm}, AC = \frac{20}{2} = 10 \text{ cm}$$

$$PA = 18 \text{ cm}, QA = 16 \text{ cm}$$

In right angle triangle PAC

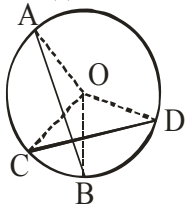
$$PC = \sqrt{18^2 - 10^2} = 4\sqrt{14}$$

In right angle triangle QAC

$$QC = \sqrt{16^2 - 10^2} = 2\sqrt{39}$$

$$\text{Distance between the centers} = 4\sqrt{14} + 2\sqrt{39}$$

54. Sol.(c)



Join $AO, ODOC$ and OB

$$m\widehat{AC} + m\widehat{BD} = \angle AOB + \angle COD - m\widehat{BC}$$

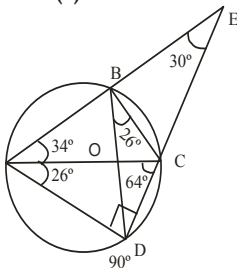
$$\Rightarrow m\widehat{AC} + m\widehat{BD}$$

$$= 113^\circ - 119^\circ - 32^\circ = 100^\circ$$

$$\angle APC = \frac{1}{2}(m\widehat{AC} + m\widehat{BD})$$

$$= \frac{1}{2}(100^\circ) = 50^\circ$$

55. Sol. (c)



$\angle ACD$ is an exterior angle of $\triangle AEC$

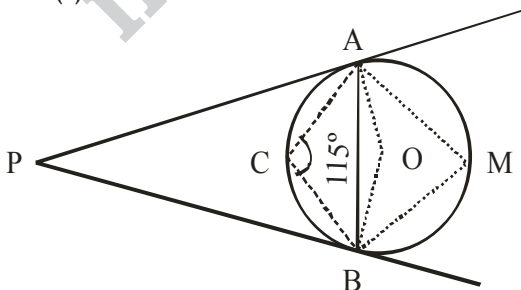
$$\angle ACD = 34^\circ + 30^\circ = 64^\circ$$

$\angle ADC = 90^\circ$ (angle in semicircle)

$\angle CAD = \angle CBD = 36^\circ$ (angle on same arc)

$$\angle CBD = 26^\circ$$

56. Sol. (a)



$$\angle AMB = 180^\circ - 115^\circ = 65^\circ$$

$$\angle AOB = 2 \times 65^\circ = 130^\circ$$

$$\angle APB = 180^\circ - 130^\circ = 50^\circ$$

$$\angle APB = 50^\circ$$

57. Sol. (d)

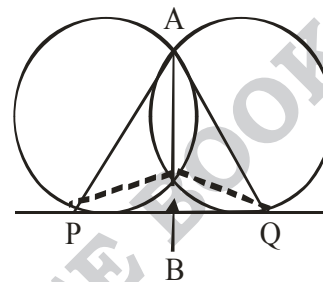
Join BQ and BP

$$\angle BQP = \angle BAQ$$

$$\angle BPQ = \angle PAB$$

$$\text{Now, } \angle PAQ = \angle PAB + \angle QAB$$

In $\triangle PBQ$



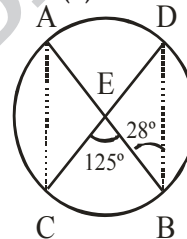
$$\angle PBQ = 180^\circ - (\angle BPQ + \angle BQP)$$

$$\Rightarrow \angle PBQ = 180^\circ - (\angle PAB + \angle BAQ)$$

$$\Rightarrow \angle PBQ = 180^\circ - (\angle PAQ)$$

$$\Rightarrow \angle PAQ + \angle PBQ = 180^\circ$$

58. Sol. (d)



From the figure (Figure is not as per scale)

$\angle DBE = 28^\circ$ so $\angle ACD = 28^\circ$ (angle made by same arc)

$$\angle CEA = 180^\circ - 125^\circ = 55^\circ$$

In $\triangle ACE$

$$\angle BAC = 180^\circ - (55^\circ + 28^\circ) = 97^\circ$$

59. Sol.(c)

$$\text{Let } \angle BCQ = \alpha = \angle BAC$$

Then, In triangle PBC

$$34^\circ + x = \alpha \quad \dots(i)$$

In triangle ABC

$$\alpha + 34^\circ = 90^\circ \quad \dots(ii)$$

On adding (i) and (ii)

$$68^\circ + x = 90^\circ$$

$$\Rightarrow x = 90^\circ - 68^\circ = 22^\circ$$

$$CB = 6 \text{ cm}, OC = 8 \text{ cm}$$

In triangle OBP and OCB

$$\angle POB = \angle COB \Rightarrow \angle OCB = \angle PBO = 90^\circ$$

$$\triangle OBP \sim \triangle OCB$$

$$\frac{OP}{OB} = \frac{OB}{OC} \Rightarrow \frac{OP}{10} = \frac{10}{8}$$

$$\Rightarrow OP = 12.5 \text{ cm}$$

Alternate :-

$$BC^2 = 10^2 - 8^2 = 6 \text{ cm}$$

using 90 into 90 tools

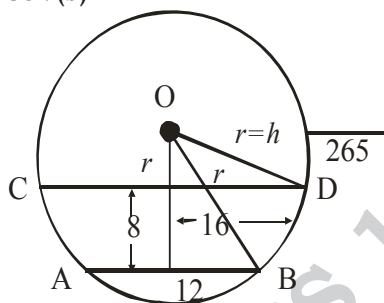
$$BC^2 = OC \times CP$$

$$\Rightarrow 6 \times 6 = 8 \times CP$$

$$\Rightarrow CP = 4.5 \Rightarrow OP = OC + CP$$

$$= 8 + 4.5 = 12.5$$

65. Sol. (b)



$$r^2 = 16^2 + x^2 = (x + 8)^2 \neq 12^2$$

$$16^2 - 12^2 = (x + 8)^2 - x^2$$

$$= x^2 + 64 + 16x - x^2$$

$$28 \times 4 = 8(2x + 8)$$

$$2x = 6, x = 3$$

$$r^2 = 256 + 9$$

$$r = \sqrt{265}$$

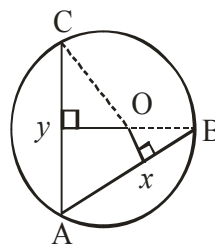
$$\text{Area} = 3.14 \times 265$$

$$832.86 \text{ cm}^2$$

66. Sol. (c)

Let OX and OY be the perpendiculars on AB and

AC respectively and let CA = 2x Then,



$$AB = 4x$$

In $\triangle CYO$

$$CO^2 = CY^2 + YO^2$$

$$r^2 = x^2 + q^2 \quad \dots (i)$$

In $\triangle OXB$

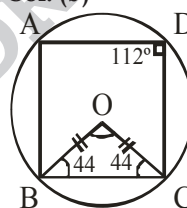
$$OB^2 = OX^2 + XB^2$$

$$r^2 = p^2 + 4x^2 \quad \dots (ii)$$

$$4(i) - (ii)$$

$$\Rightarrow 4q^2 - p^2 = 3r^2$$

67. Sol. (b)



$$\angle ABC = 180^\circ - \angle ADC (\because \text{Cyclic quad.})$$

$$\angle ABO = 180 - 112 - 44$$

$$= 24^\circ$$

68. Sol. (a)

ATQ

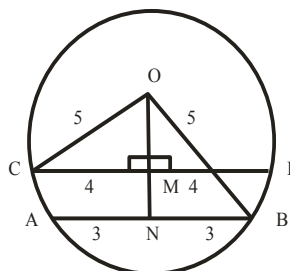
$$CM = MD = 4 \text{ cm}$$

$$AN = NB = 3 \text{ cm}$$

In $\triangle OMC$

$$OC^2 = MC^2 + OM^2$$

$$(5)^2 = (4)^2 + OM^2$$



$$OM = 3 \text{ cm}$$

In $\triangle ONB$

$$OB^2 = ON^2 + NB^2$$

$$(5)^2 = ON^2 + (3)^2$$

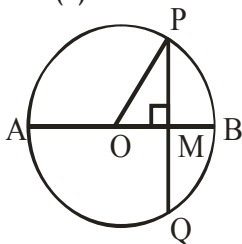
$$ON = 4 \text{ cm}$$

$$\therefore MN = ON - OM$$

$$MN = 4 - 3$$

$$MN = 1 \text{ cm}$$

69. Sol. (d)



$$AB = 18, AM = \frac{5}{9} \times 18 = 10, AO = 9$$

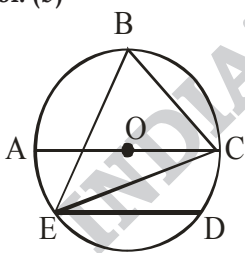
$$OM = 10 - 9 = 1 \text{ cm}$$

In triangle OMP

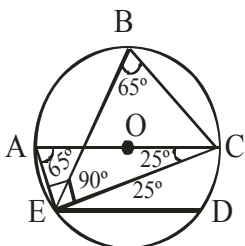
$$PM = \sqrt{OP^2 - OM^2} = \sqrt{81 - 1} = 4\sqrt{5}$$

$$PQ = 2 \times 4\sqrt{5} = 8\sqrt{5} \text{ cm}$$

70. Sol. (b)



Gain



Draw a line AE

$$\angle EBC = \angle EAC = 65^\circ \text{ (angle on same arc)}$$

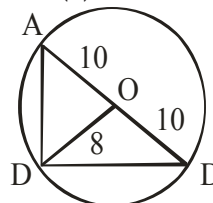
$$\angle AEC = 90^\circ \text{ (angle in semi circle)}$$

$$\angle ACE = 25^\circ$$

$$\angle AED = \angle CED = 25^\circ \text{ (angle in semi circle)}$$

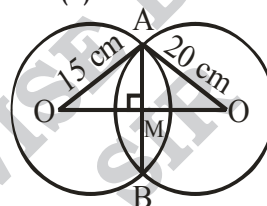
$$\angle DEC = 25^\circ$$

71. Sol. (b)



$$\begin{aligned} \text{Area of triangle} &= \frac{1}{2} \times 20 \times 8 \\ &= 80 \text{ cm}^2 \end{aligned}$$

72. Sol. (d)



$$OO' = 25 \text{ cm}$$

$$\therefore (25)^2 = (15)^2 + (20)^2$$

$\therefore \triangle OAO$ is a right angle triangle

AB is common chord

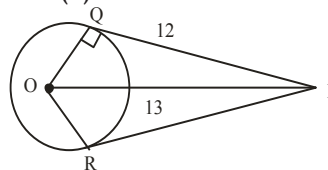
$$\triangle OMA \cong \triangle OAO$$

$$\therefore \angle OAO = \angle AMO = 90^\circ \text{ and } \angle O = \angle O \text{ (common)}$$

$$\frac{OA}{OO'} = \frac{AM}{O'A} \Rightarrow AM = \frac{15 \times 20}{25} = 12 \text{ cm}$$

$$\therefore AB = 2AM = 24 \text{ cm}$$

73. Sol. (d)



In right angled triangle PQO

$$OQ = \sqrt{PO^2 - PQ^2} = \sqrt{13^2 - 12^2} = 5$$

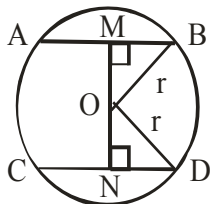
Area of triangle PQO

$$= \frac{1}{2} \times PQ \times OQ = 30$$

Area of the quadrilateral PQOR = 2 $\times$ Area of triangle PQO = 60

74. Sol. (a)

According to question Given:



$AB = CD = 8 \text{ cm}, r = 5 \text{ cm}$

$\therefore$ In $\triangle OMB$

$$O^2 = OM^2 + MB^2$$

$$r^2 = OM^2 + (4)^2$$

$$(5)^2 = OM^2 + 16$$

$$25 - 16 = OM^2$$

$$OM^2 = 25 - 16$$

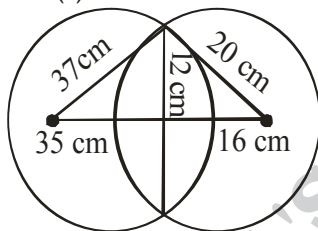
$$OM^2 = 9$$

$$OM = 3$$

$$\therefore MN = 2 \times OM$$

$$MN = 2 \times 3 = 6 \text{ cm}$$

75. Sol. (a)



(Triplets)

$$12, 16, 20$$

$$12, 35, 37$$

$$D = 35 + 16$$

$$= 51 \text{ cm.}$$

76. Sol. (d) $\angle AOC = 118^\circ$

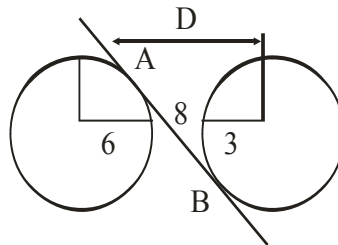
$$\angle ABC = \frac{118}{2} = 59^\circ$$

$$\angle ACD = \angle ABC = 59^\circ \text{ (Alternate segment theorem)}$$

77. Sol. (a) According to question

Let length of transverse common tangent = $AB =$

8 cm Distance between them = d



$$AB = \sqrt{d^2 - (R_1 + R_2)^2}$$

$$AB^2 = d^2 - (R_1 + R_2)^2$$

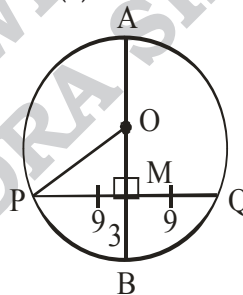
$$(8)^2 = d^2 - (6 + 3)^2$$

$$64 = d^2 - 81$$

$$d^2 = 145$$

$$d = \sqrt{145}$$

78. Sol. (b)



According to the question

$$\text{Let } OA = x = OP$$

$$AB = 2x$$

$$OM = x - 3$$

In $\triangle OMP$,

$$x^2 = (9)^2 + (x - 3)^2$$

$$x^2 = 81 + x^2 + 9 - 6x$$

$$90 = 6x$$

$$x = 15$$

$$\therefore AB = 2 \times 15 = 30 \text{ cm.}$$

Alternate:-

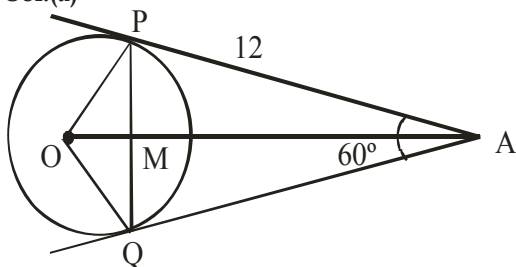
$$PM \times MQ = MB \times AM$$

$$9 \times 9 = 3 \times x$$

$$x = 27$$

$$\therefore AB = AM + BM = 27 + 3 = 30 \text{ cm}$$

79. Sol.(a)



$$AP = 12 \text{ cm}, \angle PAO = 30^\circ$$

$$\angle APO = 90^\circ, \angle AOP = 60^\circ$$

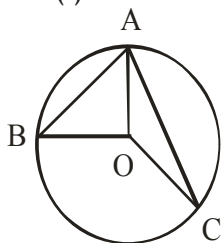
$$\tan 60^\circ = \frac{AP}{OP} \Rightarrow \sqrt{3} = \frac{12}{OP}$$

$$OP = 4\sqrt{3}, AO = 8\sqrt{3}$$

$$\frac{1}{2} \times 12 \times 4\sqrt{3} = \frac{1}{2} \times 8\sqrt{3} \times PM$$

$$PM = 6 \text{ cm}, PO = 2 \times 6 = 12 \text{ cm}$$

80. Sol. (c)



$$\angle AOB = 110^\circ \Rightarrow \angle AOC = 130^\circ$$

$$\angle AOB + \angle AOC = 240^\circ$$

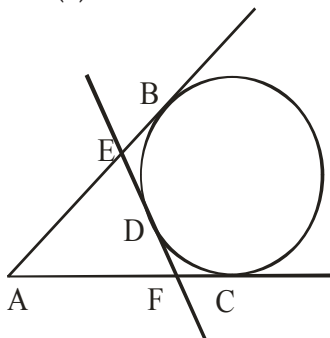
Sum of angles formed at the centre of the circle is 360°

$$\text{Thus, } \angle COB = 120^\circ$$

We know, the angle formed at the centre is double the angle formed at the circumference.

$$\text{So, } \angle BAC = 60^\circ$$

81. Sol. (d)

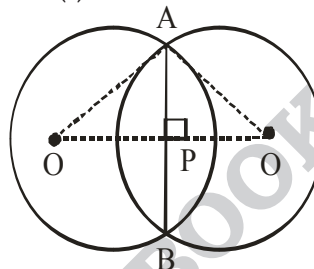


$$AC = AB = 15 \text{ cm (By tangent rule)}$$

$$DE = DF = BE = 3 \text{ cm}$$

$$AE = 15 - 3 = 12 \text{ cm}$$

82. Sol. (c)



Let O and O' be the centres of the circles

Join OO' , AO' and AO'

and let OO' and AB

intersect at P

$$AP = \frac{AB}{2} = \frac{6}{2} = 3 \text{ cm}$$

In triangle OAP

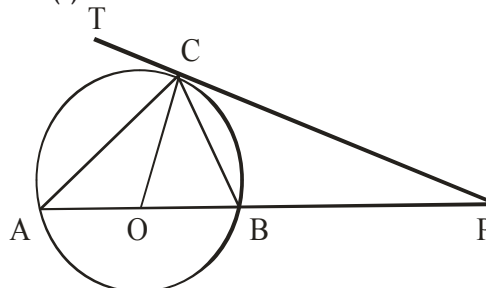
$$OP = O'P$$

$$(\because AO = AO')$$

$$= \sqrt{OA^2 - AP^2} = \sqrt{4^2 - 3^2} = \sqrt{7} \text{ cm}$$

$$OO' = 2(OP) = 2\sqrt{7} \text{ cm}$$

83. Sol.(c)



$$\angle BPT = 36^\circ, \angle OCP = 90^\circ$$

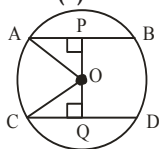
In triangle OCP

$$\angle OCP + \angle COP + \angle OPC = 180^\circ \Rightarrow \angle COP = 54^\circ$$

$$\angle CAP = \frac{1}{2} \angle COP = 27^\circ \Rightarrow \angle BCP = 27^\circ$$

(Alternate segment theorem)

84. Sol. (a)



$$AB = 16$$

$$\Rightarrow AP = \frac{1}{2} \times 16 = 8$$

In triangle APO

$$PO^2 = AO^2 - AP^2$$

$$= 17^2 - 8^2 = 15^2$$

$$\Rightarrow PO = 15$$

$$OQ = PQ - PO = 23 - 15 = 8 \text{ cm}$$

In triangle COQ

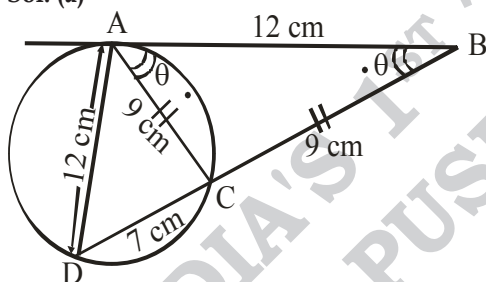
$$CQ^2 = CO^2 - OQ^2$$

$$= 17^2 - 8^2 = 15^2$$

$$\Rightarrow CQ = 15 \text{ cm}$$

$$CD = 2(CQ) = 2(15) = 30 \text{ cm}$$

85. Sol. (a)



$\angle BAC = \angle ADC$ (alternate segment th.)

$$\therefore AD = AB$$

$$AB^2 = 9 \times 16 = 144$$

$$AB = 12 \text{ cm} = AD$$

86. Sol. (a)

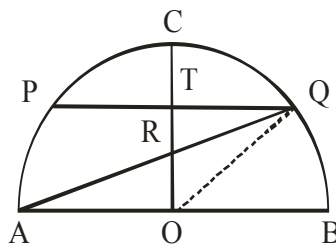
$$360^\circ = 2\pi r \text{ (where } r = \text{radius)}$$

$$\text{Then, } \frac{42^\circ}{360^\circ} = \frac{44}{2\pi r}$$

$$\therefore r = \frac{44 \times 360^\circ}{2 \times \frac{22}{7} \times 42^\circ} = 60 \text{ m.}$$

87. Sol. (c)

Join OQ



$$OT = 6 \text{ and } CT = 2$$

In triangle OTQ

$$TQ^2 = OQ^2 - OT^2$$

$$= 64 - 36 = 28$$

$$\Rightarrow TQ = \sqrt{28} = 2\sqrt{7}$$

Now

$$\triangle ARO \sim \triangle QRT \text{ (by AAA)}$$

$$\Rightarrow \frac{TR}{RO} = \frac{TQ}{AO}$$

$$\Rightarrow \frac{TR}{RO} = \frac{2\sqrt{7}}{8}$$

Add 1 on both sides

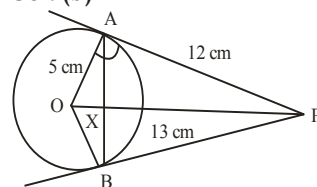
$$\Rightarrow \frac{TR}{RO} + 1 = \frac{\sqrt{7}}{4} + 1$$

$$\Rightarrow \frac{TO}{RO} = \frac{\sqrt{7} + 4}{4}$$

$$\Rightarrow RO = \frac{4(TO)}{\sqrt{7} + 4} = \frac{4(6)(4 - \sqrt{7})}{(4 + \sqrt{7})(4 - \sqrt{7})}$$

$$= \frac{4(6)(4 - \sqrt{7})}{(16 - 7)} = \frac{8}{3}(4 - \sqrt{7})$$

88. Sol. (b)



$$\text{Area of } \triangle PAB, M = \frac{1}{2} \times AB \times PX$$

$$\text{Let } OX = a \text{ and } PX = 13 - a$$

$$\text{Area of } \triangle PAO = \frac{1}{2} \times AO \times PX$$

$$= \frac{1}{2} \times AX \times PO$$

$$\Rightarrow \frac{1}{2} \times 5 \times 12 = \frac{1}{2} \times AX \times 13$$

$$\Rightarrow AX = \frac{60}{13}$$

$$AB = 2 \times AX = \frac{120}{13}$$

Use pythagoras theorem in $\triangle AXO$;

$$OX^2 = OA^2 - AX^2$$

$$\Rightarrow OX^2 = 5^2 - \left(\frac{60}{13}\right)^2 \Rightarrow OX = \frac{25}{13}$$

$$PX = 13 - \frac{25}{13} = \frac{169-25}{13} = \frac{144}{13}$$

Area of $\triangle PAB$,

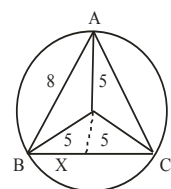
$$M = \frac{1}{2} \times \frac{120}{13} \times \frac{144}{13}$$

$$\sqrt{\frac{M}{15}} = \sqrt{\frac{1}{15} \times \frac{1}{2} \times \frac{120}{13} \times \frac{144}{13}}$$

$$= \frac{24}{13}$$

89. Sol. (c)

$$R = \frac{abc}{4\Delta}$$

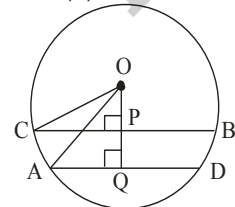


$$R = \frac{8 \times 8 \times c}{4 \times \frac{1}{2} \times c \sqrt{64 - \frac{c^2}{4}}}$$

$$5 = \frac{32}{\sqrt{64 - \frac{c^2}{4}}}$$

$$\Rightarrow \frac{c}{\frac{c^2}{4}} = \frac{1024}{25} \Rightarrow \frac{24}{4} = \frac{c^2}{25} = 9.6 \text{ cm}$$

90. Sol. (d)



Let $OP = x$

Then,

$$OQ = x + 8$$

In triangle COP

$$OC^2 = OP^2 + CP^2$$

$$\Rightarrow OC^2 = x^2 + 24^2$$

And in triangle AOQ

$$AO^2 = OQ^2 + AQ^2$$

$$\Rightarrow OA^2 = (x + 8)^2 + 20^2$$

Now

$$OC = OA \quad (\text{radius})$$

$$\Rightarrow (x + 8)^2 + 20^2 = x^2 + 24^2$$

$$\Rightarrow (x + 8)^2 - x^2 = 24^2 - 20^2$$

$$\Rightarrow (2x + 8)(8) = 44 \times 4$$

$$\Rightarrow x + 4 = 11$$

$$\Rightarrow x = 7 \text{ cm}$$

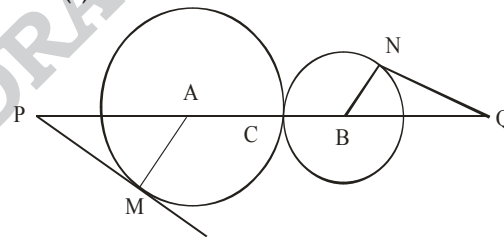
In triangle COP

$$OC^2 = OP^2 + CP^2$$

$$= 7^2 + 24^2 = 25^2$$

$$\Rightarrow OC = 25 \text{ cm}$$

91. Sol. (c)



$MP = 15 \text{ cm}$, $NQ = 8 \text{ cm}$, $PA = 17 \text{ cm}$ and $BQ =$

10 cm

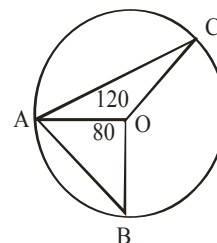
$$AM = \sqrt{17^2 - 15^2} = 8 \text{ cm}$$

$$NB = \sqrt{10^2 - 8^2} = 6 \text{ cm}$$

$$AB = 8 + 6 = 14 \text{ cm}$$

92. Sol. (b)

$$\angle BOC = (360 - 80 - 120)^\circ = 16^\circ$$

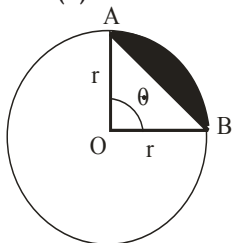


Angle formed at the circumference of the circle is

half the angle formed at its centre. Therefore,

$$\angle BAC = 80^\circ$$

93. Sol. (b)



Required area is the shaded portion

= Area of sector $\widehat{AOB}$ - Area of triangle AOB

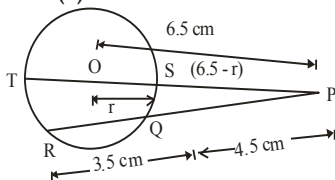
$$= \frac{1}{2\pi} \cdot \pi r^2 \cdot (\theta) - \frac{1}{2} \cdot AO \cdot OB \cdot \sin(\theta)$$

$$= \frac{1}{2} r^2 (\theta) - \frac{1}{2} \cdot r^2 \cdot \sin \theta$$

$$= \frac{1}{2} r^2 (\theta - \sin \theta)$$

$$= \frac{1}{2} r^2 \left(\theta - 2 \cdot \sin \frac{\theta}{2} \cdot \cos \frac{\theta}{2} \right)$$

94. Sol. (a)



$$PS \times PT = PQ \times PR$$

$$(6.5 - r)(6.5 + r) = 4.5 \times 8$$

$$6.5^2 - r^2 = 36 \Rightarrow 6.5^2 - r^2 = 6^2$$

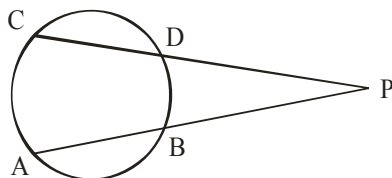
$$6.5^2 - 6^2 = r^2$$

$$r^2 = 2.5^2 \Rightarrow r = 2.5 \text{ cm}$$

95. Sol. (d)

$CD = 3, PD = 5$ and $AB = 6$ given

$$\Rightarrow PC = PD + CD = 5 + 3 = 8$$



Let $PB = x$, Then, $PA = x + 6$

We know that

$$PB \times PA = PD \times PC$$

$$x(x + 6) = 5 \times 8 \Rightarrow x(x + 6) = 40$$

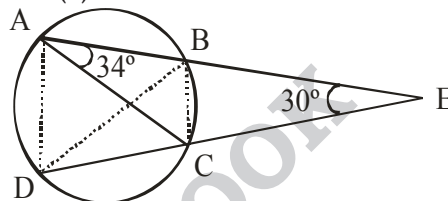
Put $x = 4$

$$x(x + 6) = 40 \Rightarrow 4(4 + 6) = 40$$

The Condition satisfied clearly $x = 4 \text{ cm}$

So, $PB = 4 \text{ cm}$

96. Sol. (b)



$$\angle ADC = 90^\circ \Rightarrow \text{In } \triangle ADE$$

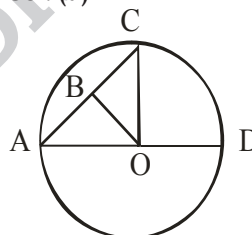
$$\angle ADC + \angle DAE + \angle AED = 180^\circ$$

$$\Rightarrow 90^\circ + \angle DAC + 34^\circ + 30^\circ = 180^\circ$$

$$\Rightarrow \angle DAC = 180^\circ - (90^\circ + 34^\circ + 30^\circ) = 26^\circ$$

$\angle DAC = \angle DBC = 26^\circ \dots$ (angle made by same chord)

97. Sol. (d)



$$\angle OCA = \angle OAC$$

$$(OA = OC = \text{radius})$$

$$\angle DOC = 60^\circ$$

$$\angle OCA + \angle OAC = \angle DOC \text{ (external opposite angle)}$$

$$2\angle OCA = 60^\circ \Rightarrow \angle OCA = 30^\circ$$

In $\triangle OBC$

$$\angle OCB = 30^\circ$$

$$\angle OBC = 180^\circ - \angle OBA$$

$$= 180^\circ - 60^\circ (\angle OBA = 60^\circ \text{ given}) = 120^\circ$$

$$\angle BOC = 180^\circ - \angle OCB - \angle OBC$$

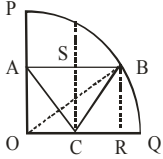
$$= 180^\circ - 30^\circ - 120^\circ = 30^\circ$$

$$\Rightarrow OB = BC = 5 \text{ cm} \dots (\angle OCB = \angle BOC)$$

Alternate :-

Remember, in such type of questions $OB = BC =$ (given value)

98. Sol. (a)



Join OB and CS where S is the mid-point of AB and draw BR perpendicular to OQ . Then,

$$BR = CS = \frac{\sqrt{3}}{2}a$$

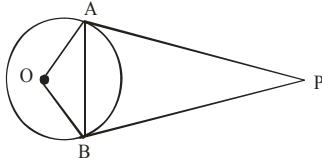
$$\text{And } OR = AB = a$$

$$\text{In } \triangle OBR, OB^2 = OR^2 + BR^2$$

$$\Rightarrow r^2 = a^2 + \frac{3a^2}{4} \Rightarrow r^2 = \frac{7a^2}{4} \Rightarrow \frac{a^2}{r^2} = \frac{4}{7}$$

$$\Rightarrow \frac{a}{r} = \frac{2}{\sqrt{7}}$$

99. Sol. (b)



$$\angle APB = 40^\circ$$

$$OA \perp AP \text{ and } OB \perp PB$$

(Angle made by radius on tangent)

$$\text{In } \triangle OAPB$$

$$\angle APB + \angle PBO + \angle BOA + \angle OAP = 360^\circ$$

$$\Rightarrow 40^\circ + 90^\circ + \angle BOA + 90^\circ = 360^\circ$$

$$\Rightarrow \angle BOA = 360^\circ - 220^\circ = 140^\circ$$

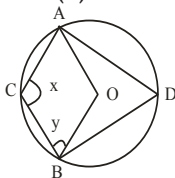
$$\text{In } \triangle OAB, \angle OAB = \angle OBA$$

$$(OB = OA = \text{radius})$$

$$\Rightarrow \angle BOA + \angle OAB + \angle OBA = 180^\circ$$

$$\Rightarrow 140^\circ + 2\angle OAB = 180^\circ \Rightarrow \angle OAB = 20^\circ$$

100. Sol. (d)



$$\text{Let } \angle ACB = x \text{ and } \angle CBO = y$$

$$\Rightarrow \angle ADB = 180^\circ - x \Rightarrow \angle AOB = 2(180^\circ - x)$$

$$x + y = 180^\circ \dots\dots(AC \parallel OB)$$

$$\Rightarrow y = 180^\circ - x$$

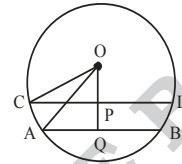
$$\Rightarrow \angle AOB + \angle OBC = 180^\circ \dots\dots(AC \parallel OB)$$

$$\Rightarrow 2(180^\circ - x) + 180^\circ - x = 180^\circ$$

$$\Rightarrow 360^\circ = 3x \Rightarrow x = 120^\circ$$

101. Sol. (a)

Given,



$$AB = 6 \text{ cm} \Rightarrow CD = 12 \text{ cm}$$

$$\text{Let } OP = x, PQ = \frac{CD}{4} = \frac{12}{4} = 3 \text{ cm}$$

$$\text{Radius of the circle} = \sqrt{6^2 + x^2}$$

$$= \sqrt{3^2 + (x+3)^2} = 36 + x^2 = 9 + 9 + 6x + x^2$$

$$6x = 18 \Rightarrow x = 3 \dots (i)$$

From equation (i)

$$\text{Radius of the circle} = \sqrt{6^2 + 3^2}$$

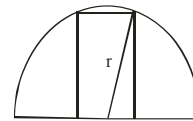
$$= \sqrt{3^2 + (3+3)^2} = \sqrt{45} = 3\sqrt{5}$$

102. Sol. (b)

Side of the square inscribed in a semicircle of

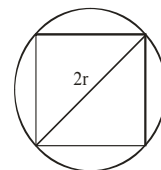
$$\text{radius } r \text{ is } s, \text{ then } (r)^2 = (s)^2 + \left(\frac{s}{2}\right)^2 \Rightarrow r^2 = \frac{5s^2}{4}$$

$$\text{Area } (s)^2 = \frac{4r^2}{5}$$



When square is drawn inside a full circle, then its

$$\text{Side} = \frac{2r}{\sqrt{2}}$$



$$\therefore \text{Area} = \frac{4r^2}{2} = 2r^2$$

$$\text{Ratio} = \frac{4r^2}{2r^2} = \frac{2}{5} = 2:5$$

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Type-1 (Prism)

1. The base of a right prism is an equilateral triangle whose side is 10 cm. If height of this prism is $10\sqrt{3}$ cm, then what is the total surface area of prism?

एक सम प्रिज्म का आधार एक समबाहु त्रिभुज है जिसकी भुजा 10 सेमी है यदि इस प्रिज्म की ऊँचाई $10\sqrt{3}$ सेमी है, तो प्रिज्म का कुल सतह क्षेत्रफल क्या है?

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- (a) $125\sqrt{3}$ cm² (b) $325\sqrt{3}$ cm²
(c) $150\sqrt{3}$ cm² (d) $350\sqrt{3}$ cm²

2. The base of a right prism is a triangle whose sides are 8 cm, 15 cm and 17 cm, and its lateral surface area is 480 cm². What is the volume (in cm³) of the prism?

एक सम प्रिज्म का आधार एक त्रिभुज है जिसकी भुजाएँ 8 सेमी, 15 सेमी और 17 सेमी हैं, और इसकी पार्श्व सतह का क्षेत्रफल 480 सेमी² है। प्रिज्म का आयतन (सेमी³ में) क्या है?

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- (a) 540 (b) 600
(c) 720 (d) 640

3. The base of a right prism is a triangle with sides 16 cm, 30 cm and 34 cm. Its height is 32 cm. The lateral surface area (in cm²) and the volume (in cm³) are, respectively:

एक सम प्रिज्म का आधार एक त्रिभुज है जिसकी भुजाएँ 16 सेमी, 30 सेमी और 34 सेमी हैं। इसकी ऊँचाई 32 सेंटीमीटर है। पार्श्व सतह क्षेत्र (सेमी² में) और मात्रा (सेमी³ में) क्रमशः हैं:

SSC CGL Tier II 29/01/2022

- (a) 2560 and 7680 (b) 2688 and 7680
(c) 2624 and 7040 (d) 2560 and 6400

4. The base of a right prism is a regular hexagon of side 5 cm. If its height is $12\sqrt{3}$ cm, then its volume (in cm³)

एक सम प्रिज्म का आधार 5 सेमी भुजा वाला एक नियमित षट्भुज है। यदि इसकी ऊँचाई $12\sqrt{3}$ cm सेमी है, तो इसका आयतन (सेमी³ में)

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- (a) 900 (b) 1800 (c) 1350 (d) 675

5. A prism has as the base a right angled triangle whose sides adjacent to the right angles are 10 cm and 12 cm long. The height of the prism is 20 cm. the density of the material of the prism is 6gm/ cubic cm. the weight of the prism is

एक प्रिज्म का आधार एक समकोण त्रिभुज है जिसकी समकोणों की आसन्न भुजाएँ 10 सेमी और 12 सेमी लंबी हैं। प्रिज्म की ऊँचाई 20 सेमी है। प्रिज्म के पदार्थ का घनत्व 6 ग्राम/घन सेमी है। प्रिज्म का वजन है

- (a) 6.4 kg (b) 7.2 kg
(c) 3.4 kg (d) 4.8 kg

6. Height of a prism-shaped part of a machine is 8 cm and its base is an isosceles triangle, whose each of the equal sides is 5 cm and remaining side is 6 cm. The volume of the part is

एक मशीन के प्रिज्म के आकार के हिस्से की ऊँचाई 8 सेमी है और इसका आधार एक समद्विबाहु त्रिभुज है, जिसकी समान भुजाओं में से प्रत्येक 5 सेमी और शेष भुजा 6 सेमी है। भाग का आयतन है

- (a) 90 cm³ (b) 96 cm³
(c) 120 cm³ (d) 86 cm³

7. The base of right prism is a triangle whose perimeter is 28 cm and the inradius of the triangle is 4 cm. If the volume of the prism is 366 cm³, then its height is

सम प्रिज्म का आधार एक त्रिभुज है जिसका परिमाप 28 सेमी है और त्रिभुज की अन्तःत्रिज्या 4 सेमी है। यदि प्रिज्म का आयतन 366 cm³ है, तो उसकी ऊँचाई है

- (a) 6 cm (b) 8 cm
(c) 4 cm (d) None of these

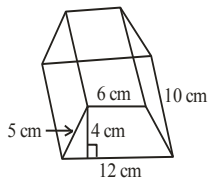
8. Calculate the volume of a prism with the height of 7 cm and an area of a base 60 cm².

7 cm ऊँचाई वाले एवं 60 सेमी आधार के क्षेत्रफल वाले प्रिज्म का आयतन की गणना कीजिए।

- (a) 420 cm³ (b) 400 cm³
(c) 450 cm³ (d) 410 cm²

9. There is a 10 cm long prism whose cross-section is an isosceles trapezoid:

एक 10 सेंटीमीटर लंबा प्रिज्म है जिसका क्रॉस-सेक्शन एक समद्विबाहु समलम्बाकार है:



What is the total surface area of the prism?

प्रिज्म का कुल पृष्ठीय क्षेत्रफल कितना है?

- (a) 350 cm^2 (b) 352 cm^2
(c) 348 cm^2 (d) None of these

10. A triangular prism has 9 edges, How many vertices does it have?

एक त्रिभुजाकार प्रिज्म के 9 किनारे हैं, यह कितने शीर्षों को बनाता है?

SSC CHSL 02/02/2017

- (a) 8 (b) 6
(c) 12 (d) 10

11. The base of a solid prism of height 10 cm is a square and its volume is 160 cm^3 , What is its total surface area of the prism (in cm^2)?

10 सेमी ऊँचाई के एक ठोस प्रिज्म का आधार एक वर्ग है और इसका आयतन 160 सेमी^3 है, प्रिज्म का कुल सतह क्षेत्रफल (सेमी^2 में) क्या है?

SSC CGL TIER II 16/11/2020

- (a) 200 (b) 192
(c) 180 (d) 176

12. A regular hexagonal base Prism has height 8 cm and side of base is 4 cm. What is the TSA of prism?

एक सम षष्ठभुज आधार वाले प्रिज्म की ऊँचाई 8 cm है, और आधार की प्रत्येक भुजा 4 cm है, तब प्रिज्म का कुल पृष्ठ क्षेत्रफल क्या होगा?

- (a) $54(3 + \sqrt{3})$ (b) $36(3 + \sqrt{3})$
(c) $48(4 + \sqrt{3})$ (d) $24(4 + \sqrt{3})$

13. A right triangular prism has equilateral triangle as its base. Side of the triangle is 15 cm. Height of the prism is $20\sqrt{3}$ cm. What is the volume of the prism?

एक लम्बवत त्रिभुजाकार प्रिज्म का आधार एक समबाहु त्रिभुज है, जिसकी प्रत्येक भुजा 15 cm है, इस प्रिज्म की ऊँचाई $20\sqrt{3}$ है, तब प्रिज्म का आयतन क्या होगा?

- (a) 1125 (b) 6750
(c) 4500 (d) 3375

14. The base of a right prism is triangle with sides 20 cm, 21 cm and 23 cm. If its volume is 7560 cm^3 then its lateral surface area (in cm^2) is:

एक सम प्रिज्म का आधार त्रिभुज है जिसकी भुजाएँ 20 सेमी, 21 सेमी और 23 सेमी हैं। यदि इसका मान 7560 सेमी^3 है तो इसका पार्श्व सतह क्षेत्रफल (सेमी^2 में) है:

- (a) 2448 (b) 2556
(c) 2484 (d) 2520

15. The base of a right prism is a square having side of 15 cm. If its height is 8 cm, then find the total surface area.

एक सम प्रिज्म का आधार एक वर्ग है जिसकी भुजा 15 सेमी है। यदि इसकी ऊँचाई 8 सेमी है, तो कुल पृष्ठीय क्षेत्रफल ज्ञात कीजिए।

SSC CGL TIER II 18/11/2020

- (a) 920 cm^2 (b) 930 cm^2
(c) 900 cm^2 (d) 940 cm^2

16. Base of a right prism is rectangle the ratio of whole length and breadth is 3:2. If the height of the prism is 12 cm and Total surface area is 288 cm^2 then the volume of the prism?

एक लम्ब प्रिज्म का आधार एक आयत है जिसकी लम्बाई और चौड़ाई का अनुपात 3:2 है यदि प्रिज्म की ऊँचाई 12 सेमी० और कुल पृष्ठ क्षेत्रफल 288 सेमी^2 है तब प्रिज्म का आयतन क्या होगा ?

- (a) 291 cm^3 (b) 288 cm^3
(c) 290 cm^3 (d) 286 cm^3

17. Base of a right prism is a triangle whose ratio of circum radius its inradius is 1:0.5 and one of its side is 8 cm. find the volume of prism. If its height is 14 cm ?

एक प्रिज्म का आधार त्रिभुजाकार है जिसके परिवृत्त और अन्तर्वृत्त की त्रिज्या का अनुपात 1:0.5 और इसकी एक भुजा 8 सेमी० है तब प्रिज्म का आयतन क्या होगा यदि इसकी ऊँचाई 14 सेमी० है ?

- (a) $224\sqrt{3}$ (b) $230\sqrt{3}$
(c) $240\sqrt{3}$ (d) $232\sqrt{3}$

18. Base of prism is triangle with sides 13, 14 and 15 cm. A cylinder is cut out from this prism whose

base is incircle of triangle. Find the volume of remaining solid when height of prism is 7 cm ?

एक लम्बवत प्रिज्म का आधार त्रिभुज है जिसकी भुजाये क्रमशः 13, 14 और 15 cm है, इस प्रिज्म से एक बेलन काटा जाता है जिसका आधार, प्रिज्म के त्रिभुजीय आधार का अन्तःवृत्त है, तब इस प्रकार शेष ठोस का आयतन क्या होगा यदि इसकी ऊँचाई 7 cm है?

- (a) 236 cm^3 (b) 242 cm^3
(c) 256 cm^3 (d) 230 cm^3

19. The base of right prism is a trapezium whose parallel sides are 11 cm and 15 cm and the distance between them is 9 cm. If the volume of the prism is 1731.6 cm^3 , then the height (in cm) of the prism will be:

सम प्रिज्म का आधार एक समलम्ब है जिसकी समांतर भुजाएँ 11 सेमी और 15 सेमी हैं और उनके बीच की दूरी 9 सेमी है। यदि प्रिज्म का आयतन 1731.6 सेमी^3 है, तो प्रिज्म की ऊँचाई (सेमी में) होगी:

SSC CGL TIER II 11/09/2019

- (a) 15.6 (b) 15.2
(c) 14.8 (d) 14.2

20. The base of a right prism, whose height is 2 cm, is a square. If the total surface area of the prism is 10 cm^2 , then its volume is:

एक सम प्रिज्म, जिसकी ऊँचाई 2 सेमी है, का बास एक वर्ग है। यदि प्रिज्म का कुल आकार क्षेत्रफल 10 सेमी है, तो इसका आयतन है:

SSC CPO 20/03/2016

- (a) 3 cm^3 (b) 1 cm^3
(c) 2 cm^3 (d) 4 cm^3

21. The base of a right prism is a $\square ABCD$. If the volume of prism is 2070. Then find the lateral surface area $AB = 9$, $BC = 14$, $CD = 13$, $DA = 12$, $\angle DAB = 90^\circ$.

एक सम प्रिज्म का आधार एक $\square ABCD$ है। यदि प्रिज्म का आयतन 2070 है। तो पार्श्व पृष्ठीय क्षेत्रफल ज्ञात कीजिए। $AB = 9$, $BC = 14$, $CD = 13$, $DA = 12$ $\angle DAB = 90^\circ$.

- (a) 720 (b) 540
(c) 920 (d) 960

22. A right prism has height 18 cm and its base is a triangle with sides 5 cm, 8 cm and 12 cm. What is the lateral surface area (in cm^2)?

एक सम प्रिज्म की ऊँचाई 18 सेमी है और इसका आधार 5 सेमी, 8 सेमी और 12 सेमी भुजाओं वाला त्रिभुज है। पार्श्व सतह क्षेत्र (सेमी² में) क्या है?

SSC CGL TIER II 13/09/2019

- (a) 450 (b) 468
(c) 432 (d) 486

23. From a prism with square base of lateral surface area 30 m^2 and height 2.5 m, two spheres of radius 42 cm and 21 cm is cut, then what will be the approximate volume of prism left after cutting the spheres?

पार्श्व सतह क्षेत्रफल 30 मी^2 और ऊँचाई 2.5 मी के वर्गाकार आधार वाले एक प्रिज्म से 42 सेमी और 21 सेमी त्रिज्या के दो गोलों को काटा जाता है, तो गोलों को काटने के बाद प्रिज्म का अनुमानित आयतन क्या होगा?

CDS 2018

- (a) 12.5 m^3 (b) 18.5 m^3
(c) 22.15 m^3 (d) 16.85 m^3

24. The height of a right prism with a square base 15 cm. If the area of the total surface of the prism is 608 sq. cm its volume is?

एक वर्गाकार आधार वाले प्रिज्म की ऊँचाई 15 cm है, यदि इस प्रिज्म का कुल पृष्ठ क्षेत्रफल 608 sq. cm है, तब इसका आयतन होगा?

- (a) 910 (b) 920
(c) 960 (d) 980

25. The base of a right prism is an equilateral triangle of area 173 cm^2 and the volume of the prism is 10380 cm^3 . The area of the lateral surface of the prism is ? [use $\sqrt{3} = 1.73$]

एक सम प्रिज्म का आधार क्षेत्रफल 173 सेमी^2 का एक समबाहु त्रिभुज है और प्रिज्म का आयतन 10380 सेमी^3 है। प्रिज्म की पार्श्व सतह का क्षेत्रफल $\text{use}(\sqrt{3}=1.73)$ है

- (a) 1200 cm^2 (b) 2400 cm^2
(c) 3600 cm^2 (d) 4380 cm^2

26. A right prism has triangular base. If v be the number of vertices, e be the number of edges and f be the number of faces of the prism. The value of $\frac{v+e-f}{2}$ is

एक सही प्रिज्म का त्रिकोणीय आधार होता है। यदि v शीर्षों की संख्या हो, e किनारों की संख्या हो और f प्रिज्म के चेहरों की संख्या हो। $\frac{v+e-f}{2}$ का मान है

- (a) 2 (b) 4
(c) 5 (d) 10

27. A right triangular prism of height 18 cm and of base sides 5 cm, 12 cm and 13 cm is transformed into another right triangular prism on a base of sides 9 cm, 12 cm and 15 cm. Find the height of new prism and the change in the whole surface area.

एक समन्वितभुजाकार प्रिज्म की ऊँचाई 18 सेमी है, और आधार की 5 सेमी, 12 सेमी और 13 सेमी है। इस प्रिज्म को एक दूसरे समन्वितभुजाकार प्रिज्म में रूपांतरित किया जाता है। जिस के आधार की भुजाएँ 9 सेमी, 12 सेमी और 15 सेमी है। तो नए प्रिज्म की ऊँचाई तथा दोनों के संपूर्ण पृष्ठीय क्षेत्रफल में अंतर ज्ञात करो।

- (a) 138 cm^2 (b) 132 cm^2
(d) 232 cm^2 (d) 140 cm^2

Type-1 (Prism) ANSWER KEY															
1	D	2	C	3	A	4	C	5	B	6	B	7	D	8	A
9	B	10	B	11	B	12	C	13	D	14	D	15	B	16	B
17	A	18	A	19	C	20	C	21	A	22	A	23	C	24	C
25	C	26	C	27	B										

Type-1 (Prism) Solution

1. Sol. (d)

Total surface area of prism = [Perimeter of base $\times$ height] + [$2 \times$ area of base] = $[(10 + 10 + 10) \times 10\sqrt{3}] + [2 \times \frac{\sqrt{3}}{4} \times 10^2]$
 $= [30 \times 10\sqrt{3}] + 50\sqrt{3}$
 $= 300\sqrt{3} + 50\sqrt{3} = 350\sqrt{3} \text{ cm}^2$

2. Sol. (c)

Lateral surface area of prism = Perimeter of base $\times$ Height

$$480 = 40 \times \text{Height} \Rightarrow \text{Height} = 12 \text{ cm}$$

Volume of prism = Area of base $\times$ height

$$= \left(\frac{1}{2} \times 8 \times 15\right) \times 12 = 720 \text{ cm}^3$$

3. Sol. (a)

16, 30 and 34 forms a triplet so it is right angled triangle.

$$\text{So, base area} = \frac{1}{2} \times 16 \times 30 = 240 \text{ cm}^2$$

$$\text{Volume of prism} = \text{base area} \times \text{height} \Rightarrow 240 \times 32 = 7680 \text{ cm}^3$$

Lateral surface area of prism = perimeter of base $\times$ height

$$\Rightarrow (16 + 30 + 34) \times 32 = 80 \times 32 = 2560 \text{ cm}^2$$

4. Sol. (c)

Regular hexagon consists of 6 equilateral triangles.

$$\text{Area of triangle} = \frac{\sqrt{3}}{4} a^2 = \frac{25\sqrt{3}}{4}$$

$$\text{Area of base} = 6 \times \text{Area of triangle} = \frac{150\sqrt{3}}{4}$$

$$\text{Volume of prism} = \text{area of base} \times \text{height} = \frac{150\sqrt{3}}{4} \times 12\sqrt{3} = 1350 \text{ cm}^3$$

5. Sol. (b)

Volume of prism

$$= \frac{1}{2} \times 10 \times 12 \times 20 = 1200 \text{ cm}^3$$

$$\Rightarrow \text{Weight of prism} = 1200 \times 6 = 7200 \text{ gm} = 7.2 \text{ kg}$$

6. Sol. (b)

Volume of the part (prism) = Area of base $\times$ height
 Area of base (Isosceles Δ)

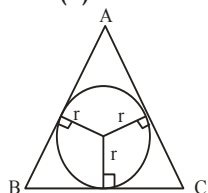
$$= \frac{b}{4} \sqrt{4a^2 - b^2}$$

$$= \frac{6}{4} \sqrt{4(5)^2 - (6)^2} = 12 \text{ cm}^2$$

$$\text{volume of prism} = 12 \times 8$$

$$= 96 \text{ cm}^3$$

7. Sol. (d)



$$\text{In radius of triangle} = \frac{\text{area of triangle}}{\text{semiperimeter}}$$

$$\text{ar(ABC)} = \text{In radius} \times \text{semi perimeter}$$

$$= 4 \times \frac{28}{2} = 4 \times 14 = 56 \text{ cm}$$

$$\text{Volume of the prism} = 366 \text{ cm}^3$$

$$(\text{area of base}) \times \text{height} = 366 \text{ cm}^3$$

$$56 \times \text{height} = 366 \text{ cm}$$

$$\text{height} = \frac{366}{56} = 6.535 \text{ cm}$$

8. Sol. (a)

$$\text{volume of prism} = \text{Base area} \times \text{height}$$

$$\text{Given, } H = 7 \text{ cm and Area of base} = 60 \text{ cm}^2$$

$$\therefore \text{The volume of the given prism} = 60 \times 7$$

$$= 420 \text{ cm}^3$$

9. Sol. (b)

$$\text{Base area} = \frac{1}{2} \times \text{Sum of } \parallel \text{ sides} \times \text{height}$$

$$= \frac{1}{2} \times (6 + 12) \times 4 = 36 \text{ cm}^2$$

$$\text{Base perimeter} = 5 + 6 + 5 + 12 = 28 \text{ cm}$$

$$\text{C.S.A.} = \text{Base perimeter} \times h$$

$$\text{C.S.A.} = 28 \times 10 = 280 \text{ cm}^2$$

$$\text{T.S.A.} = \text{C.S.A.} + 2 \text{ Base area}$$

$$\text{T.S.A.} = 280 + 2 \times 36 = 352 \text{ cm}^2$$

10. Sol. (b)

$$\text{Euler's formula: } V + f - E = 2$$

where V is number of vertices, f number of faces

and E no of edges. Triangular prism has, edge and 5 faces

$$V = 2 + E - f = 2 + 9 - 5$$

$$V = 11 - 5 = 6$$

11. Sol. (b)

$$\text{Height} = 10$$

$$\text{Volume} = \text{area of base} \times \text{height}$$

$$160 = 10 \times \text{area of base}$$

$$\text{Area of base} = 16$$

$$a^2 = 16 \Rightarrow a = 4$$

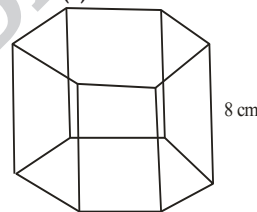
$$\text{Total surface area of prism}$$

$$= (2 \times \text{area of base}) + \text{height} \times \text{perimeter of base}$$

$$\text{Total surface area of prism} = 32 + 160$$

$$\text{Total surface area of prism} = 192$$

12. Sol. (c)



$$\text{TSA} = 24 \times 8 + 2 \times \frac{\sqrt{3}}{4} (4)^2 \times 6$$

$$= 48(4 + \sqrt{3}) \text{ cm}^2.$$

13. Sol. (d)

$$\text{Equilateral triangle Base of Prism}$$

$$\text{Side} = 15 \text{ cm}$$

$$H = 20\sqrt{3} \text{ cm}$$

$$\text{Volume} = \text{Base area} \times H$$

$$= \frac{\sqrt{3}}{4} (15)^2 \times 20\sqrt{3}$$

$$= 3375 \text{ cm}^3$$

14. Sol. (d)

As we know

$$(H)^2 = (B)^2 + (P)^2$$

$$(29)^2 = (21)^2 + (20)^2$$

$$841 = 441 + 400$$

$$841 = 841$$

Now, we can say triangle is a right angled triangle

As we know,

Volume of Prism = Area of base $\times$ height

$$\Rightarrow \frac{1}{2} \times 20 \times 21 \times h = 7560$$

$$H = 36 \text{ cm}$$

As we know, LSA = Perimeter of Base $\times$ Height

$$= (29 + 21 + 20) \times 36$$

$$= 2520 \text{ cm}^2$$

15. Sol. (b)

Total surface area of prism = $2 \times$ Area of base +

Curved surface area

$$\text{Area of base} = 15^2 = 225 \text{ cm}^2$$

Curved surface area = Perimeter of base $\times$ height

$$= 4 \times 15 \times 8 = 480 \text{ Total surface area of prism}$$

$$= 2 \times 225 + 480 = 930 \text{ cm}^2$$

16. Sol. (b)

$$\text{TSA} = 10x \times 12 + 12x^2 = 288$$

$$10x + x^2 = 24$$

$$x = 2 \therefore l = 3x = 6, b = 2x = 4$$

$$V = 6 \times 4 \times 12 = 288 \text{ cm}^3$$

17. Sol. (a)

Hence it is equilateral triangle

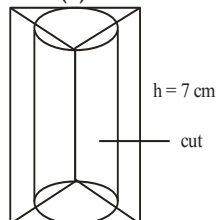
$$\text{Vol.} = \frac{\sqrt{3}}{4} a^2 \times h$$

$$V = 16\sqrt{3} \times 14$$

$$= 224\sqrt{3} \text{ cm}^2$$

$$\frac{R}{r} = \frac{2}{1}$$

18. Sol. (a)



$$r = \frac{\Delta}{S} = \frac{84}{21} = 4 \text{ cm}$$

Triangle side's - 13, 14 and 15 cm

$$\text{Area} = 84 \text{ cm}^2$$

$$\text{vol. of remaining solid} = 84 \times 7 - \frac{22}{7} \times 16 \times 7$$

($\because$ vol. prism solid = vol. of prism - vol. of cylinder)

$$= 588 - 352$$

$$= 236 \text{ cm}^3$$

19. Sol. (c)

Volume of prism = base area $\times$ height

$$1731.6 = \frac{1}{2} \times (15 + 11) \times 9 \times \text{height}$$

$$\Rightarrow \text{height} = 14.8$$

20. Sol. (c)

Let side of base = $a \text{ cm}$ and height = $h = 2 \text{ cm}$

Total surface area of prism = Curved surface area

+ (base+top) area

$$\Rightarrow 10 = \text{Perimeter of base} \times \text{height} + 2 \times$$

area of base

$$\Rightarrow (4 \times a \times 2) + (2 \times a^2) = 10$$

$$\Rightarrow a^2 + 4a - 5 = 0$$

$$\Rightarrow a^2 + 5a - a - 5 = 0$$

$$\Rightarrow a(a + 5) - 1(a + 5) = 0$$

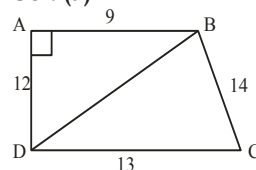
$$\Rightarrow (a + 5)(a - 1) = 0$$

$$\Rightarrow a = 1 [\because a \text{ cannot be negative.}]$$

$$\therefore \text{Volume} = \text{Base area} \times \text{height}$$

$$= (1)^2 \times 2 = 2 \text{ cm}^3$$

21. Sol. (a)



In $\triangle DAB$

$$BD^2 = AD^2 + AB^2$$

$$BD^2 = (12)^2 + 9^2$$

$$BD = 15 \text{ cm}$$

$$\text{Area of } \triangle DAB = \frac{1}{2} \times AB \times AD$$

$$= \frac{1}{2} \times 9 \times 12 = 54 \text{ cm}^2$$

In $\triangle BDC$

$$\text{Semi perimeter} = \frac{14+13+15}{2} = 21 \text{ cm}$$

Area of Δ

$$= \sqrt{21 \times (21-14) \times (21-13) \times (21-15)}$$

$$= \sqrt{21 \times 7 \times 8 \times 6} = 84 \text{ cm}$$

Volume of prism = Base area $\times$ Height

$$2070 = (54 + 84) \times \text{Height}$$

$$\text{Height} = \frac{2070}{138} = 15 \text{ cm}$$

Lateral surface area = Perimeter of base $\times$ Height

$$= (9 + 14 + 13 + 12) \times 15$$

$$= 48 \times 15 = 720 \text{ cm}^2$$

22. Sol. (a)

Lateral surface area of prism = Base perimeter $\times$ height

$$= (5 + 8 + 12) \times 18 = 450 \text{ cm}^2$$

23. Sol. (c)

FORMULA USED:

Volume of prism = Area of base $\times$ Height

Volume of sphere = $\frac{4}{3}\pi r^3$

CALCULATION:

$$\text{Perimeter of base of prism} = \frac{30}{2.5} = 12 \text{ m}$$

$$\text{Side of base of prism} = \frac{12}{4} = 3 \text{ cm}$$

Volume of prism = Area of base $\times$ Height

$$= 3^2 \times 2.5 = 22.5 \text{ m}^3$$

Volume of two spheres

$$= \left(\frac{4}{3}\right) \times \left(\frac{22}{7}\right) \times [42^3 + 21^3]$$

$$= 349272 \text{ cm}^3 = 0.349272 \text{ m}^3$$

$$= 0.35 \text{ m}^3 \text{ (Approx)}$$

$$\therefore \text{Required volume} = 22.5 - 0.35 = 22.15 \text{ m}^3$$

24. Sol. (c)

Square base of prism with height 15 cm

$$\text{T.S.A} = 680 \text{ cm}^2$$

volume = ?

$$\text{T.S.A} = \text{CSA} + 2 \times \text{Bottom area}$$

$$608 = 4a \times 15 + 2a^2$$

$$304 = 30a + a^2$$

$$a = 8$$

Volume = Base Area $\times$ h

$$= 64 \times 15 = 960 \text{ cm}^3$$

25. Sol. (c)

Volume of right prism = Area of the base $\times$ height

$$\Rightarrow 10380 = 173 \times h$$

$$\Rightarrow h = \frac{10380}{173} = 60 \text{ cm}$$

Now, Area of triangle = $\frac{\sqrt{3}}{4} \times (\text{Side})^2$

$$\Rightarrow 173 = \frac{\sqrt{3}}{4} \times (\text{Side})^2$$

$$\therefore \text{Side} = \sqrt{\frac{173 \times 4}{\sqrt{3}}} = \sqrt{\frac{173 \times 4}{1.73}} = 20 \text{ cm}$$

$$\therefore \text{Perimeter} = 3 \times 20 = 60 \text{ cm}$$

$\therefore$ Area of the lateral surface

= Perimeter base $\times$ height

$$= 60 \times 60 = 3600 \text{ sq. cm.}$$

26. Sol. (c)

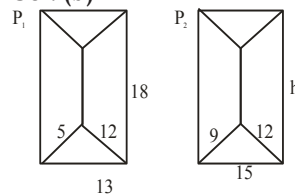
According to the question, V = number of vertices of prism = 6

e = edges of prism = 9

f = faces of the prism = 5 ATQ,

$$\frac{v+e-f}{2} = \frac{6+9-5}{2} = \frac{10}{2} = 5$$

27. Sol. (b)



$$V_1 = V_2$$

$$540 = 54h$$

New height, $h = 10 \text{ cm}$

Change in TSA = $(\text{TSA})_1 - (\text{TSA})_2$

$$= (540 + 60) - 468 = 132 \text{ cm}^2.$$

Type-2 (Pyramid, Tetrahedron)

1. The base of right pyramid is an equilateral triangle, each side of which is 20 cm. Each slant edge is 30 cm. The vertical height (in cm) of the pyramid is:

समबाहु पिरामिड का आधार एक समबाहु त्रिभुज है, जिसकी प्रत्येक भुजा 20 सेमी है, प्रत्येक तिरछी धार 30 सेमी है पिरामिड की ऊर्ध्वाधर ऊँचाई (सेमी में) है:

SSC CGL Tier II 2023

- (a) $5\sqrt{3}$ (b) $10\sqrt{\frac{23}{3}}$
(c) $10\sqrt{3}$ (d) $5\sqrt{\frac{23}{3}}$

2. Find the height of a regular tetrahedron with an edge length of 12 cm.

एक नियमित चतुष्फलक की ऊँचाई ज्ञात कीजिए, जिसके किनारे की लंबाई 12 सेमी है।

- (a) $8\sqrt{6}$ cm (b) $6\sqrt{6}$ cm
(c) $4\sqrt{6}$ cm (d) $2\sqrt{60}$ m

3. Find the volume of a regular tetrahedron with an edge length of 6 cm.

एक नियमित चतुष्फलक का आयतन ज्ञात कीजिए, जिसके किनारे की लंबाई 6 सेमी है।

- (a) $18\sqrt{2}$ cm³ (b) $18\sqrt{3}$ cm³
(c) $12\sqrt{2}$ cm³ (d) $12\sqrt{3}$ cm³

4. The base of a right pyramid is a square of side $8\sqrt{2}$ cm and each of its slant edge is of length 10 cm. What is the volume (in cm³) of the pyramid?

एक सम पिरामिड का आधार $8\sqrt{2}$ सेमी भुजा का एक वर्ग है और इसके प्रत्येक तिरछे किनारे की लंबाई 10 सेमी है। पिरामिड का आयतन (सेमी³ में) क्या है?

SSC CGL Tier II 03/02/2022

- (a) 256 (b) 224 (c) $426\frac{2}{3}$ (d) $96\sqrt{2}$

5. A right pyramid of volume 160 cm³ is formed on a square base of side 8 cm. What is the total surface area of the pyramid?

आयतन 160 सेमी³ का एक सम पिरामिड 8 सेमी भुजा वाले एक वर्गाकार आधार पर बनाया गया है। पिरामिड का कुल सतह क्षेत्रफल कितना है?

- (a) 320 cm² (b) 400 cm²
(c) 200 cm² (d) 600 cm²

6. The Volume of a pyramid with a square base is 200 cm³. The height of a pyramid is 13 cm. What will be the length of the edges (i.e the distance the apex and any other vertex) rounded to the nearest integer.?

एक वर्गाकार आधार वाले पिरामिड का आयतन 200 cm³ है यदि इसकी ऊँचाई 13 सेमी है तो इसके किनारों की लंबाई निकरतम क्या होगी?

- (a) 12 cm (b) 13 cm
(c) 14 cm (d) 15 cm

7. The volume of a tetrahedron is $18\sqrt{2}$ then find its TSA?.

यदि एक चतुष्फलक का आयतन $18\sqrt{2}$ है तो इसका कुल प्रश्न क्षेत्रफल क्या होगा?

- (a) $18\sqrt{3}$ (b) $27\sqrt{3}$
(c) $36\sqrt{3}$ (d) $45\sqrt{3}$

8. The length of each edge of a regular tetrahedron is 12 cm. The area (in sq. cm) of the total surface of the tetrahedron is

एक नियमित चतुष्फलक के प्रत्येक किनारे की लंबाई 12 सेमी है। टेट्राहेड्रॉन की कुल सतह का क्षेत्रफल (वर्ग सेमी में) है

- (a) $288\sqrt{3}$ (c) $108\sqrt{3}$
(b) $144\sqrt{2}$ (d) $144\sqrt{3}$

9. What will be the volume of a right triangle pyramid if the area of its base is 169 sqm and the height is 12 m.

एक समकोण त्रिभुज पिरामिड का आयतन क्या होगा ? यदि इसके आधार का क्षेत्रफल 169 वर्गमीटर और ऊँचाई 12 मीटर है।

- (a) 667 m³ (b) 676m³
(c) 767m³ (d) 776m³

10. The base of a pyramid is a square of side 12 m and its height is 27 m. Find its volume.

एक पिरामिड का आधार 12 मीटर भुजा वाला एक वर्ग है और इसकी ऊँचाई 27 मीटर है। इसका आयतन ज्ञात कीजिए।

SSC CHSL-2020

- (a) 1098 cubic m (b) 1944 cubic m
(c) 1296 cubic m (d) 2130 cubic m

11. Find the numerical value of the height of a tetrahedron whose volume and total surface area are numerically equal.

उस चतुष्फलक की ऊँचाई का संख्यात्मक मान ज्ञात कीजिए जिसका आयतन और कुल पृष्ठीय क्षेत्रफल संख्यात्मक रूप से बराबर हो।

(a) 8 (b) $6\sqrt{2}$ (c) $4\sqrt{3}$ (d) 12

12. The base of a right pyramid is an equilateral triangle with side 8 cm, and its height is $30\sqrt{3}$ cm. The volume (in cm^3) of the pyramid is :

एक समकोण पिरामिड का आधार 8 सेमी भुजा वाला एक समबाहु त्रिभुज है, और इसकी ऊँचाई $30\sqrt{3}$ सेमी है। पिरामिड का आयतन (cm^3 में) है:

SSC CGL TIER II 16/11/2020

(a) 480 (b) $360\sqrt{3}$

(c) 360 (d) $240\sqrt{3}$

13. Each edge of a regular tetrahedron is 3 cm, then its volume is

एक नियमित चतुष्फलक का प्रत्येक किनारा 3 सेमी है, तो इसका आयतन है

(a) $\frac{9\sqrt{2}}{4} \text{ cm}^3$ (b) $27\sqrt{3} \text{ cm}^3$

(c) $\frac{4\sqrt{2}}{9} \text{ cm}^3$ (d) $9\sqrt{3} \text{ cm}^3$

14. Find TSA of a pyramid with rectangular base whose length is 16 cm. and width is 12 cm. if the height of pyramid is 8 cm ?

आयताकार आधार जिसकी लम्बाई 16 सेमी और चौड़ाई 12 सेमी है, वाले पिरामिड का TSA कितना होगा यदि उसकी ऊँचाई 8 सेमी है।

(a) $352 + 96\sqrt{2}$ (b) $240 + 90\sqrt{2}$

(c) $324 + 96\sqrt{2}$ (d) None

15. If the length of each side of a regular tetrahedron is 12 cm, then the volume of the tetrahedron is यदि एक नियमित चतुष्फलक की प्रत्येक भुजा की लंबाई 12 सेमी है, तो चतुष्फलक का आयतन है

(a) $144\sqrt{2} \text{ cu. cm}$, (b) $72\sqrt{2} \text{ cu. cm}$

(c) $8\sqrt{2} \text{ cu. cm}$ (d) $12\sqrt{2} \text{ cu. cm}$

16. A regular pyramid has a square base. The height of the pyramid is 22 cm and side of its base is 14 cm. Volume of pyramid is equal to the volume of a sphere. What is the radius (in cm) of the sphere?

एक नियमित पिरामिड का एक वर्गाकार आधार होता है। पिरामिड की ऊँचाई 22 सेमी है और इसके आधार की भुजा

14 सेमी है, पिरामिड का आयतन एक गोले के आयतन के बराबर है। गोले की त्रिज्या (सेमी में) क्या है?

SSC CGL-2018

(a) $\sqrt[3]{49}$ (b) 7 (c) 14 (d) $\sqrt[3]{98}$

17. Find the total surface area of a regular tetrahedron whose volume is 36 cm^3 .

एक नियमित चतुष्फलक का कुल पृष्ठीय क्षेत्रफल ज्ञात कीजिए जिसका आयतन 36 cm^3 है।

(a) $2^{5/2} 3^{7/2} \text{ cm}^2$ (b) $2^{5/2} 3^{7/3} \text{ cm}^2$

(c) $2^{7/2} 3^{5/2} \text{ cm}^2$ (d) $2^{7/3} 3^{5/2} \text{ cm}^2$

18. Find the T.S.A of a tetrahedron whose height is $4\sqrt{2}$ cm.

समचतुष्फलक का कुल पृष्ठ क्षेत्रफल क्या होगा यदि उसकी ऊँचाई $4\sqrt{2}$ सेमी है?

(a) $4\sqrt{2} \text{ cm}^2$ (b) $48\sqrt{3} \text{ cm}^2$

(c) $32\sqrt{3} \text{ cm}^2$ (d) $36\sqrt{3} \text{ cm}^2$

19. The base of a pyramid is an equilateral triangle of side 10 m. If the height of the pyramid is $40\sqrt{3}$ m, then the volume of the pyramid is :

एक पिरामिड का आधार 10 मीटर भुजा वाला एक समबाहु त्रिभुज है। यदि पिरामिड की ऊँचाई $40\sqrt{3}$ मीटर है, तो पिरामिड का आयतन है:

SSC CGL TIER II 18/11/2020

(a) 800 (b) 900 (c) 1000 (d) 1200

20. The base of a right pyramid is a square of a side 10 cm. If its height is 10 cm, then the area (in cm^2) of its lateral surface is:

एक सही पिरामिड का आधार 10 सेमी भुजा का एक वर्ग है, यदि इसकी ऊँचाई 10 सेमी है, तो इसकी पार्श्व सतह का क्षेत्रफल (सेमी² में) है:

SSC CGL TIER II 15/11/2020

(a) 100 (b) $100(\sqrt{5} + 1)$

(c) $50\sqrt{5}$ (d) $100\sqrt{5}$

21. A pyramid with an equal Δ based of each side 4 cm while its slant height is twice the height of pyramid. Find its volume-

समान Δ वाला एक पिरामिड जिसकी प्रत्येक भुजा 4 सेमी है जबकि इसकी तिरछी ऊँचाई पिरामिड की ऊँचाई से दुगुनी है। इसका आयतन ज्ञात कीजिए-

(a) $8\sqrt{3}$ (b) $\frac{8}{3\sqrt{3}}$ (c) $4\sqrt{3}$ (d) $3\sqrt{3}$

22. The volume of a right pyramid is $45\sqrt{3} \text{ cm}^3$ and its base is an equilateral triangle with side 6 cm. What is the height (in cm) of the pyramid?

एक समकोण पिरामिड का आयतन $45\sqrt{3} \text{ cm}^3$ है और इसका आधार 6 सेमी भुजा वाला एक समबाहु त्रिभुज है। पिरामिड की ऊंचाई (सेमी में) क्या है?

SSC CGL Tier 2

- (a) 20 (b) 18 (c) 12 (d) 15

23. A pyramid has a square base, whose side is 8 cm. If the height of pyramid is 16 cm, then what is the total surface area (in cm^2) of the pyramid?

एक पिरामिड का एक वर्गाकार आधार है, जिसकी भुजा 8 सेमी है। यदि पिरामिड की ऊंचाई 16 सेमी है, तो पिरामिड का कुल सतह क्षेत्रफल (सेमी² में) क्या है?

- (a) $64(\sqrt{17} + 1)$ (b) $32(\sqrt{13} + 1)$
(c) $64(\sqrt{13} + 1)$ (d) $32(\sqrt{5} + 1)$

24. The lateral edge and base edge of a right pyramid which stands on a square base of side length 'a' are equal, then find the volume of the pyramid.

भुजा लंबाई 'a' के एक वर्गाकार आधार पर खड़े एक सम पिरामिड का पार्श्व किनारा और आधार किनारा बराबर हैं, तो पिरामिड का आयतन ज्ञात कीजिए।

- (a) $\frac{a^3}{3\sqrt{2}}$ (b) $\frac{a^3}{2\sqrt{3}}$ (c) $\frac{2a^3}{\sqrt{3}}$ (d) $\frac{3a^3}{\sqrt{2}}$

25. The base of a right pyramid is an equilateral triangle with side 8 cm, and the height of pyramid is $24\sqrt{3} \text{ cm}$. The volume (in cm^3) of the pyramid is :

एक समबाहु पिरामिड का आधार 8 सेमी भुजा वाला एक समबाहु त्रिभुज है, और पिरामिड की ऊंचाई $24\sqrt{3}$ सेमी है। पिरामिड का आयतन (सेमी³ में) है:

SSC CGL TIER II 12/09/2019

- (a) 1152 (b) 480 (c) 576 (d) 384

26. A pyramid is formed around a regular hexagon whose inradius is 9 cm. Find the volume of the pyramid if each lateral edge measures 12 cm.

एक नियमित षट्भुज के चारों ओर एक पिरामिड बनाया गया है जिसकी अंतःत्रिज्या 9 सेमी है। पिरामिड का आयतन ज्ञात करें यदि प्रत्येक पार्श्व किनारे की माप 12 सेमी है।

- (a) $432\sqrt{3} \text{ cm}^3$ (b) $324\sqrt{3} \text{ cm}^3$

- (c) $144\sqrt{3} \text{ cm}^3$ (d) $486\sqrt{3} \text{ cm}^3$

27. A right pyramid has a square base with side of base 4 cm and the height of pyramid is 9 cm. The pyramid is cut in three parts of equal heights by two planes parallel to its base. what is the ratio of the volume of the top, middle and the bottom part respectively?

एक सम पिरामिड का एक वर्गाकार आधार है जिसके आधार की भुजा 4 सेमी है और पिरामिड की ऊंचाई 9 सेमी है। पिरामिड को उसके आधार के समानांतर दो समतलों द्वारा समान ऊंचाई के तीन भागों में काटा गया है। क्रमशः शीर्ष, मध्य और निचले भाग के आयतन का अनुपात क्या है?

- (a) 1:8:27 (b) 1:17:19

- (c) 1:8:20 (d) 1:7:20

28. A pyramid whose base is a regular hexagon with side length 9 cm and its slant height is 12 cm. If its volume can be expressed as $\frac{a\sqrt{b}}{c} \text{ cm}^3$, then find the value of $a + b + c$.

एक पिरामिड जिसका आधार एक नियमित षट्भुज है जिसकी भुजा की लंबाई 9 सेमी है और इसकी तिरछी ऊंचाई 12 सेमी है। यदि इसका आयतन $\frac{a\sqrt{b}}{c} \text{ cm}^3$ के रूप में व्यक्त किया जा सकता है, तो $a+b+c$ का मान ज्ञात कीजिए।

- (a) 354 (b) 358 (c) 344 (d) 348

29. The base of a right pyramid is an equilateral triangle with area $16\sqrt{3} \text{ cm}^2$. If the area of one of its lateral faces is 30 cm^2 , then its height (in cm) is: एक समकोण पिरामिड का आधार एक समबाहु त्रिभुज है जिसका क्षेत्रफल $16\sqrt{3}$ वर्ग सेमी है। यदि इसके पार्श्व फलकों में से एक का क्षेत्रफल 30 वर्ग सेमी है, तो इसकी ऊंचाई (सेमी में) है:

SSC CGL TIER II 13/09/2019

- (a) $\sqrt{\frac{739}{12}}$ (b) $\sqrt{\frac{209}{12}}$ (c) $\sqrt{\frac{611}{12}}$ (d) $\sqrt{\frac{643}{12}}$

Type-2 (Pyramid, Tetrahedron Pyramid) ANSWER KEY

1	B	2	C	3	A	4	A	5	C	6	C	7	C	8	D
9	B	10	C	11	D	12	A	13	A	14	A	15	A	16	B
17	D	18	B	19	C	20	D	21	B	22	D	23	A	24	A
25	D	26	B	27	B	28	B	29	C						

Type-2 (Pyramid, Tetrahedron Pyramid) Solution

1. **Sol. (b)**

In a pyramid, (slant edge)² = (circum radius)² + (height)²

Circumradius of equilateral triangle = $\frac{a}{\sqrt{3}} = \frac{20}{\sqrt{3}}$

According to the question,

$$30^2 = \left(\frac{20}{\sqrt{3}}\right)^2 + (\text{height})^2$$

$$900 = \frac{400}{3} + (\text{height})^2$$

$$(\text{height})^2 = \frac{2700-400}{3}$$

$$\text{height} = \sqrt{\frac{2300}{3}} = 10\sqrt{\frac{23}{3}}$$

2. **Sol. (c)**

Height of Tetrahedron = $\frac{\sqrt{6}}{3}a$

$$= \frac{\sqrt{6}}{3} \times 12 = 4\sqrt{6} \text{ cm}$$

3. **Sol. (a)**

Volume of Tetrahedron = $\frac{\sqrt{2}}{12}a^3$

$$= \frac{\sqrt{2}}{12} \times 6 \times 6 \times 6 = 18\sqrt{2} \text{ cm}^3$$

4. **Sol. (a)**

In a pyramid, (slant edge)² = (circumradius)² + height²

Circumradius of square = $\frac{1}{2} \times \text{diagonal}$

$$\text{Diagonal} = a\sqrt{2} = 8\sqrt{2} \times \sqrt{2} = 16 \text{ cm.}$$

$$10^2 = 8^2 + \text{height}^2$$

$$\text{height}^2 = 100 - 64 = 36, \text{ height} = 6 \text{ cm.}$$

Volume of pyramid

$$= \frac{1}{3} \times \text{base area} \times \text{height} = \frac{1}{3} \times (8\sqrt{2})^2 \times 6$$

$$= 256 \text{ cm}^3$$

5. **Sol. (c)**

We know,

$$\text{T.S.A.} = a^2 + 2a\sqrt{\frac{a^2}{4} + h^2}$$

a = side of square base

h = height of pyramid

$$\text{and } v = a^2 \times \frac{h}{3} \Rightarrow h = \frac{3v}{a^2} \Rightarrow \frac{9v^2}{a^4}$$

$$\Rightarrow \text{T.S.A.} = a \left[a + \sqrt{a^2 + 36 \frac{v^2}{a^4}} \right]$$

$$= 8 \left[8 + \sqrt{8^2 + 36 \times \frac{(160)^2}{8^4}} \right] = 200 \text{ cm}^2$$

6. **Sol. (c)**



$$V = \frac{1}{3} \times a^2 \times 13 = 200$$

$$a^2 = \frac{600}{13}$$

$$e^2 = 13^2 + \frac{a^2}{2}$$

$$= 169 + \frac{300}{13}$$

$$e^2 = 169 + 23 = 192 \cong 196$$

$$e \cong 14 \text{ cm.}$$

7. **Sol. (c)**

$$V = \frac{a^3}{6\sqrt{2}} = 18\sqrt{2}$$

$$\Rightarrow a^3 = 108 \times 2 = 6^3$$

$$a = 6$$

$$\text{TSA} = \sqrt{3}a^2 = \sqrt{3} \times 6 \times 6 = 36\sqrt{3}$$

8. **Sol. (d)**

Total surface area of tetrahedron

$$= \sqrt{3}a^2 = \sqrt{3} \times 12^2 = 144\sqrt{3} \text{ cm}^2$$

9. **Sol. (b)**

Volume of pyramid = $\frac{1}{3}$ (Base area) height

$$= \frac{1}{3} \times (169)12 = 676 \text{ m}^3$$

10. **Sol. (c)**

Given,

$$\Rightarrow \text{Base of pyramid} = 12 \text{ m}$$

$$\Rightarrow \text{Height of pyramid} = 27 \text{ m}$$

$$\Rightarrow \text{Area of base} = 12 \times 12 = 144 \text{ sqm}$$

Now,

$$\Rightarrow \text{Volume of pyramid} = (\text{Area of base} \times \text{height})$$

$$/3 = (144 \times 27)/3 = 1296 \text{ cubic m}$$

11. Sol. (d)

$$\text{Volume of Tetrahedron} = \frac{\sqrt{2}}{12} a^3$$

$$\text{Total surface area of Tetrahedron} = \sqrt{3}a^2$$

According to question

$$\Rightarrow \frac{\sqrt{2}}{12} a^3 = \sqrt{3}a^2 \Rightarrow a = \frac{\sqrt{3} \times 12}{\sqrt{2}} = 6\sqrt{6}$$

$$\text{Height of Tetrahedron} = \frac{\sqrt{6}}{3} a = \frac{\sqrt{6}}{3} \times 6\sqrt{6} = 12$$

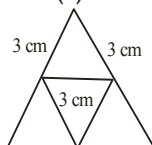
12. Sol. (a)

$$\text{Volume of pyramid} = \frac{1}{3} \times \text{area of base} \times \text{height}$$

$$\text{Area of base} = \frac{\sqrt{3}}{4} a^2 = 16\sqrt{3}$$

$$\text{Volume of pyramid} = \frac{1}{3} \times 16\sqrt{3} \times 30\sqrt{3} = 480 \text{ cm}^3$$

13. Sol. (a)



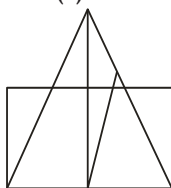
Edge of regular tetrahedron = 3 cm

$$\therefore a = 3 \text{ cm}$$

$$\therefore \text{volume} \Rightarrow \frac{\sqrt{2}}{12} a^3 \text{ cm}^3$$

$$\Rightarrow \frac{\sqrt{2}}{12} \times (3)^3 = \frac{9}{4} \sqrt{2} \text{ cm}^3$$

14. Sol. (a)



$$\frac{1}{2} \times 16 \times 10 \times 2 = 160$$

$$\frac{1}{2} \times 12 \times 8\sqrt{2} \times 2 = 96\sqrt{2}$$

$$\text{TSA} = 160 + 96\sqrt{2} + 16 \times 12 = 352 + 96\sqrt{2}$$

15. Sol. (a)

Volume of tetrahedron

$$= \frac{a^3}{6\sqrt{2}} = \frac{12^3}{6\sqrt{2}}$$

$$= \frac{1728}{6\sqrt{2}} = 144\sqrt{2} \text{ cm}^3$$

16. Sol. (b)

Volume of pyramid = $\frac{1}{3} \times \text{Area of base} \times \text{Height}$

$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

Putting the given values in the formulas and equating both the volumes,

$$\Rightarrow \frac{1}{3} \times 14 \times 14 \times 22 = \frac{4}{3} \times \frac{22}{7} \times r^3$$

$$\Rightarrow r^3 = 7 \times 7 \times 7$$

$$\therefore \text{Radius of sphere} = 7 \text{ cm}$$

17. Sol. (d)

$$\text{Volume of Tetrahedron} = \frac{a^3}{6\sqrt{2}}$$

$$\Rightarrow \frac{a^3}{6\sqrt{2}} = 36 \Rightarrow a^3 = 6 \times 6 \times 6\sqrt{2} \Rightarrow a = 6(2)^{1/6}$$

$$\text{Total surface area of Tetrahedron} = \sqrt{3}a^2 = \sqrt{3} \times 36(2)^{1/3} = (2)^{7/3}(3)^{5/2}$$

18. Sol. (b)

$$h = \frac{\sqrt{2}}{\sqrt{3}} \cdot a = 4\sqrt{2}$$

$$a = 4\sqrt{3}$$

$$\text{TSA} = \frac{\sqrt{3}}{4} a^2 \times 4 = \sqrt{3}a^2 = 48\sqrt{3} \text{ cm}^2$$

19. Sol. (c)

$$\text{Area of base} = \frac{(\sqrt{3}a^2)}{4} = 25\sqrt{3}$$

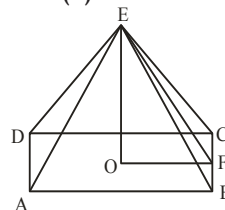
Volume of pyramid

$$= \frac{1}{3} \times \text{Height} \times \text{Area of base}$$

Volume of pyramid

$$= \frac{1}{3} \times 40\sqrt{3} \times 25\sqrt{3} = 1000 \text{ m}^3$$

20. Sol. (d)



Perimeter of base = 40 cm, Height (OE) = 10 cm

In right angled triangle OEF

$$OF = 5 \Rightarrow EF^2 = OF^2 + OE^2$$

$$EF = 5\sqrt{5}$$

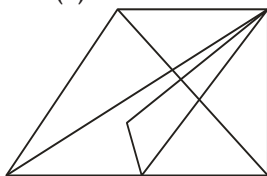
$$\text{Slant height (EF)} = 5\sqrt{5}$$

Lateral surface area

$$= \frac{1}{2} \times \text{perimeter of base} \times \text{Slant height}$$

$$= \frac{1}{2} \times 40 \times 5\sqrt{5} \Rightarrow 100\sqrt{5}$$

21. Sol. (b)



$$\text{In radius} = \frac{4}{2\sqrt{3}} = \frac{2}{\sqrt{3}}$$

$$l = 2h$$

$$(2h)^2 = h^2 + \left(\frac{2}{\sqrt{3}}\right)^2$$

$$3h^2 = \frac{4}{3}$$

$$h^2 = \frac{4}{9} \Rightarrow h = \frac{2}{3}$$

$$\text{Volume of pyramid} = \frac{1}{3} \times \text{Area of base} \times \text{Height}$$

$$\frac{1}{3} \times \frac{\sqrt{3}}{4} \times 4 \times 4 \times \frac{2}{3} = \frac{8}{3\sqrt{3}} \text{ cm}^3$$

22. Sol. (d)

As we know,

$$\text{Area of equilateral triangle} = (\sqrt{3}/4) \times a^2$$

$$\text{Volume of pyramid} = (1/3) \times (\text{Area of base}) \times \text{height}$$

$$\text{Given, Side of equilateral triangle} = 6$$

$$\text{Volume of the pyramid whose base is an}$$

$$\text{equilateral triangle} = 45\sqrt{3}$$

$$\Rightarrow (1/3) \times (\sqrt{3}/4) \times 6 \times 6 \times H = 45\sqrt{3}$$

$$\Rightarrow H = (45\sqrt{3} \times 4 \times 3) / (6 \times 6 \times \sqrt{3})$$

$$\Rightarrow H = 15 \text{ cm}$$

23. Sol. (a)

$$\text{Slant height} = \sqrt{16^2 + 4^2} = \sqrt{272} = 4\sqrt{17}$$

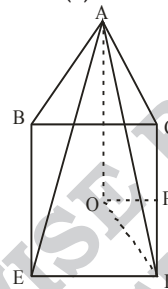
Total surface Area of pyramid

$$= \left[\frac{1}{2} \times (\text{Perimeter of base}) \times (\text{Slant height}) \right] + (\text{Area of base})$$

$$= \frac{1}{2} \times 32 \times 4\sqrt{17} + 64$$

$$= 64\sqrt{17} + 64 = 64(\sqrt{17} + 1)$$

24. Sol. (a)



Let AO perpendicular to the base

In $\triangle AOD$

$$AO^2 = (AD)^2 - (OD)^2 = a^2 - \left(\frac{a}{\sqrt{2}}\right)^2 = \frac{a^2}{2}$$

$$AO = \frac{a}{\sqrt{2}}$$

$$\text{Volume of Pyramid} = \frac{1}{3} (\text{Base area}) \times \text{height}$$

$$= \frac{1}{3} \times a^2 \times \frac{a}{\sqrt{2}} = \frac{a^3}{3\sqrt{2}}$$

25. Sol. (d)

$$\text{Volume of the pyramid} = \frac{1}{3} \times \text{Base Area} \times \text{Height}$$

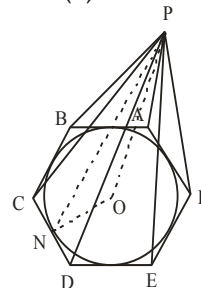
$$\text{Area of an equilateral triangle} = \frac{\sqrt{3}}{4} a^2$$

$$= \frac{\sqrt{3}}{4} \times 8 \times 8 = 16\sqrt{3}$$

$$\text{Volume of the pyramid}$$

$$= \frac{1}{3} \times 16\sqrt{3} \times 24\sqrt{3} = 384 \text{ cm}^3$$

26. Sol. (b)



Type-3 (Cube)

1. The surface area of a cube is 726 cm^2 . Find the volume (cm^3) of the cube
एक घन का पृष्ठीय क्षेत्रफल 726 सेमी^2 है। घन का आयतन (cm^3) ज्ञात कीजिए

SSC CHSL 2023 (Evening)

- (a) 2744 (b) 1729 (c) 1331 (d) 2197

2. Find the total surface area of a cube whose volume is 343 m^3 .
एक घन का कुल पृष्ठीय क्षेत्रफल ज्ञात कीजिए जिसका आयतन 343 m^3 है।

SSC CGL 08/12/2022 (3rd Shift)

- (a) 186 m^2 (b) 294 m^2
(c) 196 m^2 (d) 210 m^2

3. Find the length of diagonal (in cm) of a cube if the volume of the cube is 1331 cm^3
एक घन के विकर्ण की लंबाई (सेमी में) ज्ञात कीजिए यदि घन का आयतन 1331 cm^3 है

SSC CHSL 31/05/2022 (Evening)

- (a) $331\sqrt{3}$ (b) $21\sqrt{3}$ (c) $11\sqrt{3}$ (d) $111\sqrt{3}$

4. The total surface area of a cube is 864 cm^2 . The volume of the cube is ____
एक घन का कुल पृष्ठीय क्षेत्रफल 864 सेमी^2 है। घन का आयतन ____ है

SSC CGL 02/12/2022 (2nd Shift)

- (a) 1728 cm^3 (b) 2197 cm^3
(c) 1331 cm^3 (d) 729 cm^3

5. What is the volume of a cube whose surface area is 54 cm^2 ?
एक घन का आयतन क्या है जिसका पृष्ठीय क्षेत्रफल 54 सेमी^2 है?

SSC CPO 09/11/2022 (Morning)

- (a) 28 cm^3 (b) 3 cm^3 (c) 27 cm^3 (d) 9 cm^3

6. If the volume of the cube is 27 m^3 , find its surface area (in m^2).
यदि घन का आयतन 27 मी^3 है। इसका पृष्ठीय क्षेत्रफल ज्ञात कीजिए (मीटर^2 में)।

SSC CHSL 24/05/2022 (Afternoon)

- (a) 9 (b) 27 (c) 54 (d) 24

7. The diagonal of a cube is 24 cm . Find its total surface area in (cm^2)
एक घन का विकर्ण 24 सेमी है। इसका कुल पृष्ठीय क्षेत्रफल ज्ञात कीजिए

SSC CHSL 30/05/2022 (Morning)

- (a) 1152 (b) 1252 (c) 1100 (d) 1366

8. What is the increase in the volume of a cube of 1 unit edge if each of its edges is tripled?
1 इकाई किनारे वाले घन के आयतन में कितनी वृद्धि होगी यदि इसके प्रत्येक किनारे को तीन गुना कर दिया जाए?

SSC MTS 26/07/2022 (Evening)

- (a) 26 cu units (b) 29 cu units
(c) 28 cu units (d) 27 cu units

9. A solid cube of side 8 cm is dropped into a rectangular container of length 16 cm , breadth 8 cm and height 15 cm which is partly filled with water. If the cube is completely submerged, then the rise of water level (in cm) is:
8 सेमी भुजा वाले एक ठोस घन को 16 सेमी लंबाई, 8 सेमी चौड़ाई और 15 सेमी ऊंचाई वाले एक आयतकार कंटेनर में गिराया जाता है जो अंशतः से पानी से भरा है। यदि घन पूरी तरह से डूबा हुआ है, तो जल स्तर कितना ऊपर (सेमी में) उठेगा?

SSC CGL 11/04/2022 (Shift- 01)

- (a) 2 (b) 6 (c) 5 (d) 4

10. The length of the longest diagonal that can be placed in a closed cube is $50\sqrt{3} \text{ cm}$. What is the total surface area of this cube?
एक बंद घन में रखे जा सकने वाले सबसे लंबे विकर्ण की लंबाई $50\sqrt{3} \text{ सेमी}$ है। इस घन का कुल पृष्ठीय क्षेत्रफल कितना है?

SSC MTS 14/07/2022 (Evening)

- (a) 15000 cm^2 (b) 10000 cm^2
(c) 12000 cm^2 (d) 6000 cm^2

11. A solid cube is marked to form the five solid cubes where volume are in the ratio $1:1:8:27:27$. Find the percentage by which the sum of surface area of these five cubes exceeds to the surface area of the original cube?
एक ठोस धातु घन को पिघलाकर 5 छोटे घन बनाये गये हैं जिसके आयतन का अनुपात $1:1:8:27:27$ है ज्ञात कीजिये इस प्रकार बने 5 नये पात्र का कुल पृष्ठीय क्षेत्रफल मूल घन के पृष्ठीय क्षेत्रफल से कितने प्रतिशत अधिक होगा ?

- (a) 20% (b) 40% (c) 50% (d) 60%

12. A cube of edge 6 cm is painted on all sides and then cut into unit cubes. The number of unit cubes with no sides painted is:

6 सेमी किनारे वाले एक घन को चारों तरफ से रंगा जाता है और फिर इकाई घनों में काटा जाता है। पेंट किए गए पक्षों वाले इकाई घनों की संख्या है:

- (a) 0 (b) 64 (c) 186 (d) 108

13. The ratio of the total surface areas of two cubes is 49:81. What is the ratio of their volume?

दो घनों के कुल पृष्ठीय क्षेत्रफल का अनुपात 49:81 है। उनके आयतन का अनुपात क्या है?

SSC MTS 26/07/2022 (Morning)

- (a) 343:729 (b) 294:486
(c) 7:9 (d) 49:121

14. A metal solid cube of side 22 cm is melted to make a cone of height 21 cm. What is the radius of the base of the cone? (Take $\pi = \frac{22}{7}$)

22 सेमी भुजा वाले धातु के ठोस घन को पिघलाकर 21 सेमी ऊँचा एक शंकु बनाया जाता है। शंकु के आधार की त्रिज्या क्या है? (Take $\pi = \frac{22}{7}$)

[CDS - 2021-I]

- (a) 11 cm (b) 16.5 cm
(c) 22 cm (d) 27.5 cm

15. A solid metallic cube of side $6\sqrt{4}$ cm, is melted and recast into a cuboid of length 12 cm and breadth 9 cm. What is the length (in cm) of the longest diagonal of the cuboid?

$6\sqrt{4}$ cm भुजा वाले एक ठोस धातु के घन को पिघलाकर 12 cm लम्बाई और 9 cm चौड़ाई वाले घनाभ में ढाला जाता है। घनाभ के सबसे लम्बे विकर्ण की लम्बाई 1 cm में क्या होगी?

SSC CHSL 09/06/2022 (Shift- 01)

- (a) 19 (b) 18 (c) 15 (d) 17

16. Three equal cubes are placed adjacently in a row. Find the ratio of total surface area of the new cuboid to that of the sum of the surface areas of the three cubes.

तीन समान घनों को एक पंक्ति में आसन्न रखा गया है। नए घनाभ के कुल पृष्ठीय क्षेत्रफल का तीनों घनों के पृष्ठीय क्षेत्रफलों के योग से अनुपात ज्ञात कीजिए।

- (a) 7:9 (c) 9:7 (b) 49:81 (d) 27:23

17. Three smaller cubes with sides of 3, 4 and 5 cm are melted together to form a large cube. What is the ratio of the smaller cube's total surface area to the large cube's total surface area?

3, 4 और 5 सेमी भुजाओं वाले तीन छोटे घनों को एक साथ पिघलाकर एक बड़ा घन बनाया जाता है। छोटे घन के कुल

पृष्ठीय क्षेत्रफल का बड़े घन के कुल पृष्ठीय क्षेत्रफल से अनुपात क्या है?

SSC CHSL 07/06/2022 (Evening)

- (a) 16:21 (b) 5:4 (c) 25:18 (d) 3:5

18. A metal cube of edge 18 cm is melted to form three smaller cubes, which are unequal in dimensions. If the edges of two smaller cubes are 9 cm and 15 cm, then what is the surface area (in cm^2) of the third smaller cube?

18 सेमी किनारे वाले धातु के एक घन को पिघलाकर तीन छोटे घन बनाए गए हैं, जो विमाओं में असमान हैं। यदि दो छोटे घनों की भुजाएँ 9 सेमी और 15 सेमी हैं, तो तीसरे छोटे घन का पृष्ठीय क्षेत्रफल (सेमी^2 में) क्या है?

SSC MTS 8/10/2021 (Morning)

- (a) 1944 (b) 864 (c) 1728 (d) 486

19. The square of the diagonal of a cube is 2175 cm^2 . What is the total surface area (in cm^2) of the cube? एक घन के विकर्ण का वर्ग 2175 सेमी^2 है। घन का कुल पृष्ठीय क्षेत्रफल (सेमी^2 में) क्या है?

SSC CHSL 12/8/2021 (Afternoon)

- (a) 4305 (b) 4272 (c) 4530 (d) 4350

20. A solid cube is cut into 64 identical cubes what is the percentage Increase in total surface area? एक ठोस घन को 64 समरूप समरूप घनों में काटा जाता है कुल पृष्ठीय क्षेत्रफल में प्रतिशत वृद्धि क्या है?

- (a) 150% (b) 200% (c) 300% (d) 250%

21. The length, breadth and height of a cuboid are in the ratio 27: 8: 1. The cuboid is melted and recast into a cube. If P is the surface area of the cuboid and q is the surface area of the cube, then what is p/q equal to?

एक घनाभ की लंबाई, चौड़ाई और ऊँचाई का अनुपात 27: 8: 1 है। घनाभ को पिघलाकर एक घन में बदल दिया जाता है। यदि घनाभ के पृष्ठीय क्षेत्रफल में P और घन का पृष्ठीय क्षेत्रफल q है, तो p/q किसके बराबर है?

[CDS - 2022-I]

- (a) $\frac{247}{108}$ (b) $\frac{251}{108}$ (c) $\frac{503}{216}$ (d) $\frac{505}{216}$

22. When the length of each edge of a cube is increased by 4 m, the volume of the cube is increased by 2716 m^3 . Find the total surface area of the original cube.

जब घन के प्रत्येक किनारे की लंबाई 4 मीटर बढ़ा दी जाती है, तो घन की मात्रा 2716 मीटर^3 बढ़ जाती है। मूल घन का कुल पृष्ठीय क्षेत्रफल ज्ञात कीजिए।

- (a) 1176 m^2 (b) 1350 m^2
(c) 1014 m^2 (d) 864 m^2

23. A metal solid cube of edge 24 cm is melted and made into three small cubes. If the edges of two small cubes are 12 cm and 16 cm, then what is the surface area of the third small cube?

24 सेमी किनारे वाले एक धातु के ठोस घन को पिघलाकर तीन छोटे घनों में बनाया जाता है। यदि दो छोटे घनों की भुजाएँ 12 सेमी और 16 सेमी हैं, तो तीसरे छोटे घन का पृष्ठीय क्षेत्रफल क्या है?

[CDS - 2021-I]

- (a) 1200 cm^2 (b) 1800 cm^2
(c) 2400 cm^2 (d) 3600 cm^2

24. A solid cube of side length 1 cm is removed from each corner of a Solid cube of side length 3 cm. How many edges does remaining solid have.
भुजा की लंबाई 1 सेमी का एक ठोस घन, भुजा की लंबाई 3 सेमी के ठोस घन के प्रत्येक सही से निकाला जाता है। कितने किनारे शेष ठोस हैं।

- (a) 36 (b) 60 (c) 72 (d) 84

25. A solid metal cube of edge 12 cm is immersed completely in water in a cylindrical vessel whose radius is 20 cm and height is 32 cm, and the water in the vessel is up to a height of 15 cm. The height (in cm) by which the water will rise in the vessel is (correct to one decimal place):

12 सेमी धार वाले धातु के एक ठोस घन को एक बेलनाकार बर्तन में पानी में पूरी तरह डुबा दिया जाता है जिसकी त्रिज्या 20 सेमी और ऊँचाई 32 सेमी है और बर्तन में पानी 15 सेमी की ऊँचाई तक है। ऊँचाई (सेमी में) जिसके द्वारा बर्तन में पानी ऊपर उठेगा (एक दशमलव स्थान तक सही):

SSC MTS 6/10/2021 (Evening)

- (a) 0.9 (b) 1.4 (c) 1.2 (d) 1.1

26. Find the length of the diagonal a cube whose volume and total surface area are numerically equal.

एक घन के विकर्ण की लंबाई ज्ञात कीजिए जिसका आयतन और कुल पृष्ठ क्षेत्रफल संख्यात्मक रूप से बराबर है।

- (a) $6\sqrt{2}$ (b) $6\sqrt{3}$ (c) 6 (d) $6\sqrt{5}$

27. The sum of the lengths of the edges of a cube is equal to twice the perimeter of a square. If a quarter of the numerical value of the volume of the cube is equal to the numerical value of the area of the square, then the length of one side of the square is:

एक घन की भुजाओं की लंबाई का योग एक वर्ग के परिमाप के दोगुने के बराबर है। यदि घन के आयतन के संख्यात्मक मान का एक-चौथाई, वर्ग के क्षेत्रफल के संख्यात्मक मान के बराबर है, तब वर्ग की एक भुजा की लंबाई क्या है?

- (a) 13.5 Units (b) 9 Units
(c) 27 Units (d) 10.5 Units

28. The volumes of two cubes are in the ratio of 8:27. If the volume of the larger cube is 513 cm^3 more than that of the smaller cube, find the length of each side of the smaller cube.

दो घनों के आयतन 8:27 के अनुपात में हैं। यदि बड़े घन का आयतन छोटे घन के आयतन से 513 cm^3 अधिक है, तो छोटे घन की प्रत्येक भुजा की लंबाई ज्ञात कीजिए।

Higher Secondary

01/08/2022 (Shift - 3)

- (a) 27 cm (b) 7 cm (c) 6 cm (d) 16 cm

29. A solid cube having volume 46656 cm^3 is cut into 27 cubes of equal volume. The surface area (in cm^2) of the smaller cube is:

46656 cm^3 आयतन वाले एक ठोस घन को समान आयतन के 27 घनों में काटा जाता है। छोटे घन का पृष्ठीय क्षेत्रफल (cm^2 में) है:

SSC CHSL 9/8/2021 (Morning)

- (a) 864 (b) 756 (c) 936 (d) 921

30. A solid cube has side 8 cm. It is cut along diagonals of Top face to get 4 equal parts what is the Total surface area of each part?

एक ठोस घन जिसकी भुजा 8 सेमी है वह अपनी सतह को विकर्णों पर चार सतह भागों में काटा जाता है प्रत्येक भाग का कुल पृष्ठीय क्षेत्रफल क्या है?

- (a) $56 + 64\sqrt{2}$ (b) $8ct64\sqrt{11}$

- (c) $9x + 19\sqrt{2}$ (d) $80 + 45\sqrt{2}$

31. After melting three cubes of sides 6 cm, 8 cm and 10 cm, a big cube is made. Find the side of the new cube.

6 सेमी, 8 सेमी और 10 सेमी भुजाओं वाले तीन घनों को पिघलाकर एक बड़ा घन बनाया जाता है। नए घन की भुजा ज्ञात कीजिए।

SSC CHSL 02/06/2022(Evening)

- (a) 13 cm (b) 24 cm (c) 25 cm (d) 12 cm

32. A solid cube of side 12 cm is cut into two halves by a plane passing through the two opposite edges (one edge in top face of cube and another in bottom face of cube), find TSA of each part

एक ठोस घन के दो विपरीत किनारों (एक किनारा जाए की सतह पर और दूसरा किनारा घन के आधार का है।) से गुजरते हुए किसी समतल द्वारा दो भागों में काटा जात है। प्रत्येक भाग का कुल पृष्ठीय क्षेत्रफल ज्ञात कीजिए।

- (a) $144(3 + \sqrt{2})\text{cm}^2$ (b) $72(3 + \sqrt{2})\text{cm}^2$

- (c) $108(3 + \sqrt{2})\text{cm}^2$ (d) None of these

33. A solid cube of side 15 cm is dropped into a rectangular container of length 25 cm, breadth 20 cm and height 18 cm, which is partly filled with

water. If the cube is completely submerged, then the rise of water level (in cm) is:

15 सेमी भुजा वाले एक ठोस घन को 25 सेमी लंबाई, 20 सेमी चौड़ाई और 18 सेमी ऊँचाई वाले एक आयताकार पात्र में डाला जाता है, जो आंशिक रूप से पानी से भरा हुआ है। यदि घन पूरी तरह से जलमग्न है, तो जल स्तर में वृद्धि (सेमी में) है:

SSC MTS 20/10/2021 (Evening)

- (a) 7.75 (b) 5.25 (c) 8.75 (d) 6.75

34. If a string is wound on four walls of a cube of edge 'a', starting at one of the vertices and ending at the vertex exactly above the starting vertex making equally spaced two turns, then the length of the string is

यदि एक किनारे 'a' के घन की चार दीवारों पर एक तार लपेटा जाता है, जो किसी एक कोने से शुरू होता है और शुरूआती शीर्ष के ठीक ऊपर के शीर्ष पर समाप्त होता है, जिसमें समान रूप से दो मोड़ होते हैं, तो स्ट्रिंग की लंबाई होती है

- (a) $a\sqrt{17}$ (b) $a\sqrt{34}$ (c) $a\sqrt{51}$ (d) $a\sqrt{65}$

35. From the body of a solid cube of edge 7 cm, a solid sphere is removed. The volume of the remaining solid was found to be $163\frac{1}{3}$ cm³. What is the diameter (in cm) of the sphere? (Use = $22/7$)

7 सेमी भुजा वाले एक ठोस घन के पिंड से एक ठोस गोला निकाला जाता है। शेष ठोस का आयतन $163\frac{1}{3}$ cm³ पाया गया। गोले का व्यास (सेमी में) क्या है? (उपयोग $\pi = 22/7$)

SSC CGL 19/4/2022 (Morning)

- (a) 10 (b) 7 (c) 5 (d) 8

36. A cube of metal each edge of which measures 5 cm, weighs 0.625 kg. What is the length of each edge of a cube of the same metal which weight 40 kg?

धातु का एक घन जिसके प्रत्येक किनारे की माप 5 सेमी है, का वजन 0.625 किलोग्राम है। उसी धातु के घन के प्रत्येक किनारे की लंबाई कितनी है जिसका वजन 40 किग्रा है?

- (a) 20 cm (b) 25 cm (c) 15 cm (d) 30 cm

37. The length of the side of a cube is 4.2 cm. What is the volume of the largest sphere that can be taken out of the cube?

एक घन की भुजा की लंबाई 4.2 सेमी है। घन से निकाले जा सकने वाले सबसे बड़े गोले का आयतन क्या है?

SSC CGL 05/12/2022 (2nd Shift)

- (a) 26.40 cm³ (b) 20.50 cm³
(c) 38.80 cm³ (d) 48.60 cm³

38. If the length of the diagonal of a cube is $7\sqrt{3}$ cm, then the surface area of the cube is

यदि एक घन के विकर्ण की लंबाई $7\sqrt{3}$ सेमी है, तो घन का पृष्ठीय क्षेत्रफल है

SSC CGL 03/12/2022 (4th Shift)

- (a) 216 cm² (b) 256 cm²
(c) 284 cm² (d) 294 cm²

39. If the diagonal of the cube is $\sqrt{27}$ cm, then its volume is:

यदि घन का विकर्ण $\sqrt{27}$ सेमी है, तो इसका आयतन है:

SSC CHSL 26/10/2020 (Evening)

- (a) 27 (b) 32 (c) 30 (d) 25

40. If V is the volume of a cube and T is the surface area of the cube, then which of the following is true?

यदि V एक घन का आयतन है और T घन का पृष्ठीय क्षेत्रफल है, तो निम्नलिखित में से कौन सा सत्य है?

- (a) $V = \frac{T}{36}\sqrt{2T}$ (b) $V = \frac{T}{36}\sqrt{6T}$
(c) $V = \frac{T}{6}\sqrt{6T}$ (d) $V = \frac{T}{36}\sqrt{3T}$

41. The edge of a cube is increased by 100% the surface area of the cube is increased by:

एक घन का किनारा 100% बढ़ा दिया जाता है, घन का पृष्ठीय क्षेत्रफल कितना बढ़ जाता है:

- (a) 100% (b) 200% (c) 300% (d) 400%

42. A rectangular block of length 20 cm, breadth 15 cm and height 10 cm is cut up into exact number of equal cubes. The least possible number of cubes will be

लंबाई 20 सेमी, चौड़ाई 15 सेमी और ऊँचाई 10 सेमी के एक आयताकार ब्लॉक को समान घनों की सटीक संख्या में काटा जाता है। घनों की न्यूनतम संभव संख्या होगी

[CDS - 2018-II]

- (a) 12 (b) 16 (c) 20 (d) 24

43. If a cube maximum possible volume is cut off from a solid sphere of diameter d , then the volume of the remaining (waste) material of the sphere would be equal to:

यदि व्यास d के एक ठोस गोले से एक घन अधिकतम संभव आयतन काटा जाता है, तो गोले की शेष (अपशिष्ट) सामग्री का आयतन बराबर होगा:

- (a) $\frac{d^3}{3}\left(\pi - \frac{d}{2}\right)$ (b) $\frac{d^3}{3}\left(\frac{\pi}{2} - \frac{1}{\sqrt{3}}\right)$
(c) $\frac{d^2}{4}(\sqrt{2} - \pi)$ (d) None of these

44. A cube of sides 3 cm is melted and smaller cubes of sides 1 cm each are formed. How many such cubes are possible?

3 सेमी भुजाओं वाले एक घन को पिघलाया जाता है और 1 सेमी भुजाओं वाले छोटे घन बनाए जाते हैं। ऐसे कितने घन संभव हैं?

- (a) 21 (b) 23 (c) 25 (d) 27

Type-3 (Cube) ANSWER KEY															
1	C	2	B	3	C	4	A	5	C	6	C	7	A	8	A
9	D	10	A	11	C	12	B	13	A	14	C	15	D	16	A
17	C	18	B	19	D	20	C	21	B	22	C	23	C	24	D
25	B	26	B	27	A	28	C	29	A	30	A	31	D	32	A
33	D	34	D	35	B	36	A	37	C	38	D	39	A	40	B
41	C	42	D	43	B	44	D								

Type-3 (Cube) Solution

1. Sol. (c)

Surface area of a cube = 726 cm^2

$$6a^2 = 726 \Rightarrow a^2 = 121 \Rightarrow a = 11$$

$$\text{Volume of cube} = a^3 = 11^3 = 1331 \text{ cm}^3$$

2. Sol. (b)

Volume of cube = a^3

$$343 = a^3 \Rightarrow a = \sqrt[3]{343} = 7 \text{ m}$$

$$\text{TSA of cube} = 6 \times 7^2 = 294 \text{ m}^2$$

3. Sol. (c)

Volume of cube = a^3

$$1331 = a^3 \Rightarrow a = 11 \text{ cm}$$

The diagonal of cube

$$= \sqrt{3}a = \sqrt{3} \times 11 = 11\sqrt{3} \text{ cm}$$

4. Sol. (a)

Total Surface area of cube

$$= 6(\text{side})^2 = 864 \text{ cm}^2$$

$$a = \sqrt{\frac{864}{6}} \text{ cm} = 12 \text{ cm}$$

Now, volume of cube

$$= (\text{side})^3 = (12)^3 = 1728 \text{ cm}^3$$

5. Sol. (c)

TSA of cube = $6a^2$

$$54 = 6a^2 \Rightarrow 9 = a^2 \Rightarrow a = 3 \text{ cm}$$

$$\text{Volume of cube} = 3^3 = 27 \text{ cm}^3$$

6. Sol. (c)

$$\text{Volume of cube} = a^3 \Rightarrow 27 = a^3 \Rightarrow a = 3$$

$$\text{Surface area of cube} = 6 \times a^2 = 6 \times 3^2 = 54$$

7. Sol. (a)

Diagonal of the cube = $\sqrt{3} \times \text{side}$

$$24 = \sqrt{3} \times a \Rightarrow a = \frac{24}{\sqrt{3}} = 8\sqrt{3} \text{ cm}$$

$$\text{TSA of cube} = 6 \times a^2$$

$$6 \times 8\sqrt{3} \times 8\sqrt{3} = 1152 \text{ cm}^2$$

8. Sol. (a)

Edge = 1 unit

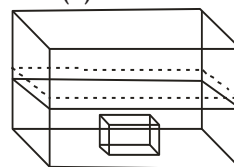
$$\text{Volume} = a^3 = 1^3 = 1$$

New edge = 3 unit

$$\text{Volume} = a^3 = 3^3 = 27$$

$$\text{Increase in volume} = 27 - 1 = 26 \text{ unit}$$

9. Sol. (d)



Side of cube = 8 cm

l, length of container = 16 cm

b, breadth of container = 8 cm

Height of container = 15 cm

Volume of rised water level = Volume of cube immersed.

Let h be the level rise after immersion.

$$\Rightarrow l \times b \times h = 8 \times 8 \times 8$$

$$\Rightarrow 16 \times 8 \times h = 8 \times 8 \times 8$$

$$h = 4 \text{ cm}$$

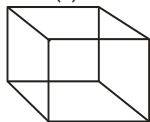
10. Sol. (a)

$$\text{Side of the cube} = \frac{50\sqrt{3}}{\sqrt{3}} = 50$$

Total surface area of cube

$$= 6 \text{ side}^2 = 6 \times 50 \times 50 = 15000 \text{ cm}^2$$

11. Sol. (c)



$$64 = 1:1:8:27:27$$

$$4 = 1:1:2:3:3$$

$$\text{TSA} : 6 \times 16 = 6(1 + 1 + 4 + 9 + 9)$$

$$\Rightarrow \frac{16}{24} \times 100 = 50\%$$

$$\Rightarrow \frac{8}{16} \times 100 = 50\%$$

12. Sol. (b)

Volume of bigger cube

$$= 6 \times 6 \times 6 = 216 \text{ cu. cm}$$

$$\text{Volume of unit cube} = 1 \times 1 \times 1$$

$$= 1 \text{ cu cm}$$

$$\text{Number of uncoloured cubes} = 4 \times 4 \times 4$$

$$= 64, \text{ because edge of uncoloured cube} = 4 \text{ cm}$$

13. Sol. (a)

$$\Rightarrow r^2 : R^2 = 49 : 81 \Rightarrow r : R = 7 : 9$$

$$\text{Ratio of volume} = r^3 : R^3 = 7^3 : 9^3$$

$$= 343 : 729$$

14. Sol. (c)

Volume of Cube = Volume of the cone

$$(22)^3 = \frac{1}{3} \times \pi \times (r)^2 \times 21$$

$$\therefore r = 22 \text{ cm}$$

15. Sol. (d)

Volume of cube = volume of cuboid

$$\Rightarrow a^3 = l \times b \times h$$

$$\Rightarrow (6\sqrt[3]{4})^3 = 12 \times 9 \times h$$

$$\Rightarrow 6 \times 6 \times 6 \times 4 = 12 \times 9 \times h$$

$$\Rightarrow h = 8 \text{ cm}$$

Now, longest diagonal of cuboid is

$$D = \sqrt{l^2 + b^2 + h^2}$$

$$\Rightarrow D = \sqrt{144 + 81 + 64} = \sqrt{289} = 17$$

16. Sol. (a)

Let arc side of the cube be = a units

Total surface area of 3 cubes

$$= 3 \times 6a^2 = 18a^2$$

Total surface area of cuboid

$$= 18a^2 - 4a^2 = 14a^2$$

$$\text{Ratio} = \frac{14a^2}{18a^2} = \frac{7}{9}$$

17. Sol. (c)

ATQ, Volume of smaller cubes = Volume of larger cube

$$3^3 + 4^3 + 5^3 = R^3$$

$$\sqrt[3]{27 + 64 + 125} = R$$

$$R = \sqrt[3]{216} = 6 \text{ cm}$$

$$\text{TSA of smaller cubes} = 6 \times (3^2 + 4^2 + 5^2)$$

$$= 6 \times 50 = 300 \text{ cm}^2$$

$$\text{TSA of larger cube} = 6 \times 6^2 = 216 \text{ cm}^2$$

So, the required ratio

$$= 300 : 216 \text{ or } 25 : 18$$

18. Sol. (b)

Let the edge of smaller cube = x

According to question,

$$18 \times 18 \times 18 = 9^3 + 15^3 + x^3$$

$$5832 = 729 + 3375 + x^3$$

$$5832 = 4104 + x^3$$

$$1728 = x^3 \Rightarrow x = 12 \text{ cm}$$

Surface area of smaller cube

$$= 6x^2 = 6(12)^2 = 864 \text{ cm}^2$$

19. Sol. (d)

If side of a cube is = a then its diagonal = $a\sqrt{3}$ andtotal surface area = $6a^2$

$$(\sqrt{3}a)^2 = 2175 \text{ then } 3a^2 = 2175,$$

$$\rightarrow a^2 = 725 \text{ and } 6a^2 = 6 \times 725 = 4350 \text{ cm}^2$$

20. Sol. (c)

Volume $\rightarrow 64 : 1$ Side $\rightarrow 4 : 1$ TSA $\rightarrow 16 : 1 \times 64$

$$\frac{16 : 64}{\times 4}$$

 $= 300\%$

21. Sol. (b)

Side length of cube $= \sqrt[3]{27 \times 8 \times 1} = 6$ cm.Now, $\frac{\text{Surface Area of Cuboid}}{\text{Surface Area of Cube}}$

$$\frac{p}{q} = \frac{2 \times (27 \times 8 + 8 \times 1 + 27 \times 1)}{6 \times (6)^2} = \frac{251}{108}$$

22. Sol. (c)

Let the edge length of the original cube be 'a' Then,

$$\Rightarrow (a + 4)^3 - a^3 = 2716$$

$$\Rightarrow a^3 + 4^3 + 12a(a + 4) - a^3 = 2716$$

$$\Rightarrow 12a(a + 4) = 2652$$

$$\Rightarrow a(a + 4) = 221 \Rightarrow a = 13$$

$$\text{Total surface area} = 6a^2 = 1014\text{m}^2$$

23. Sol. (c)

Sum of volumes of three small cube = Volume of big cube.

$$((12)^3 + (16)^3 + r^3) = (24)^3$$

$$\therefore r^3 = (24)^3 - [(12)^3 + (16)^3]$$

$$= (24)^3 - [(16 + 12)\{(16)^2 + (12)^2 - 16 \times 12\}]$$

$$= (24)^3 - [28\{256 + 144 - 192\}]$$

$$\therefore r^3 = 8000 \Rightarrow r = 20$$

Surface Area of third Cube

$$= 6(r)^2 = 6 \times (20)^2 = 2400 \text{ cm}^2$$

24. Sol. (d)

Euler's formula

$$\begin{array}{ccccc} F & + & V & = & E & + & 2 \\ \swarrow & & \searrow & & \searrow & & \\ \text{face} & & \text{vertex} & & \text{Edge} & & \end{array}$$

$$\text{Face} = 6 + (3 \times 8) = 30 \text{ (when we cut corners)}$$

$$\text{vertex} \Rightarrow 7 \times 8 = 56 \text{ (7 vertex of every corner)}$$

$$= 30 + 56 = E + 2$$

$$E = 84$$

25. Sol. (b)

Volume of the cube = base area of the cylinder $\times$ (raised height of water)

$$12 \times 12 \times 12 = \frac{22}{7} \times 20 \times 20 \times h$$

$$h = \frac{12 \times 12 \times 12 \times 7}{22 \times 20 \times 20} \approx 1.4 \text{ cm}$$

26. Sol. (b)

Volume of cube = (edge)³Total surface area of cube = 6(edge)²

From question

$$\Rightarrow (\text{Edge})^3 = 6(\text{edge})^2 \Rightarrow \text{Edge} = 6 \text{ m}$$

$$\text{Diagonal of cube} = \sqrt{3} \text{ edge} = 6\sqrt{3} \text{ m}$$

27. Sol. (a)

Let edge of cube is a and side of square is b

$$12a = 2 \times 4b$$

$$\frac{a}{b} = \frac{2}{3}$$

A.T.Q

$$\frac{1}{4}a^3 = b^2$$

$$\frac{1}{4} \times \left(\frac{2}{3}\right)^3 \times b^3 = b^2$$

$$\Rightarrow \frac{1}{4} \times \frac{8}{27} \times b^3 = b^2$$

$$\Rightarrow b = \frac{27}{2} = 13.5 \text{ units}$$

28. Sol. (c)

Volume of a cube = a³

Where a = side of a cube

$$\frac{\text{Side of smaller cube}}{\text{Side of larger cube}} = \sqrt[3]{\frac{\text{Volume of smaller cube}}{\text{volume of larger cube}}}$$

$$\frac{\text{Side of smaller cube}}{\text{Side of larger cube}} = \sqrt[3]{\frac{8}{27}} = \frac{2}{3}$$

Then, side of smaller cube = 2x

and side of larger cube = 3x

According to question,

$$27x^3 - 8x^3 = 513 \text{ cm}^3 \Rightarrow 19x^3 = 513$$

$$x^3 = 27 \Rightarrow x = 3$$

So, Side of smaller cube = 2 $\times$ 3 = 6 cm

29. Sol. (a)

Volume of a solid cube

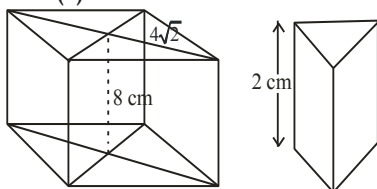
$$= 27 \times \text{volume of a smaller cube}$$

$$46656 = 27 \times a^3 \Rightarrow a = 12$$

Surface area of the smaller cube

$$= 6a^2 = 6(12)^2 = 864 \text{ cm}^2$$

30. Sol. (a)



$$\begin{aligned} \text{TSA} &= \frac{6 \times 8^2}{4} + 8 \times 4\sqrt{2} \times 2 \\ &= 96 + 64\sqrt{2} \text{ Ans.} \end{aligned}$$

31. Sol. (d)

Let the side of new cube is a According to the question,

$$(6)^3 + (8)^3 + (10)^3 = a^3$$

$$216 + 512 + 1000 = a^3$$

$$a^3 = 1728 \Rightarrow a = 12$$

32. Sol. (a)

We have squares on 2 sides, 2 right angled triangle on sides and 1 rectangle.

$$= 144 + 144 + 144 + 12 \times 12\sqrt{2} = 144(3 + \sqrt{2})$$

33. Sol. (d)

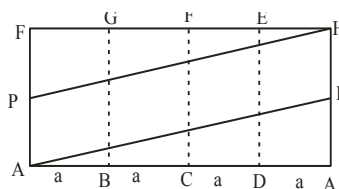
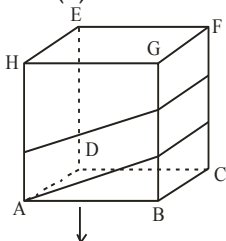
Volume of cube = base area of the container $\times$ rise in the water level

$$15 \times 15 \times 15 = 25 \times 20 \times (\text{rise in the water level})$$

$$\text{rise in the water level} = \frac{15 \times 15 \times 15}{25 \times 20}$$

$$= 6.75 \text{ cm}$$

34. Sol. (d)



$$AP = PH = \sqrt{(4AB)^2 + (AP)^2}$$

$$= \sqrt{(4a)^2 + \left(\frac{a}{2}\right)^2}$$

$$= \sqrt{16a^2 + \frac{a^2}{4}} = \sqrt{\frac{64a^2 + a^2}{4}}$$

$$= \sqrt{\frac{65a^2}{4}} = \frac{a}{2}\sqrt{65}$$

$$\text{So, the length of the string} = 2AP = 2 \times \frac{a}{2}\sqrt{65}$$

$$= a\sqrt{65}$$

35. Sol. (b)

Initial volume = final volume

Volume of cube = volume of sphere + remaining part volume

$$a^3 = \frac{4}{3}\pi r^3 + 163\frac{1}{3}$$

$$\Rightarrow 7^3 = \frac{4}{3} \times \frac{22}{7} \times r^3 + \frac{490}{3}$$

$$\Rightarrow 343 - \frac{490}{3} = \frac{4}{3} \times \frac{22}{7} \times r^3$$

$$\Rightarrow \frac{539}{3} = \frac{4}{3} \times \frac{22}{7} \times r^3$$

$$\Rightarrow r^3 = \frac{7 \times 7 \times 7}{2 \times 2 \times 2} \Rightarrow r = \frac{7}{2} \Rightarrow d = 2r = 7 \text{ cm}$$

36. Sol. (a)

Volume of the cube = $5 \times 5 \times 5 = 125 \text{ cu cm}$

$$0.625 \text{ kg} = 125 \text{ cu cm}$$

$$\therefore 40 \text{ kg} \equiv \frac{125}{0.625} \times 40 = 8000 \text{ cu cm}$$

$$\therefore \text{edge} = \sqrt[3]{8000} = 20 \text{ cm}$$

37. Sol. (c)

Side of given cube = 4.2 cm. For largest sphere to be inscribed in the cube, diameter of sphere should be equal to edge length of cube,

$$\Rightarrow 2 \times \text{radius} = 4.2 \text{ cm} \Rightarrow \text{radius} = 2.1 \text{ cm}$$

$$\text{So, Volume of the sphere} = \frac{4}{3}\pi r^3$$

$$= \frac{4}{3}\pi(2.1)^3 = 38.80 \text{ cm}^3$$

38. Sol. (d)

Diagonal of cube = side $\sqrt{3}$

According to the question, Side = 7 cm

Then, surface area of cube = $6 \times (\text{side})^2 = 6 \times 49 \text{ cm}^2 = 294 \text{ cm}^2$

39. Sol. (a)

Let the side of cube = a cm

Diagonal of cube = $\sqrt{3} a$ cm $a\sqrt{3} = \sqrt{27} \Rightarrow a = 3 \text{ cm}$ Volume of cube = $a^3 = (3)^3 = 27 \text{ cm}^3$

40. Sol. (b)

Let edge length of the cube be 'a'

 $T(\text{T.S.A}) = 6a^2 \Rightarrow a = \sqrt{\frac{T}{6}}$ $V = a^3 = \left(\frac{T}{6}\right)^{3/2} = \frac{T}{36} \sqrt{6T}$

41. Sol. (c)

 $\frac{S_2}{S_1} = \left(\frac{e_2}{e_1}\right)^2 \Rightarrow \left(\frac{2}{1}\right)^2 = \frac{4}{1}$ $\therefore$ percentage increase in surface area = $\frac{4-1}{1} \times 100 =$

300% where S = surface area, e = edge of cube.

42. Sol. (d)

Volume of rectangular

 $= 20 \times 15 \times 10 = 3000$

Now, Let number of equal dimensional small cube

 $= n$ and dimension of cube is ℓ then, $n \cdot \ell^3 = 3000$ For, least possible integer value of n, ℓ must be maximum.For $\ell = 6$, we are getting n in fraction and for $\ell = 5, n \times (5)^3 = 3000$ $n = \frac{3000}{125} = 24$

43. Sol. (b)

The diagonal of cube will be equal to the diameter of the sphere.

 $\therefore$ volume of sphere = $\frac{4}{3} \pi \left(\frac{d}{2}\right)^3 = \frac{\pi d^3}{6}$ and each side of cube = $a = \frac{d}{\sqrt{3}}$ $\therefore$ volume of cube = $a^3 = \frac{d^3}{3\sqrt{3}}$ $\therefore$ Remaining volume $= \frac{\pi d^3}{6} - \frac{d^3}{3\sqrt{3}} = \frac{d^3}{3} \left(\frac{\pi}{2} - \frac{1}{\sqrt{3}}\right)$

44. Sol. (d)

Volume of original cube = $n \times$ volume of smaller cubes $\Rightarrow n = \frac{3 \times 3 \times 3}{1 \times 1 \times 1} = 27$

* * * * *

Type-4 (Cuboid)

1. What is the length of the longest rod that can be placed in a room of dimensions $12\text{ m} \times 9\text{ m} \times 8\text{ m}$?

आयाम $12\text{ m} \times 9\text{ m} \times 8\text{ m}$ वाले कमरे में रखी जा सकने वाली सबसे लंबी छड़ की लंबाई क्या है?

SSC CPO 2023 (Morning)

- (a) 15 m (b) 17 m (c) 16 m (d) 14 m

2. The sum of the length, breadth and depth of a cuboid is 23 cm, and its diagonal is $5\sqrt{7}$ cm. Its total surface area (cm^2) is:

एक घनाभ की लंबाई, चौड़ाई और गहराई का योग 23 सेमी है, और इसका विकर्ण $5\sqrt{7}$ सेमी है। इसका कुल पृष्ठीय क्षेत्रफल (सेमी^2) है:

SSC CHSL 31/05/2022 (Morning)

- (a) 144 (b) 354 (c) 188 (d) 111

3. The internal dimensions of a rectangular closed wooden box are 30 cm and 23 cm. What space (in cm^3) will it occupy, if the wood used is 1 cm thick?

एक आयताकार बंद लकड़ी के बक्से के आंतरिक आयाम 30 सेमी और 23 सेमी हैं। यदि उपयोग की गई लकड़ी 1 सेमी है तो यह किस स्थान (सेमी^3 में) पर कब्जा करेगा

SSC MTS 8/10/2021 (Morning)

- (a) 12420 (b) 16000
(c) 14136 (d) 9408

4. Three cubes of equal volume are joined end to end. Find the surface area of the resulting cuboid if the diagonal of the cube is $6\sqrt{3}$ cm.

बराबर आयतन वाले तीन घनों को सिरे से सिरे सटाकर आपस में जोड़ा जाता है। यदि घन का विकर्ण $6\sqrt{3}$ सेमी है, तो परिणामी घनाभ का पृष्ठीय क्षेत्रफल ज्ञात कीजिए।

SSC CGL 05/12/2022 (Shift-04)

- (a) 509 cm^2 (b) 504 cm^2
(c) 516 cm^2 (d) 512 cm^2

5. The length and breadth of a cuboid is increased by 20% and 25%, respectively, while its height is reduced by 30%. What must be the total percentage increase/ decrease in the volume of the cuboid?

एक घनाभ की लंबाई और चौड़ाई में क्रमशः 20% और 25% की वृद्धि की जाती है, जबकि इसकी ऊँचाई में 30% की कमी की जाती है। घनाभ के आयतन में कुल प्रतिशत वृद्धि/कमी कितनी होनी चाहिए?

SSC CGL 07/12/2022 (Shift- 03)

- (a) Increase by 5% (b) Increase by 3%
(c) Decrease by 2% (d) Decrease by 4%

6. A cuboid tank contain 25000 lit of water if the depth of the tank $\frac{1}{5}$ th times of its length and its

breadth is $\frac{1}{8}$ th times its length than what is the length of the tank?

एक घनाभ टैंक में 25000 लीटर पानी है यदि टैंक की गहराई $\frac{1}{5}$ th गुना इसकी लंबाई और चौड़ाई का गुना $\frac{1}{8}$ th इसकी लंबाई से गुना है तो टैंक की लंबाई क्या है?

- (a) 18m (b) 12 m (c) 10m (d) 15 m

7. The measures of the outer dimensions of a closed metal box are given as $15\text{ cm} \times 18\text{ cm} \times 8\text{ cm}$. The thickness of the metal is 1.5 cm. What will be the volume of the metal required to make the box?

एक बंद धातु के बक्से के बाहरी आयामों के माप $15\text{ सेमी} \times 18\text{सेमी} \times 8\text{सेमी}$ के रूप में दिए गए हैं। धातु की मोटाई 1.5 cm है। बॉक्स बनाने के लिए आवश्यक धातु का आयतन क्या होगा?

SSC MTS 07/07/2022 (Evening)

- (a) 1680 cm^3 (b) 950 cm^3
(c) 1440 cm^3 (d) 1260 cm^3

8. The area of a cardboard (in cm^2) needed to make a closed box of size $20\text{ cm} \times 10\text{ cm} \times 8\text{ cm}$ will be:

20 सेमी $\times$ 10 सेमी $\times$ 8 सेमी आकार का एक बंद बॉक्स बनाने के लिए आवश्यक कार्डबोर्ड का क्षेत्रफल (सेमी^2 में) होगा:

SSC CGL 18/4/2022 (Evening)

- (a) 880 (b) 690 (c) 750 (d) 960

9. Find the surface area of a cuboid 17 m long, 8 m broad and 3 m high.

17 मी लम्बा, 8 मी चौड़ा और 3 मी ऊँचा एक घनाभ का पृष्ठीय क्षेत्रफल ज्ञात कीजिए।

SSC CHSL 25/05/2022 (Afternoon)

- (a) 420 m^2 (b) 417 m^2
(c) 402 m^2 (d) 422 m^2

10. Three equal cubes of edge 'a' are placed adjacently in a row. The total surface area of the new cuboid is:

कोर (edge) 'a' वाले तीन बराबर घन एक पंक्ति में आयत के रूप से रखे गए हैं। इस प्रकार निर्मित नए घनाभ का सम्पूर्ण पृष्ठीय क्षेत्रफल क्या है?

DP Head Constable 19/10/2022 (Shift.01)

- (a) $54a^2$ (b) $6a^2$ (c) $14a^2$ (d) $18a^2$

11. What is the total surface area of a cuboid whose length, breadth and height are 7 cm, 5 cm and 9 cm, respectively?

एक घनाभ का कुल सतह क्षेत्रफल क्या है जिसकी लंबाई, चौड़ाई और ऊँचाई क्रमशः 7 सेमी, 5 सेमी और 9 सेमी है?

SSC CPO 10/11/2022 (Morning)

- (a) 190 cm^2 (b) 403 cm^2
(c) 286 cm^2 (d) 386 cm^2

12. The volume of a cuboid is 3300 cm^3 . The sum of the length and the breadth of the cuboid is 37 cm. If the difference between the length and the breadth of the cuboid is 13 cm, then what is the height of the cuboid?

एक घनाभ का आयतन 3300 सेमी^3 है। घनाभ की लंबाई और चौड़ाई का योग 37 सेमी है। यदि घनाभ की लंबाई और चौड़ाई के बीच का अंतर 13 सेमी है, तो घनाभ की ऊँचाई कितनी है?

SSC MTS 08/07/2022 (Morning)

- (a) 18 cm (b) 11 cm
(c) 14 cm (d) 16 cm

13. What is the length of the longest pole that can fit itself in a hall 60 feet long, 30 feet broad and 20 feet high?

60 फीट लंबे, 30 फीट चौड़े और 20 फीट ऊँचे हॉल में फिट होने वाले सबसे लंबे पोल की लंबाई कितनी है?

SSC CPO 10/11/2022 (Morning)

- (a) 50ft. (b) 70ft. (c) 30ft. (d) 20ft.

14. A solid metallic cuboid of dimensions $12 \text{ cm} \times 54 \text{ cm} \times 72 \text{ cm}$ is melted and converted into 8 cubes of the same size. What is the sum of the lateral surface areas (in cm^2) of 2 such cubes?

आयाम $12 \text{ cm} \times 54 \text{ cm} \times 72 \text{ cm}$ का एक ठोस धातु का घनाभ पिघलाया जाता है और समान आकार के 8 घनों में परिवर्तित किया जाता है। ऐसे 2 घनों के पार्श्व सतह क्षेत्रों (सेमी² में) का योग क्या है?

SSC CGL Tier II 29/01/2022

- (a) 2592 (b) 2268 (c) 3888 (d) 1944

15. Volume of a cuboid is 4800 cm^3 . If the height of this cuboid is 20 cm, then what will be the area of the base of cuboid?

एक घनाभ का आयतन 4800 cm^3 है। यदि इस घनाभ की ऊँचाई 20 सेमी है, तो घनाभ के आधार का क्षेत्रफल क्या होगा?

SSC CGL Tier II 08/08/2022

- (a) 150 cm^2 (b) 240 cm^2
(c) 480 cm^2 (d) 120 cm^2

16. If the areas of three adjacent faces of a cuboidal box are 729 cm^2 , 529 cm^2 and 289 cm^2 , respectively, then find the volume of the box.

यदि घनाभ डिब्बे के तीन आसन्न फलकों का क्षेत्रफल क्रमशः 729 cm^2 , 529 cm^2 और 289 cm^2 है, तो डिब्बे का आयतन ज्ञात कीजिए।

SSC CHSL 03/06/2022 (Shift-03)

- (a) 10557 cm^3 (b) 10560 cm^3
(c) 10555 cm^3 (d) 10551 cm^3

17. If p, q, r, s and t represent length, breadth, height, surface area and volume of a cuboid respectively, then what is $\frac{1}{p} + \frac{1}{q} + \frac{1}{r}$ equal to?

यदि p, q, r, s और t क्रमशः एक घनाभ की लंबाई, चौड़ाई, ऊँचाई, सतह क्षेत्र और आयतन का प्रतिनिधित्व करते हैं, तो $\frac{1}{p} + \frac{1}{q} + \frac{1}{r}$ किसके बराबर है?

[CDS - 2020]

- (a) $\frac{s}{t}$ (b) $\frac{2t}{s}$ (c) $\frac{s}{2t}$ (d) $\frac{2s}{t}$

18. How many bricks each measuring $64 \text{ cm} \times 11.25 \text{ cm} \times 6 \text{ cm}$, will be needed to build a wall measuring $8 \text{ m} \times 3 \text{ m} \times 22.5 \text{ m}$?

$8 \text{ m} \times 3 \text{ m} \times 22.5 \text{ m}$ की दीवार बनाने के लिए $64 \text{ cm} \times 11.25 \text{ cm} \times 6 \text{ cm}$ माप वाली कितनी ईंटों की आवश्यकता होगी?

SSC CHSL 11/8/2021 (Morning)

- (a) 200000 (c) 67500
(b) 250000 (d) 125000

19. How many $25 \text{ cm} \times 11.25 \text{ cm} \times 6 \text{ cm}$ bricks will be required to construct an $8 \text{ m} \times 6 \text{ m} \times 22.5 \text{ cm}$ wall? (ignoring other material used)

$8 \text{ m} \times 6 \text{ m} \times 22.5 \text{ cm}$ दीवार बनाने के लिए कितनी $25 \text{ cm} \times 11.25 \text{ cm} \times 6 \text{ cm}$ ईंटों की आवश्यकता होगी? (उपयोग की गई अन्य सामग्री को अनदेखा करना)

SSC CHSL 26/05/2022 (Morning)

- (a) 7020 (b) 6400 (c) 5800 (d) 6800

20. 3 cubes each of volume 343 cm^3 are joined end to end. What is the total surface area of the resulting cuboid?
3 घन प्रत्येक आयतन 343 cm^3 अंत से अंत तक जुड़े हुए हैं। परिणामी घनाभ का कुल पृष्ठीय क्षेत्रफल क्या है?

[CDS 2021-II]

- (a) 343 cm^2 (b) 350 cm^2
(c) 686 cm^2 (d) 700 cm^2
21. A closed steel box having thickness of 10 cm and outer dimensions are $160 \text{ cm} \times 130 \text{ cm} \times 100 \text{ cm}$ has 1212596 cm^3 solution in it. 500 spherical metal balls are placed in solution for treatment. The radius of one spherical ball.
10 सेमी मोटाई और $160 \text{ सेमी} \times 130 \text{ सेमी} \times 100 \text{ सेमी}$ वते बाहरी आयामों का एक बंद बक्सा है जिसमें 1212596 से. का घोल है। 500 गोलाकार धातु के गेंदों को उपचार के लिए इस घोल में रखा जाता है। गोलाकार गेंद की त्रिज्या है-
- (a) 7 cm (b) 1.4 cm
(c) 14 cm (d) 2.1 cm
22. The volume of a wall, six times as high as its breadth and half as long as its height, is 23958 cm^3 . What is the breadth of the wall?
एक दीवार का आयतन, उसकी चौड़ाई से छह गुना ऊँचा और उसकी ऊँचाई से आधा लंबा, 23958 cm^3 है। दीवार की चौड़ाई कितनी है?
- SSC CPO 10/11/2022 (Morning)
- (a) 21 cm (b) 15 cm
(c) 11 cm (d) 18 cm
23. A field is $119 \times 18 \text{ m}$ in dimension. A tank ($17 \text{ m} \times 6 \text{ m} \times 3 \text{ m}$) is dug out in the middle and soil removed is evenly spread over the remaining part of the field.
एक खेत $119 \times 18 \text{ मी}$ आकार का है। एक टंकी ($17 \text{ मी} \times 6 \text{ मी} \times 3 \text{ मी}$) के बीच में खोदी जाती है और निकाली गई मिट्टी को खेत के बचे हुए कुंड पर फैलाया जाता है। मैदान के शेष भाग पर स्तर में वृद्धि।
- (a) 14 cm (b) 13 cm (c) 15 cm (d) 12 cm
24. From a rectangle sheet of dimensions $32 \text{ cm} \times 18 \text{ cm}$, a square of side 3 cm is cut from the four corners of the sheet and a box is made. The volume of the box is:
आयाम $32 \text{ सेमी} \times 18 \text{ सेमी}$ की एक आयताकार शीट से, शीट के चारों कोनों से 3 सेमी का एक वर्ग काटा जाता है और एक बॉक्स बनाया जाता है। बॉक्स का आयतन है:

SSC CHSL 5/8/2021 (Afternoon)

- (a) 946 (b) 936 (c) 1305 (d) 1300
25. If a cuboid of dimension $32 \text{ cm} \times 12 \text{ cm} \times 9 \text{ m}$ is melted into two cube of same size. What will be the ratio of the surface area of the cuboid to the total surface area of the two cubes?
यदि एक घनाभ जिसकी विभा $32 \text{ cm} \times 12 \text{ cm} \times 9 \text{ cm}$ है को पिघलाकर दो समान अकारे घनों में बनाया जाता है तो घनाभ का कुल सतह क्षेत्रफल और दोनो घनो का क्रल सुख? क्षेत्रफल का अनुपात होगा?
- (a) 32:39 (b) 37:48 (c) 24:36 (d) 65:72
- Q26. The internal length, breadth and height of a cuboidal room are 12 m, 8 m and 10 m, respectively. The total cost (in Rs.) of whitewashing only all four walls of the room at the cost of Rs. 25 per m^2 , is:
एक घनाभ के आकार वाले कमरे की आंतरिक लंबाई 12 m, चौड़ाई 8 m और ऊँचाई 10 m है। यदि सफेदी कराने की लागत रुपये 25 प्रति m^2 है, तो कमरे की केवल चारों दीवारों की सफेदी कराने की कुल लागत (रुपयें में) ज्ञात करें।

SSC CPO 25/11/2020 (Shift-02)

- (a) 12,600 (b) 11,400
(c) 10,000 (d) 18,000
27. The sum of length breadth and height of a cuboid is 28 cm and its diagonal is 17 cm find total surface area of cuboid?
यदि किस घनाभ की लम्बाई चौड़ाई और ऊँचाई का योग रह सेमी, है और इसका विकर्ण 17 cm है तो घनाभ का कुल पृष्ठीय क्षेत्रफल क्या है?
- (a) 495 cm^2 (b) 515 cm^2
(c) 385 cm^2 (d) 565 cm^2
28. A solid metallic cuboid of dimensions $18 \text{ cm} \times 36 \text{ cm} \times 72 \text{ cm}$ is melted and recast into 8 cubes of the same volume. What is the ratio of the total surface area of the cuboid to the sum of the lateral surface area of all 8 cubes?
आयाम $18 \text{ cm} \times 36 \text{ cm} \times 72 \text{ cm}$ का एक ठोस धात्विक घनाभ पिघलाया जाता है और उसी आयतन के 8 घनों में पुनः ढाला जाता है। घनाभ के कुल पृष्ठीय क्षेत्रफल का सभी 8 घनों के पार्श्व पृष्ठीय क्षेत्रफल के योग से अनुपात क्या है?
- SSC CGL TIER I 16/11/2020
- (a) 2:3 (b) 8:7 (c) 4:2 (d) 7:12
29. Walls (excluding roofs and floors) of 5 identical rooms having length, breadth and height 6 m, 4 m and 2.5 m respectively are to be painted. Out of five rooms, two rooms have one square window

each having a side of 2.5m. Paints are available only in cans of litre; and 1 litre of paint can be used for painting 20 square meters. The number of cans required for painting is

लंबाई, चौड़ाई और ऊँचाई 6m, 4m और 2.5 मीटर वाले 5 समान कमरों की दीवारों (छत और फर्श को छोड़कर) को पेंट किया जाना है। पाँच कमरों में से दो और कमरों में एक-एक वर्गाकार खिड़की है, जिसके किनारे 2.5 मीटर हैं। पेंट केवल लीटर के डिब्बे में उपलब्ध होते हैं; और 20 वर्ग मीटर की पेंटिंग के लिए 1 लीटर पेंट का उपयोग किया जा सकता है। पेंटिंग के लिए आवश्यक डिब्बे की संख्या है

[CDC 2018-II]

- (a) 10 (b) 12
(c) 13 (d) 14

30. The diagonal of three faces of a cuboid are 13, $\sqrt{281}$, 20 linear Then the total surface area of the cuboid is -

घनाभ के तीन सतहों के विकर्ण 13, $\sqrt{281}$, और 20 इकाई है तो घनाभ का कुल सतह क्षेत्रफल है-

- (a) 650 sq.unit (b) 658 sq. unit
(c) 664 sq. unit (d) 672 sq.unit

31. A tank is in the form of a cuboid with length 12 m. If 18 kilolitre of water is removed from it, the water level goes down by 30 cm. What is the width (in m) of the tank?

एक टंकी एक घनाभ के आकार की है जिसकी लंबाई 12 मी है। यदि इसमें से 18 किलोलीटर पानी निकाल दिया जाए, तो जल स्तर 30 सेमी नीचे चला जाता है। टंकी की चौड़ाई (मीटर में) क्या है?

SSC CGL TIER II 13/09/2019

- (a) 4 (b) 5
(c) 5.5 (d) 4.5

32. A 9 cm solid metallic cube and a solid metallic cuboid having dimensions 5 cm, 13 cm, 31 cm are melted and recast into a single cube. What is the total surface area (in cm^2) of the new cube?

5 सेमी, 13 सेमी, 31 सेमी आयाम वाले एक 9 सेमी ठोस धात्विक घन और एक ठोस धात्विक घनाभ को पिघलाकर एक एकल घन बनाया जाता है। नए घन का कुल पृष्ठीय क्षेत्रफल (सेमी² में) क्या है?

SSC CPO 23/11/2020 (Evening)

- (a) 2744 (b) 1362 (c) 865 (d) 1176

33. The volume of a wall whose height is 10 times its width and whose length is 8 times its height, is 51.2 m^3 . What is the cost (in Rs.) of painting the wall on one side at the rate of Rs. 100/ m^2 ?

एक दीवार का आयतन जिसकी ऊँचाई उसकी चौड़ाई की 10 गुनी है और जिसकी लम्बाई उसकी ऊँचाई की 8 गुनी है, 51.2 m^3 है। 100 m^2 रुपये की दर से दीवार को एक तरफ पेंट करने की लागत (रुपये में) क्या है?

SSC CGL 20/8/2021 (Afternoon)

- (a) 12750 (b) 12500
(c) 12800 (d) 12250

34. The sum of length, breadth and height of a cuboid is 20 cm. If the length of the diagonal is 12 cm, then find the total surface area of the cuboid.

एक घनाभ की लंबाई, चौड़ाई और ऊँचाई का योग 20 सेमी है। यदि विकर्ण की लंबाई 12 सेमी है, तो घनाभ का कुल पृष्ठीय क्षेत्रफल ज्ञात कीजिए।

SSC CGL TIER II 18/11/2020

- (a) 264 (b) 364 (c) 356 (d) 256

35. Find the height of a cuboid whose volume is 330 cm^3 and base area is 15 cm^2 .

एक घनाभ की ऊँचाई ज्ञात कीजिए जिसका आयतन 330 cm^3 है और आधार का क्षेत्रफल 15 cm^2 है।

SSC CGL 9/03/2020 (Afternoon)

- (a) 19 cm (b) 24 cm
(c) 22 cm (d) 21 cm

36. What is the surface area of the cuboid ?
घनाभ का पृष्ठीय क्षेत्रफल क्या है?

- (a) 288 cm^2
(b) 216 cm^2
(c) 144 cm^2
(d) Cannot be determined due to insufficient data

37. If S is the sum of the cubes of the dimensions of the cuboid and V is its volume, then what is $(S - 3V)$ equal to?

यदि घनाभ की विमाओं के घनों का योग S है और V इसका आयतन है, तो $(S - 3V)$ किसके बराबर है?

[2019-I]

- (a) 572 cm^3 (b) 728 cm^3
(c) 1144 cm^3 (d) None of the above

Type-4 (Cuboid) ANSWER KEY															
1	B	2	B	3	B	4	B	5	A	6	C	7	D	8	A
9	D	10	C	11	C	12	B	13	B	14	A	15	B	16	A
17	(*)	18	D	19	B	20	C	21	D	22	C	23	C	24	B
25	D	26	C	27	A	28	B	29	B	30	C	31	B	32	D
33	C	34	D	35	C	36	A	37	C						

Type-4 (Cuboid) Solution

1. Sol. (b)

Length of the longest rod

$$= \sqrt{12^2 + 9^2 + 8^2}$$

$$= \sqrt{144 + 81 + 64} = \sqrt{289} = 17 \text{ m}$$

2. Sol. (b)

$L + B + H = 23 \text{ cm}$ (Given) Length of the diagonal of cuboid

$$= \sqrt{L^2 + B^2 + H^2}$$

$$\Rightarrow 5\sqrt{7} = \sqrt{L^2 + B^2 + H^2}$$

$$\Rightarrow 175 = L^2 + B^2 + H^2$$

$$(L + B + H)^2 = L^2 + B^2 + H^2 + 2(LB + BH + HL)$$

$$\Rightarrow 23^2 = 175 + 2(LB + BH + HL)$$

$$\Rightarrow 529 = 175 + 2(LB + BH + HL)$$

$$\Rightarrow 354 = 2(LB + BH + HL)$$

$$\text{So, TSA of cuboid} = 354 \text{ cm}^2$$

3. Sol. (b)

Here the thickness = 1 cm,

so for outer surface: Length

$$= 30 + 2(1) = 32 \text{ cm,}$$

$$\text{Breadth} = 18 + 2(1) = 20 \text{ cm,}$$

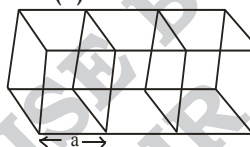
$$\text{Height} = 23 + 2(1) = 25 \text{ cm}$$

Space occupy by rectangular box

$$= \text{Length} \times \text{Breadth} \times \text{Height}$$

$$= 32 \times 20 \times 25 = 16000 \text{ cm}^3$$

4. Sol. (b)



$$\text{Diagonal of cube} = 6\sqrt{3}$$

$$= a\sqrt{3}, \text{ where } a \text{ is the side of the cube}$$

$$\Rightarrow \text{Side of cube} = 6 \text{ cm.}$$

After joining it is an cuboid of length = 3×6

$$= 18 \text{ cm, breadth} = 6 \text{ cm \& height} = 6 \text{ cm.}$$

$$\text{Total surface area} = 2(lb + bh + hl)$$

$$= 2(108 + 36 + 108) = 504 \text{ cm}^2$$

5. Sol. (a)

$$L \rightarrow 5 \quad 6$$

$$B \rightarrow 4 \quad 5$$

$$H \rightarrow 10 \quad 7$$

$$LBH \rightarrow 200 \quad 210$$

$$\% \text{ increase volumes} = \frac{10}{200} \times 100 = 5\%$$

6. Sol. (c)

$$25000 \text{ lit} = 25 \text{ m}^3$$

$$25 = l \times \frac{1}{5} \times \frac{1}{8}$$

$$l^3 = 125 \times 8 \Rightarrow l = 5 \times 2 = 10 \text{ m}$$

7. Sol. (d)

The outer dimensions of a closed metal box is

15 cm, 18 cm, 8 cm Thickness of the metal = 1.5 cm

So, the inner dimension of the metal box-

$$= 15 - 1.5 \times 2 = 15 - 3 = 12 \text{ cm}$$

$$= 18 - 1.5 \times 2 = 18 - 3 = 15 \text{ cm}$$

$$= 8 - 1.5 \times 2 = 8 - 3 = 5 \text{ cm}$$

So, the required volume of the metal

$$= 15 \times 18 \times 8 - (12 \times 15 \times 5)$$

$$= 2160 - 900 = 1260 \text{ cm}^3$$

8. **Sol. (a)**

Here, length = 20 cm, breadth b = 10 cm and

height h = 8 cm Area of a cardboard needed

$$= 2(lb + bh + hl)$$

$$= 2(20 \times 10 + 10 \times 8 + 8 \times 20)$$

$$= 2(200 + 80 + 160) = 2(440) \Rightarrow 880 \text{ cm}^2$$

9. **Sol. (d)**

Total surface area of cuboid $2(lb + bh + hl)$

$$\Rightarrow 2(17 \times 8 + 8 \times 3 + 17 \times 3)$$

$$= 2(136 + 24 + 51) = 422 \text{ m}^2$$

10. **Sol. (c)**

Length of new cuboid = $3a$

Breadth = a , Height = a

$$\text{T.S.A.} = 2[(3a \times a) + (a \times a) + (a \times 3a)]$$

$$= 2(3a^2 + a^2 + 3a^2)$$

$$= 14a^2.$$

11. **Sol. (c)**

TSA of cuboid = $2(lb + bh + hl)$

$$= 2(7 \times 5 + 5 \times 9 + 9 \times 7)$$

$$= 2(35 + 45 + 63) = 2 \times 143 = 286 \text{ cm}^2$$

12. **Sol. (b)**

It is given that,

$$L + B = 37 - (1), L - B = 13 - (2)$$

Adding eqn. (1) and (2), we have :

$$L = \frac{37+13}{2} = \frac{50}{2} = 25 \text{ cm}, B = 12 \text{ cm}$$

ATQ, Volume of cuboid = $25 \times 12 \times H$

$$3300 = 300H \Rightarrow H = \frac{3300}{300} = 11 \text{ cm}$$

13. **Sol. (b)**

Length of the longest pole

$$= \sqrt{60^2 + 30^2 + 20^2}$$

$$= \sqrt{3600 + 900 + 400}$$

$$= \sqrt{4900} = 70 \text{ feet}$$

14. **Sol. (a)**

Let side of each cube so formed be a .

$$\text{Volume of cuboid} = 8 \times a^3$$

$$12 \times 54 \times 72 = 8 \times a^3$$

$$a^3 = 5832 \Rightarrow a = 18 \text{ cm}$$

Lateral surface area of 2 such cube

$$= 2 \times (4 \times 18^2) = 8 \times 324 = 2592 \text{ cm}^2$$

15. **Sol. (b)**

Volume of cuboid

$$= \text{length} \times \text{breadth} \times \text{height}$$

$$4800 = \text{length} \times \text{breadth} \times 20 \text{ length} \times \text{breadth}$$

$$= 240$$

So, area of base of cuboid = length $\times$ breadth

$$= 240 \text{ cm}^2$$

16. **Sol. (a)**

Given that,

$$l \times b = 729, b \times h = 529, l \times h = 289$$

$$\text{Volume of cuboid} = l \times b \times h$$

Multiply (1), (2) and (3) we get

$$l^2 \times b^2 \times h^2 = 729 \times 529 \times 289$$

$$\Rightarrow lbh = \sqrt{729 \times 529 \times 289}$$

$$= 27 \times 23 \times 17 = 10557 \text{ cm}^3$$

17. **Sol.**

(c) Side of cuboid are p, q and r , then

$$\text{Surface area, } s = 2(pq + qr + pr)$$

$$\text{Volume, } t = p \cdot q \cdot r$$

$$\text{Now, } \frac{1}{p} + \frac{1}{q} + \frac{1}{r} = \frac{pq+qr+rp}{pqr} = \frac{s}{2t}$$

18. **Sol. (d)**

No. of bricks

$$= \frac{8 \times 3 \times 22.5 \times 1000000}{64 \times 11.25 \times 6} = 125000$$

19. **Sol. (b)**

Number of bricks

$$= \frac{8 \times 100 \times 6 \times 100 \times 22.5}{25 \times 11.25 \times 6} = 6,400$$

20. Sol. (c)

Side of cube = 7 cm

Length, breadth & Height of cuboid = 21, 7, 7

Total surface area = $2[147 + 49 + 147]$

$$= 686 \text{ cm}^2$$

21. Sol. (d)

Outer dimension = $160 \times 130 \times 100$

thickness = 10 cm

So, inner dimensions are

$$\text{Length} = 160 - 20 = 140 \text{ cm}$$

$$\text{Breadth} = 130 - 20 = 110 \text{ cm}$$

$$\text{Height} = 100 - 20 = 80 \text{ cm}$$

Volume of box = $140 \times 110 \times 80$

$$= 1232000 \text{ cm}^3$$

Total volume of 500 balls = $1232000 - 1212596$

$$= 19404 \text{ cm}^3$$

$$500 \times \frac{4}{3} \times \frac{22}{7} \times r^3 = 19404$$

$$r^3 = \frac{441 \times 7 \times 3}{1000} \Rightarrow r^3 = 92.61$$

$$r = 2.1 \text{ cm}$$

22. Sol. (c)

Let the breadth of wall be x Then, height of wall = $6x$ And length of wall = $3x$

$$\text{ATQ, } 3x \times x \times 6x = 23958 \Rightarrow 18x^3 = 23958$$

$$x^3 = \frac{23958}{18} = 1331 \Rightarrow x = 11 \text{ cm}$$

23. Sol. (c)

$$17\text{m} \times 6\text{m} \times 3\text{m} = (119 \times 18 - 17 \times 6) \times h$$

$$18 = (126 - 6)h$$

$$h = \frac{18}{120} \times 100 \text{ cm} = 15 \text{ cm}$$

24. Sol. (b)

After cutting

$$\text{Length of Box} = 32 - (3 + 3) \times 26$$

$$\text{Breadth of Box} = 18 - (3 + 3) = 12$$

$$\text{Height} = 3$$

$$\text{Volume of the box} = 26 \times 12 \times 3 = 936 \text{ cm}^3$$

25. Sol. (d)

$$2a^3 = 32 \times 12 \times 9$$

$$a^3 = 8 \times 216$$

$$a = 2 \times 6 = 12$$

TSA of cuboid

TSA of cubes

$$\Rightarrow 2(32 \times 12 + 12 \times 9 + 32 \times 9) : 6 \times 12 \times 12 \times 2$$

$$\Rightarrow (64 + 18 + 48) : 144$$

$$\Rightarrow 32 + 9 + 24 : 72$$

$$\Rightarrow 65:72$$

26. Sol. (c)

Area of 4 walls = $2(l \times h + b \times h)$ given, $l = 12 \text{ m}$

$$b = 8 \text{ m}$$

$$h = 10 \text{ m}$$

$$\therefore \text{Area of Walls} = 2 \times 10(12 + 8)$$

$$= 20 \times 20 = 400$$

$$\therefore \text{Cost of white washing is } 25 \times 400 = 10000$$

27. Sol. (a)

$$l + b + h = 28, \sqrt{l^2 + b^2 + h^2} = 17$$

$$(l + b + h)^2 = 28^2$$

$$l^2 + b^2 + h^2 + 2(lb + bh + hl) = 28^2$$

$$2(lb + bh + hl) = 28^2 - 17^2 = 45 \times 11 = 495 \text{ cm}^2$$

28. Sol. (b)

Volume of cuboid

$$= 18 \text{ cm} \times 36 \text{ cm} \times 72 \text{ cm} = 46656$$

$$\text{Volume of 1 cube} = \frac{46656}{8} = 5832$$

$$\text{Side of cube} = \sqrt[3]{5832} = 18$$

Lateral surface area of 8 cubes

$$= 8 \times 4 \times 18 \times 18 = 10368$$

Total surface area of the cuboid

$$= 2((18 \times 36) + (36 \times 72) + (72 \times 18))$$

$$= 9072$$

$$\text{Required ratio} = 9072:10368 = 8:7$$

29. Sol. (b)

Total area of four walls of 5 rooms excluding 2 windows

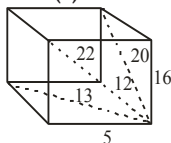
$$= 5 \times 2 \times h(\ell + b) - (2.5)^2 \times 2$$

$$= 5 \times 2 \times 2.5(6 + 4) - 12.5$$

$$= 237.5$$

$$\text{Number of cans required} = \frac{237.5}{20} = 12$$

30. Sol. (c)



Diagonal - 13 $\rightarrow$ 5, 12 (Triplet)

$$20 \rightarrow 12, 16$$

$$\sqrt{281} \rightarrow 5, 16$$

$$l, b, h = 5, 12, 13$$

$$\text{TSA} = 2(60 + 192 + 80)$$

$$= 2 \times 332 = 664$$

31. Sol. (b)

We know that,

$$1000 \text{ litre} = 1 \text{ m}^3$$

$$\Rightarrow 18000 \text{ litre} = 18 \text{ m}^3$$

Let the width of the tank = w

$$18 \text{ m}^3 = l \times h \times w,$$

$$18 = 12 \times \frac{30}{100} \times w \Rightarrow w = 5 \text{ m}$$

32. Sol. (d)

$$\text{Volume of cube} = a^3 = 9^3 = 729$$

$$\text{Volume of cuboid} = 5 \times 13 \times 31 = 2015$$

$$\text{Total volume} = 2015 + 729 = 2744$$

$$\text{Side of resultant cube} = 14 \text{ cm}$$

$$\text{Surface area of resultant cube}$$

$$= 6a^2 = 6 \times 14^2 = 1176 \text{ cm}^2$$

33. Sol. (c)

Let width of the wall = x

$$\text{Height of the wall} = 10x$$

$$\text{Length of the wall} = 80x$$

Volume of the wall

$$= 800x^3 = 51.2 \text{ m}^3 \Rightarrow x = 0.4 \text{ m}$$

$$\text{Length of the wall} = 32 \text{ m}$$

$$\text{Height of the wall} = 4 \text{ m}$$

$$\text{Area of the one side of the wall} = 128 \text{ m}^2$$

$$\text{Cost of painting} = 128 \times 100 = 12800$$

34. Sol. (d)

$$l + b + h = 20$$

$$\sqrt{l^2 + b^2 + h^2} = 12$$

$$\Rightarrow l^2 + b^2 + h^2 = 144$$

$$(l + b + h)^2 = l^2 + b^2 + h^2 + 2(lb + bh + hl)$$

$$400 - 144 = 2(lb + bh + hl)$$

$$256 = 2(lb + bh + hl)$$

35. Sol. (c)

Volume of a cuboid

$$= l \times b \times h = 330 \text{ cm}^3$$

$$\text{Base Area} = l \times b = 15 \text{ cm}^2$$

$$\text{Height} = \frac{330}{15} = 22 \text{ cm}$$

36. Sol. (a)

Let lengths, breadth and height of cuboid be l, b

and h respectively

According to question

$$l + b + h = 22 \text{ cm} \dots (i)$$

$$\text{and } \sqrt{l^2 + b^2 + h^2} = 14 \dots (ii)$$

$$\text{Surface area of cuboid} = 2(lb + bh + lh)$$

Squaring eq. (i) gives

$$l^2 + b^2 + h^2 + 2(lb + bh + lh) = 484$$

$$\text{Substituting } l^2 + b^2 + h^2 \text{ from eq. (ii) } 2(lb + bh + lh) = 484 - 196 = 288 \text{ cm}^2$$

37. Sol. (c)

$$S = l^3 + b^3 + h^3$$

$$\text{and } V = lbh$$

$$\text{Now, } S - 3V = l^3 + b^3 + h^3 - 3lbh$$

$$= (l + b + h)(l^2 + b^2 + h^2 - (lb + bh + lh))$$

$$= 22(196 - 144) = 1144 \text{ cm}^2$$

Type-5 (Cone)

1. The height and slant height of a conical vessel are 12 cm and 13 cm, respectively. The capacity of the vessel is: (Use $\pi = 3.14$)
एक शंकाकार पात्र की ऊँचाई और तिर्यक ऊँचाई क्रमशः 12 cm और 13 cm है। पात्र की क्षमता कितनी है? ($\pi = 3.14$ का प्रयोग कीजिए)

SSC CHSL 2023 (Shift- 01)

- (a) 0.314 Litres (b) 0.424 Litres
(c) 0.5 Litres (d) 0.298 Litres

2. The slant height and the radius of a right circular cone are 11 cm and 6 cm, respectively. What is the curved surface area of the cone?

एक लम्बवृत्तीय शंकु की तिरछी ऊँचाई और त्रिज्या क्रमशः 11 सेमी और 6 सेमी है। शंकु का वक्र पृष्ठीय क्षेत्रफल कितना है?

SSC MTS 12/07/2022 (Afternoon)

- (a) $74\pi\text{cm}^2$ (c) $44\pi\text{cm}^2$
(b) $60\pi\text{cm}^2$ (d) $66\pi\text{cm}^2$

3. A cone of height 16 cm and diameter 14 cm is mounted on a hemisphere of same diameter. What is the volume of the solid thus formed? (take $\pi = \frac{22}{7}$)

16 सेमी ऊँचाई और 14 सेमी व्यास का एक शंकु समान व्यास के एक अर्धगोले पर रखा गया है। इस प्रकार बने ठोस का आयतन क्या है?

[CDS-2021-II]

- (a) 1540 cm^3 (c) 1048 cm^3
(b) 1078 cm^3 (d) 770 cm^3

4. The radius a circular cone is R and its height is H . the volume of cone is:

एक वृत्ताकार शंकु की त्रिज्या R है और इसकी ऊँचाई H है। शंकु का आयतन है:

SSC CHSL 19/03/2020 (Morning)

- (a) $\frac{\pi R^2 H}{3}$ (b) $\frac{2}{3\pi R^2 H}$
(c) $\pi R^2 H$ (d) $\pi R^2 H$

5. A conical vessel (solid) is made of iron. Its base radius is 7 cm and height is 15 cm. If the weight of the iron per cubic centimetre is 15 g, what is the weight of the vessel?

एक शंकाकार पात्र (ठोस) लोहे का बना है। इसके आधार की त्रिज्या 7 सेमी और ऊँचाई 15 सेंटीमीटर है। यदि प्रति घन सेमी लोहे का भार 15 ग्राम है, तो पात्र का भार ज्ञात कीजिए।

SSC CGL 09/12/2022 (Shift- 02)

- (a) 13.55 kg (b) 12.55 kg
(c) 14.55 kg (d) 11.55 kg

6. A cone-shaped storage tank's height and radius are 9 and 7 feet, respectively. Determine how much liquid the tank can contain. (Take $\pi = 3.14$)

एक शंकु के आकार के भंडारण टैंक की ऊँचाई और त्रिज्या क्रमशः 9 और 7 फीट है। निर्धारित करें कि टैंक में कितना तरल हो सकता है। ($\pi=3.14$ लीजिए)

SSC CPO 11/11/2022 (Morning)

- (a) 471 cubic feet (b) 450 cubic feet
(c) 435.32 cubic feet (d) 461.58 cubic feet

7. A conical vessel has radius 4 cm and its curved surface area is $20\pi\text{cm}^2$. The volume of conical vessel is:

एक शंकाकार बर्तन की त्रिज्या 4 सेमी है और इसकी घुमावदार सतह का क्षेत्रफल $20\pi\text{ cm}^2$ है। शंकाकार बर्तन का आयतन है:

Graduate Level 02/08/2022 (Shift - 3)

- (a) $18\pi\text{cm}^3$ (c) $26\pi\text{cm}^3$
(b) $12\pi\text{cm}^3$ (d) $16\pi\text{cm}^3$

8. What is the area of the curved surface of a right circular cone with height 8 m and slant height 10 m?

8 मीटर ऊँचाई और 10 मीटर तिर्यक ऊँचाई वाले एक लंब वृत्तीय शंकु के वक्र पृष्ठ का क्षेत्रफल क्या है?

SSC CGL 08/12/2022(Shift 01)

- (a) 60 m^2 (b) $60\pi\text{m}^2$
(c) 40 m^2 (d) $40\pi\text{m}^2$

9. A right circular cone is cut parallel to its base in to five parts by four cut such that height of each part is same. If the difference between volume of largest and smallest part is 480 cm^3 . Then find the volume of middle most part.

एक लम्बवृत्तीय शंकु को आधार के समान्तर चार कटाव के द्वारा पाँच भागों में काटा गया है। प्रत्येक भाग की ऊँचाई एक समान है। यदि सबसे बड़े भाग तथा सबसे छोटे भाग के आयतनों का अन्तर 480 cm^3 है तो मध्य भाग का आयतन बताओ।

- (a) 152 (c) 172
(b) 352 (d) None

10. The height of a right circular cone is 6 cm and its base diameter is 16 cm. Find the volume of this cone.

एक लम्बवृत्तीय शंकु की ऊँचाई 6 सेमी है और इसके आधार का व्यास 16 सेमी है। इस शंकु का आयतन ज्ञात कीजिए।

SSC CHSL 03/06/2022 (Morning)

- (a) 384π (b) 786π (c) 128π (d) 512π

11. The slant height and radius of a right circular cone are in the ratio 29: 20. If its volume is $4838.4\pi\text{cm}^3$, then its radius is:

एक लम्बवृत्तीय शंकु की तिर्यक ऊँचाई और त्रिज्या का अनुपात 29:20 है। यदि इसका आयतन $4838.4\pi\text{cm}^3$ है, तो इसकी त्रिज्या है:

SSC CGL Tier II 29/01/2022

- (a) 20 cm (b) 28 cm (c) 24 cm (d) 25 cm

12. What is the total surface area of a cone having a height of 12 cm and a slant height of 13 cm (Take $\pi = 3.14$)

12 cm ऊँचाई और 13 cm तिर्यक ऊँचाई वाले शंकु है संपूर्ण पृष्ठीय क्षेत्रफल कितना है? ($\pi = 3.14$ लीजिए)

[DP Head constable 12/10/2022 Shift-03].

- (a) 282.6 cm^2 (c) 264.71 cm^2

- (b) 136.36 cm^2 (d) 292.4 cm^2

13. If the ratio of the radius of the base of a right circular cone to its slant height is 1: 3, what is the ratio of the total surface area to the curved surface area?

यदि एक लंब वृत्तीय शंकु के आधार की त्रिज्या का उसकी तिर्यक ऊँचाई से अनुपात 1:3 है, तो कुल पृष्ठीय क्षेत्रफल का वक्र पृष्ठीय क्षेत्रफल से अनुपात क्या है?

[CDS -2018-I]

- (a) 5:3 (b) 3:1 (c) 4:1 (d) 4:3

14. A paper cone of volume $100\pi\text{cm}^3$ and height of 12 cm can be made by cutting a sector of circle from paper. Find the perimeter of the sector cut from the paper. Use $\pi = 3.14$.

$100\pi\text{ cm}^3$ के आयतन और 12 सेमी की ऊँचाई का एक कागज का शंकु कागज से एक वृत्त के एक भाग को काटकर बनाया जा सकता है। कागज से काटे गये भाग का परिमाण ज्ञात कीजिये। $\pi = 3.14$ उपयोग कीजिये।

- (a) 51.4 cm (b) 53.4 cm

- (c) 55.4 cm (d) 57.4 cm

15. A right angle triangle whose side are 15 cm and 20 cm (other than Hypotenuse) is made to revalue about its hypotenuse find the volume and surface area of double cone reformed?

एक समकोण त्रिभुज जिसकी भुजायें 15 cm और 20 cm है (कर्ण के अलावा) को उसके कर्म के चारो ओर घुमाया जाता है

इस प्रकार बने शंकुओं का आयतन और पृष्ठीय क्षेत्रफल ज्ञात कीजिये ?

- (a) $1200\pi, 1320$ (b) $1600\pi, 1320$

- (c) $1250\pi, 1444$ (d) $1000\pi, 1260$

16. The volume of a right circular cone is $196\pi\text{cm}^3$. If the area of its base is 154 cm^2 , What is the vertical height of the cone? [use $\pi = \frac{22}{7}$]

एक लम्बवृत्तीय शंकु का आयतन $196\pi\text{ cm}^3$ है। यदि इसके आधार का क्षेत्रफल 154 सेमी^2 है, तो शंकु की ऊर्ध्वाधर ऊँचाई क्या है?

SSC MTS 19/07/2022 (Morning)

- (a) 10 cm (b) 12 cm (c) 14 cm (d) 16 cm

17. A cloth of 3 m width is used to make a conical tent 12 m in diameter with a slant height of 7 m. What is the length of the cloth? (Take $\pi = \frac{22}{7}$)

7 मीटर की तिरछी ऊँचाई के साथ 12 मीटर व्यास वाला एक शंकाकार तम्बू बनाने के लिए 3 मीटर चौड़ाई के कपड़े का उपयोग किया जाता है। कपड़े की लंबाई कितनी है?

[CDS - 2021-I]

- (a) 21 m (b) 28 m (c) 44 m (d) 66 m

18. A cone has base radius 8 cm and vertical height 15 cm. What is its total surface area of (in cm^2 , rounded off to the nearest integer (Take $\pi = \frac{22}{7}$)

एक शंकु के आधार की त्रिज्या 8 सेमी. और जाँघो ऊँचाई 15 सेमी. है। इसका संपूर्ण पृष्ठीय क्षेत्रफल (रे में, निकटतम पूर्णांक तक पूर्णांकित) क्या होगा ($\pi = \frac{22}{7}$ लीजिए)

DP Head Constable 12/10/2022

- (a) 629 (b) 721 (c) 578 (d) 427

19. The radius and height of a right circular cone are in the ratio 3: 7. If the volume of the cone is 528 cm^3 , then what is the height of the cone? (Take $\pi = \frac{22}{7}$)

एक लम्बवृत्तीय शंकु की त्रिज्या और ऊँचाई का अनुपात 3:7 है। यदि शंकु का आयतन 528 सेमी^3 है, तो शंकु की ऊँचाई कितनी है?

[CDS 2022-I]

- (a) 3.5 cm (b) 7.0 cm

- (c) 10.5 cm (d) 14.0 cm

20. The ratio of the radii of two cones is 5: 6 and their volume is in the ratio 8 : 9. The ratio of their height is :

दो शंकुओं की त्रिज्याओं का अनुपात 5:6 है और उनके आयतन का अनुपात 8:9 है। उनकी ऊँचाई का अनुपात है:

SSC CGL TIER II 16/11/2020

- (a) 25:27 (b) 27:20 (c) 20:27 (d) 32:25

21. What is the volume of the largest right circular cone that can be cut out from a cube whose edge is 10 cm ?

10 सेमी किनारे वाले घन से काटे जा सकने वाले सबसे बड़े लंब वृत्तीय शंकु का आयतन क्या है?

SSC CHSL 26/05/2022 (Morning)

- (a) $\frac{250\pi}{3}$ (b) $\frac{351\pi}{3}$ (c) $\frac{145\pi}{3}$ (d) $\frac{150\pi}{3}$

22. A cone of radius 90 cm and height 120 cm stands on its base. It cut into 3 parts by 2 cuts parallel to its base such that the height of the three parts (from top to bottom) are in ratio of 1:2:3. What is the total surface area (in cm^2) of the middle part? एक 90 सेमी. त्रिज्या तथा ऊँचाई 120 सेमी. ऊँचाई वाला शंकु अपने आधार पर खड़ा है। इसे आधार के समांतर 2 कटाव से 3 भागों में इस प्रकार काटा जाता है कि तीनों भागों की ऊँचाई (ऊपर से नीचे की ओर) का अनुपात 1:2:3 है। मध्य भाग का कुल पृष्ठीय क्षेत्रफल (सेमी. ² में) क्या है?

- (a) 14600 (b) 16500 (c) 17800 (d) 18500

23. A small cone of base area $4\pi\text{cm}^2$ and volume is $12\pi\text{cm}^3$ is cut from the top of a large cone of base area $16\pi\text{cm}^2$ and volume of $80\pi\text{cm}^3$. Find the height of the remaining solid figure. एक छोटा शंकु जिसके आधार का क्षेत्रफल 4π सेमी ² और आयतन 12π सेमी ³ है, का आधार के क्षेत्रफल 16π सेमी ² और आयतन 80π सेमी ³ वाले किसी बड़े शंकु से काटा गया है। शेष ठोस आकृति की ऊँचाई ज्ञात कीजिए।

- (a) 2 cm (b) 4 cm (c) 6 cm (d) 8 cm

24. A right circular cone is inscribed in a cube of side 14 cm occupying the maximum space possible. What is the ratio of the volume of the cube to the volume of the cone? ($\pi = 22/7$) एक समवृत्ताकार शंकु 14 सेमी भुजा वाले एक घन में अंकित है जो अधिकतम संभव स्थान घेरता है। घन के आयतन का शंकु के आयतन से अनुपात क्या है? ($\pi = 22/7$)

SSC MTS 18/10/2021 (Afternoon)

- (a) 81:22 (b) 11:42 (c) 42:11 (d) 22:81

25. A semi-circular plate is rolled up to form a conical surface. The angle between the generator and the axis of the cone is

एक शंकाकार सतह बनाने के लिए एक अर्ध-वृत्ताकार प्लेट को रोल किया जाता है। जनित्र तथा शंकु के अक्ष के बीच का कोण है

[CDS - 2018-II]

- (a) 60° (b) 45° (c) 30° (d) 15°

26. The lateral surface area of a cone is 462cm^2 . Its slant height is 35 cm. The radius of the base of the cone is

एक शंकु का पार्श्व पृष्ठीय क्षेत्रफल 462सेमी^2 है। इसकी तिरछी ऊँचाई 35 सेमी. शंकु के आधार की त्रिज्या है

[CDS - 2018-II]

- (a) 8.4 cm (b) 6.5 cm
(c) 4.2 cm (d) 3.2 cm

27. If H, C and V are respectively the height, curved surface area and volume of a cone, then what is $3\pi VH^3 + 9V^2$ equal to ?

यदि H, C और V क्रमशः एक शंकु की ऊँचाई, घुमावदार सतह क्षेत्र और आयतन हैं, तो $3\pi VH^3 + 9V^2$ किसके बराबर है?

[CDS - 2020-II]

- (a) C^2H^2 (b) $2C^2H^2$
(c) $5C^2H^2$ (d) $7C^2H^2$

28. Rohit has a toy which is right cylindrical in shape. He completely inserted that toy in to a right conical shaped toy of height 30 cm. The vertical angle of the conical toy is 60° and the diameter of the cylindrical toy is $8\sqrt{3}\text{cm}$. Find the volume of the conical toy (in cm^3).

रोहित के पास एक खिलौना है जो आकार में सीधा बेलनाकार है। उसने उस खिलौने को पूरी तरह से 30 सेंटीमीटर ऊँचाई वाले एक दाहिने शंकाकार आकार के खिलौने में डाला। शंकाकार खिलौने का ऊर्ध्वाधर कोण 60° है और बेलनाकार खिलौने का व्यास $8\sqrt{3}$ सेमी है। शंकाकार खिलौने का आयतन ज्ञात कीजिए (सेमी³ में)।

- (a) 3000π (b) 4860π
(c) 3260π (d) 4475π

29. The radius and height of a right circular cone are in ratio 3:4. If its curved surface area (in cm^2) is 240π , then its volume (in cm^3) is:

एक लम्ब वृत्तीय शंकु की त्रिज्या और ऊँचाई का अनुपात 3:4 है। यदि इसका वक्र पृष्ठीय क्षेत्रफल (सेमी² में) 240π है, तो इसका आयतन (सेमी³ में) है:

SSC CGL TIER II 15/11/2020

- (a) 768π (b) 384π
(c) 2304π (d) 1536π

30. A right circular cone is cut parallel to its base in two parts by one cut such that volume of each part is same. Find out the ratio of height of upper and lower part.

एक लम्बवृत्तीय शंकु को आधार के समान्तर एक कटाव के द्वारा दो भागों में बांटा गया है। प्रत्येक भाग का आयतन एक समान है। ऊपरी तथा नीचले भाग की ऊँचाई का अनुपात बताओ।

- (a) $1:(\sqrt[3]{2}+1)$ (b) $1:\sqrt{2}$

- (c) $1:\sqrt[3]{2}$ (d) $1:(\sqrt[3]{2}-1)$

31. The radius and height of a right circular cone are in the ratios $1:2.4$ if its curved surface area is 2502.5 cm^2 , then what is its volume?
एक लम्ब वृत्तीय शंकु की त्रिज्या और ऊँचाई का अनुपात $1:2.4$ है यदि इसका वक्र पृष्ठीय क्षेत्रफल 2502.5 cm^2 है, तो इसका आयतन क्या है?
(a) 8085 (b) 8820 (c) 11550 (d) 13475
32. The Volume of a solid right circular cone is $600\pi \text{ cm}^3$ and the diameter of its base is 30cm. The total surface area (in cm^2) of the cone is
एक ठोस लंब वृत्तीय शंकु का आयतन 600π सेमी³ है और इसके आधार का व्यास 30 सेमी है। शंकु का कुल पृष्ठीय क्षेत्रफल कितना है
(a) 486π (b) 480π (c) 255π (d) 472π
33. A cone is 68 m high and its slant height is inclined at 30° to the horizon. Find the area of its curved surface area (approx.)?
एक शंकु 68 मी. ऊँचा है और तिरछी ऊँचाई समतल से 30° पर झुकी हुई है। पार्श्व पृष्ठीय क्षेत्रफल (लगभग) क्या है?
(a) 50344 m^2 (b) 50349 m^2
(c) 50341 m^2 (d) 50346 m^2
34. Four identical cone each of radius 10.5 cm and height 14 cm are cut from a cuboid of dimension $30 \text{ cm} \times 32 \text{ cm} \times 40 \text{ cm}$ base of each cone base the surface of cuboid. What is the TSA of remaining solid?
एक $30 \times 32 \times 40 \text{ cm}$ माप वाले घनाभ से चार एक समान शंकु इस प्रकार काटे गये हैं कि इनके आधार घनाभ की सतह पर स्थित हैं जिनकी त्रिज्या 10.5 cm और ऊँचाई 14 सेमी है तब शेष बचे TSA का कुल पृष्ठ क्षेत्रफल क्या है?
(a) 6528 (b) 7804 (c) 5926 (d) 6824
35. The circumference of the base of a conical tent is 66 m. If the height of the tent is 36 m. what is the area of the canvas used in making the tent?
एक शंक्याकार तंबू के आधार की परिधि 66 मीटर है। यदि तंबू की ऊँचाई 36 मीटर है। इसे बनाने के लिये कितने क्षेत्रफल के कैनवास की आवश्यकता है?
(a) 1155 (b) 1237.5 (c) 1171.5 (d) 1254
36. If the radius of the base of a cone is doubled, and the volume of the new cone is three times the volume of the original cone, then what will be the ratio of the height of the original cone to that of the new cone?

यदि एक शंकु के आधार की त्रिज्या दोगुनी कर दी जाए, और नए शंकु का आयतन मूल शंकु के आयतन का तीन गुना हो जाए, तो मूल शंकु की ऊँचाई का नए शंकु की ऊँचाई से क्या अनुपात होगा?

SSC CGL TIER II 11/09/2019

- (a) $1:3$ (b) $4:3$ (c) $2:9$ (d) $9:4$

37. A right circular cone is sliced into a smaller cone and a frustum of a cone by a plane perpendicular to its axis. The volume of the smaller cone and the frustum of the cone are in the ratio $64:61$. Then their curved surface areas are in the ratio
एक लम्ब वृत्तीय शंकु को एक छोटे शंकु में और एक शंकु के एक छिन्नक को उसके अक्ष के लम्बवत् समतल द्वारा काटा जाता है। छोटे शंकु और शंकु के छिन्नक का आयतन $64:61$ के अनुपात में है। तब उनके वक्र पृष्ठीय क्षेत्रफल अनुपात में होते हैं

[CDS - 2018-I]

- (a) $4:1$ (b) $16:9$ (c) $64:61$ (d) $81:64$

38. A circular sheet of paper of radius 10 cm. A sector of 40% area is removed and the remaining part is used to make a conical surface. Find the volume of conical surface.

त्रिज्या 10 cm के कागज की एक वृत्ताकार शीट से, एक वृत्तखण्ड जिसका क्षेत्रफल 40% है, काटकर निकाल दिया गया है, यदि शेष भाग से एक शंकाकार कप बनाया है। शंकाकार कप का आयतन बताओ?

- (a) $90\pi \text{ cm}^3$ (b) $96\pi \text{ cm}^3$
(c) $86\pi \text{ cm}^3$ (d) None

39. The radius and slant height of a right circular cone are 5 cm and 13 cm respectively. What is the volume of the cone?

एक लम्ब वृत्तीय शंकु की त्रिज्या और तिरछी ऊँचाई क्रमशः 5 सेमी और 13 सेमी है। शंकु का आयतन क्या है?

[CDS-2018-I]

- (a) $100\pi \text{ cm}^3$ (b) $50\pi \text{ cm}^3$
(c) $65\pi \text{ cm}^3$ (d) $169\pi \text{ cm}^3$

40. A cube of maximum possible size is cut from a cone of radius $15\sqrt{2} \text{ cm}$ and height 20 cm, then find maximum volume of cube?

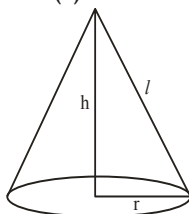
$15\sqrt{2}$ सेमी⁰ त्रिज्या और 20 सेमी ऊँचाई वाले एक शंकु से अधिकतम भुजा वाला एक घन कटा गया है इस घन का अधिकतम आयतन क्या होगा?

- (a) 1728 (b) 3375 (c) 1000 (d) 2048

Type-5 (Cone) ANSWER KEY															
1	A	2	D	3	A	4	A	5	D	6	D	7	D	8	B
9	A	10	C	11	C	12	A	13	D	14	D	15	A	16	B
17	C	18	A	19	D	20	D	21	A	22	B	23	C	24	C
25	C	26	C	27	A	28	A	29	A	30	D	31	D	32	B
33	C	34	B	35	B	36	B	37	B	38	B	39	A	40	A

Type-5 (Cone) Solution

1. Sol. (a)



Given, $h = 12$ cm, $l = 13$ cm

$$r = \sqrt{l^2 - h^2} = \sqrt{13^2 - 12^2} = 5$$

$$V = \frac{1}{3} \pi r^2 h$$

$$\therefore V = \frac{1}{3} \times 3.14 \times 5 \times 5 \times 12$$

$$= 314 \text{ cm}^3 = \frac{314}{1000} \text{ litre} = 0.314 \text{ litre}$$

2. Sol. (d)

Curved Surface area of cone

$$= \pi r l = \pi \times 6 \times 11 = 66\pi$$

3. Sol. (a)

$$\frac{2}{3} \times \frac{22}{7} \times 7 \times 7 \times 7 + \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 16 \Rightarrow 1540 \text{ cm}^3$$

4. Sol. (a)

$$\text{Volume of cone} = \frac{1}{3} \pi R^2 H$$

5. Sol. (d)

Given, base radius of cone = 7 cm = r , Height of cone = 15 cm = h

Density = weight of iron per $\text{cm}^3 = 15\text{g per cm}^3$

We know, weight = volume $\times$ density

$$\text{Volume of cone} = \frac{1}{3} \pi r^2 h$$

$$= \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 15 = 770 \text{ cm}^3$$

$$\text{Weight of vessel} = 770 \times 15\text{g}$$

$$= 11550 \text{ g} = 11.55 \text{ kg}$$

6. Sol. (d)

Volume of cone-shaped storage

$$= \frac{1}{3} \times 3.14 \times 7^2 \times 9 = 461.58 \text{ cubic feet}$$

7. Sol. (d)

Given, radius of the cone = 4 cm,

$$\text{C.S.A of cone} = \pi r l$$

$$\Rightarrow \pi r l = 20\pi \Rightarrow l = \frac{20}{4} = 5 \text{ cm}$$

$$\text{Now, height of the cone} = \sqrt{l^2 - (r)^2}$$

$$= \sqrt{25 - 16} = 3 \text{ cm}$$

Volume of the conical vessel

$$= \frac{1}{3} \pi r^2 h = \frac{1}{3} \times \pi \times 4 \times 4 \times 3 = 16\pi \text{ cm}^3$$

8. Sol. (b)

$h = 8$ m, $l = 10$ m

$$r = \sqrt{l^2 - h^2} = \sqrt{100 - 64} = 6$$

Covered surface area of right circular cone = at

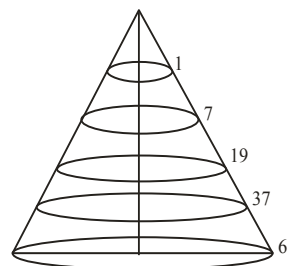
$$= \pi \times 6 \times 10 = 60\pi \text{ m}^2$$

9. Sol. (a)

$$16 = 480 \text{ cm}^3$$

$$1 = 8 \text{ cm}^3$$

$$19 = 19 \times 8 \text{ cm}^3$$

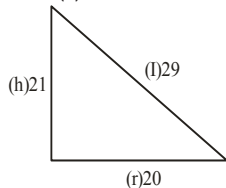


10. Sol. (c)

volume of cone

$$= \frac{1}{3} \times \pi \times \frac{16}{2} \times \frac{16}{2} \times 6 = 128\pi \text{ cm}^3$$

11. Sol. (c)



As height, radius and slant height of a cone form a triplet, we have height $21x$ and radius $= 20x$

$$\frac{1}{3} \pi \cdot (20x)^2 \times 21x = 4838.4\pi$$

$$x^3 = 1.728 \Rightarrow x = 1.2$$

$$\text{radius} = 20x = 20 \times 1.2 = 24 \text{ cm}$$

12. Sol. (a)

Given, $h = 12, l = 13$

$$(r)^2 = (l)^2 - (h)^2$$

$$(r)^2 = 169 - 144$$

$$r^2 = 25 \Rightarrow r = 5 \text{ cm.}$$

$$\text{Now, T.S.A. of cone} \Rightarrow \pi r(l + r)$$

$$\Rightarrow 3.14 \times 5 \times (13 + 5)$$

$$\Rightarrow 3.14 \times 5 \times 18$$

$$\Rightarrow 282.6 \text{ cm}^2$$

13. Sol. (d)

Let radius of cone be x and slant height of cone be

$$3x \text{ Total surface area of cone} = \pi r(r + l) = \pi \times$$

$$x(x + 3x) = 4x^2\pi$$

$$\text{Curved surface area of cone} = \pi rl = \pi \times x \times 3x =$$

$$3x^2\pi \text{ Required ratio} = 4x^2\pi : 3x^2\pi = 4 : 3$$

14. Sol. (d)

$$\text{Volume of cone} = \frac{1}{3} \pi r^2 h$$

$$\frac{1}{3} \times \frac{22}{7} \times r^2 \times 12 = 100 \times \frac{22}{7}$$

$$r^2 = 25$$

$$r = 5 \text{ cm}$$

$$l = \sqrt{h^2 + r^2}$$

$$= \sqrt{144 + 25} = 13 \text{ cm}$$

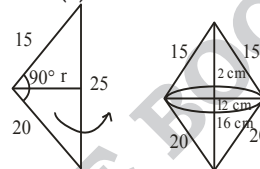
If we cut a sector from circle then slant height of cone is equal to radius and length of is equal to circumference of cone.

$$\text{Perimeter of sector} = 2l + 2\pi r$$

$$= 2 \times 13 + 2 \times 3.14 \times 5$$

$$= 26 + 31.4 = 57.4 \text{ cm}$$

15. Sol. (a)



$$r = \frac{15 \times 20}{25} = 12 \text{ cm, } V = \frac{1}{3} \pi 12^2 (9 + 16)$$

$$V = 1200\pi \text{ cm}^3, \text{SA} = \pi \times 12(15 + 20) = 1320 \text{ cm}^3$$

16. Sol. (b)

$$\text{Area of base} = 154 \text{ cm}^2$$

$$\Rightarrow \pi r^2 = 154 \Rightarrow \frac{22}{7} r^2 = 154$$

$$\Rightarrow r^2 = 49 \Rightarrow r = \sqrt{49} = 7$$

The volume of right circular cone

$$= \frac{1}{3} \pi r^2 h \Rightarrow \frac{1}{3} \pi r^2 h = 196\pi$$

$$\Rightarrow \frac{1}{3} \times 7 \times 7 \times h = 196 \Rightarrow h = 12 \text{ cm}$$

17. Sol. (c)

$$\text{Radius of the tent} = \frac{12}{2} = 6 \text{ m}$$

lateral surface Area of the tent = Area of the cloth

$$\pi r.l = (\text{length of the cloth}) \times 3$$

$$\frac{22}{7} \times 6 \times 7 = (l) \times 3$$

$$\therefore \text{length of the cloth } (l) = 44 \text{ m.}$$

18. Sol. (a)

There, $r = 8 \text{ cm, } h = 15 \text{ cm,}$

$$(l) = \sqrt{(8)^2 + (15)^2}$$

$$\Rightarrow \sqrt{64 + 225}$$

$$l = 17 \text{ cm}$$

$$\text{T.S.A.} = \pi r(r + l) \Rightarrow \frac{22}{7} \times 8 \times (17 + 8)$$

$$\Rightarrow \frac{22}{7} \times 8 \times 25 \approx 628.58$$

$$\text{Closest integer} \Rightarrow 629 \text{ cm}^2.$$

19 Sol. (d)

Let height of the cone is $7x$ and radius of the cone is $3x$ cm.

$$\frac{1}{3}\pi r^2 h = 528 \text{ (given)}$$

$$\frac{1}{3} \times \frac{22}{7} \times 9x^2 \times 7x = 528$$

$$22 \times 3x^3 = 528$$

$$x^3 = \frac{528}{22 \times 3}$$

$$x^3 = 8$$

$$x = 2 \text{ cm}$$

$$\therefore \text{Height of the cone} = 7x = 14 \text{ cm}$$

20. Sol. (d)

Ratio of radius = 5:6

Ratio of volume = 8:9

$$= \frac{1}{3}\pi r^2 h : \frac{1}{3}\pi R^2 H$$

$$8:9 = 25h:36H \Rightarrow 32:25 = h:H$$

21. Sol. (a)

Edge of cube = 10 cm

Height of the largest cone = Edge of the cube
= 10 cm

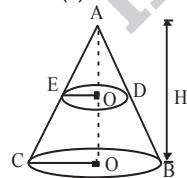
$$\text{Radius of the largest cone} = \frac{10}{2} = 5 \text{ cm}$$

Volume of the largest cone

$$= \frac{1}{3} \times \pi \times 5 \times 5 \times 10 = \frac{250\pi}{3} \text{ cm}^3$$

22. Sol. (b)

23. Sol. (c)



Given

$$\pi r^2 = 4\pi$$

$$\Rightarrow r = 2 \text{ cm}$$

$$\text{Volume of smaller cone} = \frac{1}{3}\pi r^2 h = 12\pi$$

$$\Rightarrow \frac{1}{3}\pi \times 4 \times h = 12\pi \Rightarrow h = 9 \text{ cm}$$

Also, area of circle with centre O = 16π

$$\Rightarrow \pi R^2 = 16\pi \Rightarrow R = 4 \text{ cm}$$

and volume of larger cone = 80π

$$\Rightarrow \frac{1}{3}\pi R^2 H = 80\pi \Rightarrow \frac{1}{3}\pi \times 16 \times H = 80\pi$$

$\therefore$ height of remaining figure

$$= H - h = 15 - 9 = 6 \text{ cm}$$

24. Sol. (c)

For maximum volume of the cone we must have the height and diameter of the cone equal to the side of the cube.

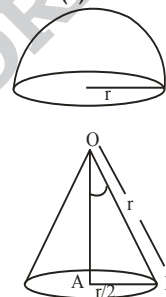
The side of the cube be 14 units, then the height of the cone is 14 units and its radius is 7 units.

Required ratio

$$= 14 \times 14 \times 14 : \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 14$$

$$\Rightarrow 42:11$$

25. Sol. (c)



Since, the radius of semicircle = slant height of the cone = r

And the circumference of semicircle = circumference of base of cone.

$$\pi r = 2\pi R$$

$$\Rightarrow \frac{r}{2} = R$$

In $\triangle OAB$

$$\sin \theta = \frac{R}{r} = \frac{r/2}{r} = \frac{1}{2} = \sin 30^\circ$$

$$\theta = 30^\circ$$

26. Sol. (c)

Lateral Surface area of the cone = $\pi r.l$ so, $\pi r \times$

$$35 = 462$$

$$r = \frac{462}{35 \times 22} \times 7 = 4.2 \text{ cm}$$

27. Sol. (a)

Let radius of the cone is r .

Then $C^2 = \pi^2 r^2 l^2 = \pi^2 r^2 (r^2 + H^2)$ and

$$V = \frac{1}{3} \pi r^2 \cdot H$$

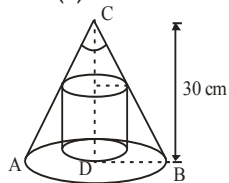
$$\therefore 3\pi \cdot V \cdot H^3 + 9V^2$$

$$= 3\pi \left(\frac{1}{3} \pi r^2 H \right) \cdot H^3 + 9 \cdot \left(\frac{1}{3} \pi r^2 H \right)^2$$

$$= \pi^2 r^2 H^4 + \pi^2 r^4 H^2$$

$$= \pi^2 \cdot r^2 H^2 \{H^2 + r^2\} = \pi^2 \cdot r^2 H^2 \cdot l^2 = C^2 H^2$$

28. Sol. (a)



$$\Rightarrow \angle CBA = 60^\circ$$

$$\Rightarrow \tan 60^\circ = \frac{CD}{BD} = \frac{30}{r}, \text{ where } r \text{ is radius of cone}$$

$$\sqrt{3} = \frac{30}{r} \Rightarrow r = \frac{30}{\sqrt{3}}$$

$$\Rightarrow \text{Volume of cone toy} = \frac{1}{3} \pi r^2 h$$

$$= \frac{1}{3} \times \pi \times \left(\frac{30}{\sqrt{3}} \right)^2 \times 30$$

$$= \frac{1}{3} \times \pi \times \frac{900}{3} \times 30 = 3000\pi$$

29. Sol. (a)

Radius: Height = 3:4 Slant height = 5 (in ratio)

Curved surface area = $\pi r l$

$$240\pi = \pi \times 3r \times 5r \Rightarrow r = 4$$

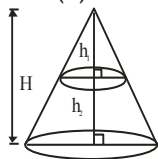
Radius = 12; Height = 16

$$\text{Volume} = \frac{1}{3} \pi r^2 h$$

$$= \frac{1}{3} \pi 12 \times 12 \times 16$$

$$\text{Volume} = 768\pi \text{ cm}^3$$

30. Sol. (d)



$$V_{O1} = V_{O2}$$

$$\frac{h^3}{H^3} = \frac{1}{2}$$

$$h = 1, H = \sqrt[3]{2}$$

$$h_1 : h_2$$

$$1 : (\sqrt[3]{2} - 1)$$

31. Sol. (d)

$$\frac{r}{h} = \frac{1}{2.4} = \frac{1}{12/5} = \frac{5}{12} = \frac{5x}{12x} \quad l = 13x$$

$$\text{CSA} = \frac{22}{7} \times 5x \cdot 13x = \frac{5005}{2}$$

$$x^2 = \frac{7^2}{2^2} \Rightarrow x = \frac{7}{2}$$

$$V = \frac{1}{3} \pi 25x^2 \cdot 12x = \frac{22}{7} \times 100 \times \frac{343}{8} = 275 \times 49 =$$

$$13475 \text{ cm}^3$$

32. Sol. (b)

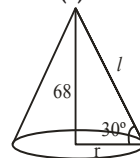
$$V = \frac{1}{3} \pi 15 \cdot 15 \cdot h = 600\pi$$

$$h = 8, R = 15, l = 17$$

$$\text{TSA} = \pi R(l + R) = \pi \times 15(15 + 17)$$

$$= 480\pi$$

33. Sol. (c)



$$\Rightarrow \tan 30 = \frac{68}{r}$$

$$\Rightarrow r = \frac{68}{1/\sqrt{3}} = 68\sqrt{3} \text{ m}$$

$$l = \sqrt{h^2 + r^2}$$

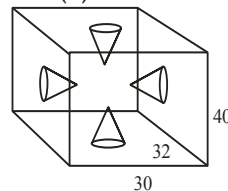
$$= \sqrt{(68)^2 + (68\sqrt{3})^2}$$

$$l = 136 \text{ m}$$

Now, C.S.A = $\pi r l$

$$= \frac{22}{7} \times 68 \times \sqrt{3} \times 136 = 50341 \text{ m}^2$$

34. Sol. (b)



$$\text{TSA of cuboid} = 2(30 \times 32 + 30 \times 40 + 40 \times 32)$$

$$= 2(960 + 1200 + 1280) = 6880$$

Total TSA = TSA of cuboid + CSA of cone

– Area of circle

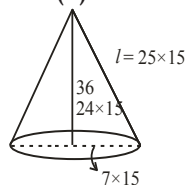
$$= 6880 + 4\pi r l - 4\pi r^2$$

$$= 6880 + 4\pi r(l - r)$$

$$= 6880 + 4 \times \frac{22}{7} \times 10.5 \times 7$$

$$= 6880 + 924 = 7804$$

35. Sol. (b)



$$\begin{aligned} \frac{r}{7} \times 15 &= \frac{44}{66} \times 1.5 \\ r &= 10.5 \end{aligned}$$

$$CSA = \pi r l$$

$$= \frac{22}{7} \times 7 \times 1.5 \times 25 \times 1.5$$

$$= 550 \times 2.25 = 1237.5$$

36. Sol. (b)

Let original volume = v , original radius = r and original height = h and new height = H

$$v = \frac{1}{3} \pi r^2 h \Rightarrow h = \frac{3v}{\pi r^2}$$

According to the question

$$3v = \frac{1}{3} \pi (2r)^2 H \Rightarrow H = \frac{9v}{4\pi r^2}$$

$$\text{Required ratio} = \frac{3v}{\pi r^2} : \frac{9v}{4\pi r^2} = 4:3$$

37. Sol. (b)

Let volume of smaller cone be 64 unit and volume of frustum be 61 unit Total volume of bigger cone = $64 + 61 = 125$ units Here smaller cone is cut from bigger cone then respective ratio of their radius, height will be equal

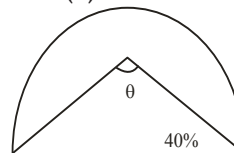
$\therefore$ Respective ratio of area bigger cone to that of smaller cone

$$= (\sqrt[3]{125})^2 : (\sqrt[3]{64})^2 = 25:16$$

Respective ratio of area of smaller cone to that of frustum

$$= 16:25 - 16 = 16:9$$

38. Sol. (b)



$r = 10, 40\%$ area removed

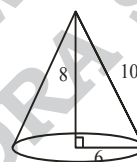
$$\text{Area} = \text{L.S.A of cone}, \Rightarrow 60\pi = \pi \times r \times 10$$

$$r = 6$$

$$r^2 + h^2 = l^2$$

$$36 + h^2 = 100$$

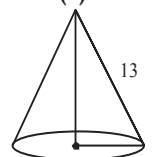
$$h = 8$$



$$\text{volume of cone} = \frac{1}{3} \pi r^2 \times h$$

$$= \frac{1}{3} \times \pi \times 36 \times 8 = 96\pi \text{ cm}^3$$

39. Sol. (a)



$$r = 5 \text{ cm}, l = 13 \text{ cm}$$

$$h = \sqrt{l^2 - r^2} = \sqrt{13^2 - 5^2} = \sqrt{144} = 12$$

$$\text{Hence, volume of cone} = \frac{1}{3} \times \pi \times r^2 \times h$$

$$= 100\pi \text{ cm}^2$$

40. Sol. (a)

$$\text{Side of cube (a)} = \frac{\sqrt{2}rh}{\sqrt{2}r+h}$$

$$\text{Side of cube} = \frac{\sqrt{2} \times 15 \times \sqrt{2} \times 20}{\sqrt{2} \times \sqrt{5} \times \sqrt{2} + 20} = \frac{600}{50} = 12 \text{ cm}$$

$$\text{Volume} = 12^3 = 1728$$

Type-6 (Cylinder)

1. The total surface area of a solid cylinder whose radius is r cm and height is $\frac{r}{2}$ cm (in cm^2) is :
एक ठोस सिलेंडर का कुल सतह क्षेत्र जिसका त्रिज्या r cm है और ऊँचाई $\frac{r}{2}$ cm (सेमी² में) है:

SSC CHSL 2023 (Morning)

- (a) $3\pi\frac{r^2}{2}$ (b) $4\pi r^2$ (c) $3\pi r^2$ (d) $\pi\frac{r^3}{2}$

2. The radius of a right circular cylinder is thrice of its height. If the height of the cylinder is 2.1 cm, then what is the volume of cylinder?
एक लंब वृत्ताकार बेलन की त्रिज्या उसकी ऊँचाई की तीन गुना है। यदि बेलन की ऊँचाई की गुना है। यदि बेलन की ऊँचाई 2.1 cm है, तो बेलन का आयतन क्या है?

SSC CGL 03/12/2022 (Shift- 03)

- (a) 224.65 cm^3 (b) 194.72 cm^3
(c) 324.86 cm^3 (d) 261.95 cm^3

3. Two cylinders have their heights in the ratio 1:2 and their radii in the ratio 2:1. What is the ratio of their volumes?
दो बेलनों की ऊँचाई 1:2 के अनुपात में है और उनकी त्रिज्या 2:1 के अनुपात में है। उनके आयतन का अनुपात क्या है?

SSC MTS 15/07/2022 (Evening)

- (a) 3:1 (b) 1:3 (c) 2:1 (d) 1:2

4. A cylindrical tank having an internal radius 14 m, contains water up to the depth of 10 m. What is the total area of the wet surface? (Use $\pi = \frac{22}{7}$)
एक बेलनाकार टैंक, जिसकी आंतरिक त्रिज्या 14 m है, में 10 m की गहराई तक पानी है। गीली सरीह का कुल क्षेत्रफल कितना है? ($\pi = \frac{22}{7}$ लीजिए)

DP Head Constable 10/10/2022 (Shift-01)

- (a) 1496 m^2 (b) 1492 m^2
(c) 1494 m^2 (d) 1498 m^2

5. What is the volume (cm^3) of a right circular cylinder whose curved surface area is $12\pi\text{cm}^2$ and the circumference of its base is $4\pi\text{cm}$?
एक लम्ब वृत्तीय बेलन का आयतन (सेमी³) क्या है जिसका वक्र पृष्ठीय क्षेत्रफल $12\pi\text{cm}^2$ है और इसके आधार की परिधि $4\pi\text{cm}$ है?

SSC CHSL 30/05/2022 (Evening)

- (a) 48π (b) 36π (c) 12π (d) 24π

6. A cylindrical pipe has inner diameter of 14 cm. Water flows through it at a rate of 154 litres per minute. What is the speed of water in km/hr? (Take $\pi = \frac{22}{7}$)

एक बेलनाकार पाइप का आंतरिक व्यास 14 सेमी है। इसके माध्यम से पानी 154 लीटर प्रति मिनट की दर से बहता है। किमी/घंटा में पानी की गति क्या है? [$\pi = \frac{22}{7}$ का प्रयोग करें]

[CDS-2022-I]

- (a) 0.5 (b) 0.6 (c) 0.8 (d) 1

7. The height of a cylinder is 3 cm more than the radius of its base. If the height is 10 cm, then what is the volume of this cylinder? [use $\pi = \frac{22}{7}$]

एक बेलन की ऊँचाई उसके आधार की त्रिज्या से 3 सेमी अधिक है। यदि ऊँचाई 10 सेमी है, तो इस बेलन का आयतन क्या है? [$\pi = \frac{22}{7}$ का प्रयोग करें]

SSC MTS 20/07/2022 (Morning)

- (a) 1540 cm^3 (b) 1860 cm^3
(c) 2160 cm^3 (d) 1240 cm^3

8. What is the radius of a normal cylinder whose height is 21 cm and curved surface area is 1386cm^2 ?

एक सामान्य बेलन की त्रिज्या क्या है जिसकी ऊँचाई 21 सेमी और वक्र पृष्ठीय क्षेत्रफल 1386सेमी^2 है?

SSC CPO 10/11/2022 (Afternoon)

- (a) 10.5 cm (b) 3.5 cm
(c) 7 cm (d) 10 cm

9. The radius of a right circular cylinder is five times of its height. If the height of the cylinder is 3.5 cm, then what is the volume of the cylinder?

एक लम्ब वृत्तीय बेलन की त्रिज्या उसकी ऊँचाई की पाँच गुनी है। यदि बेलन की ऊँचाई 3.5 सेमी है, तो बेलन का आयतन क्या है?

SSC CGL 02/12/2022 (3rd Shift)

- (a) 3368.75 cm^3 (b) 3872.75 cm^3
(c) 3146.75 cm^3 (d) 3524.25 cm^3

10. The external and Internal radius of hollow right circular cylinder of height 15 cm are 6.75 cm and 5.25 cm, respectively. If it is melted to form a solid cylinder of height half of the original cylinder then the radius of the solid cylinder is:

15 सेमी ऊँचाई के खोखले लम्ब वृत्तीय बेलन की बहरी और आंतरिक त्रिज्या क्रमशः 6.75 सेमी और 5.25 सेमी, है। यदि मूल बेलन के आधे हिस्से को एक ठोस बेलन बनाने के लिये पिघलाया जाता है तो ठोस बेलन की त्रिज्या क्या है?

- (a) 6 cm (b) 6.5 cm
(c) 4 cm (d) 7.25 cm

11. The radius of a right circular cylinder is four times of its height. If the height of the cylinder is 14 cm, then what is the volume of the cylinder?

एक लम्बवृत्तीय बेलन की त्रिज्या उसकी ऊँचाई की चार गुनी है। यदि बेलन की ऊँचाई 14 सेमी है, तो बेलन का आयतन क्या है?

SSC CGL 12/12/2022 (2nd Shift)

- (a) 15468 cm³ (b) 14262 cm³
(c) 137984 cm³ (d) 11296 cm³

12. The area of the base of a closed cylinder is 1386 cm². If the height of the cylinder is 20 cm, then what is the total surface area of the cylinder? [use $\pi = \frac{22}{7}$]

एक बंद बेलन के आधार का क्षेत्रफल 1386 सेमी² है। यदि बेलन की ऊँचाई 20 सेमी है, तो बेलन का कुल पृष्ठीय क्षेत्रफल कितना है? [$\pi = 22/7$ का प्रयोग करें]

SSC MTS 05/07/2022 (Afternoon)

- (a) 7032 cm² (b) 5412 cm²
(c) 6112 cm² (d) 8132 cm²

13. The curved surface area and circumference at the base of a solid right circular cylinder are 2200 cm² and 110 cm, respectively. Find the height of the cylinder.

एक ठोस लम्बवृत्तीय बेलन के आधार पर घुमावदार सतह का क्षेत्रफल और परिधि क्रमशः 2200 cm² और 110 सेमी है। बेलन की ऊँचाई ज्ञात कीजिए।

SSC CPO 10/11/2022 (Morning)

- (a) 24 cm (b) 22 cm
(c) 20 cm (d) 18 cm

14. Find the curved surface area of a solid cylinder whose radius of base is 14 cm and volume is 7392 cm³. [Use $\pi = \frac{22}{7}$]

एक ठोस बेलन का वक्र पृष्ठीय क्षेत्रफल ज्ञात कीजिए जिसके आधार की त्रिज्या 14 सेमी और आयतन 7392 cm³ है। [$\pi = 22/7$ का प्रयोग करें]

SSC MTS 05/07/2022 (Evening)

- (a) 1840 cm² (b) 1056 cm²
(c) 1081 cm² (d) 996 cm²

15. If the curved surface area of a cylindrical cup is 90% of the total surface area of the cup; then find the ratio of the height of the cup to its diameter.

यदि एक बेलनाकार कप का घुमावदार सतह क्षेत्रफल कप के कुल सतह क्षेत्रफल का 90% है, तो इसके ऊँचाई से व्यास का अनुपात ज्ञात कीजिये।

- (a) 3:2 (b) 3:4 (c) 9:2 (d) 9:4

16. What is the total surface area of solid right circular cylinder of radius 7 cm and height 8 cm ? ($\pi = \frac{22}{7}$)

7 सेमी त्रिज्या और 8 सेमी ऊँचाई वाले ठोस समवृत्तीय बेलन का कुल पृष्ठीय क्षेत्रफल क्या है? ($\pi = 22/7$)

SSC CPO 09/11/2022 (Evening)

- (a) 560 cm² (b) 660 cm²
(c) 850 cm² (d) 760 cm²

17. The circumference of the base of a cylindrical vessel is 264 cm and its height is 50 cm. The capacity (in litres) of the vessel is: (Use $\pi = 22/7$)

एक बेलनाकार बर्तन के आधार की परिधि 264 सेमी है और इसकी ऊँचाई 50 सेमी है। बर्तन की क्षमता (लीटर में) है:। (उपयोग $\pi = 22/7$)

SSC CGL Tier II 03/02/2022

- (a) 277.2 (b) 278.4 (c) 280.6 (d) 267.4

18. What is the difference between the total surface area and the curved surface area of a cylinder whose radius is 5 cm and height is 7 cm ? (Take $\pi = 3.14$)

5 सेमी त्रिज्या और 7 सेमी ऊँचाई वाले एक बेलन के संपूर्ण पृष्ठीय क्षेत्रफल और वक्र पृष्ठीय क्षेत्रफल के बीच का अंतर कितना है? ($\pi = 3.14$ लें)

DP Head Constable 13/10/2022

(Shift-03)

- (a) 159.3 cm² (b) 155.7 cm²
(c) 157 cm² (d) 159.2 cm²

19. The ratio between the height and radius of the base of a cylinder is 7:5. If its volume is 14836.5 cm³, then find its total surface area (take $\pi = 3.14$).

एक बेलन के आधार की ऊँचाई और त्रिज्या के बीच का अनुपात 7:5 है। यदि इसका आयतन 14836.5 सेमी³ है, तो इसका कुल पृष्ठीय क्षेत्रफल ज्ञात कीजिए ($\pi = 3.14$ लीजिए)।

SSC CPO 09/11/2022 (Morning)

- (a) 3391.2 cm² (b) 5391.2 cm²
(c) 4391.2 cm² (d) 5591.2 cm²

20. The total surface area of a solid right circular cylinder of height 13 cm, is 880 cm². Its volume (in cm³) is 11k. The value of k is: (Use $\pi = 22/7$)

13 सेमी ऊँचाई वाले एक ठोस लम्बवृत्तीय बेलन का कुल पृष्ठीय क्षेत्रफल 880 सेमी² है। इसकी मात्रा (सेमी³ में) 11k है। k का मान है: ($\pi=22/7$ का प्रयोग करें)

SSC MTS 5/10/2021(Afternoon)

- (a) 208 (b) 182 (c) 104 (d) 91

21. A rectangular paper is 44 cm long and 22 cm wide. Let x be the volume of the largest cylinder formed by rolling the paper along its length and y be the volume of the largest cylinder formed by rolling the paper along its width. What is the ratio of x to y ? (Take $\pi = \frac{22}{7}$)

एक आयताकार कागज 44 सेमी लंबा और 22 सेमी चौड़ा है। मान लीजिए x कागज को उसकी लंबाई के अनुदिश लुढ़काकर बनाए गए सबसे बड़े बेलन का आयतन है और y कागज को उसकी चौड़ाई के अनुदिश घुमाकर बनाए गए सबसे बड़े बेलन का आयतन है। x का अनुपात क्या है? (उपयोग $=22/7$)

[CDS - 2021-I]

- (a) 1:1 (b) 2:1 (c) 1:2 (d) 3:2

22. The radius of the base and height of a solid right circular cylinder are in the ratio 2:3 and its volume is 1617 cm³. what is total surface area of the cylinder.

एक लम्ब वृत्तीय बेलन की आधार की त्रिज्या और ऊँचाई 2:3 के अनुपात में है और इसका आयतन 1617 cm³ है तो इसका कुल सतह क्षेत्रफल क्या है?

- (a) 462 (b) 616 (c) 770 (d) 786

23. A 15 m deep well with radius 2.8 m is dig and the earth taken out from it is spread evenly to form a plat form of breadth. 8 m and height 1.5 m. what will be the length of the plat form P.

एक 15 मीटर गहराई के कुएँ को खोदा जाता है और इससे बाहर निकाली गई मिट्टी को इसके ऊपर चारों तरफ फैलाकर 8 मीटर और 1.5 मीटर ऊँचाई का एक चबूतरा बनाया जाता है तो चबूतरे की लम्बाई क्या होगी?

- (a) 88.8 m (b) 30.8 m
(c) 28.4 m (d) 30.2 m

24. A cylindrical tube, open at both ends, is made of a metal sheet which is 0.5 cm thick. Its outer radius is 4 cm and length is 2 m. How much metal (in cm³) has been used in making the tube?

दोनों सिरों पर खुली एक बेलनाकार ट्यूब धातु की एक शीट से बनी है जो 0.5 सेमी मोटी है। इसकी बाहरी त्रिज्या 4 सेंटीमीटर और लंबाई 2 मीटर है। ट्यूब बनाने में कितनी धातु (सेमी³ में) का उपयोग किया गया है?

SSC CGL Tier II 03/02/2022

- (a) 800 π (b) 450 π (c) 750 π (d) 550 π

25. The radius of the base of a right circular cylinder in increased by 20% by what percent should its height be decreased so that It volume return the same as before?

एक लम्बवृत्तीय बेलन की आधार की त्रिज्या को 20% बढ़ाया जाता है तो इसकी ऊँचाई के कितने प्रतिशत कम किया जाये ताकि आयतन पहले के समान रहे?

- (a) 25 (b) 28 (c) 30 $\frac{2}{9}$ (d) 30 $\frac{5}{9}$

26. If the radius of a cylinder is decreased by 40% and the height is increased by 60% to form a new cylinder, then the volume will be decreased by:

यदि एक नया बेलन बनाने के लिए एक बेलन की त्रिज्या 40% कम कर दी जाती है और ऊँचाई 60% बढ़ा दी जाती है, तो आयतन कितना कम हो जाएगा:

SSC MTS 6/10/ 2021 (Morning)

- (a) 41.5% (b) 32.4%
(c) 40.5% (d) 42.4%

27. The ratio of the radius of base to the height of a cylinder is 2:3. If the volume of the cylinder is 1617 cm³, then what is the curved surface area of the cylinder? (Take $\pi = \frac{22}{7}$)

आधार की त्रिज्या का बेलन की ऊँचाई से अनुपात 2:3 है। यदि बेलन का आयतन 1617 सेमी³ है, तो बेलन का वक्र पृष्ठीय क्षेत्रफल क्या है? ($\pi=22/7$ का प्रयोग करें)

[CDS - 2021-I]

- (a) 242 cm² (b) 385 cm²
(c) 462 cm² (d) 770 cm²

28. The difference between the outside and the inside surface area of a cylindrical pipe 14 cm long is 44 cm². The pipe is made of 99 cm³ of metal. If R is the outer radius and r is the inner radius of the pipe, then what is $(R + r)$ equal to? (Take $\pi = \frac{22}{7}$)

14 सेमी लंबे एक बेलनाकार पाइप के बाहरी और भीतरी सतह के क्षेत्रफल का अंतर 44 सेमी² है। पाइप 99 सेमी³ धातु से बना है। यदि R बाहरी त्रिज्या है और r पाइप की आंतरिक त्रिज्या है, तो $(R+r)$ किसके बराबर है? ($\pi=22/7$ का प्रयोग करें)

[CDS - 2021-I]

- (a) 9 cm (b) 7.5 cm
(c) 6 cm (d) 4.5 cm

29. Water is trickling out of a completely filled cylindrical of height 1 m and diameter 2 m. Every second a spherical droplet of 1 cm radius trickles down from the bottom of the tank. The tank will be emptied in approximately

1 मीटर ऊंचाई और 2 मीटर व्यास वाले एक पूरी तरह से भरे हुए बेलनाकार से पानी टपक रहा है। प्रति सेकंड एक स्फटि। 1 सेमी त्रिज्या की बूंद टैंक के नीचे से टपकती है। टैंक लगभग खाली हो जाएगा

[CDS-2011-II]

- (a) 280 hours (b) 260 hours
(c) 230 hours (d) 210 hours

30. A cylindrical vessel of radius 30 cm and height 42 cm is full of water. Its contents are emptied into a rectangular tub of length 75 cm and breadth 44 cm. The height(in cm) to which the water rises in the tub is: ($\pi = 22/7$)

त्रिज्या 30 सेमी और ऊंचाई 42 सेमी का एक बेलनाकार बर्तन पानी से भरा है। इसकी सामग्री को 75 सेमी लंबाई और 44 सेमी चौड़ाई वाले एक आयताकार टब में खाली कर दिया जाता है। टब में पानी की ऊंचाई (सेमी में) है: ($\pi = 22/7$)

SSC CGL 4/03/2020 (Afternoon)

- (a) 36 (b) 30 (c) 40 (d) 45

31. A right circular cylinder of radius 9 cm and height 16 cm is cut into four equal parts by 3 cuts parallel to base what is % increase in TSA?

एक 9 सेमी त्रिज्या और 16 सेमी ऊंचाई का लम्ब वृत्तीय बेलन आधार के समान्तर तीन जगह से काटकर चार समान भागों में काटा जाता है तो कुल पृष्ठीय क्षेत्रफल में प्रतिशत बदलाव क्या है?

- (a) 72% (b) 108% (c) 144% (d) 96%

32. The height of a cylinder is 30 cm and the diameter of its base is 10 cm. Two identical conical holes each of radius 5 cm and $h = 12$ cm are drilled out. what is the surface area (in cm^2) of the remaining solid?

एक बेलन की ऊंचाई 30 सेमी है और इसके आधार का व्यास 10 सेमी है। 5 सेमी त्रिज्या और 12 सेमी ऊंचाई के दो समान शंकाकार छेद किए गए हैं। शेष ठोस का पृष्ठीय क्षेत्रफल (cm^2 में) क्या है?

SSC CGL TIER II 15/11/2020

- (a) 230π (b) 430π (c) 330π (d) 120π

33. If 3.96 cubic cm of lead is to be drawn in to a cylindrical wire of diameter 0.6 cm, then the length of the wire (in metres), is:

यदि 3.96 घन cm सीसा होना है: 0.6 सेमी व्यास के एक बेलनाकार तार में खींचा जाता है, तो (मीटर में) तार की लंबाई, है:

SSC CHSL 20/10/2020 (Morning)

- (a) 130 m (b) 125 m
(c) 140 m (d) 120 m

34. The ratio of TSA and CSA of cylinder is 7:4 and to volume is 4851 cm^3 then what is the sum of area of two bases of the cylinder.

एक लम्ब क्षत्तीम बेलन का TSA और CSA का अनुपात 7:4 और आयतन 4851 सेमी^3 है तब इस बेलन के दोनों आधारों के क्षेत्रफलों का योग क्या है?

- (a) 462 cm^2 (b) 693 cm^2
(c) 650 cm^2 (d) 308 cm^2

35. A hollow right circular cylindrical vessel of volume whose diameter is equal to its height, is completely filled with water. A heavy sphere of maximum possible volume is then completely immersed in the vessel. What volume of water remains in the vessel?

आयतन r का एक खोखला लंबवृत्तीय बेलनाकार बर्तन जिसका व्यास उसकी ऊंचाई के बराबर है, पूरी तरह से पानी से भरा हुआ है। अधिकतम संभव आयतन का एक भारी गोला तब बर्तन में पूरी तरह से डूब जाता है। बर्तन में पानी की कितनी मात्रा रहती है?

[CDS-2019-II]

- (a) $\frac{V}{2}$ (b) $\frac{V}{3}$ (c) $\frac{2V}{3}$ (d) $\frac{V}{4}$

36. A cylinder 84 cm long is made of steel. Its external and internal diameters are 10 cm and 8 cm respectively. What is the volume of the steel in the cylinder (in 10^{-3} m^3 and correct upto three decimal places)?

84 सेमी लम्बा एक बेलन स्टील का बना है। इसका बाहरी और आंतरिक व्यास क्रमशः 10 सेमी और 8 सेमी है। सिलिंडर में स्टील का आयतन क्या है (10^{-3} m^3 में और तीन दशमलव स्थानों तक सही)?

SSC CPO 9/12/19 (Morning)

- (a) 2.112 (b) 2.376 (c) 4.752 (d) 9.504

37. A solid metallic cylinder of height 10 cm and radius 6 cm is melted to make two cones in the ratio of volume 1:2 and of same height as 10 cm. What is the percentage increase in the flat surface area?

ऊंचाई 10 सेमी और त्रिज्या 6 सेमी वाले एक ठोस धातु के बेलन को पिघलाकर 1:2 आयतन के अनुपात में और समान ऊंचाई 10 सेमी के दो शंकु बनाए जाते हैं। समतल सतह क्षेत्र में प्रतिशत वृद्धि क्या है?

[CDS - 2019-II]

- (a) 25% (b) 50% (c) 75% (d) 100%

38. A Right circular cylinder has radius 14 cm and height 40 cm. one lateral part is cut from each base of cylinder. Radius and height of each conical part is 9 cm, and 12 cm find TSA of reamaining solid?

एक लम्बवृत्तीय बेलन में त्रिज्या 14 सेमी० और ऊँचाई 40 सेमी० है। बेलन के प्रत्येक आधार से एक शंकाकार भाग काटा जाता है। प्रत्येक शंकाकार भाग की त्रिज्या और ऊँचाई क्रमशः 9 सेमी० और 12 सेमी० है। शेष ठोस का TSA ज्ञात कीजिये?

- (a) 1620π (b) 1540π
(c) 1780π (d) 1650π

39. From a solid cylindrical wooden block of height 18 cm and radius 7.5 cm, a conical cavity of same radius and same height is taken out. What is total surface area (in cm^2) of the remaining solid?

ऊँचाई 18 सेमी और त्रिज्या 7.5 सेमी वाले एक ठोस बेलनाकार लकड़ी के ब्लॉक से समान त्रिज्या और समान ऊँचाई का एक शंकाकार गुहा निकाला जाता है। शेष ठोस का कुल पृष्ठीय क्षेत्रफल (सेमी² में) क्या है?

SSC CGL TIER II 16/11/2020

- (a) 326.25π (b) 416.25π
(c) 472.5π (d) 270π

40. The radius of the base of a right circular cylinder is increased by 20%. By what percent should its height be reduced so that its volume remains the same as before?

एक लम्बवृत्तीय बेलन के आधार की त्रिज्या में 20% की वृद्धि की जाती है। इसकी ऊँचाई को कितने प्रतिशत कम किया जाए कि इसका आयतन पहले जैसा ही रहे?

SSC CGL TIER II 13/09/2019

- (a) 25 (b) $30\frac{2}{9}$ (c) $30\frac{5}{9}$ (d) 28

41. A cylindrical vessel of radius 3.5 m is full of water. If 15400 litres of water is taken out from it, then the drop in the water level in the vessel will be:

त्रिज्या 3.5 मीटर का एक बेलनाकार बर्तन पानी से भरा है। यदि उसमें से 15400 लीटर पानी निकाल लिया जाए, तो बर्तन में पानी के स्तर में गिरावट होगी:

SSC CGL TIER II 12/09/2019

- (a) 72 cm (b) 40 cm (c) 35 cm (d) 60 cm

42. 60 discs each of diameter 21 cm and thickness $\frac{1}{3}$ cm are stacked one above the other to form a right circular cylinder. What is its volume in m^3 (if $\pi = 22/7$)?

21 सेमी व्यास और $\frac{1}{3}$ सेमी मोटाई वाली 60 डिस्कें को एक के ऊपर एक रखकर एक लम्ब वृत्ताकार बेलन बनाया जाता है। m^3 में इसका आयतन क्या है (यदि $\pi = 22/7$)?

SSC CPO 9/12/19 (Morning)

- (a) 4.25×10^{-2} (b) 8.05×10^{-3}
(c) 7.62×10^{-2} (d) 6.93×10^{-3}

43. The surface area of closed cylindrical box is 352 square cm. If its height is 10 cm, then what is its diameter? (Use $= \frac{22}{7}$)

बंद बेलनाकार डिब्बे का पृष्ठीय क्षेत्रफल 352 वर्ग सेमी है। यदि इसकी ऊँचाई 10 सेमी है, तो इसका व्यास क्या है? (उपयोग $= 22/7$)

[CDS - 2018-I]

- (a) 4 cm (c) 9.12 cm
(b) 8 cm (d) 19.26 cm

44. If the sum of radius and height of a solid cylinder is 20 cm and its total surface area is 880 cm^2 then its volume is -

यदि एक ठोस बेलन की त्रिज्या और ऊँचाई का योग 20 सेमी० है तथा इसका कुल पृष्ठीय क्षेत्रफल 880 cm^2 है तब इसका आयतन क्या है ?

- (a) 176 cm^3 (b) 151.5 cm^3
(c) 2002 cm^3 (d) 4804 cm^3

45. A circus tent is in the form of a right circular cylinder with a right form of a right circular cone above it. The diameter and the height of the cylindrical part of the tent are 120 m and 7m, respectively. The total height of the tent is 18 m. What is the surface area (in m^2) of the tent?

एक सर्कस का तम्बू एक लम्ब वृत्तीय बेलन के आकार का है और उसके ऊपर एक लम्ब वृत्तीय शंकु है। तम्बू के बेलनाकार भाग का व्यास और ऊँचाई क्रमशः 120 m और 7 m है। तम्बू की कुल ऊँचाई 18 m है। तम्बू का पृष्ठीय क्षेत्रफल (m^2 में) क्या होगा?

ICAR Assistant 29/07/2022 (Shift- 03)

- (a) 4200π (b) 4400π
(c) 4800π (d) 4500π

Type-6 (Cylinder) ANSWER KEY

1	C	2	D	3	C	4	A	5	C	6	B	7	A	8	A
9	A	10	A	11	C	12	B	13	C	14	B	15	D	16	B
17	A	18	C	19	A	20	B	21	B	22	C	23	B	24	C
25	D	26	D	27	C	28	D	29	D	30	A	31	B	32	B
33	C	34	B	35	C	36	B	37	B	38	A	39	C	40	C
41	B	42	D	43	B	44	C	45	D						

Type-6 (Cylinder) Solution

1. Sol. (c)

TSA of cylinder = $2\pi r(r + h)$

$$\Rightarrow 2\pi r \left(r + \frac{r}{2} \right) = 2\pi r \times \frac{3r}{2} = 3\pi r^2$$

2. Sol. (d)

Given, Radius of cylinder, $r = 3 \times$ height, h also,

$$h = 2.1 \text{ cm}$$

$$\Rightarrow r = 3 \times 2.1 = 6.3 \text{ cm}$$

Volume of cylinder = $\pi r^2 h$

$$= \frac{22}{7} \times 6.3 \times 6.3 \times 2.1 = 261.95 \text{ cm}^3$$

3. Sol. (c)

$$\frac{V_1}{V_2} = \frac{\pi R_1^2 H_1}{\pi R_2^2 H_2} = \frac{2^2 \times 1}{1^2 \times 2} = \frac{4}{2} = 2:1$$

4. Sol. (a)

Total area of wet surface = $2\pi rh + \pi r^2$

$$= \frac{22}{7} [2 \times 14 \times 10 + 196]$$

$$= \frac{22}{7} \times 476 = 1496 \text{ m}^2$$

5. Sol. (c)

Circumference of the base cylinder

$$= 2\pi r \Rightarrow 4\pi = 2\pi r \Rightarrow r = 2 \text{ cm CSA of cylinder}$$

$$= 2\pi rh,$$

$$12\pi = 2 \times \pi \times 2 \times h \Rightarrow h = \frac{12}{4} = 3 \text{ cm}$$

$$\text{Volume of cylinder} = \pi \times 2 \times 2 \times 3 = 12\pi$$

6. Sol. (b)

$$\frac{22}{7} \times 7 \times 7 \times h = 60 \times 154 \times 1000 \left(\begin{array}{l} \because 1\text{L} = 1000\text{cm}^3 \\ 60\text{min} = 1\text{hr} \end{array} \right)$$

$$h = 6000 \text{ cm/hr}$$

$$= \frac{60000}{1000 \times 100} = 0.6 \text{ km/hr}$$

7. Sol. (a)

Height of a cylinder = 10 cm

According to the question,

$$\text{radius} = 10 - 3 = 7 \text{ cm}$$

$$\text{So, volume of cylinder} = \pi r^2 h$$

$$\Rightarrow \frac{22}{7} \times 7 \times 7 \times 10 \Rightarrow 22 \times 7 \times 10 = 1540 \text{ cm}^3$$

8. Sol. (a)

CSA of cylinder = $2\pi rh$

$$1386 = 2 \times \frac{22}{7} \times r \times 21$$

$$1386 = 132r \Rightarrow r = \frac{1386}{132} = 10.5 \text{ cm}$$

9. Sol. (a)

Height of the cylinder = 3.5 cm

Then radius of the cylinder = 17.5 cm

Volume of cylinder = $\pi r^2 h$

$$= \frac{22}{7} \times (17.5)^2 \times 3.5 = 3368.75 \text{ cm}^3$$

10. Sol. (a)

$$V = \pi(6.75^2 - 5.25^2)15 = \pi \cdot x^2 \cdot \frac{15}{2}$$

$$\Rightarrow (6.75 + 5.25)(6.75 - 5.25) = \frac{\pi}{2}$$

$$\Rightarrow 12 \times 1.5 = \frac{x^2}{2}$$

$$x^2 = 36, x = 6 \text{ cm}$$

11. Sol. (c)

It is given that height = 14 cm

$$\text{So radius} = 4 \times 14 = 56 \text{ cm}$$

Volume of cylinder = $\pi r^2 h$

$$= \frac{22}{7} \times 56 \times 56 \times 14 = 1,37,984 \text{ cm}^3$$

12. Sol. (b)

Area of base of cylinder = 1386

$$\pi r^2 = 1386 \Rightarrow \frac{22}{7} \times r^2 = 1386$$

$$r^2 = \frac{1386 \times 7}{22} = 441 \Rightarrow r = \sqrt{441} = 21 \text{ cm}$$

TSA of closed cylinder = $2(\pi r^2 + \pi rh)$

$$= 2 \left(1386 + \frac{22}{7} \times 21 \times 20 \right)$$

$$= 2(1386 + 1320) \Rightarrow 2 \times 2706 \Rightarrow 5412 \text{ cm}^2$$

13. Sol. (c)

$$\text{CSA of cylinder} = 2\pi rh = 2200 \quad \dots(1)$$

Circumference at the base of cylinder = 2

$$\pi r = 110 \dots (2)$$

Dividing eq. (1) and (2) we have :

$$h = \frac{2200}{110} = 20 \text{ cm}$$

14. Sol. (b)

Volume of cylinder = 7392

$$\Rightarrow \pi r^2 h = 7392 \Rightarrow \pi \times r \times 14 \times h = 7392$$

$$\Rightarrow \pi r h = \frac{7392}{14} = 528$$

So, the CSA of cylinder

$$= 2\pi r h = 2 \times 528 = 1056 \text{ cm}^2$$

15. Sol. (d) A. T. Q

$$2\pi r h = \frac{90}{100}(2\pi r h + \pi r^2)$$

$$2\pi r h = \frac{90}{100} \times \pi r(2h + r)$$

$$\frac{2h}{2h+r} = \frac{9}{10}$$

$$20h = 18h + 9r$$

$$2h = 9r$$

$$\frac{2h}{r} = 9 \Rightarrow \frac{h}{r} = \frac{9}{2}$$

[height : diameter = 9 : 4]

16. Sol. (b)

Given, radius of the cylinder

= 7 cm, height = 8 cm

TSA of cylinder = $2\pi r(r + h)$

$$= 2 \times \frac{22}{7} \times 7 \times (7 + 8) = 44 \times 15 = 660 \text{ cm}^2$$

17. Sol. (a)

According to the question, Circumference of the

base of a cylindrical = 264

So, $2\pi r = 264$

$$2 \times \frac{22}{7} \times r = 264 \Rightarrow r = 42 \text{ cm}$$

Capacity of vessel

$$= \pi r^2 h = \frac{22}{7} \times (42)^2 \times 50$$

$$= 2,77,200 \text{ cm}^3$$

1000 cm^3 corresponds to 1 litre,

$$\text{so } 2,77,200 \text{ cm}^3 = \frac{277200}{1000} = 277.2 \text{ litres}$$

18. Sol. (c)

T.S.A. of Cylinder $\Rightarrow 2\pi r(h + r)$

C.S.A. of Cylinder $\Rightarrow 2\pi r h$

Difference $\Rightarrow 2\pi r(h + r - h)$

$$\Rightarrow 2\pi r^2 \Rightarrow 2 \times 3.14 \times 25$$

$$\Rightarrow 50 \times 3.14 \Rightarrow 157 \text{ cm}^2$$

19. Sol. (a)

Let the height and radius of cylinder be $7x$ and $5x$ respectively

Volume of cylinder = $3.14 \times 25x^2 \times 7x$

$$14836.5 = 549.5x^3$$

$$x^3 = \frac{14836.5}{549.5} = 27 \Rightarrow x = 3 \text{ cm}$$

So, TSA of cylinder = $2\pi r(r + h)$

$$= 2 \times 3.14 \times (5x)(5x + 7x) = (31.4x) \times (12x)$$

$$= 376.8x^2 = 376.8 \times 9 = 3,391.2 \text{ cm}^2$$

20. Sol. (b)

TSA of cylinder = 880 cm^2

$$2\pi r(h + r) = 880$$

$$2 \times \frac{22}{7} \times r(13 + r) = 880$$

$$13r + r^2 = 140 \Rightarrow r^2 + 13r - 140 = 0$$

$$r^2 + 20r - 7r - 140 = 0$$

$$r(r + 20) - 7(r + 20) = 0 \Rightarrow r = 7 \text{ cm}$$

According to question,

Volume of cylinder = $11k$

$$\Rightarrow \pi r^2 h = 11k \Rightarrow \frac{22}{7} \times (7)^2 \times 13 = 11k$$

$$\Rightarrow k = 182$$

21. Sol. (b)

When paper is folded along its width.

Let circumference of the base = width of the

$$\therefore 2\pi \cdot r = 22$$

$$\therefore r = \frac{7}{2} \text{ cm}$$

$$\text{Volume of Cylinder (Y)} = \frac{22}{7} \times \left(\frac{7}{2}\right)^2 \times 44$$

$$\text{Similarly, Volume (X)} = \frac{22}{7} \times (7)^2 \times 22$$

$$\text{Ratio } \left(\frac{X}{Y}\right) = \frac{\frac{22}{7} \times (7)^2 \times 22}{\frac{22}{7} \times \left(\frac{7}{2}\right)^2 \times 44} = 2:1$$

22. Sol. (c)

$$V = 1617 = \frac{22}{7} \times 4x^2 \cdot 3x \quad \left[\frac{r}{h} = \frac{2x}{3x} \right]$$

$$x^3 = \frac{7^3}{2^3} \therefore x = \frac{7}{2}$$

$$r = 7, h = \frac{21}{2}$$

$$\text{TSA} = 2\pi r(h + r)$$

$$\text{TSA} = 44\left(7 + \frac{21}{2}\right)$$

$$= 44 \times \frac{35}{2} = 770 \text{ cm}^2$$

23. Sol. (b)

$$V = \pi(2.8)^2 \times 15 = l \times 8 \times 1.5$$

$$\Rightarrow \frac{22}{7} \times 2.8 \times 2.8 \times 10 = l \times 8$$

$$l = 1.4 \times 22 = 30.8$$

24. Sol. (c)

Volume of the sheet = volume of cylinder with outer radius - volume of cylinder with inner radius. Inner radius = 4 cm - 0.5 cm = 3.5 cm

$$h = 2 \text{ m} = 200 \text{ cm.}$$

$$\text{Required volume} = \pi \times 200(4^2 - 3.5^2) \pi \times$$

$$200(16 - 12.25) = \pi \times 200 \times 3.75 = 750\pi$$

25. Sol. (d)

$$V = \pi r^2 h, r = 5^2 : 6^2, h = 6^2 : 5^2$$

$$36 : 25$$

$$\frac{11}{36} \times 100 = \frac{275}{9} = 30\frac{5}{9}\%$$

26. Sol. (d)

Old : New

Radius $\rightarrow 5 : 3$

Height $\rightarrow 5 : 8$

So, Old volume: New volume

$$= 5^2 \times 5 : 3^2 \times 8, \rightarrow 125 : 72$$

$$\% \text{ age decrease} = \frac{125-72}{125} \times 100 = 42.4\%$$

27. Sol. (c)

$$\text{Volume of the cylinder} = \pi r^2 \cdot h$$

$$1617 = \pi \cdot (2k)^2 \cdot 3k$$

$$\therefore k = \sqrt[3]{\frac{1617 \times 7}{22 \times 12}}$$

$$= \sqrt[3]{\frac{7 \times 7 \times 7 \times 3 \times 11}{2 \times 2 \times 2 \times 11 \times 3}} = 3.5$$

$$\therefore r = 2k = 7 \text{ cm}, h = 3k = 10.5$$

$$\text{Curved Surface Area} = 2\pi \cdot r \cdot h$$

$$= 2 \times \frac{22}{7} \times 7 \times 10.5 = 462 \text{ cm}^2$$

28. Sol. (d)

$$\text{Difference in surface Area} = 2\pi \cdot h(R - r) = 44$$

$$\Rightarrow 2 \times \frac{22}{7} \times 14(R - r) = 44$$

$$\therefore R - r = 0.5 \quad \dots (i)$$

$$\text{Again, metal used} = \pi(R^2 - r^2) \cdot h$$

$$99 = \frac{22}{7}(R^2 - r^2) \cdot 14$$

$$R^2 - r^2 = 2.25 \quad \dots (ii)$$

From (i) and (ii), we get

$$(R + r) = \frac{2.25}{0.5} = 4.5 \text{ cm}$$

29. Sol. (d)

$$\text{Time required} = \frac{\text{Volume of Cylinder}}{\text{Volume of spherical drop}}$$

$$= \frac{\pi(1)^2 \times 1}{\frac{4}{3}\pi(0.01)^3} = 3 \times 25 \times 10000$$

$$\text{or, } \frac{3 \times 25 \times 10000}{3600} \text{ hr} \approx 210 \text{ hrs}$$

30. Sol. (a)

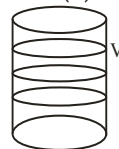
Volume of water in cylinder = Volume of rectangular tub

$$\pi r^2 h = l \times b \times h$$

$$\frac{22}{7} \times 30 \times 30 \times 42 = 75 \times 44 \times h$$

$$H = 36 \text{ cm}$$

31. Sol. (b)



$$\text{TSA} = 2\pi r(h + r)$$

$$\% \text{ Change} = \frac{6 \times \pi r^2 \times 100}{2\pi r(h + r)} = \frac{3 \times 9}{25} \times 100 = 108\%$$

32. Sol. (b)

$$\text{Curved surface area of cylinder} = 2\pi r h$$

$$= 2\pi \times 5 \times 30 = 300\pi$$

$$\text{Slant height of cone} = \sqrt{5^2 + 12^2} = 13$$

$$\text{Surface area of cone} = \pi r l = \pi \times 5 \times 13 = 65\pi$$

$$\text{Surface area of 2 cone} = 130\pi$$

$$\text{Total surface area} = 430\pi$$

33. Sol. (c)

$$\text{Volume of cylindrical wire} = \pi r^2 h$$

$$3.96 \times 1000 = \frac{22}{7} \times \frac{3}{10} \times \frac{3}{10} \times h$$

$$h = 14000 \text{ cm or } 140 \text{ m}$$

34. Sol. (b)

$$\frac{\text{TSA}}{\text{CSA}} = \frac{7}{4} = \frac{h+r}{h}, \frac{r}{h} = \frac{3}{4}$$

$$\text{Volume} = \pi r^2 h$$

$$= \frac{22}{7} \cdot r^2 \cdot \frac{4r}{3} = 4851$$

$$\Rightarrow r^3 = \frac{21^2 \times 7 \times 3}{2^3}$$

$$\Rightarrow r^3 = \frac{21^3}{2^3} \Rightarrow r = \frac{21}{2}$$

$$\text{Sum of area of both base} = 2 \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2}$$

$$= 693 \text{ cm}^2$$

35. Sol. (c)

As per the given condition, the radius of sphere and cylinder will be same.

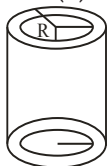
$$\text{Volume of cylinder} = \pi R^2 H = \pi R^2 \cdot D = 2\pi R^3$$

(where R = Radius)

$$\text{Volume of sphere } V_s = \frac{4}{3}\pi R^3$$

$$\Rightarrow \frac{V_s}{V} = \frac{\frac{4}{3}\pi R^3}{2\pi R^3} = \frac{2}{3} \Rightarrow V_s = \frac{2}{3} V$$

36. Sol. (b)



The volume of steel in the cylinder

= outer volume - inner volume

Outer radius(R) = 5 cm

Inner radius(r) = 4 cm

The volume of the steel in cylinder

$$= \pi R^2 h - \pi r^2 h = \pi h(R^2 - r^2)$$

$$= \frac{(22 \times 84 \times 9)}{7}$$

$$= 216 \times 11 = 2376 \text{ cm}^3 = 2.376 \text{ m}^3$$

37. Sol. (b)

$$\text{Volume of Solid metallic cylinder} = \pi r^2 h$$

$$= \pi \times 36 \times 10 = 360\pi$$

$$\text{flat surface area of cylinder} = 2\pi r^2$$

$$= 2 \times \pi \times 6 \times 6 = 72\pi$$

After melted to make two cones in the ratio of volume 1:2

$$\text{volume of first cone} = \frac{1}{3}\pi r_1^2 h = 120\pi$$

$$r_1^2 h = 360$$

$$\therefore r_1^2 = 36$$

$$\text{Volume of second cone} = \frac{1}{3}\pi r_2^2 h = 240\pi$$

$$r_2^2 h = 720 \Rightarrow r_2^2 = 72$$

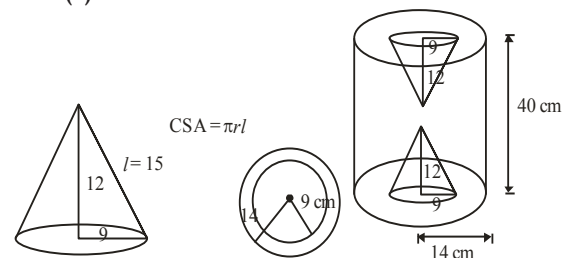
Flat Surface area of two cone =

$$72\pi + 36\pi = 108\pi$$

$$\text{Change in surface area} = 108\pi - 72\pi = 36\pi$$

$$\% \text{ change} = \frac{36\pi}{72\pi} \times 100 = 50\%$$

38. Sol. (a)

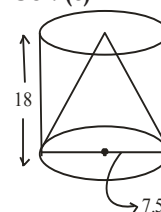


$$\text{TSA} = 2\pi r h + 2(\pi r l) + 2(\pi(R^2 - r^2))$$

$$\text{TSA} = 2\pi \cdot 14 \times 40 + 2\pi \cdot 9 \times 15 + \pi(14^2 - 9^2) \times 2$$

$$= 1120\pi + 270\pi + 230\pi = 1620\pi$$

39. Sol. (c)



$$h = 18; r = 7.5$$

$$l = 19.5 \text{ (by pythagoras theorem)}$$

Total surface area = curved surface area of cylinder
+ area of cone + area of circular side (above)

$$\text{Total surface area} = 2\pi rh + \pi rl + \pi r^2$$

$$\text{Total surface area} = \pi r(2h + l + r)$$

$$\text{Total surface area} = \pi \cdot 7.5(36 + 19.5 + 7.5)$$

$$\text{Total surface area} = \pi \cdot 7.5(63)$$

$$\text{Total surface area} = 472.5\pi \text{ cm}^2$$

40. Sol. (c)

$$20\% = \frac{1}{5}$$

We know that volume is directly proportional to the product of the square of the radius and the height

	Old	:	New
Radius	5	:	6
Height	H	:	h
Volume	25H	:	36h

According to the question

$$25H = 36h, H:h = 36:25$$

$$\text{Required \% age} = \frac{36-25}{36} \times 100 = 30\frac{5}{9}\%$$

41. Sol. (b)

We know that, 1000 liter = 1 m³

⇒ Volume of the water taken out

$$= \frac{15400}{1000} = 15.4 \text{ m}^3$$

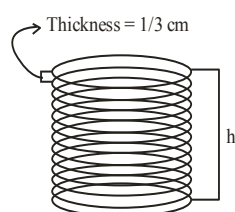
$$\text{Volume of water taken out} = \pi r^2 h$$

$$15.4 = \pi \times 3.5 \times 3.5 \times h$$

$$\Rightarrow h = 0.4 \text{ m or } 40 \text{ cm}$$

42. Sol. (d)

$$\text{Thickness} = \frac{1}{3} \text{ cm}$$



As per the question

60 discs are stacked in the above manner having thickness $\frac{1}{3}$ cm

$$\text{Diameter of each disc} = 21 \text{ cm}$$

$$\text{Radius} = \frac{21}{2} \text{ cm}$$

Total number of discs $\times$ thickness of one disc = height of the cylinder

$$\text{Height (h)} = 60 \times \frac{1}{3} = 20 \text{ cm}$$

Thus, Volume of the cylinder is (V)

$$= \pi r^2 h = \frac{22 \times 21 \times 21 \times 20}{7 \times 2 \times 2}$$

$$= 6930 \text{ cm}^3 = 6.930 \times 10^{-3} \text{ m}^3$$

43. Sol. (b)

According to the question

$$2\pi(r+h) = 352$$

$$2 \times \frac{22}{7} \times r(r+10) = 352$$

$$r^2 + 10r = 56$$

$$r^2 + 10r - 56 = 0$$

$$r^2 + 14r - 4r - 56 = 0$$

$$r(r+4) - 4(r+14) = 0$$

$$(r-4)(r+14) = 0$$

$$\therefore r = 4, -14$$

Hence radius of circle = 4

$$\text{diameter} = 2 \times 4 = 8$$

44. Sol. (c)

$$r + h = 20 \text{ cm (given)}$$

$$\text{TSA} = 2\pi r(h+r) = 880$$

$$2\pi r \cdot 20 = 880$$

$$2\pi r = 44 \Rightarrow r = 7$$

$$\text{Volume} = \pi r^2 h = \frac{22}{7} \times 7 \times 7 \times 13 = 2002 \text{ cm}^3$$

45. Sol. (d)

$$\text{Surface area of tent} = \pi rl + 2\pi rh$$

$$l = \sqrt{60^2 + 11^2} = 61$$

$$\text{Surface area of tent} = \pi \times 60 \times 61 + 2\pi \times 60 \times 7$$

$$= 3660\pi + 840\pi = 4500\pi$$

Type-7 (Sphere)

1. What is the volume of a sphere whose diameter is 16.8 cm ? [Use $\pi = 22/7$]
एक गोले का आयतन क्या है जिसका व्यास 16.8 सेमी है? [उपयोग $\pi = 22/7$]

SSC CHSL 2023 (Morning)

- (a) 2487.312 cm³ (b) 2473.812 cm³
(c) 2483.712 cm³ (d) 2483.172 cm³

2. If the radius of a sphere increases by 10%, what would be the change in the surface area of the sphere?

यदि किसी गोले की त्रिज्या में 10% की वृद्धि कर दी जाए, तो गोले के पृष्ठीय क्षेत्रफल में क्या परिवर्तन होगा?

SSC CPO 10/11/2022 (Evening)

- (a) 20% (b) 21% (c) 31% (d) 25%

3. A spherical ball of lead 6 cm in diameter is melted and recast into three spherical balls. The diameters of the balls are 2 cm, 4 cm and x cm. Which one of the following is correct?

6 सेमी व्यास की सीसे की एक गोलाकार गेंद को पिघलाकर तीन गोलाकार गेंदों में ढाला जाता है। गेंदों का व्यास 2 सेमी, 4 सेमी और x सेमी है। निम्नलिखित में से कौन सा सही है?

[2022-I]

- (a) 5 cm < x cm < 5.2 cm
(b) 5.2 cm < x cm < 5.4 cm
(c) 5.4 cm < x cm < 5.6 cm
(b) 5.6 cm < x cm < 5.8 cm

4. If the total surface area of a sphere of radius r cm is equal to the total surface area of a cube of side s cm, which of the following is true?

यदि त्रिज्या r सेमी के एक गोले का कुल पृष्ठीय क्षेत्रफल, s भुजा वाले घन के कुल पृष्ठीय क्षेत्रफल के बराबर है, तो निम्न में से कौन सा सत्य है?

SSC MTS 06/07/2022 (Morning)

- (a) $r > s$ (b) $r \geq s$
(c) $r = s$ (d) $r < s$

5. If the ratio of surface area of two spheres 9:4, then the ratio of their diameter is

यदि दो गोलों के पृष्ठीय क्षेत्रफलों का अनुपात 9:4 है, तो उनके व्यासों का अनुपात होगा

(DP Head Constable 13/10/2022 (Shift-01))

- (a) 3:2 (b) 9:4 (c) 2:3 (d) 4:9

6. The volume of a solid cylinder is 2002 cm³ and its height is 13 cm. What is the area (in cm²) of its base? (Use $\pi = 22/7$)

एक ठोस बेलन का आयतन 2002 सेमी³ है और इसकी ऊँचाई 13 सेमी है। इसके आधार का क्षेत्रफल (सेमी² में) क्या है? (Use $\pi = 22/7$)

SSC CGL Tier II 29/01/2022

- (a) 154 (b) 77 (c) 308 (d) 231

7. A certain number of identical spheres are formed by melting a large sphere of radius 28 cm. What is the number of small spheres formed if the surface area of each small sphere is 2464 cm² ? [use $\pi = \frac{22}{7}$]

28 सेमी त्रिज्या के एक बड़े गोले को पिघलाकर निश्चित संख्या में समरूप गोलों का निर्माण किया जाता है। यदि प्रत्येक छोटे गोले का पृष्ठीय क्षेत्रफल 2464 cm² है तो बनने वाले छोटे गोलों की संख्या क्या है ?

SSC MTS 08/07/2022 (Afternoon)

- (a) 8 (b) 9 (c) 6 (d) 7

8. If the volume of a sphere is 24,416.64 cm³, find its surface area (take $\pi = 3.14$) correct to two places of decimal.

यदि एक गोले का आयतन 24,416.64 cm³ है, तो इसका पृष्ठीय क्षेत्रफल ज्ञात कीजिए जो दशमलव के दो स्थानों तक सही हो। ($\pi = 3.14$ लीजिए)

SSC CGL 03/12/2022 (Shift- 01)

- (a) 3069.55 cm² (c) 5069.66 cm²
(b) 4069.44 cm² (d) 6069.67 cm²

9. A solid metal sphere has radius 14cm. It is melted to form small cones of radius 1.75 cm and height 3.5 cm. How many small cones will be obtained from the sphere?

एक ठोस गोले की त्रिज्या 14 सेमी, है इस गोले को पिघलाकर छोटे शंकु बनाए गए हैं, जिनकी त्रिज्या 1.75 सेमी और ऊँचाई 3.5 सेमी, है। ज्ञात कीजिए ऐसे कितने शंकु बनेंगे ?

- (a) 512 (b) 1256 (c) 1024 (d) 2048

10. The sum of the radius and the diameter of a solid sphere is 63 cm. What will be the volume of this sphere? [use $\pi = \frac{22}{7}$]

एक ठोस गोले की त्रिज्या और व्यास का योग 63 सेमी है। इस गोले का आयतन क्या होगा?

SSC MTS 07/07/2022 (Afternoon)

- (a) 38808 cm³ (b) 39206 cm³

- (c) 34604 cm^3 (d) 41244 cm^3
11. If the surface area of a sphere is 1386 cm^2 , then find the radius of the sphere.
यदि एक गोले का पृष्ठीय क्षेत्रफल 1386 cm^2 है, तो गोले की त्रिज्या ज्ञात कीजिए।
SSC CHSL 24/05/2022 (Evening)
(a) 12.5 (b) 10.5 (c) 10 (d) 12
12. A sphere is of radius 5 cm. What is the surface area of the sphere?
एक गोले की त्रिज्या 5 सेमी है। गोले का पृष्ठीय क्षेत्रफल कितना है?
SSC CPO 10/11/2022 (Morning)
(a) $100\pi \text{ cm}^2$ (b) $150\pi \text{ cm}^2$
(c) $200\pi \text{ cm}^2$ (d) $120\pi \text{ cm}^2$
13. The surface area of a sphere is 616 cm^2 . Calculate its volume. (Take $\pi = \frac{22}{7}$)
एक गोले का पृष्ठीय क्षेत्रफल 616 cm^2 है। इसका आयतन ज्ञात कीजिए। ($\pi = \frac{22}{7}$ लीजिए)
DP Head Constable 20/10/2022 (Shift - 01)
(a) 1436.33 cm^3 (b) 1434.33 cm^3
(c) 1437.33 cm^3 (d) 1435.33 cm^3
14. What is the radius of a sphere having volume of 4851 cm^3 ?
(Use $\pi = 22/7$)
4851 सेमी³ आयतन वाले गोले की त्रिज्या क्या है?
SSC CHSL 03/06/2022 (Afternoon)
(a) 12.5 (b) 10.5 (c) 9.5 (d) 11.5
15. The radius of a spherical balloon is inflated from 7 cm to 10.5 cm. The percentage increase in its surface area is:
एक गोलाकार गुब्बारे की त्रिज्या 7 सेमी से 10.5 सेमी तक फुलाई जाती है। इसके सतह क्षेत्र में प्रतिशत वृद्धि है:
SSC CGL Tier II 03/02/2022
(a) 150% (b) 125% (c) 120% (d) 135%
16. A hollow sphere has an outer radius of 4 cm and inner radius of 1 cm. What is the volume of this hollow sphere?
एक खोखले गोले की बाहरी त्रिज्या 4 सेमी तथा आंतरिक त्रिज्या 1 सेमी है। इस खोखले गोले का आयतन क्या है?
SSC CGL 05/12/2022 (Shift.03)
(a) $84\pi \text{ cm}^3$ (b) $68\pi \text{ cm}^3$
(c) $48\pi \text{ cm}^3$ (d) $92\pi \text{ cm}^3$

17. The length of the side of a cube is 2.8 cm. What is the volume of the largest sphere that can be taken out of the cube?
एक घन की भुजा की लंबाई 2.8 सेमी है। सबसे बड़ा आयतन क्या है। गोला जिसे घन से बाहर निकाला जा सकता है?
SSC CGL 09/12/2022 (2nd Shift)
(a) 11.50 cm^3 (b) 1.15 cm^2
(c) 11.55 cm^3 (d) 115 cm
18. The length of the side of a cube is 5.6 cm. What is the volume of the largest sphere that can be taken out of the cube?
एक घन की भुजा की लंबाई 5.6 सेमी है। घन से निकाले जा सकने वाले सबसे बड़े गोले का आयतन क्या है?
SSC CGL 05/12/2022 (1st Shift)
(a) 91.98 cm^3 (c) 96.98 cm^3
(b) 99.96 cm^3 (d) 90.69 cm^3
19. The radius of a sphere and that of the base of a cylinder are equal. The ratio of the radius of the base of the cylinder and the height of the cylinder is 3:4. What is the ratio of the volume of the sphere to that of the cylinder?
एक गोले की त्रिज्या और एक बेलन के आधार की त्रिज्या बराबर होती है। बेलन के आधार की त्रिज्या और बेलन की ऊँचाई का अनुपात 3:4 है। गोले के आयतन का बेलन के आयतन से अनुपात क्या है?
SSC MTS 11/07/2022 (Morning)
(a) 27:64 (b) 1:2 (c) 1:1 (d) 9:16
20. A solid metallic sphere of radius 8.4 cm is melted and recast into a right circular cylinder of radius 12 cm. What is the height of cylinder.
एक ठोस धातु के गोले को पिघलाकर जिसकी त्रिज्या 8.4 सेंटीमीटर है। 12 सेंटीमीटर त्रिज्या का एक लम्ब वृतीय बेलन बनाया जाता है तो बेलन की ऊँचाई क्या है।
(a) 6.5 cm (b) 7.0 cm
(c) 5.5 cm (d) 6.0 cm
21. A solid sphere has a radius 21 cm. It is melted to form a cube, 20% material is wasted in this process. The cube is melted to form hemisphere. In this process 20% material is wasted. The hemisphere is melted to form two spheres of equal radius. 20% material was also wasted in this process. What is the radius (in cm) of each new sphere?
एक ठोस गोले की त्रिज्या 21 सेमी है। इसे पिघलाकर एक घन बनाया जाता है। इस प्रक्रिया में 20% सामग्री व्यर्थ हो जाती है। घन को पिघलाकर एक अर्द्धगोला बनाया जाता है। इस प्रक्रिया

में 20% सामग्री व्यर्थ हो जाती है। अर्द्धगोले को पिघलाकर दो समान त्रिज्या वाले दो गोले बनाये जाते हैं। इस प्रक्रिया में भी 20% सामग्री भी व्यर्थ हो गई थी। प्रत्येक नए गोले की त्रिज्या (सेमी, में) क्या है?

- (a) $4.2\sqrt[3]{2}$ (b) $2.1(\sqrt[3]{2})$
(c) $2.1(\sqrt[3]{4})$ (d) $8.4(\sqrt[3]{4})$

22. The material of a sphere of radius r is melted and recast into a hollow cylindrical shell of thickness a and outer radius b . What is its length assuming that no material is lost in recasting?

त्रिज्या r के एक गोले की सामग्री को पिघलाया जाता है और मोटाई a और बाहरी त्रिज्या b के खोखले बेलनाकार खोल में पुनः ढाला जाता है। इसकी लंबाई क्या है यह मानते हुए कि कोई सामग्री पुनर्चना में नष्ट नहीं हुई है?

SSC MTS 12/10/2021 (Afternoon)

- (a) $\frac{4r^3}{3a(2a-b)}$ (b) $\frac{4r^3}{3a(b+a)(b-a)}$
(c) $\frac{4r^3}{3a(b-a)}$ (d) $\frac{4r^3}{3a(2b-a)}$

23. The surface area of a spherical balloon is $400\pi\text{cm}^2$. What is the volume (in cm^3) of air in it?

एक गोलाकार गुब्बारे का पृष्ठीय क्षेत्रफल $400\pi\text{cm}^2$ है। इसमें वायु का आयतन (सेमी³ में) क्या है?

SSC CHSL 07/06/2022 (Morning)

- (a) $\frac{4000}{3}\pi$ (b) $\frac{1000}{3}\pi$ (c) $\frac{3000}{3}\pi$ (d) $\frac{400}{3}\pi$

24. A sphere of diameter 6 cm is dropped into a cylindrical vessel partly filled with water. The radius of the vessel is 6 cm. If the sphere is completely submerged in water, then by how much will the surface level of water be raised?

व्यास 6 सेमी का एक गोला आंशिक रूप से पानी से भरे एक बेलनाकार बर्तन में गिराया जाता है। बर्तन की त्रिज्या 6 सेमी है। यदि गोला पूरी तरह से पानी में डूबा हुआ है, तो पानी की सतह का स्तर कितना ऊपर उठ जाएगा?

[CDS - [2021-I]

- (a) 0.5 cm (b) 1 cm (c) 1.5 cm (d) 2 cm

25. Eight metallic spheres of radius 1 cm are melted to form one sphere. The radius of the resulting sphere is:

1 सेमी त्रिज्या वाले धातु के आठ गोलों को पिघलाकर एक गोला बनाया जाता है। परिणामी गोले की त्रिज्या है:

SSC MTS 20/10/2021 (Morning)

- (a) 2 cm (b) 8 cm (c) 3 cm (d) 6 cm

26. A solid sphere of diameter 18 cm is hollowed by removing a sphere shape from inside, such that it can contain $288\pi\text{cm}^3$ of liquid. What is the

difference between the outer surface area and the inner surface area of the hollow sphere so formed?

18 सेमी व्यास के एक ठोस गोले को भीतर से एक गोले के आकार को हटाकर खोखला कर दिया जाता है, जिससे कि इसमें $288\pi\text{सेमी}^3$ तरल आ सकता है। खोखले गोले के बाह्य पृष्ठीय क्षेत्रफल और अंतः पृष्ठीय क्षेत्रफल के बीच अंतर कितना है?

- (a) $120\pi\text{cm}^2$ (b) $150\pi\text{cm}^2$
(c) $180\pi\text{cm}^2$ (d) $210\pi\text{cm}^2$

27. A solid metallic sphere of radius 12 cm is melted and recast in the form of small spheres of radius 2 cm. How many small spheres are formed?

त्रिज्या 12 सेमी का एक ठोस धात्विक गोला पिघलाया जाता है और त्रिज्या 2 सेमी के छोटे गोले के रूप में पुनः बनाया जाता है। कितने छोटे गोले बनते हैं?

SSC CHSL 12/8/2021 (Morning)

- (a) 24 (b) 96 (c) 864 (d) 216

28. A hollow spherical shell is made up of a metal of density 3 g/cm^3 . If the internal and external radii are 5 cm and 6 cm respectively, then what is the mass of the shell?

एक खोखला गोलाकार खोल 3 g/cm^3 घनत्व की धातु से बना है। यदि आंतरिक और बाहरी त्रिज्या क्रमशः 5 सेमी और 6 सेमी हैं, तो खोल का द्रव्यमान क्या है?

(Take $= \frac{22}{7}$)

[CDS - [2021-I]

- (a) 1144 g (b) 1024 g
(c) 840 g (d) 570 g

29. How many metallic spheres, each of diameter 6 cm can be melted to mould into a solid cylinder of diameter 8 cm and height of 18 cm?

6 सेमी व्यास वाले कितने धातु के गोलों को पिघलाकर 8 सेमी व्यास और 18 सेमी की ऊँचाई का एक ठोस बेलन बनाया जा सकता है?

SSC CPO 10/11/2022 (Morning)

- (a) 6 (b) 12 (c) 8 (d) 10

30. A metallic sphere of diameter 40 cm is melted into a smaller sphere of radius 0.5 cm. How many such small balls can be made?

40 सेमी व्यास वाले एक धातु के गोले को 0.5 सेमी त्रिज्या के एक छोटे गोले में पिघलाया जाता है। ऐसी कितनी छोटी गेंदें बनाई जा सकती हैं?

SSC CGL 6/03/2020 (Morning)

- (a) 64,000 (b) 32,000
(c) 3200 (d) 6400

31. A solid lead sphere of radius 11 cm is melted and recast into small sphere of radius 2 cm each. How many maximum (in integer) of such sphere can be made?

त्रिज्या 11 सेमी के एक ठोस सीसे के गोले को पिघलाया जाता है और त्रिज्या 2 सेमी के छोटे गोले में पुनः ढाला जाता है। ऐसे गोले का अधिकतम (पूर्णांक में) कितना बनाया जा सकता है?

SSC CPO 24/11/2020 (Morning)

- (a) 100 (b) 30 (c) 166 (d) 125

32. The surface areas of two spheres are in the ratio 1:4. What is the ratio of their volumes?

दो गोलों के पृष्ठीय क्षेत्रफलों का अनुपात 1:4 है। उनके आयतन का अनुपात क्या है?

[CDS - [2020-II]

- (a) 1:16 (b) 1:12
(c) 1:10 (d) 1:8

33. The sum of radii of two sphere is 10 cm and the sum of their volume is 880 cm^3 . what will be the product of their radii

यदि दो गोलों की त्रिज्याओं का योग 10 सेमी और इनके आयतनों का योग 880 सेमी³ है तो उनकी त्रिज्याओं का गुणनफल क्या होगा?

- (a) $25\frac{2}{3} \text{ cm}^2$ (b) $26\frac{1}{3} \text{ cm}^2$
(c) $33\frac{1}{3} \text{ cm}^2$ (d) $27\frac{1}{3} \text{ cm}^2$

34. A hollow spherical is made of a metal of density shell 7 g cm^3 . If its internal and external radii are 3 cm and 6 cm respectively, then what is the mass of the shell? (take $= \frac{22}{7}$)

एक खोखला गोलाकार घनत्व खोल 7 g cm^3 की धातु से बना है। यदि इसकी आंतरिक और बाहरी त्रिज्याएँ क्रमशः 3 सेमी और 6 सेमी हैं, तो खोल का द्रव्यमान क्या है?

[CDS - [2021-II]

- (a) 2772 g (b) 3322 g
(c) 4433 g (d) 5544 g

35. A metallic solid spherical ball of radius 3 cm is melted and recast into three spherical balls. The radii of two of these balls are 2 cm and 1.5 cm. What is the surface area (in cm^2) of the third ball?

त्रिज्या 3 सेमी की एक धात्विक ठोस गोलाकार गेंद को पिघलाया जाता है और तीन गोलाकार गेंदों में पुनः ढाला जाता है। इनमें से दो गेंदों की त्रिज्या 2 सेमी और 1.5 सेमी है। तीसरी गेंद का पृष्ठीय क्षेत्रफल (सेमी² में) क्या है?

SSC CGL TIER II 16/11/2020

- (a) $\frac{25}{2} \pi$ (b) $\frac{25}{4} \pi$ (c) 50π (d) 25π

36. A spherical metallic shell with 6 cm external radius weighs 6688 g. What is the thickness of the shell if the density of metal is 10.5 g per cm^3 ($\pi = 22/7$)

6 सेमी बाहरी त्रिज्या वाले एक गोलाकार धात्विक खोल का वजन 6688 g है। यदि धातु का घनत्व $10.5 \text{ g प्रति cm}^3$ है तो खोल की मोटाई क्या होगी ($\pi = 22/7$)

SSC CGL TIER II 15/11/2020

- (a) 2 cm (b) 3 cm (c) $2\frac{1}{2} \text{ cm}$ (d) 4 cm

37. A solid sphere of diameter 60 mm is melted to stretch into a wire of length 144 cm. What is the diameter of the wire?

60 मिमी व्यास के एक ठोस गोले को पिघलाकर 144 सेमी लम्बाई का एक तार बनाया जाता है। तार का व्यास कितना है?

[CDS - [2021-I]

- (a) 0.5 cm (b) 1 cm (c) 1.5 cm (d) 2 cm

38. Three copper spheres of radii 3 cm, 4 cm and 5 cm are melted to form a large sphere. What is its radius?

त्रिज्या 3 सेमी, 4 सेमी और 5 सेमी के तीन तांबे के गोलों को पिघलाकर एक बड़ा गोला बनाया जाता है। इसकी त्रिज्या क्या है?

[CDS - [2019-II]

- (a) 12 cm (b) 10 cm (c) 8 cm (d) 6 cm

39. There are as many square centimetres in the surface area of a sphere as there are cubic centimetres in its volume. What is the radius of the sphere?

एक गोले के पृष्ठीय क्षेत्रफल में उतने ही वर्ग सेंटीमीटर होते हैं जितने उसके आयतन में घन सेंटीमीटर होते हैं। गोले की त्रिज्या क्या है?

[CDS - [2018-I]

- (a) 4 cm (b) 3 cm
(c) 2 cm (d) 1 cm

40. When the radius of a sphere is increased by 5 cm, its surface area increases by 704 cm^2 . The diameter of the original sphere is (take $\pi = 22/7$)

जब एक गोले की त्रिज्या में 5 सेमी की वृद्धि की जाती है, तो इसकी सतह का क्षेत्रफल 704 सेमी^2 बढ़ जाता है। मूल गोले का व्यास है ($\pi = 22/7$ लें)

SSC CPO 13/12/19 (Evening)

- (a) 8.2 (b) 5.2 (c) 6.8 (d) 6.2

41. The total surface area of a cone and sphere is equal and base radius of cone is equal to radius of sphere then find the ratio of radius to the height of cone.
एक शंकु का कुल पृष्ठ का गोले के सम्पूर्ण पृष्ठ के क्षेत्रफल के बराबर है और उसके आधार की त्रिज्या भी समान है तब शंकु की त्रिज्या और इसकी ऊँचाई में अनुपात ज्ञात करें ?
(a) $1/2\sqrt{2}$ (b) $2\sqrt{2}/9$
(c) $1/3$ (d) $2/2\sqrt{3}$
42. Three solid metallic spheres whose radii are 1 cm, x cm and 8 cm, are melted and recast into a single solid sphere of diameter 18 cm. The surface area (in cm^2) of the sphere with radius x cm is :
धातु के तीन ठोस गोले जिनकी त्रिज्याएँ 1 सेमी, x सेमी और 8 सेमी हैं, को पिघलाया जाता है और 18 सेमी व्यास

वाले एक ठोस गोले में ढाला जाता है। त्रिज्या x सेमी वाले गोले का पृष्ठीय क्षेत्रफल (सेमी² में) है:

SSC CGL TIER II 11/09/2019

- (a) 144π (b) 72π (c) 64π (d) 100π

43. The volume of a spherical balloon is increased by 700%. What is the percentage increase in its surface area ?

एक गोलाकार गुब्बारे का आयतन 700% बढ़ा दिया जाता है। इसके सतह क्षेत्र में प्रतिशत वृद्धि क्या है?

[CDS - [2019-I]

- (a) 300% (b) 400%
(c) 450% (d) 500%

Type-7 (Sphere) ANSWER KEY															
1	C	2	B	3	B	4	D	5	A	6	A	7	A	8	B
9	C	10	A	11	B	12	A	13	C	14	B	15	B	16	A
17	A	18	A	19	C	20	C	21	D	22	D	23	A	24	B
25	A	26	C	27	D	28	A	29	C	30	A	31	C	32	D
33	B	34	D	35	D	36	A	37	B	38	D	39	B	40	D
41	A	42	A	43	A										

Type-7 (Sphere) Solution

1. Sol. (c)

Volume of sphere

$$= \frac{4}{3} \times \frac{22}{7} \times \left(\frac{16.8}{2}\right)^3$$

$$= \frac{88}{21} \times 8.4 \times 8.4 \times 8.4 = 2483.712 \text{ cm}^3$$

2. Sol. (b)

$$\% \text{ age increase} = 10 + 10 + \frac{10 \times 10}{100} = 21\%$$

3. Sol. (b)

$$\frac{4}{3} \pi (3)^3 = \frac{4}{3} \pi \left[1^3 + 2^3 + \frac{x^3}{8}\right]$$

$$27 = 9 + \frac{x^3}{8}$$

$$144 = x^3 (\because 5^3 = 125, (5.2)^3 = 140.608)$$

$$\therefore 5.2 \text{ cm} < x \text{ cm} < 5.4 \text{ cm}$$

4. Sol. (d)

ATQ,

TSA of Sphere = TSA of cube

$$4\pi r^2 = 6s^2 \Rightarrow 4 \times \frac{22}{7} \times r^2 = 6s^2$$

$$\Rightarrow \frac{r^2}{s^2} = \frac{6 \times 7}{4 \times 22} = \frac{42}{88} = \frac{21}{44}$$

So, we can see that $r < s$

5. Sol. (a)

Surface Area $\Rightarrow 9:4$

$$\text{Diameter} \Rightarrow \sqrt{9}:\sqrt{4} \Rightarrow 3:2$$

6. Sol. (a)

Volume of cylinder = $\pi r^2 h$

$$\frac{22}{7} \times r^2 \times 13 = 2002$$

$$r^2 = 49, r = 7 \text{ cm}$$

$$\text{Area of base} = \pi r^2 = \frac{22}{7} \times 7^2 = 154 \text{ cm}^2.$$

7. Sol. (a)

In small sphere

$$4\pi r^2 = 2464$$

$$\Rightarrow 4 \times \frac{22}{7} \times r^2 = 2464$$

$$\Rightarrow r^2 = 2464 \times \frac{7}{22 \times 4} \Rightarrow 28 \times 7$$

$$\Rightarrow r = \sqrt{196} \Rightarrow 14 \text{ cm}$$

Hence, large sphere rescasted in small sphere (Let number of small spheres : N)

$$N \times \frac{4}{3} \pi r^3 = \frac{4}{3} \pi R^3$$

$$\Rightarrow N \times 14 \times 14 \times 14 = 28 \times 28 \times 28 \text{ So, } N = 8$$

8. **Sol. (b)**

Given,

$$\text{Volume of sphere} = 24,416.64 = \frac{4}{3} \pi r^3$$

Where, r is the radius of sphere.

$$\text{Surface area of sphere} = 4\pi r^2$$

$$\Rightarrow \frac{4}{3} \pi r^3 = 24416.64$$

$$\Rightarrow r^3 = 5832 \Rightarrow r = 18$$

$$\text{Now, } 4\pi r^2 = 4 \times 3.14 \times 18 \times 18 = 4069.44 \text{ cm}^2$$

9. **Sol. (c)**

$$\frac{4}{3} \pi 14^3 = \frac{1}{3} \pi \cdot \frac{7^2}{4^2} \times \frac{7}{2} \times n$$

$$n = 128 \times 8 = 1024$$

10. **Sol. (a)**

Sum of radius and diameter of sphere = 63

$$R + 2R = 63 \Rightarrow 3R = 63 \Rightarrow R = 21 \text{ cm}$$

Volume of sphere -

$$= \frac{4}{3} \times \frac{22}{7} \times 21 \times 21 \times 21 = 38808 \text{ cm}^3$$

11. **Sol. (b)**

$$\text{Surface area of sphere} = 4\pi r^2$$

$$\Rightarrow 1386 = 4 \times \frac{22}{7} \times r^2$$

$$\Rightarrow r^2 = \frac{1386 \times 7}{22 \times 4} = \frac{441}{4}$$

$$\Rightarrow r = \sqrt{\frac{441}{4}} = \frac{21}{2} = 10.5 \text{ cm}$$

12. **Sol. (a)**

Surface area of sphere

$$= 4\pi R^2 = 4\pi \times 5^2 = 100\pi \text{ cm}^2$$

13. **Sol. (c)**

Surface area of sphere = 616 cm².

$$4\pi r^2 = 616$$

$$r^2 = \frac{616 \times 7}{4 \times 22}$$

$$r^2 = 49 \Rightarrow r = 7 \text{ cm}$$

$$\text{volume} = \frac{4}{3} \pi r^3 = \frac{4}{3} \times \frac{22}{7} \times (7)^3 \Rightarrow 1437.33 \text{ cm}^3$$

14. **Sol. (b)**

$$\text{Volume of sphere} = \frac{4}{3} \times \frac{22}{7} \times r^3$$

$$\Rightarrow 4851 = \frac{88}{21} r^3$$

$$r^3 = \frac{4851 \times 21}{88} = \frac{441 \times 21}{8}$$

$$r = \frac{21}{2} = 10.5 \text{ cm}$$

15. **Sol. (b)**

According to the question, $r = 7 \text{ cm}$ and $R = \frac{21}{2} \text{ cm}$

% age increase in radius

$$\frac{\frac{21}{2} - 7}{7} \times 100 = \frac{\frac{7}{2}}{7} \times 100 = 50\%$$

So, % age increase in surface area

$$= 50 + 50 + \frac{50 \times 50}{100} = 100 + 25 = 125\%$$

16. **Sol. (a)**

Given, a hollow sphere with outer, radius, R

= 4 cm and inner radius, $r = 1 \text{ cm}$

$$\text{Volume of hollow sphere} = \frac{4}{3} \pi (R^3 - r^3)$$

$$= \frac{4}{3} \times \pi (4^3 - 1^3)$$

$$= \frac{4}{3} \times \pi \times (64 - 1) = 84\pi \text{ cm}^3$$

17. **Sol. (a)**

diameter the largest sphere that can be taken out from cube will be 2.8 cm

$$\text{Volume of sphere} = \frac{4}{3} \times \frac{22}{7} \times \left(\frac{2.8}{2}\right)^3$$

$$= \frac{34.496}{3} \approx 11.50 \text{ cm}^3$$

18. **Sol. (a)**

Side of given cube = 5.6 cm. For largest sphere to be inscribed in the cube,

diameter of sphere should be equal to edge length of cube,

$$\Rightarrow 2 \times \text{radius} = 5.6 \text{ cm} \Rightarrow \text{radius (r)} = 2.8$$

$$\text{Volume of the sphere} = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi(2.8)^3 =$$

$$91.98 \text{ cm}^3$$

19. **Sol. (c)**

Let radius of sphere = R and radius of cylinder = r

$$\begin{array}{ccc} R & : & r & : & h \\ 1 \times 3 & : & 1 \times 3 & & \\ \hline & & 3 & : & 4 \times 1 \\ & & 3 & : & 3 & : & 4 \end{array}$$

Then the ratio of volumes -

$$= \frac{4}{3}\pi R^3 : \pi r^2 h$$

$$\Rightarrow \frac{4}{3} \times 3 \times 3 \times 3 : 3 \times 3 \times 4 \Rightarrow 1:1$$

20. **Sol. (c)**

$$\frac{4}{3}\pi(8.4)^3 = \pi \cdot 12^2 \cdot h$$

$$h = \frac{4}{3} \times \frac{8.4 \times 8.4 \times 8.4}{12 \times 12}$$

$$= 2.8 \times 2.8 \times 0.7$$

$$= 7.84 \times 0.7 \times 5.488 \approx 5.5 \text{ cm}$$

21. **Sol. (d)**

22. **Sol. (d)**

For hollow cylindrical shell:

Outer radius R = b, Inner radius P = b - a and

$$R + P = b + (b - a) = 2b - a$$

According to the question,

Volume of sphere = Volume of hollow cylindrical shell

$$\frac{4}{3}\pi r^3 = \pi(R^2 - P^2)H$$

$$\frac{4}{3}r^3 = (R^2 - P^2)H$$

$$\frac{4}{3}r^3 = (R - P)(R + P)H$$

$$\frac{4}{3}r^3 = (a) \times (2b - a) \times H$$

$$H = \frac{\frac{4}{3}r^3}{(a) \times (2b - a)} = \frac{4r^3}{3a(2b - a)}$$

23. **Sol. (a)**

Surface area of spherical balloon = $4\pi r^2 \Rightarrow 400\pi =$

$$4\pi r^2$$

$$r^2 = \frac{400}{4} = 100 \Rightarrow r = 10 \text{ cm}$$

Volume of spherical balloon

$$= \frac{4}{3} \times \pi \times 10^3 = \frac{4000}{3}\pi \text{ cm}^3$$

24. **Sol. (b)**

As the sphere is completely submerged in water, then

Surface Area of the sphere = Volume of the water displaced in the cylinder.

$$\therefore 4\pi(r_s)^2 = \pi(r_c)^2 \times h$$

$$4\pi(3)^2 = \pi(6)^2 \times h$$

$$\therefore h = 1 \text{ cm}$$

25. **Sol. (a)**

$8 \times$ Volume of original sphere = Volume of resulting sphere

$$8 \times \frac{4}{3}\pi r^3 = \frac{4}{3}\pi R^3$$

$$8 \times \frac{4}{3}\pi(1)^3 = \frac{4}{3}\pi R^3$$

$$R^3 = 8, \text{ so } R = 2 \text{ cm}$$

26. **Sol. (c)**

Let inner radius of hollow sphere = r cm

Outer radius of hollow sphere = R cm

Volume of sphere removed = volume of liquid

$$\frac{4}{3}\pi r^3 = 288\pi$$

$$r^3 = 216 \Rightarrow r = 6 \text{ cm}$$

$$\text{Outer radius} = R = \frac{18}{2} = 9 \text{ cm}$$

Difference (Outer surface area - inner surface

$$\text{area}) = 4\pi(R^2 - r^2)$$

$$= 4\pi(81 - 36) = 45 \times 4\pi = 180\pi \text{ cm}^2$$

27. Sol. (d)

$$\frac{4}{3} \times \pi \times R^3 = n \times \frac{4}{3} \times \pi \times r^3$$

$$12 \times 12 \times 12 = n \times 2 \times 2 \times 2 \Rightarrow n = 216$$

28. Sol. (a)

Volume of material used in the shell

$$= \frac{4}{3} \pi (6^3 - 5^3) = \frac{4}{3} \pi \times 91$$

$$\therefore \text{Mass of the shell} = \frac{4}{3} \times \frac{22}{7} \times 91 \times 3 = 1144\text{g}$$

29. Sol. (c)

$$N \times \text{Volume of sphere} = \text{Volume of cylinder}$$

$$N \times \frac{4}{3} \pi \times \left(\frac{6}{2}\right)^3 = \pi \times \left(\frac{8}{2}\right)^2 \times 18$$

$$N \times 36 = 288 \Rightarrow N = \frac{288}{36} = 8$$

30. Sol. (a)

Let x spheres be made out of one big sphere

Volume of big sphere = Volume of x small spheres

$$\frac{4}{3} \times \pi \times R^3 = x \times \frac{4}{3} \times \pi \times r^3$$

$$x = \left(\frac{R}{r}\right)^3 = \left(\frac{20}{0.5}\right)^3 = 64,000$$

31. Sol. (c)

$$\text{Area of bigger sphere} = \frac{4}{3} \pi 11^3$$

$$\text{Area of smaller sphere} = \frac{4}{3} \pi 2^3$$

$$\text{Number of spheres} = \frac{1331}{8} = 166.375$$

Approximately 166 spheres can be made.

32. Sol. (d)

Radius $(r)^2 \propto$ Surface area(s)

$$\therefore \frac{r_1}{r_2} = \sqrt{\frac{1}{4}} = \frac{1}{2}$$

$$\therefore \text{Volume, } \frac{v_1}{v_2} = \frac{(r_1)^3}{(r_2)^3} = \frac{1}{(2)^3} = \frac{1}{8}$$

33. Sol. (b)

$$r_1 + r_2 = 10$$

$$\frac{4}{3} \times \frac{22}{7} (r_1^3 + r_2^3) = 880$$

$$(r_1 + r_2)(r_1^2 + r_2^2 - r_1 r_2) = 210$$

$$r_1^2 + r_2^2 - r_1 r_2 = 21$$

$$(r_1 + r_2)^2 - 3r_1 r_2 = 21$$

$$100 - 3r_1 r_2 = 21$$

$$3r_1 r_2 = 79$$

$$r_1 r_2 = \frac{79}{3} = 26\frac{1}{3} \text{ cm}^2$$

34. Sol. (d)

$$\text{Mass of shell} = \frac{4}{3} \times \frac{22}{7} \times (6^3 - 3^3) \times 7$$

$$= \frac{4}{3} \times 22 \times 189 = 5544\text{g}$$

35. Sol. (d)

$$\text{Volume of the sphere} = \frac{4}{3} \pi r^3$$

$$\text{Volume of the sphere} = 27 \times \frac{4}{3} \pi$$

$$\text{Volume of the first sphere} = 8 \times \frac{4}{3} \pi$$

Volume of the second sphere

$$= 3.375 \times \frac{4}{3} \pi$$

Volume of third sphere

$$= 27 \times \frac{4}{3} \pi - \left(8 \times \frac{4}{3} \pi + 3.375 \times \frac{4}{3} \pi\right)$$

$$= 15.625 \times \frac{4}{3} \pi$$

Radius of the third sphere = 2.5

Surface area of the third sphere

$$= 4\pi r^2 = 4 \times \pi \times 6.25 = 25\pi$$

36. Sol. (a)

$$\text{Density} = \frac{\text{mass}}{\text{volume}} \Rightarrow 10.5$$

$$= \frac{6688}{\text{volume}} \Rightarrow \text{volume} = \frac{6688}{10.5}$$

Volume of spherical shell

$$= \frac{4}{3} \pi (R^3 - r^3)$$

$$\frac{6688}{10.5} = \frac{4}{3} \times \frac{22}{7} (216 - r^3)$$

Solving the above eq.

$$216 - r^3 = 152 \Rightarrow r = 4$$

$$\text{Thickness} = 6 - 4 = 2 \text{ cm}$$

37. Sol. (b)

Length of wire = 144 cm = 1440 mm

Volume of sphere = Volume of wire.

$$\frac{4}{3}\pi\left(\frac{60}{2}\right)^3 = \pi \cdot (r)^2 \cdot (1440)$$

$$r^2 = \frac{4 \times 30 \times 30}{144}$$

$$\Rightarrow r = \sqrt{\frac{4 \times 30 \times 30}{144}} = \frac{2 \times 30}{12} = 5 \text{ mm}$$

$$\therefore \text{Diameter} = 2r = 2 \times 5 = 10 \text{ mm} = 1 \text{ cm}$$

38. Sol. (d)

Let R = radius of larger sphere

$$\text{ATQ, } \frac{4\pi}{3}(3^3 + 4^3 + 5^3) = \frac{4\pi}{3}R^3$$

$$\Rightarrow R^3 = 3^3 + 4^3 + 5^3 = 216 = 6^3$$

$$\therefore R = 6$$

39. Sol. (b)

Let radius of the sphere be r According to the question

$$4\pi r^2 = \frac{4}{3}\pi r^3 \Rightarrow r^2 = \frac{r^3}{3}$$

$$\therefore r = 3 \text{ cm}$$

40. Sol. (d)

Initially area of sphere = $4\pi r^2$ Increased area of sphere = $4\pi(r+5)^2$

$$\text{ATQ, } 4\pi(r+5)^2 - 4\pi r^2 = 704$$

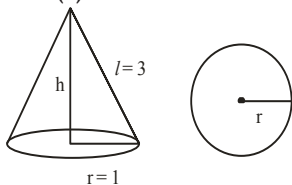
$$\Rightarrow 4\pi\{(r+5)^2 - r^2\} = 704$$

$$\Rightarrow 4 \times \frac{22}{7} \times (2r+5) \times 5 = 704$$

$$2r+5 = 8 \times \frac{7}{5} \Rightarrow 2r = 6.2$$

$$\text{diameter} = 6.2 \text{ cm}$$

41. Sol. (a)



$$\text{TSA} = \pi r(l+r) = 4\pi r^2$$

$$l = 3r$$

$$\frac{l}{r} = \frac{3}{1}, \therefore h = 2\sqrt{2}$$

$$\Rightarrow R : H = 1 : 2\sqrt{2}$$

42. Sol. (a)

$$\text{Volume of the sphere} = \frac{4}{3}\pi r^3$$

Here,

$$\frac{4}{3}\pi 9^3 = \frac{4}{3}\pi 1^3 + \frac{4}{3}\pi x^3 + \frac{4}{3}\pi 8^3$$

$$\Rightarrow \frac{4}{3}\pi 9^3 = \frac{4}{3}\pi (1^3 + x^3 + 8^3)$$

$$\Rightarrow 729 = 1 + x^3 + 512 \Rightarrow x = 6$$

$$\text{Surface area of the sphere} = 4\pi r^2$$

$$= 4 \times \pi \times 6^2 \Rightarrow 144\pi$$

43. Sol. (a)

$$\text{Let radius of the sphere is } r \text{ then, volume } V = \frac{4}{3}\pi r^3$$

When, volume increases by 700%

$$\text{New volume } V'' = V + \frac{700}{100} \times V = 8V$$

Let changed radius is r.

$$\therefore V' = \frac{4}{3}\pi(r)^3$$

$$8V = \frac{4}{3}\pi(r)^3$$

$$\therefore 8\left(\frac{4}{3}\pi r^3\right) = \frac{4}{3}\pi(r')^3$$

$$\text{or } r' = (8r^3)^{\frac{1}{3}} = 2r$$

Percent change in surface area

$$= \left(\frac{S'-S}{S}\right) \times 100 = \frac{4\pi\{(r')^2 - r^2\}}{4\pi r^2} \times 100$$

$$= \left(\frac{(r')^2 - r^2}{r^2}\right) \times 100 = \left(\frac{(2r)^2 - r^2}{r^2}\right) \times 100 = 300\%$$

Type-8 (Hemisphere)

1. The radius of a hemispherical bowl is given as 7 cm. What is the capacity (cm^3) of the bowl ?
 $[\pi = 22/7]$
 एक अर्द्धगोलीय कटोरे की त्रिज्या 7 सेमी दी गई है। कटोरे की क्षमता (cm^3) क्या है? $[\pi = 22/7]$

SSC CHSL 2023(Afternoon)

- (a) $718\frac{2}{3}$ (b) $812\frac{1}{3}$
 (c) $618\frac{1}{3}$ (d) $518\frac{2}{3}$

2. The total surface area of a solid hemisphere is 1039.5 cm^2 . The volume of the hemisphere is:-
 एक अर्द्धगोले का सम्पूर्ण पृष्ठ क्षेत्रफल 1039.5 सेमी² है तो अर्द्धगोले का आयतन क्या होगा ?

- (a) 2225.5 (b) 2530.6
 (c) 2425.5 (d) 2525.6

3. Find the volume of a hemisphere whose diameter is 6 cm. (Take $= 22/7$)
 एक अर्द्धगोले का आयतन ज्ञात कीजिए जिसका व्यास 6 सेमी है। (Take $= 22/7$)

SSC CHSL 24/05/2022 (Afternoon)

- (a) 144π (b) 48π
 (c) 18π (d) 36π

4. Determine the total surface area of a hemisphere closed at bottom Radius of the hemisphere is $\sqrt{\frac{25}{\pi}}$ unit.

निचले भाग पर बंद अर्द्धगोले का कुल पृष्ठीय क्षेत्रफल निर्धारित करें अर्द्धगोले की त्रिज्या $\sqrt{\frac{25}{\pi}}$ इकाई है।

SSC CPO 09/11/2022 (Morning)

- (a) 75 unit^2 (b) 70 unit^2
 (c) 60 unit^2 (d) 50 unit^2

5. A solid sphere is cut through its centre into two equal parts. What is the total surface area of each part, if the radius of the sphere 7 cm ?

एक ठोस गोले को उसके केंद्र से दो बराबर भागों में काटा जाता है। यदि गोले की त्रिज्या 7 cm है, तो पृष्ठीय भाग का सम्पूर्ण पृष्ठीय क्षेत्रफल क्या है?

DP Flead Constable 14/10/2022 (Shift.0).

- (a) 154 cm^2 (b) 231 cm^2
 (c) 462 cm^2 (d) 308 cm^2

6. A hemispherical bowl whose radius is 21 cm is full of ice cream. Find the volume of the ice cream.
 $(\text{take} = \frac{22}{7})$
 एक अर्द्धगोलाकार कटोरा जिसकी त्रिज्या 21 सेमी है, आइसक्रीम से भरा है। आइसक्रीम का आयतन ज्ञात कीजिए।
 $(\text{take} = \frac{22}{7})$

SSC CPO 09/11/2022 (Afternoon)

- (a) 20000 cm^3 (b) 21000 cm^3
 (c) 22000 cm^3 (d) 19404 cm^3

7. The radius of a hemisphere is 5.6 cm. What will be its volume?

एक अर्द्धगोले की त्रिज्या 5.6 सेमी है। इसका आयतन क्या होगा?

SSC CGL 07/12/2022 (4th Shift)

- (a) 367.95 cm^3 (c) 380 cm^3
 (b) 195.95 cm^3 (d) 265.65 cm^3

8. The volume of the hemisphere is $19,404 \text{ cm}^3$. The radius of the hemisphere is

गोलार्ध का आयतन $19,404$ सेमी³ है। अर्द्धगोले की त्रिज्या है

SSC CGL 05/12/2022 (3rd Shift)

- (a) 14 cm (b) 19 cm
 (c) 21 cm (d) 17 cm

9. The curved surface area of a solid hemisphere is 22 cm^2 . What is the total surface area of the hemisphere? (use $= \frac{22}{7}$)

एक ठोस अर्द्धगोले का वक्र पृष्ठीय क्षेत्रफल 22 सेमी² है। अर्द्धगोले का कुल पृष्ठीय क्षेत्रफल कितना है? (use $= \frac{22}{7}$)

SSC CGL Tier II 08/08/2022

- (a) 66 cm^2 (b) 44 cm^2
 (c) 33 cm^2 (d) 30 cm^2

10. A cone and a hemisphere have equal bases and equal volumes. What is the ratio of the height of the cone to the radius of the hemisphere?

एक शंकु और एक अर्द्धगोले के समान आधार और समान आयतन हैं। शंकु की ऊँचाई का अर्द्धगोले की त्रिज्या से अनुपात क्या है?

[CDS-2021-I]

- (a) 1:1 (b) 2:1 (c) 3:2 (d) 4:3

11. A solid metallic hemisphere of radius 6.3 cm is melted and recast into a right circular cylinder of radius 9 cm. What is the height (in cm, correct to one decimal place) of the cylinder?

त्रिज्या 6.3 सेमी का एक ठोस धात्विक अर्द्ध गोलाकार पिघलाया जाता है और 9 सेमी त्रिज्या के एक लम्ब वृत्तीय बेलन में ढाला जाता है। बेलन की ऊँचाई (सेमी में, एक दशमलव स्थान तक सही) क्या है?

SSC CHSL 4/8/2021 (Morning)

- (a) 1.9 (b) 2.7 (c) 2.5 (d) 2.1

12. A solid metallic toy has a hemispherical base with radius 3.5 cm surmounted by a cone. If the height of the cone is the same as the radius of its base, then the volume of metal used in cm^3

एक ठोस धातु के खिलौने का अर्धगोलाकार आधार है जिसकी त्रिज्या 3.5 सेमी है जिसके ऊपर एक शंकु है। यदि शंकु की ऊँचाई उसके आधार की त्रिज्या के समान है, तो प्रयुक्त धातु का आयतन सेमी³ में है

SSC MTS 27/10/2021 (Morning)

- (a) $89\frac{2}{3}$ (b) $144\frac{3}{4}$
(c) $134\frac{3}{4}$ (d) $179\frac{2}{3}$

13. The internal and external radii of a hollow hemispherical bowl are 20 cm and 23 cm, respectively. What is the total surface area (in cm^2) of the bowl?

एक खोखले अर्धगोलाकार कटोरे की आंतरिक और बाहरी त्रिज्याएँ क्रमशः 20 सेमी और 23 सेमी हैं। कटोरे का कुल पृष्ठीय क्षेत्रफल (सेमी² में) क्या है?

SSC MTS 11/10/2021 (Evening)

- (a) 2082π (b) 1858π
(c) 1987π (d) 2194π

14. A hemispherical bowl is 176 cm round the brim. supposing it to be half full, how many persons may be swerved from it in hemispherical glasses 4 cm in diameter at the top?

एक गोलाकार कटोरा किनारों के चारों ओर 176 सेमी है। मान लीजिए कि यह आधा भरा हुआ है, शीर्ष पर 4 सेंटीमीटर व्यास वाले अर्द्ध गोलाकार कटोरे में कितने व्यक्ति इससे तैर सकते हैं?

- (a) 1372 (b) 1272 (c) 1172 (d) 1472

15. A hemispherical bowl of internal radius 18 cm contains a liquid. The liquid is filled in small cylindrical bottles of internal radius 3 cm and internal height 4 cm. What is the number of bottles used to empty the bowl?

आंतरिक त्रिज्या 18 सेमी के अर्धगोलीय कटोरे में एक तरल होता है। तरल को आंतरिक त्रिज्या 3 सेमी और आंतरिक ऊँचाई 4 सेमी की छोटी बेलनाकार बोतलों में भरा जाता है। कटोरे को खाली करने के लिए कितनी बोतलों का उपयोग किया जाता है?

[CDS - 2021-II]

- (a) 54 (b) 81 (c) 108 (d) 135

16. A cubical block of side 14 cm is surmounted by a hemisphere of radius 7 cm. What is the total surface area of the solid thus formed? (take $\pi = \frac{22}{7}$)

भुजा 14 सेमी वाले एक घनाकार खंड के ऊपर 7 सेमी त्रिज्या का एक अर्द्ध गोलाकार है। इस प्रकार बने ठोस का कुल पृष्ठीय क्षेत्रफल कितना है? (take $\pi = \frac{22}{7}$)

[CDS-2021-II]

- (a) $1330 cm^2$ (b) $1306 cm^2$
(c) $1296 cm^2$ (d) $1256 cm^2$

17. A solid is hemispherical at the bottom and conical above. If the surface areas of the two parts are equal, then the ratio of radius and height of its conical part is :

एक ठोस तल पर अर्धगोलाकार और ऊपर शंकाकार होता है। यदि दो भागों का पृष्ठीय क्षेत्रफल बराबर है, तो उसके शंकाकार भाग की त्रिज्या और ऊँचाई का अनुपात है:

- (a) 1:3 (b) 1:1 (c) $\sqrt{3}:1$ (d) $1:\sqrt{3}$

18. A hemispherical bowl of radius 30 cm is filled with water by using a cylindrical glass. If the water from the cylindrical glass is poured 72 times to fill the bowl completely and the height of the glass is 10 cm, then what is the base radius of the cylindrical glass ?

30 सेमी त्रिज्या के एक अर्धगोलीय कटोरे को एक बेलनाकार गिलास का उपयोग करके पानी से भर दिया जाता है। यदि कटोरे को पूरा भरने के लिए बेलनाकार गिलास से 72 बार पानी डाला जाता है और गिलास की ऊँचाई 10 सेमी है, तो बेलनाकार गिलास की आधार त्रिज्या क्या है?

SSC MTS 11/07/2022 (Afternoon)

- (a) 7.5 cm (b) 8 cm (c) 5 cm (d) 6 cm

19. A solid toy is in the shape which is a combination of a cylinder, cone and a hemispherical bowl. The cylinder contributes to 50% of the total volume of the toy, the cone contributes to 20% of the volume. Find the ratio of the contribution (in terms of volume) of the cone, cylinder and hemisphere.

एक ठोस खिलौना एक बेलन, शंकु और एक अर्धगोलीय कटोरे के संयोजन के आकार का है। सिलेंडर खिलौने की कुल मात्रा का 50% योगदान देता है, शंकु मात्रा का 20% योगदान देता है। शंकु, बेलन और अर्धगोले के योगदान (आयतन के संदर्भ में) का अनुपात ज्ञात कीजिए।

SSC CHSL 30/05/2022 (Afternoon)

- (a) 2:3:5 (b) 2:5:3 (c) 5:2:3 (d) 4:5:3

20. Steel is used to make a hemispherical bowl that is 0.37 cm thick. The bowl's inner radius is 6 cm. Find the bowl's outside curved surface area (take $\pi = \frac{22}{7}$)

स्टील का उपयोग एक अर्द्ध गोलार्द्ध कटोरा बनाने के लिए किया जाता है जो 0.37 सेमी मोटा होता है कटोरे की भीतरी त्रिज्या 6 सेमी है। कटोरे के बाहरी वक्र पृष्ठीय क्षेत्रफल ज्ञात कीजिए।

SSC CGL 07/12/2022 (Shift- 01)

- (a) 532 cm² (b) 255.0548 cm²
(c) 484 cm² (d) 523.41.7 cm²

21. Three Toys are in the shape of cylinder, hemisphere and cone. The Three toys have same base. Height of each toy is $2\sqrt{2}$ cm. What is ratio of the total surface areas of cylinder, hemisphere and cone respectively?

तीन खेलौने बेलन, अर्द्ध गोलार्द्ध, और शंकु के आकार में हैं तीनों खेलौनों का आधार एक ही है प्रत्येक खेलौने की ऊँचाई $2\sqrt{2}$ सेमी है क्रमशः बेलन, अर्द्ध गोलार्द्ध, और शंकु के कुल पृष्ठ क्षेत्रफल का अनुपात क्या है?

- (a) 4: 3: $\sqrt{2} + 1$ (b) 4: 3: $(2 + \sqrt{2})$
(c) 2: 1: $(1 + \sqrt{2})$ (d) 4: 3: $2\sqrt{2}$

22. The radius of a hollow sphere is 21 cm, It cut into two equal halves by a plane passes through its centre. What is 75% of the curved surface area (in cm², rounded off to the nearest tens) of the hemisphere? (Take $\pi = \frac{22}{7}$)

एक खोखले गोले की त्रिज्या 21 cm है। इसके केन्द्र में गुजरने वाले तल द्वारा इसे दो बराबर भागों में काटा जाता है। अर्द्ध गोलार्द्ध के वक्र पृष्ठीय क्षेत्रफल का 75% (cm² में निकटतम दहाई तक पूर्णांकित) कितना होगा? ($\pi = \frac{22}{7}$ लीजिए)

SSC CPO 09/11/2022 (Shift- 03)

- (a) 4160 (b) 3470 (c) 2280 (d) 2770

23. Twelve solid hemispheres of the same size are melted and recast into a right circular cylinder of diameter 7 cm and height 28 cm. What is the radius of the hemisphere?

समान आकार के बारह ठोस अर्द्ध गोलार्द्धों को पिघलाया जाता है और व्यास 7 सेमी और ऊँचाई 28 सेमी वाले एक लम्ब वृत्तीय बेलन में ढाला जाता है। अर्द्ध गोलार्द्ध की त्रिज्या क्या है?

SSC CPO 12/12/19 (Evening)

- (a) 4.5 cm (b) 3.5 cm (c) 3 cm (d) 3.8 cm

24. The volume of a hemisphere is 155232 cm³ radius of the hemisphere?

एक अर्धगोले का आयतन 155232 सेमी³ है, अर्धगोले की त्रिज्या?

[CDS - 2019-1]

- (a) 40 cm (b) 42 cm (c) 38 cm (d) 36 cm

25. A hemispherical tank full of water is emptied by a pipe at the rate of 7.7 litres per seconds. How much time(in hours) will it take to empty $\frac{2}{3}$ part of the tank if the internal radius of the tank is 10.5 m ?

पानी से भरे एक अर्धगोलाकार टैंक को एक पाइप द्वारा 7.7 लीटर प्रति सेकंड की दर से खाली किया जाता है। यदि टंकी की आंतरिक त्रिज्या 10.5 मीटर है, तो टंकी के $\frac{2}{3}$ भाग को खाली करने में कितना समय (घंटों में) लगेगा?

SSC CGL TIER II 16/11/2020

- (a) $\frac{185}{6}$ (b) $\frac{175}{3}$ (c) $\frac{185}{3}$ (d) $\frac{175}{2}$

26. A hemispherical bowl of internal diameter 36 cm is full of a liquid. This liquid is to be filled into cylindrical bottles each of radius 3 cm and height 12 cm. How many such bottles are required to empty the bowl?

आंतरिक व्यास 36 सेमी का एक अर्द्ध गोलार्द्ध कटोरा एक तरल से भरा है। इस द्रव को 3 सेमी त्रिज्या और 12 सेमी ऊँचाई वाली बेलनाकार बोतलों में भरना है। इस कटोरे को खाली करने के लिए ऐसी कितनी बोतलों की आवश्यकता होगी?

SSC CGL TIER II 12/09/2019

- (a) 72 (b) 54 (c) 36 (d) 27

27. A hemi-spherical bowl has 3.5 cm radius. It is to be painted inside as well as outside. The cost of painting it at the rate of Rs. 5 per 10 sq. cm. will be: एक अर्ध-गोलाकार कटोरे की त्रिज्या 3.5 सेमी है। इसे अंदर के साथ-साथ बाहर भी चित्रित किया जाना है। रुपये की दर से इसे पेंट करने की लागत। 5 प्रति 10 वर्ग सेमी। होगा:

- (a) Rs. 77 (b) Rs. 175
(c) Rs. 50 (d) Rs. 100

28. A sphere of maximum volume is cut out from a solid hemisphere. What is the ratio of the volume of the sphere to that of the remaining solid?

एक ठोस अर्धगोले से अधिकतम आयतन का एक गोला काटा जाता है। गोले के आयतन का शेष ठोस के आयतन से अनुपात क्या है?

SSC CGL TIER II 13/09/2019

- (a) 1: 4 (b) 1: 2 (c) 1: 3 (d) 1: 1

Type-8 (Hemisphere) ANSWER KEY

1	A	2	C	3	C	4	A	5	C	6	D	7	A	8	C
9	C	10	B	11	D	12	C	13	C	14	A	15	C	16	A
17	D	18	C	19	C	20	B	21	A	22	C	23	B	24	B
25	B	26	C	27	A	28	C								

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Type-8 (Hemisphere) Solution

1. Sol. (a)

Volume of Hemisphere

$$= \frac{2}{3} \times \frac{22}{7} \times 7 \times 7 \times 7 = \frac{2156}{3} = 718\frac{2}{3} \text{ cm}^3$$

2. Sol. (c)

$$\text{TSA} = 3\pi R^2 = 1039.5 \times 2 \times \frac{1}{2}$$

$$3 \times \frac{22}{7} \cdot R^2 = \frac{2079}{2}$$

$$R^2 = \frac{9 \times 7 \times 7}{4}$$

$$R = \frac{3 \times 7}{2} = \frac{21}{2}$$

$$\begin{aligned} \text{Volume} &= \frac{2}{3} \pi r^3 = \frac{2}{3} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2} \\ &= 11 \times 220.5 = 2425.5 \end{aligned}$$

3. Sol. (c)

$$\text{Volume of hemisphere} = \frac{2}{3} \pi r^3$$

$$= \frac{2}{3} \times \pi \times \left(\frac{6}{2}\right)^3 = 18\pi \text{ cm}^3$$

4. Sol. (a)

$$\text{TSA of hemisphere} = 3\pi r^2$$

$$= 3\pi \times \frac{25}{\pi} = 75 \text{ unit}^2$$

5. Sol. (c)

If forms 2 hemisphere of radius 7 cm.

$$\text{T.S.A. of each part} \Rightarrow 3\pi r^2$$

$$\Rightarrow 3 \times \frac{22}{7} \times 7 \times 7$$

$$\Rightarrow 66 \times 7 \Rightarrow 462 \text{ cm}^2$$

6. Sol. (d)

$$\text{Volume of hemisphere} = \frac{2}{3} \times \pi r^3$$

Volume of the ice-cream

$$= \frac{2}{3} \times \frac{22}{7} \times 21 \times 21 \times 21 = 19404 \text{ cm}^3$$

7. Sol. (a)

Given, Radius = 5.6 cm

$$\text{Then, Volume of hemisphere} = \frac{2}{3} \pi R^3$$

$$= \frac{2}{3} \times \frac{22}{7} \times 5.6 \times 5.6 \times 5.6 = 367.95 \text{ cm}^3$$

8. Sol. (c)

$$\text{Volume of hemisphere} = \frac{2}{3} \pi r^3$$

$$\Rightarrow 19404 = \frac{2}{3} \times \frac{22}{7} \times r^3$$

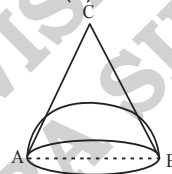
$$\Rightarrow r^3 = 9261 \Rightarrow r = 21 \text{ cm}$$

9. Sol. (c)

$$\text{CSA of hemisphere} = 2\pi r^2 = 22 \Rightarrow \pi r^2 = 11 \text{ cm}^2$$

$$\text{Then, TSA of hemisphere} = 3\pi r^2 = 3 \times 11 = 33 \text{ cm}^2$$

10. Sol. (b)



Let AB(= 2r) is the diameter of the base of cone & hemisphere.

According to the question

$$\text{Volume of cone} = \text{Volume of hemisphere}$$

$$\frac{1}{3} \times \pi \cdot r^2 \times h = \frac{2}{3} \pi \cdot r^3$$

Where h = Height of the cone.

$$\therefore \frac{h}{r} = \frac{2}{1} \Rightarrow 2:1$$

11. Sol. (d)

Let height of Cylinder = H

$$\text{Radius of hemisphere} = r = 6.3 \text{ cm}$$

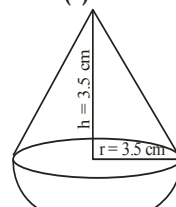
$$\text{Radius of cylinder} = R = 9 \text{ cm}$$

ATQ, Volume of cylinder = Volume of hemisphere

$$\Rightarrow \pi R^2 H = \frac{2}{3} \pi r^3 \Rightarrow 9 \times 9 \times H = \frac{2}{3} \times 6.3 \times 6.3 \times 6.3$$

$$\Rightarrow H = 2.058 \text{ cm} \approx 2.1 \text{ cm}$$

12. Sol. (c)



Height of cone = radius of base,

So $h = r$

Volume of metal used = Volume of cone + volume of hemisphere

$$= \frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^2 = \frac{1}{3}\pi r^3 + \frac{2}{3}\pi r^3$$

$$= \frac{1}{3}\pi r^3(1 + 2) = \frac{1}{3}\pi r^3(3)$$

$$= \frac{27}{7} \times \left(\frac{7}{2}\right)^3 = \frac{53}{4} = 134\frac{3}{4} \text{ cm}$$

13. Sol. (c)

Inner radius = 20 cm, Outer radius $R = 23$ cm

Total surface area of the bowl

$$= 2\pi r^2 + 2\pi R^2 + \pi(R^2 - r^2)$$

$$= \pi[2r^2 + 2R^2 + (R^2 - r^2)]$$

$$= \pi[2(20)^2 + 2(23)^2 + (23^2 - 20^2)]$$

$$= \pi[800 + 1058 + (529 - 400)]$$

$$= \pi[800 + 1058 + 129] = 1987\pi \text{ cm}^2$$

14. Sol. (a)

Circumference of hemispherical bowl = 176

$$= 2\pi r = 176$$

$$= r = 28 \text{ cm}$$

When bowl is half full

$$= \frac{2}{3}\pi r^3 \times \frac{1}{2} = \frac{1}{3}\pi(28)^3$$

Volume of hemispherical glass = $\frac{2}{3}\pi(2)^3$

No. of persons may be served =

$$\frac{\frac{1}{3}\pi(28)^3}{\frac{2}{3}\pi(2)^3} = 1372$$

15. Sol. (c)

$$\frac{2}{3}\pi r^3 = \pi R^2 h \times N$$

$$\Rightarrow \frac{2}{3} \times 18 \times 18 \times 18 = 3 \times 3 \times 4 \times N$$

$$\Rightarrow N = 108$$

16. Sol. (a)

Total surface area of solid: $6a^2 + 2\pi r^2 - \pi r^2$

$$= 6a^2 + \pi r^2$$

$$= 6 \times 196 + \frac{22}{7} \times 7 \times 7$$

$$= 1176 + 154 = 1330 \text{ cm}^2$$

17. Sol. (d)

$$\therefore 2\pi r^2 = \pi r \sqrt{r^2 + h^2}$$

$$\Rightarrow 2r = \sqrt{r^2 + h^2} \Rightarrow 4r^2 = r^2 + h^2$$

$$\Rightarrow 3r^2 = h^2 \Rightarrow \sqrt{3}r = h \Rightarrow \frac{r}{h} = \frac{1}{\sqrt{3}}$$

18. Sol. (c)

Because hemispherical bowl filled with water by using a cylindrical glass at 72 times, So,

Volume of hemispherical bowl

$$= 72 \times \text{volume of cylindrical glass}$$

$$- \text{Radius of hemispherical bowl (R)} = 30 \text{ cm}$$

and height of glass = 10 cm

$$\Rightarrow \frac{2}{3}\pi R^3 = 72 \times \pi r^2 h$$

$$\Rightarrow 72 \times \pi r^2 \times 10 = \frac{2}{3}\pi \times 30 \times 30 \times 30$$

$$\Rightarrow 72 \times r^2 \times 10 = 2 \times 10 \times 30 \times 30$$

$$\Rightarrow r^2 = \frac{2 \times 10 \times 30 \times 30}{72 \times 10}$$

$$\Rightarrow r^2 = \frac{2 \times 30 \times 30}{72}$$

$$\Rightarrow r^2 = 25 \Rightarrow r = \sqrt{25} = 5$$

So radius of glass is 5 cm

19. Sol. (b)

According to the question, Percentage contribution of hemisphere in total volume of toy = $100 - (50 + 20) = 100 - 70 = 30\%$

So, required ratio

$$= 20:50:30 = 2:5:3$$

20. Sol. (b)

Given, thickness of hemispherical bowl = 0.37 cm

Thickness = outer radius - inner radius

$$= R - r$$

$$\Rightarrow R - r = 0.37 \text{ cm}$$

Also, inner radius, $r = 6$ cm

$$\Rightarrow \text{Outer radius} = 6.37 \text{ cm}$$

We know,

Curved surface Area of hemisphere = $2\pi r^2$

$$= 2 \times \frac{22}{7} \times (6.37)^2 = 255.0548 \text{ cm}^2$$

Short Trick

Since, outer radius is 6.37 cm,

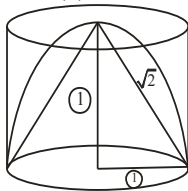
⇒ Outer SA must be in decimal.

⇒ Option (a) & (c) eliminated.

Now just check the divisibility of 11.

⇒ Only option (b) satisfied.

21. Sol. (a)



Height of hemisphere is equal to its base radius $r = h$

cylinder : Hemi : cone

$$\text{TSA} \Rightarrow 2\pi r(h + r) : 3\pi r^2 : \pi r(l + r)$$

$$\text{TSA} = 2\pi \cdot 1(1 + 1) : 3\pi 1^2 : \pi 1(\sqrt{2} + 1)$$

$$4 : 3 : (\sqrt{2} + 1)$$

22. Sol. (c)

Radius = 21 cm

Curved surface area of hemisphere = $2\pi r^2$

$$= 2 \times \frac{22}{7} \times 21 \times 21$$

$$\text{We need 75\% of C.S.A.} = \frac{3}{4} \times 2 \times \frac{22}{7} \times 441$$

$$= 2080 \text{ (approx)}$$

23. Sol. (b)

As per question

$$12 \times \frac{2}{3} \pi r^3 = \pi R^2 H$$

$$\text{On solving, } r^3 = \frac{7^2 \times 28}{2^2 \times 8}$$

$$r^3 = \frac{(7)^3}{2^3} \Rightarrow r = \frac{7}{2} \Rightarrow r = 3.5 \text{ cm}$$

24. Sol. (b)

Let r = radius of hemisphere Volume of

hemisphere = 155232

$$\therefore \frac{2}{3} \times \frac{22}{7} r^3 = 155232$$

$$\Rightarrow r^3 = \frac{155232 \times 21}{44} = 3528 \times 21$$

$$= 2^3 \times 3^3 \times 7^3 = (42)^3$$

25. Sol. (b)

Volume of the tank

$$= \frac{2}{3} \times \pi \times 10.5^3 \times \frac{2}{3} = 1617 \text{ m}^3$$

$$1 \text{ m}^3 = 1000 \text{ l}$$

$$1617 \text{ m}^3 = 1617000 \text{ l}$$

$$\text{Time required} = \frac{1617000}{7.7 \times 3600} = \frac{175}{3} \text{ hrs}$$

26. Sol. (c)

Let the number of bottles required = n

$$\text{Quantity of the liquid} = \frac{2}{3} \times \pi \times r^3$$

$$= \frac{2}{3} \times \pi \times 18^3$$

$$\text{Capacity of a bottle} = \pi r^2 h = \pi \times 3^2 \times 12$$

$$\text{Now, } \frac{2}{3} \times \pi \times 18^3 = n \times \pi \times 3^2 \times 12$$

$$n = \frac{2 \times 18 \times 18 \times 18}{3 \times 3 \times 3 \times 12} = 36$$

27. Sol. (a)

According to the question, Radius = 3.5 cm

⇒ In the question it is given that A hemi-spherical bowl is to be painted inside as well as outside Total area that is to be painted = Inside area of bowl + outside area of bowl

$$= 2\pi r^2 + 2\pi r^2 = 4\pi r^2 = 4 \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \text{ cm}^2$$

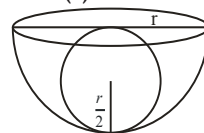
$$\Rightarrow \text{painting Rate} = 10 \text{ cm}^2 \text{ in 5 Rs.}$$

$$1 \text{ cm}^2 \text{ will be painted} = \frac{5}{10} = \text{Rs. } \frac{1}{2} \text{ so total cost will}$$

be painted in

$$= 4 \times \frac{22}{7} \times \frac{7}{2} \times \frac{1}{2} = \text{Rs. } 77$$

28. Sol. (c)



Let the radius of hemisphere = r

$$\Rightarrow \text{radius of the sphere} = \frac{r}{2}$$

$$\text{Volume of hemisphere} = \frac{2}{3} \pi r^3$$

$$\text{Volume of sphere} = \frac{4}{3} \pi \left(\frac{r}{2}\right)^3 = \frac{1}{6} \pi r^3$$

Type-9 (Frustum)

1. The radii of the ends of a frustum of a cone 7 cm high are 5 cm and 3 cm. Find its volume correct to one decimal place. (Use $= \frac{22}{7}$)

7 सेमी ऊँचे एक शंकु के छिन्नक के सिरों की त्रिज्याएँ 5 सेमी और 3 सेमी हैं। इसका आयतन एक दशमलव स्थान तक सही ज्ञात कीजिए। ($\pi=22/7$ का प्रयोग करें)

SSC CGL 2023 (2nd Shift)

- (a) 345.6 cm³ (c) 379.3 cm³
(b) 359.3 cm³ (d) 369.3 cm³

2. A frustum of a right circular cone, whose height is 18 cm, large base radius is 25 cm, and small base radius is 20 cm, is melted to form a small sphere of diameter 2 cm. How many spheres will be formed?
एक लम्ब वृत्तीय शंकु का एक छिन्नक, जिसकी ऊँचाई 18 सेमी, बड़े आधार की त्रिज्या 25 सेमी और छोटे आधार की त्रिज्या 20 सेमी है, को पिघलाकर 2 सेमी व्यास का एक छोटा गोला बनाया जाता है। कितने गोले बनेंगे?

SSC CPO 09/11/2022 (Afternoon)

- (a) 6287 (b) 6862
(c) 4575 (d) 5857

3. The frustum of a right circular cone has the radius of the base as 5 cm, radius of the top as 3 cm, and height as 6 cm. What is its volume?

एक लम्ब वृत्तीय शंकु के छिन्नक के आधार की त्रिज्या 5 सेमी, शीर्ष की त्रिज्या 3 सेमी और ऊँचाई 6 सेमी है। इसकी मात्रा क्या है?

SSC CHSL 27/05/2022 (Afternoon)

- (a) $98\pi\text{cm}^3$ (c) $96\pi\text{cm}^3$
(b) $100\pi\text{cm}^3$ (d) $90\pi\text{cm}^3$

4. In a right circular cone, the radius of its base is 7 cm and its height 24 cm. A cross-section is made through the midpoint of the height parallel to the base. The volume of the upper portion is

एक लम्ब वृत्तीय शंकु में, इसके आधार की त्रिज्या 7 सेमी और इसकी ऊँचाई 24 सेमी है। आधार के समानांतर ऊँचाई के मध्य बिंदु के माध्यम से एक अनुप्रस्थ काट बनाया जाता है। ऊपरी भाग का आयतन है

- (a) 169 cm³ (c) 1078 cm³
(b) 154 cm³ (d) 800 cm³

5. A right circular cone is cut parallel to its base in two parts by one cut such that volume of each part is same. Find out the ratio of height of upper and lower part.

एक लम्बवृत्तीय शंकु को आधार के समान्तर एक कटाव के द्वारा दो भागों में बांटा गया है। प्रत्येक भाग का आयतन एक समान है। ऊपरी तथा नीचले भाग की ऊँचाई का अनुपात बताओ।

- (a) $1:(\sqrt[3]{2}+1)$ (b) $1:\sqrt{2}$
(c) $1:\sqrt[3]{2}$ (d) $1:(\sqrt[3]{2}-1)$

6. A cone is cut at mid point of its height by a frustum parallel to its base. The ratio between the volumes of two parts of cone would be

एक शंकु को उसके आधार के समानांतर एक छिन्नक द्वारा उसकी ऊँचाई के मध्य बिंदु पर काटा जाता है। शंकु के दो भागों के आयतन के बीच का अनुपात होगा

- (a) 1:1 (b) 1:8 (c) 1:4 (d) 1:7

7. The height of a cone is 40 cm. The cone is cut parallel to its base such that the volume of the small cone is $\frac{1}{64}$ of the cone. Find at which height from base the cone is cut?

एक शंकु की ऊँचाई 40 सेमी है। शंकु को उसके आधार के समानांतर इस प्रकार काटा जाता है कि छोटे शंकु का आयतन शंकु का $1/64$ है। ज्ञात कीजिए कि आधार से किस ऊँचाई पर शंकु काटा गया है?

- (a) 20 cm (b) 30 cm
(c) 25 cm (d) 22.5 cm

8. The radii of two circular faces of the frustum of a cone are 5 cm and 4 cm. If the height of the frustum is 21 cm. what is the volume in cm³?

यदि द्विन्धक की दोनो फलकों की त्रिज्यायें क्रमशः 5 सेमी और 4 सेमी हैं यदि इसकी ऊँचाई 21 सेमी है तो इसका आयतन क्या होगा?

- (a) 902 (b) 1056 (c) 1342 (d) 638

9. A 35 cm high bucket in the form of a frustum is full of water. Radii of its lower and upper ends are 12 cm and 18 cm, respectively. If water from this bucket is poured in a cylindrical drum, whose base radius is 20 cm, then what will be the height of water (in cm) in the drum?

एक छिन्नक के आकार की 35 सेमी ऊँची बाल्टी पानी से भरी हुई है। इसके निचले और ऊपरी सिरों की त्रिज्याएँ क्रमशः 12 सेमी और 18 सेमी हैं, यदि इस बाल्टी से पानी एक बेलनाकार ड्रम में डाला जाता है, जिसकी आधार त्रिज्या 20 सेमी है, तो ड्रम में पानी की ऊँचाई (सेमी में) क्या होगी?

SSC CGL 11/04/2022 (Evening)

- (a) 16.25 (b) 18.25 (c) 19.95 (d) 20.50

10. The height of a right circular cone and the radius of its circular base are respectively 9 cm and 3 cm. The cone is cut by a plane parallel to its base so as to divide into two parts. The volume of the frustum (lower part) of the cone is 44 cm^3 . The radius of the upper circular surface of the frustum is -
एक शंकु की ऊँचाई 9 सेमी० और त्रिज्या 3 सेमी० है इस शंकु को आधार के समांतर काटा जाता है यदि इस प्रकार बने छिन्नक का आयतन 44 cm^3 है तब रस छिन्नक के ऊपरी सिरे की त्रिज्या क्या होगी ?

- (a) $\sqrt[3]{12} \text{ cm}$ (b) $\sqrt[3]{13} \text{ cm}$
(c) $\sqrt[3]{6} \text{ cm}$ (d) $\sqrt[3]{20} \text{ cm}$

11. The radii of the circular ends of a frustum of a cone are 20 cm and 13 cm and its height is 12 cm. What is the capacity (in litres) of the frustum (correct to one decimal place)? (Use $\pi = 22/7$)
एक शंकु के एक छिन्नक के वृत्ताकार सिरों की त्रिज्याएँ 20 सेमी और 13 सेमी हैं और इसकी ऊँचाई 12 सेमी है। छिन्नक की क्षमता (लीटर में) क्या है (दशमलव के एक स्थान तक सही)? ($\pi = 22/7$ का प्रयोग करें)

SSC MTS 6/10/2021 (Morning)

- (a) 10.4 (b) 11.2 (c) 10.8 (d) 11.4

12. The height of cone is 45 cm. It is cut at a height of 15 cm from its base by a plane parallel to base. if the volume of frustum so formed is 43890 cm^3 then what is the Volume of original cone?

एक शंकु की ऊँचाई 45 सेमी० है इस शंकु को इसके आधार से 15 सेमी० की ऊँचाई पर आधार के समांतर काटा जाता है यदि इस प्रकार बने छिन्नक का आयतन 43890 सेबा है तब मूल शंकु का आयतन (सेमी. 3) में होगा?

- (a) 56133 (b) 65700 (c) 72765 (d) 62370

13. A bucket is of a height 25 cm. Its top and bottom radii are 20 cm and 10 cm, respectively. Its capacity (in L) is

एक बाल्टी की ऊँचाई 25 सेमी है। इसकी ऊपरी और निचली त्रिज्या क्रमशः 20 सेमी और 10 सेमी है। इसकी क्षमता (L में) है

[CDS - 2018-I]

- (a) $17.5\pi/3$ (b) 17.5π
(c) 20π (d) 25π

14. A cone of radius 90 cm and height 120 cm stands on its base. It cut into 3 parts by 2 cuts parallel to its base such that the height of the three parts (from top to bottom) are in ratio of 1: 2:3. What is the total surface area (in cm^2) of the middle part?
90 सेमी त्रिज्या और 120 सेमी ऊँचाई का एक शंकु इसके आधार पर खड़ा है। यह अपने आधार के समानांतर 2 कटों द्वारा 3 भागों में इस प्रकार कटता है कि तीन भागों की ऊँचाई

(ऊपर से नीचे) 1:2:3 के अनुपात में है। मध्य भाग का कुल पृष्ठीय क्षेत्रफल (सेमी² में) क्या है?

- (a) 14600 (b) 16500 (c) 17800 (d) 18500

15. The height of a right circular cone and the radius of its circular base are respectively 9 cm and 3 cm. The cone is cut by a plane parallel to its base so as to divide it into two parts. The volume of the frustum (i.e. the lower part) of the cone is 44 cubic cm. The radius of the upper circular surface of the frustum (take $\pi = \frac{22}{7}$) is :

एक लम्ब वृत्तीय शंकु की ऊँचाई और उसके वृत्ताकार आधार की त्रिज्या क्रमशः 9 सेमी और 3 सेमी है। शंकु को उसके आधार के समांतर समतल द्वारा इस प्रकार काटा जाता है कि वह दो भागों में विभाजित हो जाए। शंकु के छिन्नक का आयतन (अर्थात् निचला भाग) 44 घन सेमी है। छिन्नक के ऊपरी गोलाकार सतह की त्रिज्या ($\pi = 22/7$ का प्रयोग करें) है:

- (a) $\sqrt[3]{12} \text{ cm}$ (b) $\sqrt[3]{13} \text{ cm}$
(c) $\sqrt[3]{17} \text{ cm}$ (d) $\sqrt[3]{20} \text{ cm}$

16. The base radius and height of a cone is 5 cm and 25 cm respectively. If the cone is cut parallel to its base at a height of h from the base. If the volume of this frustum is 110 cm^3 . Find the radius of smaller cone?

एक शंकु के आधार की त्रिज्या और ऊँचाई क्रमशः 5 सेमी और 25 सेमी है। यदि शंकु को उसके आधार के समान्तर आधार से h ऊँचाई पर काटा जाता है। यदि इस छिन्नक का आयतन 110 सेमी³ है। छोटे शंकु की त्रिज्या ज्ञात कीजिये?

- (a) $(104)^{1/3} \text{ cm}$ (d) $(104)^{1/2} \text{ cm}$
(c) 5 cm (d) None of these

17. The radii of two circular faces of the frustum of a cone of height 21 cm are 3 cm and 2 cm respectively. What is the volume of the frustum of the cone in cubic cm? (Take $\pi = 22/7$)

21 सेमी ऊँचाई वाले एक शंकु के छिन्नक के दो वृत्ताकार फलकों की त्रिज्याएँ क्रमशः 3 सेमी और 2 सेमी हैं। घन c में शंकु के छिन्नक का आयतन क्या है? ($\pi = 22/7$ लें)

SSC CGL 11/06/2019 (Morning)

- (a) 154 (b) 286 (c) 345 (d) 418

18. A tub is in the shape of a frustum of a cone. The radii of two circular ends of the tub are 105 cm and 42 cm. If the vertical height of the tub is 16 cm, what is its slant height?

एक टब एक शंकु के छिन्नक के आकार का है। टब के दो वृत्ताकार सिरों की त्रिज्याएँ 105 सेमी और 42 सेमी हैं। यदि टब की ऊर्ध्वाधर ऊँचाई 16 सेमी है, तो इसकी तिरछी ऊँचाई क्या है?

[CDS - 2021-II]

- (a) 63.5 cm (b) 65 cm
(c) 73.5 cm (d) 75 cm

INDIA'S 1ST TYPE WISE BOOK
PUSHPENDRA SIR

Type-9 (Frustum) ANSWER KEY

1	B	2	B	3	A	4	B	5	C	6.	D	7	B	8	C
9	C	10	B	11	A	12	D	13	A	14	B	15	B	16	A
17	D	18	B												

Type- 9 (Frustum) Solution

1. Sol. (b)

Volume of a frustum

$$= \frac{1}{3} \times \pi \times h(R^2 + r^2 + R \times r)$$

$$= \frac{1}{3} \times \frac{22}{7} \times 7(5^2 + 3^2 + 5 \times 3)$$

$$= \frac{22}{3} (25 + 9 + 15)$$

$$= \frac{22 \times 49}{3} = \frac{1078}{3} = 359.3 \text{ cm}^3$$

2. Sol. (b)

Let the no of sphere formed be N

Volume of frustum = N × Volume of sphere

$$\frac{1}{3} \pi (R^2 + r^2 + Rr)h_1 = N \times \frac{4}{3} \pi \times R_1^3$$

$$(25^2 + 20^2 + 500)18 = 4N$$

$$(625 + 400 + 500)18 = 4N$$

$$1525 \times 18 = 4N$$

$$N = \frac{1525 \times 18}{4} = 6862$$

3. Sol. (a)

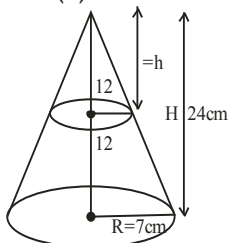
Volume of frustum

$$= \frac{1}{3} \pi h(R^2 + r^2 + Rr)$$

$$\Rightarrow \frac{1}{3} \pi \times 6(5^2 + 3^2 + 15)$$

$$\Rightarrow 2\pi(25 + 9 + 15) = 98\pi \text{ cm}^3$$

4. Sol. (b)



Volume of bigger cone

$$= \frac{1}{3} \times \pi \times (7)^2 \times 24$$

$$= \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 24$$

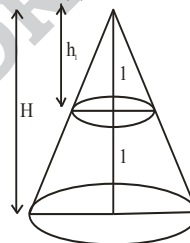
$$= 22 \times 7 \times 8 = 1232 \text{ cm}^3$$

$$\text{volume of smaller cone} = \frac{h^3}{H^3}$$

$$\frac{\text{Volume of smaller cone}}{1232} = \frac{12^3}{24^3}$$

$$\text{volume of smaller cone} = 154 \text{ cm}^3$$

5. Sol. (c)

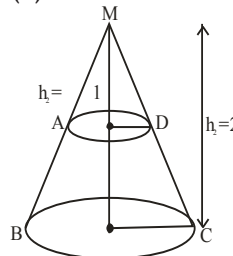


$$\frac{h^3}{H^3} = \frac{1}{2}$$

$$\frac{h}{H} = \frac{1}{\sqrt[3]{2}}$$

$$\frac{h}{H-h} = \frac{1}{\sqrt[3]{2}-1}$$

6. (d)



$$\frac{\text{ratio of smaller cone}}{\text{ratio of larger cone}} = \frac{h_1^3}{h_2^3} = \frac{1^3}{2^3} = \frac{1}{8}$$

$$\text{area of part (ABCD) (i.e. frustum)} = 8 - 1 = 7$$

$$\text{Required ratio} = 1:7$$

7. Sol. (b)

8. Sol. (c)

$$V = \frac{1}{3} \times \pi(r_1^2 + r_2^2 + r_1 \times r_2)h$$

$$V = \frac{1}{3} \times \frac{22}{7} (25 + 16 + 20) \times 21$$

$$= 22 \times 61 = 1342 \text{ cm}^3$$

9. Sol. (c)

Let, the height of water in drum = H

According to the question,

Volume of frustum = volume of water in cylindrical drum

$$\frac{1}{3} \pi h(r_1^2 + r_2^2 + r_1 \times r_2) = \pi R^2 H$$

$$\frac{1}{3} \times 35(12^2 + 18^2 + 12 \times 18)$$

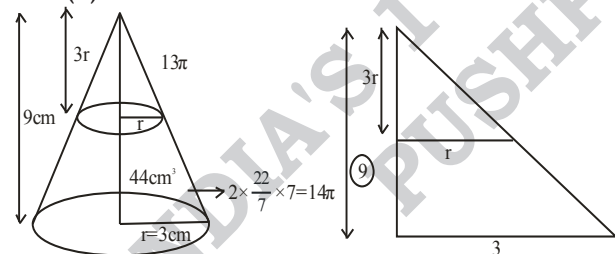
$$= 20^2 \times H$$

$$\frac{1}{3} \times 35(144 + 324 + 216) = 400 \times H$$

$$\frac{1}{3} \times 35(684) = 400 \times H$$

$$7980 = 400 \times H \Rightarrow H = 19.95 \text{ cm}$$

10. Sol. (b)



$$2 \times \frac{22}{7} \times 7 \times 7 = 14\pi$$

$$\text{Vol. of whole cone} = \frac{1}{3} \pi 3^2 \cdot 9 = 27\pi$$

$$\text{Vol. of Frustum} = 27\pi - 14\pi = 13\pi$$

$$V = \frac{1}{3} \pi r^2 \cdot 3r = 13\pi$$

$$r^3 = 13$$

$$r = \sqrt[3]{13}$$

11. Sol. (a)

Volume of frustum

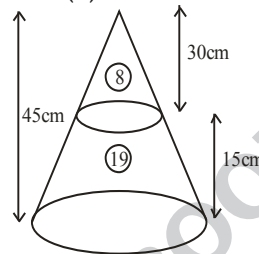
$$= \frac{1}{3} \pi h(r_1^2 + r_2^2 + r_1 r_2)$$

$$= \frac{1}{3} \times \frac{22}{7} \times 12 \times (20^2 + 13^2 + 20 \times 13)$$

$$= \frac{1}{3} \times \frac{22}{7} \times 12 \times 829 = 10422 \text{ cm}^3$$

$$10422 \text{ cm}^3 = 10.4 \text{ liters}$$

12. Sol. (d)



Height = 2 : 3

Volume = 8 : 27

$$19 \rightarrow 43890$$

$$1 \rightarrow 2310$$

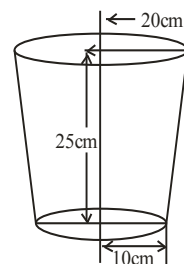
$$27 \rightarrow 27 \times 2310 = 62370 \text{ cm}^3$$

13. Sol. (a)

Given that, Height of bucket = 25 cm

Radii of top (R) = 20 cm

radii of bottom (r) = 10 cm



∴ Capacity of bucket

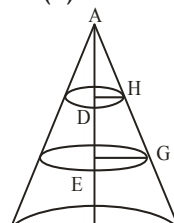
$$= \frac{\pi}{3} h(R^2 + r^2 + Rr)$$

$$= \frac{\pi}{3} \times 25(400 + 100 + 200) \text{ cm}^3$$

$$= \frac{\pi}{3} \times 25 \times 700 \text{ cm}^3$$

$$= \frac{\pi}{3} \times \frac{175 \times 100}{1000} = \frac{17.5\pi}{3} \text{ L}$$

14. Sol. (b)



Ratio of

$$\text{Ratio of AD : DE : EF} \\ 1 : 2 : 3$$

$$\text{Ratio of AD : AE : AF} \\ 1 : 3 : 6$$

Height, radius and slant height are all in same ratio.

$$FC = 90 \text{ cm}, EG = 45 \text{ cm}, DH = 15 \text{ cm}$$

$$AF = 120 \text{ cm}, AE = 60 \text{ cm}, AD = 20 \text{ cm}$$

$$AH = 25 \text{ cm}, AG = 75 \text{ cm}$$

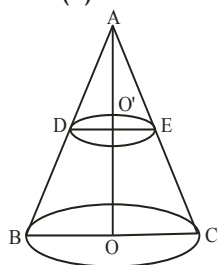
$$HG = 50 \text{ cm}$$

$$\text{Area of middle part} = \pi[l(R+r) + R^2 + r^2]$$

$$= \pi(50(60) + 15^2 + 45^2)$$

$$= 16500 \text{ cm}^2$$

15. Sol. (b)



$$\text{Let } DO' = r \text{ cm and } OO' = h \text{ cm,}$$

From similar triangles ADO' and ABO,

$$= \frac{AO'}{AO} = \frac{DO'}{BO} \Rightarrow \frac{9-h}{9} = \frac{r}{3}$$

$$\Rightarrow 9 - h = 3r \Rightarrow h = 9 - 3r$$

$$\text{Volume of frustum} = \frac{1}{3}\pi h(r_1^2 + r_1 r_2 + r_2^2)$$

$$\Rightarrow 44 = \frac{1}{3} \times \frac{22}{7} (9 - 3r)(9 + r^2 + 3r)$$

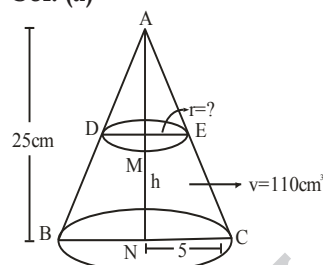
$$\Rightarrow 44 = \frac{22}{7} (3 - r)(3^2 + 3r + r^2)$$

$$\Rightarrow \frac{44 \times 7}{22} = 3^3 - r^3$$

$$\Rightarrow 14 = 27 - r^3 \Rightarrow r^3 = 27 - 14 = 13$$

$$\therefore r = \sqrt[3]{13} \text{ cm}$$

16. Sol. (a)



$$\triangle AME \sim \triangle ANC$$

$$\therefore \frac{25-h}{25} = \frac{r}{5}$$

$$\Rightarrow h = 25 - 5r \quad \dots (i)$$

Volume of frustum (V)

$$= \frac{1}{3}\pi[5^2 + r^2 + 5r]h$$

$$\Rightarrow 110 = \frac{1}{3}\pi[25 + r^2 + 5r](25 - 5r)$$

$$\Rightarrow \frac{5}{3}\pi[(5 - r)(5^2 + r^2 + 5r)] = 110$$

$$\Rightarrow \frac{5}{3}\pi[(5 - r)(5^2 + r^2 + 5r)] = 110$$

$$\Rightarrow \frac{5}{3}\pi[5^3 - r^3] = 110$$

$$\Rightarrow 5^3 - r^3 = \frac{110 \times 3}{5\pi}$$

$$\Rightarrow 125 - r^3 = \frac{110 \times 3}{5 \times \frac{22}{7}}$$

$$\Rightarrow r = (104)^{1/3} \text{ cm}$$

17. Sol. (d)

Volume of Frustum

$$= \frac{1}{3}\pi(R^2 + r^2 + R \times r)h$$

$$= \frac{1}{3} \times \frac{22}{7} \times (3^2 + 2^2 + 3 \times 2) \times 21 = 418$$

18. Sol. (b)

$$r_1 = 42 \text{ cm}, r_2 = 105 \text{ cm}$$

$$\text{Slant height} = \sqrt{16^2 + 63^2}$$

$$= \sqrt{256 + 3969} = \sqrt{4225} = 65 \text{ cm}$$

Type-10 (Mixed)

1. A 36 cm long, 22 cm broad, and 49 cm high cuboid is melted and moulded into a solid sphere. What will be the radius of this sphere? [use $\pi = \frac{22}{7}$]

एक 36 सेमी लंबा, 22 सेमी चौड़ा और 49 सेमी ऊँचा घनाभ को पिघलाकर एक ठोस गोले में ढाला जाता है। इस गोले की त्रिज्या क्या होगी ? [$\pi = 22/7$ का प्रयोग करें]

SSC MTS 2023 (Afternoon)

- (a) 21 cm (b) 7 cm (c) 49 cm (d) 22 cm

2. A solid right-circular cylinder, whose radius of the base is 15 cm and height is 12 cm, is melted and moulded into the solid right-circular cone, whose radius of the base is 24 cm. What will be the height of this cone?

एक ठोस लंबवृत्तीय बेलन, जिसके आधार की त्रिज्या 15 सेमी और ऊँचाई 12 सेमी है, को पिघलाकर ठोस लंबवृत्तीय शंकु में ढाला जाता है, जिसके आधार की त्रिज्या 24 सेमी है। इस शंकु की ऊँचाई कितनी होगी?

SSC CHSL. 27/05/2022 (Evening)

- (a) 14.0625 cm (b) 14.0675 cm
(c) 14.6025 cm (d) 14.0525 cm

3. A solid copper sphere of radius 9 cm hammered and moulded into a wire of radius 2 cm. What is the length of this wire?

9 सेमी. त्रिज्या वाले एक ताँबे के ठोस गोले को हथौड़े में पीट-पीट कर 2 सेमी. त्रिज्या वाला तार निर्मित किया जाता है। इस निर्मित तार की लंबाई कितनी है?

SSC CGL 03/12/2022 (Shift- 03)

- (a) 224 cm (b) 183 cm
(c) 198 cm (d) 243 cm

4. Find the volume of the cylinder circumscribing a sphere with a diameter of 14 cm. [Use = $22/7$]

14 सेमी व्यास वाले एक गोले के परिगत बेलन का आयतन ज्ञात कीजिए। [उपयोग $\pi = 22/7$]

SSC CHSL 07/06/2022 (Evening)

- (a) 2156 cm³ (b) 2158 cm³
(c) 2155 cm³ (d) 2157 cm³

5. A solid sphere whose radius is 21 cm is melted and recast into a regular pyramid of square base. If the height of the pyramid is 66 cm, then what is the length of each side of the base of the pyramid? [use $\pi = \frac{22}{7}$].

एक ठोस गोला जिसकी त्रिज्या 21 सेमी है, को पिघलाया जाता है और वर्गाकार आधार के एक नियमित पिरामिड में ढाला जाता है। यदि पिरामिड की ऊँचाई 66 सेमी है, तो पिरामिड के आधार की प्रत्येक भुजा की लंबाई कितनी है? [उपयोग $\pi = 22/7$]

SSC MTS 08/07/2022 (Evening)

- (a) 68 cm (b) 85 cm (c) 42 cm (d) 48 cm

6. A solid metallic cube of side $6\sqrt[3]{4}$ cm, is melted and recast into a cuboid of length 12 cm and breadth 9 cm. What is the length (in cm) of the longest diagonal of the cuboid?

$6\sqrt[3]{4}$ सेमी भुजा वाले धातु के एक ठोस घन को पिघलाकर 12 सेमी लम्बाई और 9 सेमी चौड़ाई वाला एक घनाभ बनाया जाता है। घनाभ के सबसे लंबे विकर्ण की लंबाई (सेमी में) क्या है?

SSC CHSL 09/06/2022 (Morning)

- (a) 19 (b) 18 (c) 15 (d) 17

7. The radius of a hollow sphere is 21 cm. It is cut into two equal halves by a plane passing through its centre. What is 75% of the curved surface area (in cm², rounded off to the nearest tens) of the hemisphere? (Take $\pi = \frac{22}{7}$)

एक खोखले गोले की त्रिज्या 21 सेमी है। इसके केंद्र से गुजरने वाले विमान द्वारा इसे दो बराबर हिस्सों में काटा जाता है। गोलार्ध के घुमावदार सतह क्षेत्र का 75% (सेमी² में, निकटतम दहाई तक गोल) क्या है? (उपयोग $\pi = 22/7$)

SSC CPO 09/11/2022 (Evening)

- (a) 4160 (b) 3470 (c) 2080 (d) 2770

8. A copper sphere of diameter 18 cm is drawn into a wire of diameter 6 mm. Find the length of the wire. (in meter)

18 सेमी व्यास वाले ताँबे के एक गोले को 6 मिमी व्यास वाले एक तार के रूप में खींचा जाता है। तार की लम्बाई ज्ञात कीजिए। (मीटर में)

SSC CGL 01/12/2022 (3rd Shift)

- (a) 143 (b) 108
(c) 324 (d) 234

9. A solid metallic cylinder of height 10 cm and radius 9 cm is melted to make two cones in the ratio of Volume 3:4 and of same height as 10 cm. What is the percentage increase the flat sustace area?

- 9 सेमी० त्रिज्या और 10 सेमी ऊँचाई के एक टोस धातु के बेलन को पिघलाकर दो शंकु इसके आयतन को 3:4 के अनुपात में तथा ऊँचाई 10 सेमी करके बनाये जाते हैं तो इसके सतह क्षेत्रफल में कितने प्रतिशत की वृद्धि हुई?
- (a) 83.33% (b) 82%
(c) 75% (d) 88%
10. A cylindrical vessel of radius 16 cm contains water to a depth of 20 cm. A solid spherical metallic ball is dropped into the vessel which is fully submersed and raises the level by 9 cm. What is the S.A of the ball?
- 16 cm त्रिज्या वाले एक बेलनाकार बर्तन में 20 cm की गहराई तक पानी है। धातु की एक ठोस गोलाकार गेंद को बर्तन में डाला जाता है जो पूर्णतः डूब जाता है और बर्तन में पानी का स्तर 9 cm बढ़ा देता है। गेंद का पृष्ठांक क्षेत्रफल (cm² में) ज्ञात करें। (मान लें कि पानी में आघात नहीं है)।
- ICAR Assistant 29/07/2022 (Shift- 04)
- (a) 288π (b) 784π (c) 324π (d) 576π
11. A hemispherical bowl is completely filled with water from it poured into a cylindrical tank of radius is 1.5 cm. If the width of bowl is 1.5 cm and inner radius is 10.5 cm, then what is the height of water in the tank?
- एक अर्द्धगोलाकार कटोरा पानी से भरा हुआ है। इस पानी को किसी बेलनाकार तैंक में डाला जाता है जिसकी त्रिज्या 1.5 सेमी है। यदि कटोरे की चौड़ाई 1.5 सेमी और आंतरिक त्रिज्या 10.5 सेमी हो तो तैंक में भरे हुए जल की ऊँचाई क्या है?
- (a) 200 cm (b) 343 cm
(c) 150 cm (d) 125 cm
12. A sphere passes through the eight corners of a cube of side 14 cm. Find the volume (in cm³) of the sphere. ($\pi = 22/7$)
- एक गोला 14 सेमी भुजा वाले घन के आठ कोनों से होकर गुजरता है। गोले का आयतन (सेमी³ में) ज्ञात कीजिए। ($\pi = 22/7$)
- SSC CHSL 25/05/2022 (Morning)
- (a) $4312\sqrt{3}$ (b) $4012\sqrt{3}$
(c) $4312\sqrt{2}$ (d) $4012\sqrt{2}$
13. A solid metallic sphere of radius 13 cm is melted and recast into a cone having diameter of the base as 13 cm. What is the height of the cone?
- एक 13 सेमी. त्रिज्या वाले ठोस धात्विक गोले को पिघलाकर एक शंकु का आकार दिया जाता है जिसके आधार का व्यास 13 से.मी. है। शंकु की ऊँचाई क्या है?
- SSC CGL 01/12/2022 (Shift- 03)
- (a) 246 cm (b) 152 cm
(c) 174 cm (d) 208 cm
14. A solid cone of height 42 cm with diameter of its base 42 cm is cut out from a wooden solid sphere of radius 24 cm. Find the percentage of wood wasted correct to two places of decimal.
- 42 सेमी ऊँचाई का एक ठोस शंकु जिसके आधार का व्यास 42 सेमी है, 24 सेमी त्रिज्या के लकड़ी के ठोस गोले से काटा जाता है। बर्बाद हुई लकड़ी का प्रतिशत ज्ञात कीजिए जो दशमलव के दो स्थानों तक सही हो।
- SSC CGL 09/12/2022 (Shift-01)
- (a) 75.56% (b) 56.65%
(c) 66.50% (d) 67.50%
15. Water is flowing through a cylindrical canal with an internal diameter of 7 m at the speed of 18 km/h. Find the volume of water flowing through the canal in 30 minutes. (taken $= \frac{22}{7}$)
- 7 मीटर आंतरिक व्यास वाली एक बेलनाकार नहर में पानी 18 किमी/घंटा की गति से बह रहा है। 30 मिनट में नहर से बहने वाले पानी का आयतन ज्ञात कीजिए। (उपयोग $= 22/7$)
- SSC CPO 09/11/2022 (Afternoon)
- (a) $3,76,500 \text{ m}^3$ (c) $3,66,500 \text{ m}^3$
(b) $3,56,500 \text{ m}^3$ (d) $3,46,500 \text{ m}^3$
16. An iron rod with diameter 4 cm and length 12 cm is drawn into a wire of length 12 m uniform thickness. Determine the thickness of the wire.
- 4 सेमी व्यास और 12 सेमी लंबाई वाली एक लोहे है छड़ को समान मोटाई के 12 मीटर लंबे तार में खींचा जाता है। तार की मोटाई ज्ञात कीजिए।
- SSC CGL 08/12/2022 (Shift: o)
- (a) 0.6 m (b) 0.7 m (c) 0.3 m (d) 0.4 m
17. A solid cylinder of diameter 12 cm and height 15 cm is melted and recast into toys with the shape of a right circular cone mounted into Hemisphere of radius 3 cm if the height of the Toy is 12 cm find, the number of toys so formed?
- व्यास 12 सेमी और ऊँचाई 15 सेमी के ठोस बेलन को पिघलकर खिलौने बनाये जाते हैं, जो शंकु के आकार का है जिस पर 3 सेमी के त्रिज्या का अर्धगोल स्थित है यदि खिलौने की ऊँचाई 12 सेमी, है तो खिलौने की संख्या ज्ञात करें
- (a) 15 (b) 15 (c) 18 (d) 12
18. A conical vessel, whose internal radius is 20 cm and height is 27 cm, is full of water. If this water is poured into a cylindrical vessel with internal radius 15 cm, what will be the height to which the water rises in it?
- एक शंकाकार बर्तन, जिसकी आंतरिक त्रिज्या 20 सेमी और ऊँचाई 27 सेमी है, पानी से भरा है। यदि इस पानी को 15 सेमी आंतरिक त्रिज्या वाले एक बेलनाकार पात्र में डाला जाए, तो इसमें पानी की ऊँचाई कितनी होगी?

SSC CGL 12/12/2022 (4th Shift)

- (a) 16 cm (b) 10 cm (c) 12 cm (d) 14 cm

19. A cuboid of length 36 m, breadth 18 m and height 9 m is melted and recast into a cube. Find the length of the diagonal of the cube.
36 मीटर लंबाई, 18 मीटर चौड़ाई और 9 मीटर ऊँचाई वाले एक घनाभ को पिघलाकर एक घन बनाया जाता है। घन के विकर्ण की लंबाई ज्ञात कीजिए।

SSC CGL 02/12/2022 (3rd Shift)

- (a) $18\sqrt{3}$ m (b) $15\sqrt{3}$ m
(c) $12\sqrt{3}$ m (d) $17\sqrt{3}$ m

20. The surface area of a cube is equal to that of a sphere. If x is the volume of the cube and y is the volume of the sphere, then what is $x^2 : y^2$ equal to :
एक घन का पृष्ठीय क्षेत्रफल एक गोले के क्षेत्रफल के बराबर होता है। यदि x घन का आयतन है और y गोले का आयतन है, तो $x^2 : y^2$ किसके बराबर है?

[CDS - 2021-I]

- (a)
- $\pi : 6$
- (b)
- $6 : \pi$
- (c)
- $\pi : 3$
- (d)
- $3 : \pi$

21. A conical vessel whose internal radius is 5 cm and height 240 cm is full of water. The water is emptied into cylindrical vessel with internal radius 10 cm. What is the height of which the water rises?
एक शंकाकार बर्तन जिसकी आंतरिक त्रिज्या 5 सेमी और ऊँचाई 240 सेमी है, पानी से भरा है। पानी को आंतरिक त्रिज्या 10 सेमी के बेलनाकार बर्तन में खाली किया जाता है। जल किस ऊँचाई से ऊपर उठता है?

[CDS - 2021-I]

एकल घन बनाया जाता है। 10 रुपये प्रति सेमी² की दर से नए घन को पॉलिश करने की लागत (रुपये में) कितनी है?

SSC CPO 24/11/2020 (Morning)

- (a) 13,620 (b) 11,760
(c) 8,650 (d) 27,440

31. find the total surface area of a frustum open at the top whose top and bottom radii are 13 cm. and 8cm, respectively and height of frustum is 12 cm. (use $\pi = 3.14$)

शीर्ष पर खुले एक छिन्नक का कुल सतह का क्षेत्रफल ज्ञात कीजिए जिसकी शीर्ष और निचली त्रिज्याएँ 13 सेमी और 8 सेमी हैं। और छिन्नक की ऊँचाई 12 सेमी है। ($\pi = 3.14$ का उपयोग करें)

- (a) 1821.2cm^2 (b) 1789.8cm^2
(c) 1915.4cm^2 (d) 1978.2cm^2

32. A right circular cone of largest volume is cut from a solid wooden hemisphere. The remaining material is what percentage of the volume of the original hemisphere?

23. A solid metallic right circular cylinder has diameter 32 cm and height 9 cm. It is melted and recast into a solid sphere. What is the radius (in cm) of the sphere?

एक ठोस धात्विक लम्बवृत्तीय बेलन का व्यास 32 सेमी और ऊँचाई 9 सेमी है। इसे पिघलाया जाता है और एक ठोस गोले में बदल दिया जाता है। गोले की त्रिज्या (सेमी में) क्या है?

SSC CHSL 16/4/2021 (Morning)

- (a) 14 (b) 25 (c) 10 (d) 12

24. A solid metallic cylinder with a base radius of 3 cm and a height of 120 cm is melted and recast into a sphere of radius r cm. What is the value of r if there is a 10% metal loss in the conversion?

3 सेमी के आधार त्रिज्या और 120 सेमी की ऊँचाई वाला एक ठोस धातु का बेलन पिघलाया जाता है और त्रिज्या r cm के एक गोले में बदल दिया जाता है। यदि रूपांतरण में 10% धातु की हानि होती है तो r का मान क्या होगा?

SSC MTS 08/10/2021 (Afternoon)

- (a) 9 (b) 8 (c) 13.5 (d) 1

25. A corner of a cube of side length 8m, when cut by a plane which bisect the sides of the cube we get a pyramid whose volume is :

8 मी भुजा के घन को किसी समतल द्वारा काटने पर घन की भुजा को द्विभाजित किया जाता है। जिससे एक पिरामिड प्राप्त होता है, जिसका आयतन है-

- (a) 8.37 m^3 (c) 11.20 m^3
(b) 10.67 m^3 (d) 9.68 m^3

26. A container in the shape of right circular cone, exactly. The depth of water in can before the sphere was past?

एक बेलन जिसकी आंतरिक त्रिज्या 3.5 सेमी. है इस बेलन के अंदर इतना पानी भरा हुआ है, जब इसके अंदर एक गोला डाला जाता है तो यह गोले को पूर्णतः डुबो देता है, गोला डूबने से पहले पानी की गहराई क्या थी?

- (a) $\frac{25}{3}$ (b) $\frac{17}{3}$ (c) $\frac{7}{3}$ (d) $\frac{14}{3}$

36. A hollow sphere of external and internal diameter 6cm and 4 cm respectively is melted into a cone of base diameters 6 cm diameter 8 cm. What is the height of the cone?

एक खोखले बेलन की बाह्य तथा आन्तरिक त्रिज्याएँ 6 सेमी तथा 4 सेमी है। इसको 8 सेमी व्यास वाले शंकु में बदला जाता है। शंकु की ऊँचाई?

[CDS -2019-II]

- (a) 4.75 cm (b) 5.50 cm
(c) 6.25 cm (d) 6.75 cm

37. What is the volume of a cone of maximum volume cut out from a cube of edge $2a$ such that their bases are on the same plane?
किनारे $2a$ वाले घन से काटे गए अधिकतम आयतन वाले शंकु का आयतन कितना है, जिसके आधार एक ही तल पर हों?

[CDS - 2018-I]

- (a) πa^3 (b) $\frac{\pi a^3}{3}$ (c) $\frac{2\pi a^3}{3}$ (d) $\frac{3\pi a^3}{4}$

38. A ball of diameter 4 cm is kept on top of a hollow cylinder standing vertically. The height of the cylinder is 3 cm, while its volume is $9\pi \text{ cm}^3$. Then the vertical distance, in cm, of the topmost point of the ball from the base of the cylinder is-
व्यास 4 सेमी की एक गेंद एक खोखले बेलन के ऊपर ऊर्ध्वाधर (सीधी) रखी है बेलन की ऊँचाई 3 सेमी है जबकि इसका आयतन $9\pi \text{ सेमी}^3$ है बेलन के आधार से गेंद के सबसे ऊपरी बिंदु की ऊर्ध्वाधर दूरी (सेमी में) है-
(a) 6 (b) 7 (c) 5 (d) 4

39. A solid metallic sphere of radius 15 cm melted and recast into spherical balls of radius 3 cm each.

What is the ratio of the surface area of the original and the sum of the surface area of the balls?

15 सेमी त्रिज्या का एक ठोस धातु का गोला पिघलाया जाता है और प्रत्येक 3 सेमी त्रिज्या की गोलाकार गेंदें बनाई जाती हैं। मूल गेंद के पृष्ठीय क्षेत्रफल और गेंदों के पृष्ठीय क्षेत्रफल के योग का अनुपात क्या है?

SSC CGL TIER II 15/11/2020

- (a) 1:5 (b) 1:10 (c) 5:27 (d) 3:40

40. The base radius and height of a cone is 6 cm and 36 cm respectively. The cone is cut parallel to its base at a height of 'h' cm from base. If volume of this frustum is 132 cm^3 . Find the radius of the smaller cone.

एक शंकु के आधार की त्रिज्या और ऊँचाई क्रमशः 6 सेमी और 36 सेमी है। शंकु को उसके आधार के समान्तर आधार से 'h' सेमी की ऊँचाई पर काटा जाता है। यदि इस छिन्नक का आयतन 132 सेमी^3 है। छोटे शंकु की त्रिज्या ज्ञात कीजिए।

- (a) 195 cm (b) $(195)^{\frac{1}{2}} \text{ cm}$
(c) $(195)^{\frac{1}{3}} \text{ cm}$ (d) $39\sqrt{5} \text{ cm}$

Type-10 (Mixed) ANSWER KEY

1	A	2	A	3.	D	4	A	5	C	6	D	7	C	8	B
9	A	10	D	11	B	12	A	13	D	14	C	15	D	16	D
17	D	18	A	19	A	20	A	21	B	22	D	23	D	24	A
25	B	26	C	27	A	28	C	29	A	30	B	31	C	32	A
33	A	34	D	35	C	36	A	37	C	38	A	39	A	40	C

Type-10 (Mixed) Solution

1. Sol. (a)

$$36 \times 22 \times 49 = \frac{4}{3} \pi R^3$$

$$\text{Radius}(R) = \sqrt[3]{\frac{36 \times 22 \times 49 \times 3 \times 7}{4 \times 22}} = 21 \text{ cm}$$

2. Sol. (a)

Volume of cylinder = Volume of cone

$$\pi \times 15^2 \times 12 = \frac{1}{3} \times \pi \times 24^2 \times H$$

$$H = \frac{225 \times 36}{576} = \frac{8100}{576} = 14.0625 \text{ cm}$$

3. Sol. (d)

Given, Radius of copper sphere, $R = 9 \text{ cm}$ Radius of wire, $r = 2 \text{ cm}$ Let h be the length of wire

A. T.Q,

Volume of sphere = volume of wire (cylinder)

$$\frac{4}{3} \pi R^3 = \pi r^2 h$$

$$\Rightarrow \frac{4}{3} \times 9 \times 9 \times 9 = 2 \times 2 \times h$$

$$\Rightarrow h = 3 \times 81 = 243 \text{ cm}$$

4. Sol. (a)

$$\text{Radius of cylinder} = \frac{14}{2} = 7 \text{ cm}$$

Diameter of sphere = height of cylinder (Since cylinder is circumscribing a sphere)

So, volume of cylinder

$$= \frac{22}{7} \times 7^2 \times 14 = 2156 \text{ cm}^3$$

5. **Sol. (c)**

Sphere is melted and recast into pyramid

Then the volume of sphere = volume of pyramid

$$\Rightarrow \frac{4}{3}\pi r^3 = \frac{1}{3} \times (\text{area of base}) \times \text{height}$$

Let side of pyramid having square base = a

$$\Rightarrow 4 \times \frac{22}{7} \times 21^3 = a^2 \times 66$$

{area of square = (side)²}

$$\Rightarrow a^2 = 4 \times \frac{22}{66 \times 7} \times 21 \times 21 \times 21$$

$$\Rightarrow a^2 = 4 \times 21 \times 21$$

$$\text{Therefore, } a = \sqrt{21 \times 21 \times 4} = 42 \text{ cm}$$

6. **Sol. (d)**

According to the question, Volume of cube =

Volume of cuboid

$$(6\sqrt[3]{4})^3 = 12 \times 9 \times \text{Height } 864 = 12 \times 9 \times \text{Height}$$

$$\text{Height} = 8 \text{ cm}$$

So, the length of the longest diagonal of the cuboid

$$= \sqrt{12^2 + 9^2 + 8^2} = \sqrt{144 + 81 + 64} = \sqrt{289} =$$

$$17 \text{ cm}$$

7. **Sol. (c)**

$$\text{C.S.A of hemisphere} = 2\pi R^2$$

$$75\% \text{ of CSA of hemisphere} = \frac{3}{4} \times 2 \times \frac{22}{7} \times 21 \times$$

$$21 = 2079 \approx 2080 \text{ cm}^2$$

8. **Sol. (b)**

$$1 \text{ m} = 100 \text{ cm} = 1000 \text{ mm}$$

If any 3D figure cast into another 3D figure always equates to their Volume.

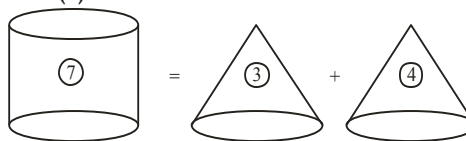
Volume of sphere = Volume of cylinder

$$\frac{4}{3}\pi r_1^3 = \pi r_2^2 h$$

$$\frac{4}{3} \times 9^3 = \left(\frac{3}{10}\right)^2 h$$

$$h = 4 \times 3 \times 9 \times 100 \text{ cm} = 108 \text{ m}$$

9. **Sol. (a)**



$$V = \pi r^2 h = \frac{1}{3}\pi r_1^2 K + \frac{1}{3}\pi r_2^2 K$$

$$\frac{\pi r^2}{\pi r_1^2 + \pi r_2^2} = \frac{3}{1}$$

$$6:1 \Rightarrow \frac{5}{6} = 83.33\%$$

10. **Sol. (d)**

Volume of sphere = Volume of water rice in cylindrical vessel

$$\frac{4}{3}\pi r^3 = \pi R^2 h$$

$$\Rightarrow \frac{4}{3}r^3 = 16 \times 16 \times 9$$

$$\Rightarrow r^3 = 4 \times 4 \times 4 \times 3 \times 3 \times 3$$

$$\Rightarrow r = 12 \text{ cm}$$

$$\text{Surface area of ball} \Rightarrow 4\pi r^2 \Rightarrow 4 \times \pi \times (12)^2$$

$$\Rightarrow 576\pi$$

11. **Sol. (b)**

Volume of hemispherical bowl = Volume of cylinder tank

$$\frac{2}{3}\pi R^3 = \pi r^3 h$$

$$\frac{2}{3} \times 10.5 \times 10.5 \times 10.5 = 1.5 \times 1.5 \times h$$

$$h = 7 \times 7 \times 3.5 \times 2$$

$$h = 343 \text{ cm.}$$

12. **Sol. (a)**

$$\text{Diagonal of cube} = \text{diameter of sphere} = 14\sqrt{3} \text{ cm}$$

$$\text{Radius of sphere} = \frac{14\sqrt{3}}{2} = 7\sqrt{3} \text{ cm}$$

$$\text{Volume of Sphere} = \frac{4}{3} \times \frac{22}{7} \times 7\sqrt{3} \times$$

$$7\sqrt{3} \times 7\sqrt{3} = 4312\sqrt{3} \text{ cm}^3$$

13. **Sol. (d)**

Volume of sphere = volume of cone

$$\frac{4}{3}\pi r_1^3 = \frac{1}{3}\pi \left(\frac{13}{2}\right)^2 \times h$$

$$\Rightarrow \frac{4}{3}\pi(13)^3 = \frac{1}{3}\pi\left(\frac{13}{2}\right)^2 \times h$$

$$\Rightarrow 4 \times 4 \times 13 = h$$

$$\Rightarrow h = 208 \text{ cm}$$

14. Sol. (c)

Wastage = volume of sphere - volume of cone

$$= \frac{4}{3}\pi(24)^3 - \frac{1}{3}\pi(21)^2 \times 42$$

$$\Rightarrow \frac{1}{3}\pi[24^3 \times 4 - 42 \times 21^2]$$

$$= \frac{1}{3}\pi[55296 - 18522] = \frac{1}{3}\pi[36774] \text{ cm}^3$$

$$\% \text{ of wood wasted} = \frac{\text{Waste}}{\text{Volume of sphere}} \times 100$$

$$= \frac{\frac{1}{3}\pi \times 36774}{\frac{1}{3}\pi \times 55296} \times 100$$

$$= \frac{36774}{55296} \times 100 = 66.50\%$$

15. Sol. (d)

Volume of water flowing through the canal in

30 min

$$= \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times \left(18 \times \frac{5}{18}\right) \times (30 \times 60)$$

$$= 3,46,500 \text{ m}^3$$

16. Sol. (d)

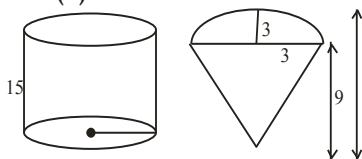
A.T.Q. volume of iron rod = volume of wire

$$\pi r_1^2 h_1 = \pi r_2^2 h_2$$

$$\Rightarrow (2)^2 \times 12 = (r_2)^2 \times 1200$$

$$r_2 = \frac{4}{10} = 0.2 \text{ cm}$$

$$\Rightarrow \text{diameter} = 2 \times r_2 = 0.4 \text{ cm}$$

17. Sol. (d)

Vol. of cylinder = [Vol. of cone ABC + vol. of hemisphere BDC] $\times n$

$$\pi \cdot 6^2 \cdot 15 = \left(\frac{1}{3}\pi \cdot 3^2 \cdot 9 + \frac{2}{3}\pi 3^3\right) n$$

$$\pi \cdot 36 \cdot 15 = (\pi \cdot 27 + \pi \cdot 18)n$$

$$60 = 5n \Rightarrow n = 12$$

18. Sol. (a)

Let the height of water raised be h

ATQ,

Volume of conical = Volume of cylindrical vessel

$$\frac{1}{3}\pi \times 20 \times 20 \times 27 = \pi \times 15 \times 15 \times h$$

$$\Rightarrow 3600 = 225h \Rightarrow h = \frac{3600}{225} = 16 \text{ cm}$$

19. Sol. (a)

Volume of cuboid = $L \times B \times H$

Volume of cube = $(\text{side})^3$

According to question,

$$36 \times 18 \times 9 = (\text{side})^3$$

$$\text{Side} = \sqrt[3]{36 \times 18 \times 9}$$

$$= \sqrt[3]{6 \times 6 \times 6 \times 3 \times 3 \times 3} = 18 \text{ cm}$$

Now,

$$\text{diagonal of cube} = \text{Side} \sqrt{3} = 18\sqrt{3} \text{ cm}$$

20. Sol. (a)

Let side of the cube is p and radius of the sphere is r .

Then, According to the question,

$$6p^2 = 4\pi(r)^2$$

$$6p^2 = 4\pi(r)^2 \Rightarrow \frac{p}{r} = \left(\frac{4\pi}{6}\right)^{\frac{1}{2}}$$

$$\text{Now, } \frac{\text{Volume of Cube}}{\text{Volume of Sphere}} = \frac{x}{y} = \frac{p^3}{\frac{4}{3}\pi r^3}$$

$$= \left(\frac{4\pi}{6}\right)^{\frac{3}{2}} \times \frac{3}{4\pi} = \frac{\sqrt{4\pi}}{2(6)^{\frac{1}{2}}}$$

$$\therefore \frac{x^2}{y^2} = \frac{4\pi}{4.6} = \frac{\pi}{6}$$

21. Sol. (b)

Volume of water in conical vessel = Volume of water in cylindrical vessel

$$\Rightarrow \frac{1}{3}\pi(r_1)^2 \times h_1 = \pi(r_2)^2 \cdot h_2$$

$$\therefore h_2 = \frac{5 \times 5 \times 8}{10 \times 10} = 2 \text{ cm}$$

22. Sol. (a)

We will find volume in both the cases:

1. Volume of cuboid = length $\times$ breadth $\times$ height

$$= 6 \times 7 \times 8 = 336 \text{ cm}^3$$

II. Volume of cube = (side)³ = (7)³ = 343 cm³

23. Sol. (d)

Let radius of sphere = r cm

$$\frac{4}{3} \times \frac{22}{7} \times r^3 = \frac{22}{7} \times 16 \times 16 \times 9$$

$$r^3 = 1728 \Rightarrow r = 12 \text{ cm}$$

24. Sol. (a)

According to question,

$$\frac{90}{100} \times [\text{Volume of cylinder}]$$

= Volume of sphere

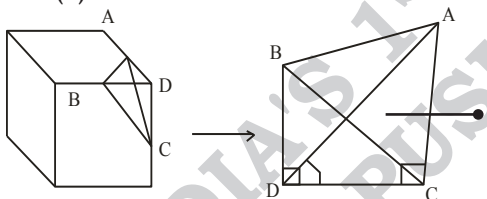
$$\frac{90}{100} \times [\pi R^2 h] = \frac{4}{3} \pi r^3$$

$$\frac{9}{10} \times [3^2 \times 120] = \frac{4}{3} r^3$$

$$\frac{9}{10} \times [1080] = \frac{4}{3} r^3$$

$$r^3 = 729 \Rightarrow r = 9 \text{ cm}$$

25. Sol. (b)



Given,

The resultant figure we get is a pyramid with base as a right angled triangle.

 $\rightarrow$ given, side of cube = 8 cm

$$\Rightarrow OB = OC = OA = 4 \text{ cm}$$

We know,

Volume of pyramid = $\frac{1}{3} \times$ based area $\times$ height

$$\text{area} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$\frac{1}{2} \times 4 \times 4 = 8 \text{ m}$$

$$OA \perp OC$$

i.e, height of pyramid = OA = 4 cm

$$\text{Volume of pyramid} = \frac{1}{3} \times 8 \times 4 = \frac{32}{3} = 10.67 \text{ m}^3$$

26. Sol. (c)

$$\text{Radius of spherical droplet (in cm)} = R = \frac{2}{10 \times 2} =$$

$$\frac{1}{10} \text{ cm}$$

$$\text{Radius of cone} = \text{Height of cone} = r$$

Volume of 128000 droplets = Volume of cone

$$128000 \times \frac{4}{3} \pi R^3 = \frac{1}{3} \pi r^2 h$$

$$128000 \times 4 \left(\frac{1}{10}\right)^3 = r^2 \times r$$

$$r^3 = 512 \Rightarrow r = 8 \text{ cm}$$

27. Sol. (a)

$$\text{TSA of hemisphere} = 3\pi r^2, \Rightarrow 462 = 3 \times \frac{22}{7} \times r^2$$

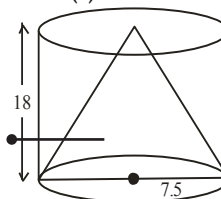
$$\Rightarrow r^2 = \frac{462 \times 7}{66} = 49 \Rightarrow r = 7 \text{ cm}$$

Volume of hemisphere = Volume of cone

$$\Rightarrow \frac{2}{3} \pi \times 7^3 = \frac{1}{3} \pi \times 7^2 \times h$$

$$\Rightarrow 686 = 49 h \Rightarrow h = \frac{686}{49} = 14 \text{ cm}$$

28. Sol. (c)



$$h = 18; r = 7.5$$

$$l = 19.5 (\text{by pythagoras theorem})$$

Total surface area = curved surface area of cylinder + area of cone + area of circular side (above)

Total surface area

$$= 2\pi rh + \pi rl + \pi r^2$$

$$\text{Total surface area} = \pi r(2h + l + r)$$

$$\text{Total surface area} = \pi \times 7.5(36 + 19.5 + 7.5)$$

$$\text{Total surface area} = \pi \times 7.5(63)$$

$$\text{Total surface area} = 472.5\pi \text{ cm}^2$$

29. Sol. (a)

Volume of water in cylinder = Volume of rectangular tub

$$\pi r^2 h = l \times b \times h$$

$$\frac{22}{7} \times 30 \times 30 \times 42 = 75 \times 44 \times h$$

$$H = 36 \text{ cm}$$

30. **Sol. (b)**

$$\text{Volume of cube} = a^3 = 9^3 = 729 \text{ cm}^3$$

$$\text{Volume of cuboid} = 5 \times 13 \times 31 = 2015$$

$$\text{Total volume} = 2015 + 729 = 2744 \text{ cm}^3$$

$$\text{Side of a new cube} = 14 \text{ cm}$$

$$\text{Surface area of a new cube}$$

$$= 6a^2 = 6 \times 14^2 = 1176 \text{ cm}^2$$

$$\text{Cost} = 1176 \times 10 = 11,760$$

31. **Sol. (c)**

$$\text{Slant height of frustum } l = \sqrt{h^2 + (R - r)^2}$$

$$= \sqrt{12^2 + 5^2} = 13$$

$$\text{TSA of frustum}$$

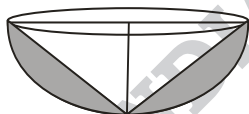
$$= 2[\pi(R + r)l] + \pi r^2$$

$$\pi[2(21)(13) + 64]$$

$$\pi[(610) = 3.14 \times 610] = 1915.4 \text{ cm}^2$$

32. **Sol. (a)**

Here, the height of the cone will be equal to radius.



Volume of the shaded portion = volume of hemisphere - volume of cone

$$= \frac{2}{3}\pi r^3 - \frac{1}{3}\pi r^3 = \frac{1}{3}\pi r^3$$

Required percentage

$$= \frac{\frac{1}{3}\pi r^3}{\frac{2}{3}\pi r^3} \times 100 = 50\%$$

33. **Sol. (a)**

Let the side of cube = a

= sides of the cuboid a, a and $\frac{a}{3}$

$$\text{Total surface area of the cube} = 6a^2$$

Total surface area of the cuboid

$$\text{Required ratio} = 6a^2 : 2 \times \frac{10}{3}a^2 = 9 : 10$$

34. **Sol. (d)**

Curved Surface area of cylinder = $2\pi rh$

Volume of cylinder = $\pi r^2 h$

According to the question

$$2\pi rh = 132 \quad \dots(i)$$

$$\pi r^2 h = 528 \quad \dots(ii)$$

Dividing eq. (ii) by eq. (i), $r = 8 \text{ cm}$

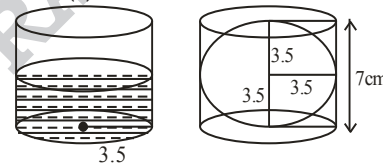
Put this value in either of the equations

For example put $r = 8$ in eq. (i)

$$2\pi rh = 132 \Rightarrow 2 \times \frac{22}{7} \times 8 \times h = 132$$

$$h = 2\frac{5}{8} \text{ m}$$

35. **Sol. (c)**



$$\left(\pi \left(\frac{7}{2}\right)^2 \times 7 - \frac{4}{3}\pi \left(\frac{7}{2}\right)^3\right) = \pi \left(\frac{7}{2}\right)^2 \times h$$

$$7 - \frac{4}{3} \times \frac{7}{2} = h \Rightarrow h = \frac{7}{3}$$

36. **Sol. (a)**

$$\text{volume of cone} = \frac{1}{3}\pi r_c^2 h_c$$

$$\text{volume of hollow sphere} = \frac{4}{3}\pi(R_1^3 - R_2^3)$$

$$\text{Now, } \frac{1}{3}\pi r_c^2 h_c = \frac{4}{3}\pi(R_1^3 - R_2^3)$$

$$(4)^2 H_c = 4(3^3 - 2^3) \Rightarrow 16 H_c = 19 \times 4$$

$$\therefore H_c = \frac{19}{4} = 4.75 \text{ cm}$$

37. **Sol. (c)**

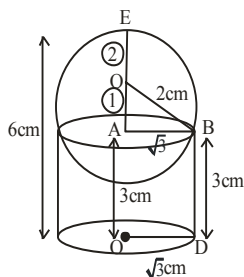
$$\text{edge of cube} = 2a$$

$$\text{radius of cone} = \frac{2a}{2} = a$$

$$\text{height of cone} = 2a$$

$$\text{Volume of cone} = \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \pi \times a^2 \times 2a$$

$$= \frac{2a^3\pi}{3} = \frac{2\pi a^3}{3}$$



$$V = \pi r^2 h = 9\pi$$

$$r^2 \times 3 = 9 \Rightarrow r = \sqrt{3}$$

$$\text{vertical distance} = 3 + 2 + 1 = 6 \text{ cm}$$

39. Sol. (a)

$$\text{Total number of new formed ball} = \frac{\frac{4}{3}\pi 15^3}{\frac{4}{3}\pi 3^3} = 125$$

$$\text{Surface area of bigger sphere} = 4\pi 15^2$$

$$\text{Surface area of smaller sphere} = 4\pi 3^2$$

$$\text{Total surface area of smaller spheres} = 125 \times 4\pi 3^2$$

$$\text{Ratio of surface area} = \frac{4\pi 15^2}{125 \times 4\pi 3^2} = 1:5$$

40. Sol. (c)

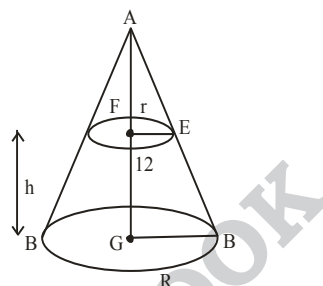
Given:

$$\text{Radius of cone} = 6 \text{ cm} = R$$

$$\text{Height of cone} = 36 \text{ cm} = H$$

$$\text{Volume of frustum} = 132 \text{ cm}^2$$

$$= \frac{1}{3}\pi[R^2 + r^2 + Rr]h$$



Let cone be cut from height h from base. Consider,

$$\triangle AFE \sim \triangle AGC$$

$$\Rightarrow \frac{36-h}{36} = \frac{r}{6} \Rightarrow h = 36 - 6r$$

$$\text{Volume of frustum} = 132 \text{ cm}^3$$

$$\Rightarrow \frac{1}{3}\pi[36 + r^2 + 6r](36 - 6r) = 132$$

$$\Rightarrow \frac{6}{3}\pi[36 + r^2 + 6r](6 - r) = 132$$

$$\Rightarrow 2\pi[6^2 - r^2] = 132$$

$$\Rightarrow r^3 = 6^3 - 21 = r = \sqrt[3]{195} = (195)^{\frac{1}{3}}$$

Type-11 (Triangle)

1. The perimeter of an equilateral triangle is 40 cm more than the length of each of its sides. What is the length of each side of this equilateral triangle?
एक समबाहु त्रिभुज का परिमाण उसकी प्रत्येक भुजा की लंबाई से 40 सेमी अधिक है। इस समबाहु त्रिभुज की प्रत्येक भुजा की लंबाई क्या है?

SSC MTS 2023 (Evening)

- (a) 10 cm (b) 30 cm (c) 15 cm (d) 20 cm

2. If $\triangle ABC$ is similar to $\triangle DEF$ such that $BC = 3$ cm, $EF = 4$ cm and the area of $\triangle ABC = 54$ cm², then the area of $\triangle DEF$ is:
यदि $\triangle ABC$, $\triangle DEF$ के समान है जैसे कि $BC = 3$ सेमी, $EF = 4$ सेमी और $\triangle ABC$ का क्षेत्रफल = 54 सेमी², तो $\triangle DEF$ का क्षेत्रफल है:

SSC MTS 22/07/2022 (Morning)

- (a) 78 cm² (b) 96 cm²
(c) 66 cm² (d) 44 cm²

3. The area of a triangle is 96 cm² and the length of one of its sides is 24 cm. What is the length of the perpendicular drawn to this side of the triangle from the opposite vertex?
एक त्रिभुज का क्षेत्रफल 96 सेमी है और इसकी एक भुजा की लंबाई 24 वर्ग सेमी है। त्रिभुज की इस भुजा पर सम्मुख शीर्ष से खींचे गए लंब की लंबाई क्या है?

SSC CHSL 01/06/2022 (Morning)

- (a) 16 cm (b) 8 cm (c) 4 cm (d) 12 cm

4. Find the area of an equilateral triangle whose altitude is 7 cm.
एक समबाहु त्रिभुज का क्षेत्रफल ज्ञात कीजिए जिसकी ऊँचाई 7 सेमी है।

- (a) $42\sqrt{3}$ cm² (b) $49\sqrt{3}$ cm²
(c) $\frac{49}{\sqrt{3}}$ cm² (d) $\frac{42}{\sqrt{3}}$ cm²

5. The sides of a triangle are 8 cm, 12 cm and 16 cm. What is the area of the triangle?
एक त्रिभुज की भुजाएँ 8 सेमी, 12 सेमी और 16 सेमी हैं। त्रिभुज का क्षेत्रफल कितना है?

SSC CPO 09/11/2022 (Evening)

- (a) $24\sqrt{15}$ (b) $6\sqrt{15}$
(c) $8\sqrt{15}$ (d) $12\sqrt{15}$

6. The area of a triangle is 480 cm² and the ratio of its sides is 10:24:26. What is the perimeter of the triangle?

एक त्रिभुज का क्षेत्रफल 480 सेमी² है और इसकी भुजाओं का अनुपात 10:24:26 है। त्रिभुज का परिमाण क्या है?

SSC CGL 01/12/2022 (4th Shift)

- (a) 120 cm (b) 30 cm (c) 150 cm (d) 60 cm

7. Find the altitude of an equilateral triangle whose area is 27 cm².

एक समबाहु त्रिभुज की ऊँचाई ज्ञात कीजिए जिसका क्षेत्रफल 27 सेमी² है।

- (a) $3\sqrt{3}$ cm (b) $9\sqrt{3}$ cm
(c) $6\sqrt{3}$ cm (d) $(3)^{\frac{7}{4}}$ cm

8. Suppose $\triangle ABC$ be a right-angled triangle where $\angle A = 90^\circ$ and $AD \perp BC$. If area ($\triangle ABC$) = 80 cm² and $BC = 16$ cm, then the length of AD is:
मान लीजिए $\triangle ABC$ एक समकोण त्रिभुज है जहाँ $\angle A = 90^\circ$ और $AD \perp BC$ है। यदि क्षेत्रफल ($\triangle ABC$) = 80 सेमी² और $BC = 16$ सेमी, तो AD की लंबाई है:

SSC CGL 03/12/2022 (3rd Shift)

- (a) 10 cm (b) 24 cm (c) 18 cm (d) 12 cm

9. The sides of a triangular field are 39 m, 42 m and 45 m. Find the number of rose beds that can be prepared in the field. If each rose bed on an average need 270 cm² of space.

एक त्रिभुजाकार दायर की भुजाएँ 39 मीटर, 42 मीटर और 45 मीटर हैं। खेत में तैयार की जा सकने वाली गुलाब की क्यारियों की संख्या ज्ञात कीजिए। यदि प्रत्येक गुलाब की क्यारी को औसतन 270 सेमी² स्थान की आवश्यकता होती है।

- (a) 28 (b) 280 (c) 2800 (d) 28000

10. In a right angled $\triangle ABC$, if $\angle ABC = 90^\circ$, BN is perpendicular to AC , $AB = 12$ cm, and $AC = 20$ cm, then $AN : NC$ is:

एक समकोण $\triangle ABC$ में, यदि $\angle ABC = 90^\circ$, BN , AC पर लंबवत है, $AB = 12$ cm और $AC = 20$ cm है, तो $AN : NC$ ज्ञात कीजिए।

DP Head Constable 19/10/2022

(Shift - 01)

- (a) 3:1 (b) 1:4 (c) 2:3 (d) 9:16

11. If the side of an equilateral triangle is 24 cm, then what is its area?

यदि एक समबाहु त्रिभुज की भुजा 24 सेमी है, तो इसका क्षेत्रफल क्या है?

SSC CGL 02/12/2022 (2nd Shift)

- (a) $169\sqrt{3}$ cm² (b) $125\sqrt{3}$ cm²
(c) $256\sqrt{3}$ cm² (d) $144\sqrt{3}$ cm²

12. If the perimeter of an equilateral triangle is 60 units, then its area is _____ unit².

यदि एक समबाहु त्रिभुज का परिमाप 60 इकाई है, तो इसका क्षेत्रफल _____ इकाई² है।

Graduate Level 01/108/2022(Shift - 4)

- (a) $100\sqrt{3}$ (b) $200\sqrt{3}$ (c) $60\sqrt{3}$ (d) $50\sqrt{3}$

13. The sides of a triangular field are 360 m, 480 m and 600 m. Its area is equal to the area of a square field. What is the side (in m) of the square field?

एक त्रिभुजाकार मैदान की भुजाएँ 360 मीटर, 480 मीटर और 600 मीटर हैं। इसका क्षेत्रफल एक वर्गाकार मैदान के क्षेत्रफल के बराबर है। वर्गाकार मैदान की भुजा (मीटर में) क्या है?

SSC CGL 21/04/2022 (Morning)

- (a) $120\sqrt{6}$ (b) $160\sqrt{6}$
(c) $160\sqrt{3}$ (d) $120\sqrt{3}$

14. In an isosceles right-angled triangle, the perimeter is 49 metres. Find its area (in m²).

एक समद्विबाहु समकोण त्रिभुज का परिमाप 49 m है। इसका क्षेत्रफल (m² में) ज्ञात कीजिए।

DP Flead Constable 13/10/2022 (Shift- 02)

- (a) 100.98 (b) 102.98
(c) 103.96 (d) 101.96

15. The angle of a triangle are in the ratio 1:1:4 if the perimeter of the triangle is k times its largest side, then what is the value of k .

एक त्रिभुज के कोण 1:1:4 के अनुपात में हैं यदि त्रिभुज की परिमाप उसकी सबसे बड़ी भुजा की k गुना है तो k का माप क्या है?

- (a) $1 + 2/\sqrt{3}$ (b) $1 - 2/\sqrt{3}$
(c) $2 + 2/\sqrt{3}$ (d) 2

16. The sides of a triangular park are in the ratio 12:17:25 and its perimeter is 648 m, at each corner of the park, there is a flower bed in the form of a sector of radius 35 m, when is the area (in m²) of the remaining part of the park? (Take $\pi = \frac{22}{7}$)

एक त्रिभुजाकार पार्क की भुजाओं का अनुपात 12:17:25 है और इसका परिमाप 648 m है। पार्क के प्रति कोने में एक त्रिज्यखंड के रूप में 35 m त्रिज्या बाने फूलों की बगियाची है। पार्क के शेष भाग का क्षेत्रफल (सेमी² में) ज्ञात करें।

ICAR Assistant 29/07/2022 (Shift-02)

- (a) 9,180 (b) 9,210
(c) 9,220 (d) 11,035

17. One side of the triangle is 15 cm and the corresponding height is 6 cm, then area of the triangle is:

त्रिभुज की एक भुजा 15 सेमी और संगत ऊँचाई 6 सेमी है, तो त्रिभुज का क्षेत्रफल है:

SSC CPO 11/11/2022 (Afternoon)

- (a) $46\text{sq} \cdot \text{cm}$ (b) $45\text{sq} \cdot \text{cm}$
(c) $47\text{sq} \cdot \text{cm}$ (d) $48\text{sq} \cdot \text{cm}$

18. The lengths of three sides of a triangle are in the ratio 3:4:5. Among three sides, the difference between the largest side and the smallest side of this triangle is 3.6 cm. The area of this triangle is:

एक त्रिभुज की तीन भुजाओं की लंबाई का अनुपात 3:4:5 है। तीन भुजाओं में, इस त्रिभुज की सबसे बड़ी भुजा और सबसे छोटी भुजा के बीच का अंतर 3.6 सेमी है। इस त्रिभुज का क्षेत्रफल है:

SSC CHSL 16/4/2021 (Evening)

- (a) 19.44 (b) 32.4 (c) 21.75 (d) 15.64

19. One of the angles of a right-angled triangle is 15°, and the hypotenuse is 1 m. The area of the triangle (in sq. cm.) is

एक समकोण त्रिभुज का एक कोण 15° है, और कर्ण 1 मीटर है। त्रिभुज का क्षेत्रफल (वर्ग सेमी. में) है

- (a) 1220 (b) 1250 (c) 1200 (d) 1215

20. The area of a triangular field with sides 60 m, 175 m and 185 m is equal to that of a rectangular park whose sides are in the ratio of 21:10. The perimeter (in) of the park is:

60 मीटर, 175 मीटर और 185 मीटर भुजाओं वाले एक त्रिभुजाकार मैदान का क्षेत्रफल एक आयताकार पार्क के क्षेत्रफल के बराबर है, जिसकी भुजाएँ 21:10 के अनुपात में हैं। पार्क की परिधि (में) है:

SSC MTS 26/10/2021 (Afternoon)

- (a) 341 (b) 403 (c) 372 (d) 310

21. When each side of an equilateral triangle is increased by 4 cm its area increases by 24 cm², then the length of the side of the original triangle is जब एक समबाहु त्रिभुज की प्रत्येक भुजा में 4 सेमी की वृद्धि की जाती है तो इसका क्षेत्रफल 24 सेमी² बढ़ जाता है, तो मूल त्रिभुज की भुजा की लंबाई है

- (a) $2\sqrt{3}$ cm (b) $(4\sqrt{3} - 2)$ cm
(c) $(3\sqrt{3} - 2)$ cm (d) $(4\sqrt{3} - 3)$ cm

22. The perimeter of a triangle is 22 cm. Through each vertex of the triangle, a straight line parallel to the opposite side is drawn. What is the perimeter of triangle formed by these lines?

एक त्रिभुज का परिमाप 22 सेमी है। त्रिभुज के प्रत्येक शीर्ष से विपरीत भुजा के समानांतर एक सीधी रेखा खींची जाती है। इन रेखाओं से बने त्रिभुज का परिमाप क्या है?

[CDS - 2019-II]

- (a) 33 cm (b) 44 cm (c) 66 cm (d) 88 cm

23. If 'A' is the area of a right-angled triangle and 'b' is one of the sides containing the right angle, then the length of the altitude on the hypotenuse is
यदि 'A' एक समकोण त्रिभुज का क्षेत्रफल है और 'b' समकोण वाली भुजाओं में से एक है, तो कर्ण पर शीर्षलंब की लंबाई है

- (a) $\frac{2Ab}{\sqrt{4A^2+b^4}}$ (b) $\frac{2Ab}{\sqrt{4A^2+b^2}}$
(c) $\frac{2Ab}{\sqrt{2A^2+b^4}}$ (d) $\frac{2Ab}{\sqrt{2A^2+b^2}}$

24. The perimeter of an isosceles triangle is 91 cm and its base is $1\frac{1}{4}$ times each of its equal sides. What is the length of its base? (in cm)

एक समद्विबाहु त्रिभुज का परिमाप 91 सेमी है और इसका आधार इसकी समान भुजाओं में से प्रत्येक का $1\frac{1}{4}$ गुना है। इसके आधार की लंबाई कितनी है? (सेमी में)

SSC CHSL 16/4/2021 (Morning)

- (a) 38 (b) 20 (c) 25 (d) 28

25. In a triangle ABC, AB = AC, and the perimeter of triangle 544 cm, & equal side are $\frac{5}{6}$ th of the unequal side, then find the area of triangle.

त्रिभुज ABC में, AB = AC है, त्रिभुज का परिमाप 544 cm है यदि त्रिभुज की बराबर भुजाएँ तीसरी असमान भुजा का $\frac{5}{6}$ गुना है तब त्रिभुज का क्षेत्रफल होगा

- (a) 13872 cm² (b) 17340 cm²
(c) 19606 cm² (d) 19507 cm²

26. The base of a triangle is 8.5 cm and height is 14 cm. The height of another triangle, having base 14 cm and double the area of the first triangle, is:

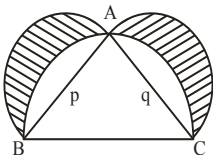
एक त्रिभुज का आधार 8.5 सेमी और ऊँचाई 14 सेमी है। एक अन्य त्रिभुज की ऊँचाई, जिसका आधार 14 सेमी है और पहले त्रिभुज का क्षेत्रफल दोगुना है, है:

- (a) 17 (b) 16 (c) 15 (d) 14

SSC MTS 11/10/2021 (Afternoon)

27. In the fig given below ABC is a right angle triangle where $\angle A = 90^\circ$, AB = p. and AC = q cm, on the three sides as diameters semicircles are drawn as shown in the fig. The area of the shaded portion in sq. cm is

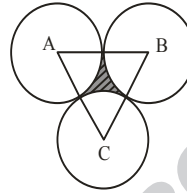
दिये गये चित्र में, ABC एक समकोण त्रिभुज है जहाँ $\angle A = 90^\circ$, AB = p cm, और AC = q cm. तीनों भुजाओं को व्यास मानकर अर्धवृत्त खींचे जाते हैं छायांकित भाग का क्षेत्रफल ज्ञात करें?



- (a) pq (b) pq/2

- (c) $\pi(p^2 + q^2)/2$ (d) $\pi(p^2 - q^2)/2$

28. What is the area of the shaded region in the given figure, if the radius of each of the circles is 2 cm?
दी गई आकृति में छायांकित क्षेत्र का क्षेत्रफल क्या है, यदि प्रत्येक वृत्त की त्रिज्या 2 सेमी है?



[CDS - 2020-I]

- (a) $4\sqrt{3} - 2\pi\text{cm}^2$ (b) $\sqrt{3} - \pi\text{cm}^2$
(c) $\sqrt{3} - \frac{\pi}{2}\text{cm}^2$ (d) $2\pi - 2\sqrt{3}\text{cm}^2$

29. The area of a triangle is 96 cm² and the ratio of its sides is 6:8:10. What is the perimeter of the triangle?

एक त्रिभुज का क्षेत्रफल 96 सेमी² है और इसकी भुजाओं का अनुपात 6:8:10 है। त्रिभुज का परिमाप क्या है?

SSC CGL 12/12/2022 (2nd Shift)

- (c) 48 (b) 56 (c) 64 (d) 44

30. Three sides of a triangle measure 6 cm, 10 cm and cm. The minimum integral value of x is:

एक त्रिभुज की तीन भुजाओं की माप 6 सेमी, 10 सेमी और x सेमी है। x का न्यूनतम अभिन्न मूल्य है:

SSC CHSL 19/10/2020 (Evening)

- (a) 2 (b) 1 (c) 3 (d) 5

31. ABC is an isosceles triangle with AB = BC = 5 cm and AC = 6 cm. P is a point on extended AB such that $\triangle APC$ is also an isosceles triangle, then find the area of $\triangle APC$.

ABC एक समद्विबाहु त्रिभुज है जिसमें AB = BC = 5 सेमी और AC = 6 सेमी। P विस्तारित AB पर एक बिंदु है जैसे कि $\triangle APC$ भी एक समद्विबाहु त्रिभुज है, तो $\triangle APC$ का क्षेत्रफल ज्ञात कीजिए।

- (a) 7.76 cm² (b) 7.12 cm²
(c) 8.64 cm² (d) 5.12 cm²

32. Find the base of an isosceles triangle whose area is 120 m² also, the length of one of the equal sides is 17 m.

एक समद्विबाहु त्रिभुज का आधार ज्ञात कीजिए जिसका क्षेत्रफल भी 120 वर्ग मीटर है, समान भुजाओं में से एक की लंबाई 17 मीटर है।

- (a) 12m
(b) 14m

(c) 16m

(d) Can't be determined.

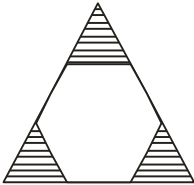
33. A triangle PQR is a right angled triangle at Q. E and F are the mid points of QR and PR respectively. What will be the ratio of the area of quadrilateral PQEF to the area of triangle PQR.
एक त्रिभुज PQR, Q पर एक समकोण त्रिभुज है। E और F क्रमशः QR और PR के मध्य बिंदु हैं। चतुर्भुज PQEF के क्षेत्रफल का त्रिभुज PQR के क्षेत्रफल से अनुपात क्या होगा?

SSC CHSL 19/10/2020 (Morning)

(a) $\frac{2}{3}$ (b) $\frac{3}{4}$ (c) $\frac{3}{2}$ (d) $\frac{4}{3}$

34. ABC is an equilateral triangle with each side 12 cm. Each side is divided in the three equal parts and the corners are shaded in from of equilateral triangles as in the diagram. Find what Percent of area of triangle ABC is unshaded?

ABC एक समबाहु त्रिभुज है जिसकी प्रत्येक भुजा 12 सेमी है। प्रत्येक पक्ष को तीन समान भागों में विभाजित किया गया है और आरेख के अनुसार कोनों को समबाहु त्रिभुजों से छायांकित किया गया है। ज्ञात कीजिए कि त्रिभुज ABC का क्षेत्रफल का कितना प्रतिशत छायांकित नहीं है?



(a) 33.33% (b) 66.66%
(c) 50% (d) 70%

35. The base of a triangle is equal to the perimeter of a square whose diagonal is $6\sqrt{2}$ cm, and its height is equal to the side of a square whose area is 144 cm^2 . The area of the triangle (in m^2):
एक त्रिभुज का आधार एक वर्ग के परिमाप के बराबर है जिसका विकर्ण $6\sqrt{2}$ सेमी है, और इसकी ऊँचाई एक वर्ग की भुजा के बराबर है जिसका क्षेत्रफल 144 सेमी^2 है। त्रिभुज का क्षेत्रफल (m^2 में):

SSC CPO 24/11/2020 (Evening)

(a) 144 (b) 216 (c) 288 (d) 72

36. The area of an isosceles $\triangle ABC$ with $AB = AC$ is 12 sqcm and altitude $AD = 3 \text{ cm}$. What is its perimeter?

AB = AC वाले एक समद्विबाहु $\triangle ABC$ का क्षेत्रफल 12 वर्ग सेमी और ऊँचाई = 3 सेमी है। इसकी परिधि क्या है?

(a) 18 cm (c) 14 cm (b) 16 cm (d) 12 cm

37. If the perimeter of an isosceles right triangle is $8(\sqrt{2} + 1) \text{ cm}$, then the length of the hypotenuse of the triangle is:

यदि एक समद्विबाहु समकोण त्रिभुज का परिमाप $8(\sqrt{2} + 1)$ सेमी है, तो त्रिभुज के कर्ण की लंबाई है:

SSC CGL TIER II 18/11/2020

(a) 10 cm (b) 8 cm (c) 24 cm (d) 12 cm

38. In $\triangle ABC$, $\angle A = 90^\circ$, $AB = 16 \text{ cm}$ and $AC = 12 \text{ cm}$. D is the midpoint of AC and $DE \perp CB$ at E. What is the area (in cm^2) of $\triangle CDE$?

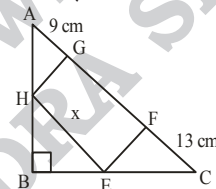
$\triangle ABC$ में, $\angle A = 90^\circ$, $AB = 16$ सेमी और $AC = 12$ सेमी। D, AC का मध्यबिंदु है और E पर $DE \perp CB$ है। $\triangle CDE$ का क्षेत्रफल (सेमी² में) क्या है?

SSC CPO 11/12/19 (Evening)

(a) 8.64 (b) 7.68 (c) 5.76 (d) 6.25

39. $\triangle ABC$ is a right angle triangle right angled at B. $AG = 9 \text{ cm}$. $FC = 13 \text{ cm}$. find the area of the square EFGH.

$\triangle ABC$ एक समकोण त्रिभुज है जो B पर तंग कोण है। $AG = 9$ सेमी। $FC = 13$ सेमी। वर्ग EFGH का क्षेत्रफल ज्ञात कीजिए।



(a) 169 (b) 117 (c) 81 (d) 125

40. $\triangle ABC$ is a right angled triangle right angled at A. A circle is inscribed in it. The lengths of two sides containing the right angle are 48 cm and 14 cm. The radius of the inscribed circle is:

$\triangle ABC$ एक समकोण त्रिभुज है जिसका कोण A समकोण है, इसमें एक वृत्त है। समकोण बनाने वाली दो भुजाओं की लंबाई 48 सेमी और 14 सेमी है। वृत्त की त्रिज्या बताओ?

SSCC-SL 20/10/2020 (Morning)

(a) 4 cm (b) 6 cm (c) 8 cm (d) 5 cm

41. A triangular park has side lengths of 65 m, 70 m and 75 m. A gardener Naman has to put fences all around it and also plant flowers inside. How much it will cost him for fencing and planting if the cost of planting is ₹35 per m^2 and the cost of fencing is ₹20 per m.

एक त्रिकोणीय पार्क की भुजाओं की लंबाई 65 मीटर, 70 मीटर और 75 मीटर है। एक माली नमन को इसके चारों ओर बाड़ लगानी पड़ती है और अंदर फूल भी लगाने पड़ते हैं। बाड़ लगाने और रोपण के लिए उसे कितना खर्चा आएगा यदि रोपण की लागत ₹35 प्रति मीटर² है और बाड़ लगाने की लागत ₹20 प्रति मीटर है।

(a) ₹65430 (b) ₹75210

(c) ₹77700 (d) ₹62370

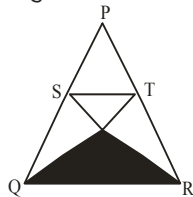
42. The area of the largest triangle that can be inscribed in a semicircle of radius 4 cm in square centimetres is
वर्ग सेंटीमीटर में, त्रिज्या 4 सेमी के अर्धवृत्त में अंकित किए जा सकने वाले सबसे बड़े त्रिभुज का क्षेत्रफल है

SSC CHSL 15/10/2020 (Evening)

- (a) 16 (b) 14 (c) 12 (d) 18

43. In the given figure, PQR is an equilateral triangle with side as 12 cm. S and T are the mid points of the sides PQ and PR respectively. What is the area (in cm^2) of the shaded region?

दी गई आकृति में, PQR एक समबाहु त्रिभुज है जिसकी भुजा 12 सेमी है। S और T क्रमशः भुजाओं PQ और PR के मध्य बिंदु हैं। छायांकित क्षेत्र का क्षेत्रफल (सेमी² में) क्या है?



- (a) $10\sqrt{3}$ (b) $12\sqrt{3}$ (c) $9\sqrt{3}$ (d) $14\sqrt{3}$

44. The sides of a triangle are 24 cm, 26 cm and 10 cm. At each of its vertices, circles of radius 4.2 cm are drawn. What is the area (in cm^2) of the triangle, excluding the portion covered by the sectors of the circle?

एक त्रिभुज की भुजाएँ 24 सेमी, 26 सेमी और 10 सेमी हैं। इसके प्रत्येक शीर्ष पर 4.2 सेमी त्रिज्या के वृत्त खींचे गए हैं। वृत्त के त्रिज्यखंडों द्वारा कवर किए गए भाग को छोड़कर, त्रिभुज का क्षेत्रफल (सेमी² में) क्या है?

SSC CPO 23/11/2020 (Morning)

- (a) 27.72 (b) 120 (c) 105.86 (d) 92.28

45. ABC is a triangular field with $AB = 24$ m, $BC = 40$ m and $CA = 30$ m. Three poles of heights 13 m, 20 m and 29 m are vertically erected at A, B and C respectively. Find the cost of triangular

canvas whose vertices has to tie on tips of the poles at the rate of ₹57 per meter square. (Use $\sqrt{2} = 1.41$)

ABC एक त्रिकोणीय क्षेत्र है जिसमें $AB = 24$ मीटर, $BC = 40$ मीटर और $CA = 30$ मीटर है। 13 मीटर, 20 मीटर और 29 मीटर ऊँचाई वाले तीन खंभे क्रमशः A, B और C पर खड़े हैं। त्रिभुजाकार केनवास का मूल्य ज्ञात कीजिए जिसके शीर्षों को खंभों के सिरों पर ₹57 प्रति वर्ग मीटर की दर से बांधना है। ($\sqrt{2}=1.41$ का प्रयोग करें)

- (a) ₹ 19881 (c) ₹ 21573

- (b) ₹ 22419 (d) ₹ 24111

46. The sides of the triangular park are 60 m, 112 m and 164 m. The cost of levelling the park at the rate of Rs. 8.50/ m^2 is:

त्रिकोणीय पार्क की भुजाएँ 60 मीटर, 112 मीटर और 164 मीटर हैं। 8.50 रुपये/मी² की दर से पार्क को समतल करने की लागत है:

SSC CPO 9/12/19 (Evening)

- (a) Rs. 18,316 (b) Rs. 17,136

- (c) Rs. 18,164 (d) Rs. 17,085

47. In the $\triangle ABC$, the base BC is intersected at D and E. The line through D, parallel to AB, meets AC at F and the line through E parallel to AC meets AB at G. If EG and DF intersect at H, then what is the ratio of the sum of the area of parallelogram AGHF and the area of the $\triangle DHE$ to the area of the triangle ABC ?

$\triangle ABC$ में, आधार BC को D और E पर प्रतिच्छेदित किया गया है। D से होकर AB के समानांतर रेखा, AC से F पर मिलती है और E से होकर AC के समानांतर रेखा AB से G पर मिलती है। यदि EG और DF, H पर प्रतिच्छेद करते हैं, तो समांतर चतुर्भुज AGHF के क्षेत्रफल और $\triangle DHE$ के क्षेत्रफल का त्रिभुज ABC के क्षेत्रफल से अनुपात क्या है?

- (a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{1}{4}$ (d) $\frac{1}{6}$

Type-11 (Triangle) ANSWER KEY

1	D	2	B	3	B	4	C	5	D	6	A	7	D	8	A
9	D	10.	D	11	D	12	A	13	A	14	B	15	A	16	D
17	B	18	A	19	B	20	D	21	B	22	B	23	A	24	A
25	A	26	A	27	B	28	A	29	A	30	D	31	C	32	C
33	B	34	B	35.	A	36.	A	37	B	38	A	39	B	40	B
42	A	43	B	44	D	45	D	46	B	47	B				

Type-11 (Triangle) Solution

1. Sol. (d)

Let the length of each side = a

So, perimeter = a + 40

Now, 3a = a + 40

$$\Rightarrow 2a = 40, a = 20 \text{ cm}$$

2. Sol. (b)

 $\triangle ABC$ is similar to $\triangle DEF$

$$\frac{54}{x} = \left(\frac{3}{4}\right)^2 \Rightarrow x = 96 \text{ cm}^2$$

3. Sol. (b)

Let the base of the triangle = 24 cm

Area of $\triangle = \frac{1}{2} \times 24 \times \text{height}$

$$96 = 12 \times \text{height} \Rightarrow H = \frac{96}{12} = 8 \text{ cm}$$

4. Sol. (c)

Altitude of an equilateral triangle = $\frac{\sqrt{3}}{2}$ (side)

$$\Rightarrow \frac{\sqrt{3}}{2} (\text{side}) = 7 \text{ cm} \Rightarrow \text{Side} = \frac{14}{\sqrt{3}} \text{ cm}$$

$$\text{Area of } \triangle = \frac{1}{2} \times b \times h = \frac{1}{2} \times \frac{14}{\sqrt{3}} \times 7 = \frac{49}{\sqrt{3}} \text{ cm}^2$$

5. Sol. (d)

Let a, b, c be the sides of a triangle Semiperimeter

(s)

$$= \frac{8+12+16}{2} = \frac{36}{2} = 18$$

Area of triangle

$$\sqrt{s(s-a)(s-b)(s-c)} \text{ (By Heron's formula)}$$

$$= \sqrt{18 \times 10 \times 6 \times 2} = \sqrt{2160}$$

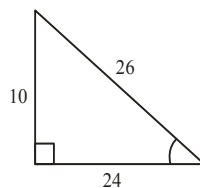
$$= 12\sqrt{15} \text{ cm}^2$$

6. Sol. (a)

Ratio of sides of triangle = 10x: 24x: 26x

$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{height} = 480 \text{ cm}^2$$

$$\Rightarrow \frac{1}{2} \times 24x \times 10x = 480 \text{ cm}^2$$



$$\Rightarrow x^2 = 4 \text{ cm} \Rightarrow x = 2 \text{ cm}$$

$$\text{Perimeter} = 20 + 48 + 52 = 120 \text{ cm}$$

7. Sol. (d)

Area of an equilateral triangle = $\frac{\sqrt{3}}{4} a^2$ (Where a is side)

$$= \frac{\sqrt{3}}{4} a^2 = 27 \text{ cm}^2$$

$$\Rightarrow a^2 = 9 \times 4 \times \sqrt{3}$$

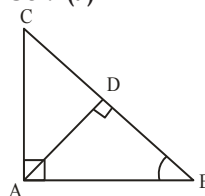
$$\Rightarrow a = 6 \times (3)^{1/4} \text{ cm}$$

Height of equilateral triangle = $\frac{\sqrt{3}}{2} \times a$

$$= \frac{\sqrt{3}}{2} \times 6 \times (3)^{1/4}$$

$$= 3 \times (3)^{3/4} = (3)^{7/4} \text{ cm}$$

8. Sol. (a)



$$\text{Area } \triangle ABC = \frac{1}{2} \times BC \times AD$$

$$80 \text{ cm}^2 = \frac{1}{2} \times 16 \times AD \Rightarrow AD = 10 \text{ cm}$$

9. Sol. (d)

Area of a triangle field

$$= \sqrt{S(S-a)(S-b)(S-c)} \left[\text{where } S = \frac{a+b+c}{2} \right]$$

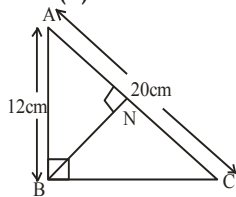
$$= \frac{39+42+45}{2} = 63$$

$$= \sqrt{63 \times 24 \times 21 \times 18}$$

$$= \sqrt{9 \times 7 \times 8 \times 3 \times 7 \times 3 \times 9 \times 2} = 756 \text{ m}^2$$

$$\text{Number of rose beds} = \frac{756 \times 100 \times 100}{270} = 28000$$

10. Sol. (d)



$$BC = \sqrt{20^2 - 12^2} = 16$$

$$BN = \frac{12 \times 16}{20} = 9.6$$

In $\triangle ABN$

$$12^2 = 9.6^2 + AN^2$$

$$AN = 7.2$$

$$NC = 20 - 7.2 = 12.8$$

$$AN:NC = 7.2:12.8 \Rightarrow 9:16$$

11. Sol. (d)

Area of equilateral Triangle

$$= \frac{\sqrt{3}}{4} \times (\text{side})^2 = \frac{\sqrt{3}}{4} \times (24)^2 = 144\sqrt{3} \text{ cm}^2$$

12. Sol. (a)

Perimeter of an equilateral triangle = 60 units

$$3a = 60 \Rightarrow a = \frac{60}{3} = 20$$

$$\text{Area of an equilateral triangle} = \frac{\sqrt{3}}{4} a^2 = \frac{\sqrt{3}}{4} \times (20)^2$$

$$= 100\sqrt{3} \text{ square units}$$

13. Sol. (a)

Sides of a triangle are 360, 480 and 600 hence it is triplet ratio of 3, 4 and 5

So it is right angle triangle

Let side of a square is 'a'

According to the question

Area of triangle = area of square

$$\frac{1}{2} \times 360 \times 480 = a^2$$

$$a^2 = 120 \times 120 \times 6 \Rightarrow a = 120\sqrt{6}$$

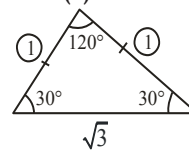
14. Sol. (b)

$$\text{Area} = \frac{1}{4} p^2 (3 - 2\sqrt{2})$$

$$A = \frac{1}{4} \times 49 \times 49 \times (3 - 2.828)$$

$$= \frac{1}{4} \times 49 \times 49 \times 0.172 = 102.98$$

15. Sol. (a)

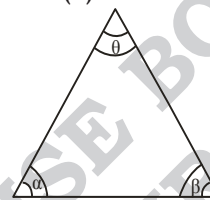


$$4 + 1 + 1 \rightarrow 6 \rightarrow 180^\circ$$

$$1 \rightarrow 30^\circ$$

$$k = \frac{2+\sqrt{3}}{\sqrt{3}} = 1 + \frac{2}{\sqrt{3}}$$

16. Sol. (d)



[Let the sides are 12x, 17x and 25x]

$$\text{Now, } 12x + 17x + 25x = 648$$

$$\Rightarrow 54x = 648 \Rightarrow x = 12$$

So, sides are $12 \times 12 = 144 \text{ m}$,

$$17 \times 12 = 204 \text{ m}, 25 \times 12 = 300 \text{ m}.$$

$$\text{Here, Semi perimeter (s)} = \frac{a+b+c}{2} = \frac{648}{2} = 324 \text{ m}$$

$$\text{So, area of the triangle} = \sqrt{s(s-a)(s-b)(s-c)}$$

$$\Rightarrow \sqrt{324(324-144)(324-204)(324-300)}$$

$$\Rightarrow \sqrt{324 \times 180 \times 120 \times 24}$$

$$\Rightarrow 18 \times 24 \times 30 \Rightarrow 12960 \text{ m}^2$$

Now, Area of three sectors

$$\Rightarrow \pi 35^2 \frac{\theta}{360^\circ} + \pi 35^2 \frac{\beta}{360^\circ} + \pi 35^2 \frac{\alpha}{360^\circ}$$

$$\Rightarrow \frac{\pi 35^2}{360^\circ} (\theta + \beta + \alpha) \Rightarrow \frac{\pi 35^2}{360^\circ} (180^\circ)$$

$$[\because \text{Sum of angles of } \Delta = 180^\circ]$$

$$\Rightarrow \frac{\pi 35^2}{2}$$

$$\Rightarrow 22 \times 5 \times \frac{35}{2} \Rightarrow 1925 \text{ m}^2$$

$$\text{Remaining portion} \Rightarrow 12960 - 1925 = 11035 \text{ m}^2.$$

17. Sol. (b)

Given, side of triangle = 15 cm and height = 6 cm

$$\text{Area of the triangle} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$= \frac{1}{2} \times 15 \times 6 = 45 \text{ sq. cm}$$

18. Sol. (a)

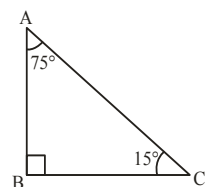
Let the sides of a triangle are $3x, 4x$ and $5x$ respectively.

$$5x - 3x = 3.6 \Rightarrow x = 1.8 \text{ cm}$$

$$\begin{aligned} \text{Area of triangle} &= \frac{1}{2} \times 3x \times 4x \\ &= 6 \times 1.8 \times 1.8 = 19.44 \text{ cm}^2 \end{aligned}$$

19. Sol. (b)

According to the question,



$$\sin 15^\circ = \frac{P}{H} = \frac{AB}{1}$$

$$AB = \sin 15^\circ$$

$$\cos 15^\circ = \frac{B}{H} = \frac{BC}{1}$$

$$BC = \cos 15^\circ$$

$$\text{Area of } \triangle ABC = \frac{1}{2} \times AB \times BC$$

$$= \frac{1}{2} \times \sin 15^\circ \cos 15^\circ$$

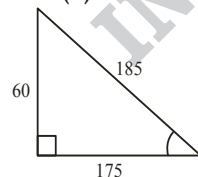
$$= \frac{1}{4} \times \sin 2 \times 15 \quad [\because \sin 2\theta = 2\sin\theta\cos\theta]$$

$$= \frac{1}{4} \times \sin 30^\circ$$

$$= \frac{1}{4} \times \frac{1}{2} = \frac{1}{8} \text{ m}$$

$$= \frac{1}{8} \times 100 \times 100 = 1250 \text{ cm}^2$$

20. Sol. (d)



Sides of the triangular field are triplets.

Area of Δ = Area of rectangular park

$$\frac{1}{2} \times 60 \times 175 = 21x \times 10x$$

$$x^2 = 25 \Rightarrow x = 5$$

Perimeter of rectangular park

$$= 2[21x + 10x] = 62x = 62(5) = 310 \text{ m}$$

21. Sol. (b)

Let the length of the side of the original triangle be 'a'. Then according to question

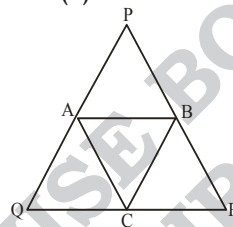
$$\Rightarrow \frac{\sqrt{3}}{4}(a+4)^2 - \frac{\sqrt{3}}{4}a^2 = 24 \text{ cm}^2$$

$$\Rightarrow (a+4)^2 - a^2 = 32\sqrt{3}$$

$$\Rightarrow a^2 + 16 + 8a - a^2 = 32\sqrt{3}$$

$$\Rightarrow 8a = 32\sqrt{3} - 16 \Rightarrow a = (4\sqrt{3} - 2) \text{ cm}$$

22. Sol. (b)



$$\text{Perimeter of } \triangle ABC = 22$$

$$\text{Perimeter of } \triangle PQR$$

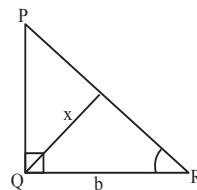
$$= 2(AB + BC + AC) = 2 \times 22 = 44$$

23. Sol. (a)

Let PQR be the right-angled triangle with $\angle PQR = 90^\circ$ and $QR = 'b'$.

$$\text{Then, Area of triangle PQR} = \frac{1}{2} PQ \times QR$$

$$\Rightarrow A = \frac{1}{2} PQ \times b \Rightarrow PQ = \frac{2A}{b}$$



Now in $\triangle PQR$

$$PR^2 = PQ^2 + QR^2 = \left(\frac{2A}{b}\right)^2 + b^2 = \frac{4A^2 + b^4}{b^2}$$

$$PR = \frac{\sqrt{4A^2 + b^4}}{b}$$

$$\text{Area of } \triangle PQR = \frac{1}{2} \times PR \times X = A$$

$$\Rightarrow X = \frac{2A}{PR} \Rightarrow X = \frac{2Ab}{\sqrt{4A^2 + b^4}}$$

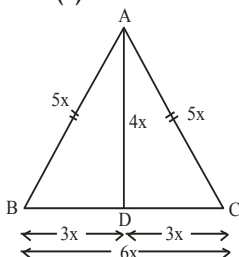
24. Sol. (a)

Let the equal side of the isosceles triangle = $4x$ and its base = $5x$

$$4x + 4x + 5x = 91 \Rightarrow x = 7 \text{ cm}$$

Length of its base = 35 cm

25. Sol. (a)



$$\text{Perimeter} = 16x = 544 \Rightarrow x = 3$$

$$\text{Area} = \frac{1}{2} \times 6x \times 4x = 12x^2$$

$$12x^2 = 12 \times 34 \times 34 \Rightarrow 13872 \text{ cm}^2$$

26. Sol. (a)

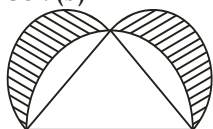
Let the height of another triangle be H.

So, area of another triangle = 2 (area of original triangle)

$$\frac{1}{2} \times 14 \times H = 2 \left(\frac{1}{2} \times 8.5 \times 14 \right)$$

$$7H = 119 \Rightarrow H = 17 \text{ cm}$$

27. Sol. (b)



Area of shaded Region

$$= \text{Area of triangle} = \frac{1}{2} \times pq = \frac{pq}{2}$$

28. Sol. (a)

$$\text{Area of all three sectors} = 3 \times \frac{\pi}{3} \times \frac{(2)^2}{2} = 2\pi$$

$$\text{Area of equilateral triangle} = \frac{\sqrt{3}}{4} \times 4^2 = 4\sqrt{3}$$

$$\text{Area of shaded portion} = 4\sqrt{3} - 2\pi$$

29. Sol. (a)

Let the sides of a triangle be $6x, 8x$ and $10x$ respectively

Since, the given sides of triangle form a triplet i.e.

$$6^2 + 8^2 = 10^2$$

$$\text{ATQ, } \frac{1}{2} \times 6x \times 8x = 96 \Rightarrow 24x^2 = 96$$

$$\Rightarrow x^2 = 4 \Rightarrow x = 2$$

So, the perimeter of triangle = $6x + 8x + 10x$

$$= 24x = 24 \times 2 = 48 \text{ cm}$$

30. Sol. (d)

The minimum integral value of $x = 6 + x > 10, x >$

$$4, x = 5$$

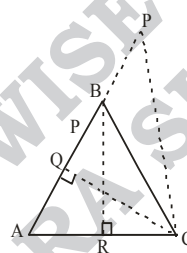
31. Sol. (c)

Let $BR \perp AC$ and $CQ \perp AB$

In $\triangle BRC$

$$BR^2 = BC^2 - RC^2 = 5^2 - 3^2 = 4^2$$

$$BR = 4 \text{ cm}$$



Now area of $\triangle ABC = \text{Area of } \triangle ABC$

$$= \frac{1}{2} \times AC \times BR = \frac{1}{2} \times AB \times CQ$$

$$= 6 \times 4 = 5 \times CQ$$

$$= CQ = \frac{6 \times 4}{5} = \frac{24}{5} \text{ cm}$$

In $\triangle AQC$

$$AQ^2 = AC^2 - CQ^2 = 6^2 - \left(\frac{6 \times 4}{5} \right)^2 = \left(\frac{18}{5} \right)^2$$

$$AQ = \frac{18}{5} \text{ cm}$$

$$PA = 2AQ = \frac{36}{5} \text{ cm}$$

Area of $\triangle APC$

$$= \frac{1}{2} \times AP \times CQ = \frac{1}{2} \times \frac{18}{5} \times \frac{24}{5} = \frac{216}{25} = 8.64 \text{ cm}^2$$

32. Sol. (c)

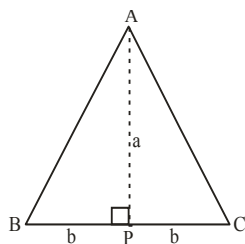
Let the altitude be 'a' and base be $2b$

$$\text{In } \triangle APC, a^2 + b^2 = AC^2$$

$$a^2 + b^2 = 17^2$$

$$\text{And } \frac{1}{2} \times BC \times AP = 120 \text{ m}^2$$

$$\Rightarrow ab = 120 \text{ m}^2$$



Now, $(a + b)^2 = a^2 + b^2 + 2ab$

$$= 289 + 240 = 529$$

$$\Rightarrow a + b = 23\text{m}$$

$$\text{Again, } (a - b)^2 = a^2 + b^2 - 2ab = 289 - 240 = 49$$

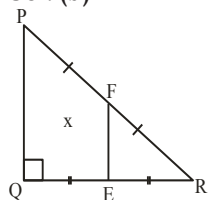
$$\Rightarrow a - b = 7\text{m}$$

From eqn. (i) and (ii)

$$a = 15\text{m and } b = 8\text{m}$$

$$\text{Base} = 2b = 16\text{m} = BC$$

33. Sol. (b)

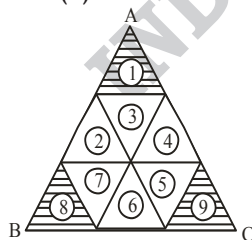


$$QE:ER = 1:1$$

$$QR = 2 \text{ unit}$$

$$\frac{\text{Area of quadrilateral PQEF}}{\text{Area of triangle PQR}} = \frac{2^2 - 1}{2^2} = \frac{3}{4}$$

34. Sol. (b)



Area of triangle (1), (2), (3), (4), (5), (6), (7), (8) and (9) are equal.

$$\text{Let total area of } ABC = 9$$

$$\text{then unshaded part} = 6$$

$$\text{then unshaded part \%}$$

$$= \frac{6}{9} \times 100 = 66.66\%$$

35. Sol. (a)

$$\text{Diagonal of square} = 6\sqrt{2}$$

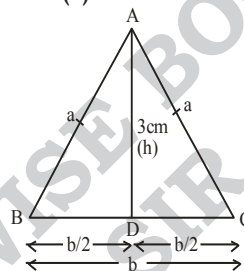
$$\text{Side of square} = 6, \text{ perimeter of square} = 24$$

$$\text{Base of triangle} = 24$$

$$\text{Height of triangle} = \sqrt{144} = 12 \text{ (area of square} = \text{side}^2)$$

$$\text{Area of triangle} = \frac{1}{2} \times 12 \times 24 = 144 \text{ cm}^2$$

36. Sol. (a)



Area of the $\triangle ABC$

$$= \frac{1}{2} \times b \times h \Rightarrow 12 = \frac{1}{2} \times b \times 3$$

$$\therefore b = \frac{12 \times 2}{3} = 8 \text{ cm}$$

$$\text{Here, } BD = CD = \frac{b}{2} = \frac{8}{2} = 4 \text{ cm} = 4 \text{ cm}$$

In right angled $\triangle ABD$, by pythagoras theorem,

$$AB = \sqrt{BD^2 + AD^2}$$

$$\Rightarrow a = \sqrt{4^2 + 3^2} = \sqrt{16 + 9} = \sqrt{25} = 5 \text{ cm}$$

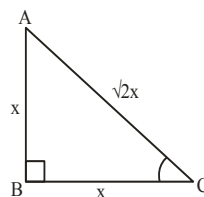
Now, perimeter of an isosceles triangle

$$= 2a + b = 2 \times 5 + 8 = 10 + 8 = 18 \text{ cm}$$

37. Sol. (b)

Let the length of equal sides (Perpendicular and Base) = x

$$\text{Hypotenuse} = \sqrt{2}x,$$

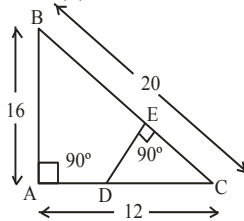


$$\text{Perimeter} = (2 + \sqrt{2})x$$

$$8(\sqrt{2} + 1) = (2 + \sqrt{2})x$$

$$\text{On solving } x = 4\sqrt{2}$$

38. Sol. (a)



$\triangle CAB \& \triangle CED$ are similar triangles

$$\angle CAB = \angle CED = 90^\circ$$

$$\angle C = \angle C, \angle CBA = \angle CDE$$

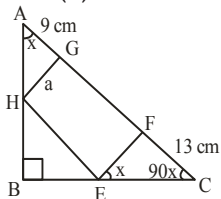
$$\text{Now } \frac{\text{Area of } \triangle CED}{\text{Area of } \triangle CAB} = \left(\frac{6}{20}\right)^2 = \frac{36}{400}$$

Here, 400 units corresponds to 96 cm^2

So 36 units corresponds to $\frac{36 \times 96}{400} = 8.64 \text{ cm}^2$

$$\text{area } \triangle DEC = 8.64 \text{ cm}^2$$

39. Sol. (b)



Side of square = a

$$\text{Let } \angle BAC = \alpha$$

$$\Rightarrow \angle BCA = 90 - \alpha$$

$$\Rightarrow \angle AHG = 90 - \alpha$$

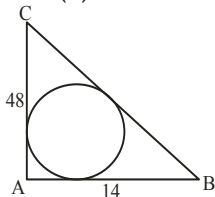
$$\text{and } \angle FEC = \alpha$$

$$\triangle AHG \sim \triangle EFC$$

$$\Rightarrow \frac{a}{9} = \frac{13}{a} \Rightarrow a^2 = 13 \times 9$$

$$a^2 = 117$$

40. Sol. (b)



$$BC = \sqrt{48^2 + 14^2} = 50$$

$$\text{In radius} = \frac{P+B-H}{2}$$

$$\text{In radius} = \frac{48+14-50}{2} = 6 \text{ cm}$$

41. Sol. (c)

Area of triangular park

$$= \sqrt{s(s-a)(s-b)(s-c)}$$

$$\left(\text{Where } s = \frac{a+b+c}{2} = \frac{65+70+75}{2} = 105 \right)$$

$$= \sqrt{105 \times 40 \times 35 \times 30}$$

$$= \sqrt{7 \times 3 \times 5 \times 4 \times 5 \times 3 \times 7 \times 5 \times 3 \times 5 \times 2}$$

$$= 5 \times 5 \times 7 \times 4 \times 3 = 2100 \text{ m}^2$$

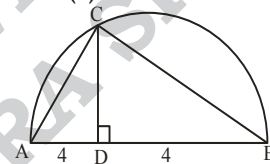
$$\text{Perimeter of park} = a + b + c = 210 \text{ m}$$

Cost of fencing and planting

$$= 2100 \times 35 + 210 \times 20 = 210(350 + 20)$$

$$= 210 \times 370 = ₹77700$$

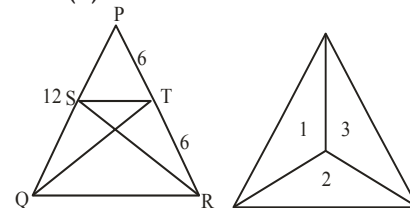
42. Sol. (a)



$$AD = DB = CD = 4 \text{ cm}, AB = 8 \text{ cm}$$

$$\text{Area of triangle} = \frac{1}{2} \times 8 \times 4 = 16 \text{ cm}^2$$

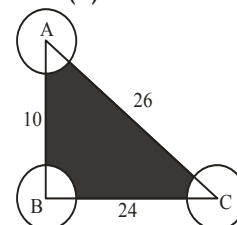
43. Sol. (b)



This triangle area is divided in three equal part:
required area (2)

$$= \left[\frac{\sqrt{3}}{4} (12)^2 \right] \times \frac{1}{3} = \left[\frac{\sqrt{3}}{4} \times 144 \right] \times \frac{1}{3} = 12\sqrt{3} \text{ cm}^2$$

44. Sol. (d)



Since we know that (10,24,26) is a pythagorean triplet so we can easily find out the area of the

$$= \frac{1}{2} \times \text{base} \times \text{height}$$

$$= \frac{1}{2} \times 24 \times 10 = 120$$

So the area of the triangle will be equal to 120.

At each vertices a circle of radius 4.2 cm is drawn so the total area of circle will be $= \frac{1}{2} \times \text{area of a circle}$ (as the sum of angles of a triangle is equal to 180°)

$$\text{Area of circle} = \frac{1}{2} \times \pi \times 4.2 \times 4.2 = 27.72$$

$$\text{Area of triangle excluding the portion covered by circle} = 120 - 27.72 = 92.28 \text{ cm}^2$$

45. Sol. (d)

Let the side lengths of triangular canvas be S_1, S_2 and S_3

Then,

$$S_1 = \sqrt{(24)^2 + (20 - 13)^2} = \sqrt{24^2 + 7^2} = 25 \text{ m}$$

$$S_2 = \sqrt{(40)^2 + (29 - 20)^2} = \sqrt{40^2 + 9^2} = 41 \text{ m}$$

And

$$S_3 = \sqrt{(30)^2 + (29 - 13)^2} = \sqrt{30^2 + 16^2} = 34 \text{ m}$$

Area of required triangular canvas

$$= \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \sqrt{50(50-25)(50-41)(50-34)}$$

$$= \sqrt{50(25)(9)(16)} = 300\sqrt{2} = 423 \text{ m}^2$$

$$\text{Cost of canvas} = 423 \times ₹57 = ₹24111$$

46. Sol. (b)

Sides of triangular park are 60 m, 112 m and 164 m.

Semi perimeter,

$$s = \frac{60+112+164}{2} = 168$$

Area of triangular park

$$= \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \sqrt{168(168-60)(168-112)(168-164)}$$

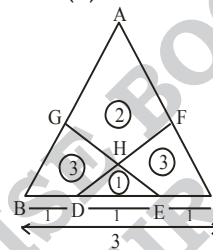
$$= \sqrt{168(108)(56)(4)}$$

$$= \sqrt{2 \times 12 \times 7 \times 12 \times 9 \times 7 \times 4 \times 2 \times 4}$$

$$= 2 \times 12 \times 7 \times 4 \times 3 = 2016$$

$$\text{Cost of leveling} = 8.5 \times 2016 = ₹17136$$

47. Sol. (b)



Let $BC = 3$ units.

$$\therefore BD = DE = EC = \frac{3}{3} = 1 \text{ unit}$$

In $\triangle GBE$ & $\triangle ABC$ $GE \parallel AC$

$$\frac{\text{area of } \triangle GBE}{\text{area of } \triangle ABC} = \frac{(2)^2}{(3)^2} = \frac{4}{9}$$

$$\therefore \text{area of } \triangle GBE = 4$$

In $\triangle HED$ & $\triangle GEB$

$$\text{area of } \triangle GBE = 4 \text{ units}$$

$$\text{area of } \triangle HDE = 1 \text{ unit}$$

$$4 \text{ unit} - 4$$

$$1 \text{ unit} - 1$$

$$\text{area of } \triangle DHE = 1$$

$$\text{area of } \square GBDH = 3 \text{ units}$$

Similarly, area of $HFCE = 3$ units.

$$\text{area of } \triangle ABC = 9 - 7 = 2 \text{ units}$$

$$\text{Area of } \square AGHF + \text{area of } \triangle HDE : \text{area of } \triangle ABC$$

$$\frac{\text{area of rhombus } AGHF - \text{area of } \triangle HDE}{\text{area of } \triangle ABC}$$

$$= \frac{2+1}{9} = \frac{1}{3}$$

Type-12A (Rectangle)

1. The difference between the length and the breadth of a rectangle is 16 cm. If its perimeter is 188 cm, then what is its area?

एक आयत की लंबाई और चौड़ाई के बीच का अंतर 16 सेमी है। यदि इसका परिमाण 188 सेमी है, तो इसका क्षेत्रफल कितना है?

SSC MTS 2023 (Evening)

- (a) 2100 cm² (b) 2145 cm²
(c) 2050 cm² (d) 2375 cm²

2. The length and the breadth of a rectangle are made to increase and decrease, respectively, by 8% and 10%. What is the percentage increase or decrease in its area?

एक आयत की लंबाई और चौड़ाई को क्रमशः 8% और 10% घटाया और बढ़ाया जाता है। इसके क्षेत्रफल में प्रतिशत वृद्धि या कमी क्या है? एक आयत की लंबाई और चौड़ाई को क्रमशः 8% और 10% बढ़ाया और घटाया जाता है। इसके क्षेत्रफल में प्रतिशत वृद्धि या कमी क्या है?

SSC CGL 11/04/2022 (Afternoon)

- (a) Decrease by 1.8 (b) Increase by 1.8
(c) Increase by 2.8 (d) Decrease by 2.8

3. The perimeter of a rectangle is equal to the perimeter of a square. If the length and the breadth of the rectangle are 10 cm and 8 cm, respectively, then what will be the area of the square?

एक आयत का परिमाण एक वर्ग के परिमाण के बराबर है। यदि आयत की लंबाई और चौड़ाई क्रमशः 10 सेमी और 8 सेमी है, तो वर्ग का क्षेत्रफल क्या होगा?

SSC CPO 09/11/2022 (Evening)

- (a) 72 cm² (c) 81 cm²
(b) 98 cm² (d) 64 cm²

4. The diagonal of a rectangle is 12 cm long and it is twice as long as one of the sides of the rectangle. Find area of the rectangle?

एक आयत का विकर्ण 12 सेमी लंबा है और यह आयत की एक भुजा से दोगुना लंबा है। आयत का क्षेत्रफल ज्ञात कीजिये?

SSC MTS 08/07/2022 (Evening)

- (a) $25\sqrt{3}$ cm² (b) $30\sqrt{3}$ cm²
(c) $36\sqrt{3}$ cm² (d) $42\sqrt{3}$ cm²

5. The area of a rectangular park is 10,560 m². The sum of its one diagonal and the shorter side is 2.2 times its longer side. Its perimeter is 12 m more than that of a square field. What is the length (in m) of each diagonal of the square field?

एक आयताकार पार्क का क्षेत्रफल 10560 m² है। इसके एक विकर्ण और छोटी भुजा का योग इसकी लंबी भुजा के 2.2 गुना के बराबर है। इसका परिमाण एक वर्गाकार मैदान के परिमाण से 12 m अधिक है। वर्गाकार मैदान के प्रत्येक विकर्ण की लंबाई (m में) क्या है?

ICAR Assistant 29/07/2022 (Shift-01)

- (a) $108\sqrt{2}$ (b) $90\sqrt{2}$
(c) $106\sqrt{2}$ (d) $100\sqrt{2}$

6. The ratio of the length to the width of a rectangle is 3:2. If the length of this rectangle is increased by 25% and its width is kept constant, then the area of the rectangle increases by 24 m². What is the width of this rectangle?

एक आयत की लंबाई और चौड़ाई का अनुपात 3:2 है। यदि इस आयत की लंबाई में 25% की वृद्धि की जाए और इसकी चौड़ाई को स्थिर रखा जाए, तो आयत का क्षेत्रफल 24 वर्ग मीटर बढ़ जाता है। इस आयत की चौड़ाई कितनी है?

SSC MTS 22/07/2022 (Morning)

- (a) 12 m (b) 10 m (c) 8 m (d) 15 m

7. The length of a rectangle is $2x + 9$, and its breadth is $3x + 2$. If its diagonal is 29 m, then find the area of the rectangle.

एक आयत की लंबाई $2x+9$ है, और इसकी चौड़ाई $3x+2$ है। यदि इसका विकर्ण 29 मीटर है, तो आयत का क्षेत्रफल ज्ञात कीजिए।

- (a) 396 m² (b) 429 m²
(c) 420 m² (d) 386 m²

8. The length and breadth of a rectangle are increased by 8% and 5%, respectively. By how much percentage will the area of the rectangle increase?

एक आयत की लंबाई और चौड़ाई में क्रमशः 8% और 5% की वृद्धि की जाती है। आयत के क्षेत्रफल में कितने प्रतिशत की वृद्धि होगी?

SSC CGL 01/12/2022 (1st Shift)

- (a) 13.4% (b) 15.4%
(c) 12.4% (d) 16.4%

9. The perimeter of a rectangle is 68 cm. If the area of the rectangle is 240 cm², then what is the length of each of its diagonals?

एक आयत का परिमाण 68 सेमी है। यदि आयत का क्षेत्रफल 240 सेमी² है, तो इसके प्रत्येक विकर्ण की लंबाई क्या है?

SSC MTS 14/07/2022 (Morning)

- (a) 25 cm (b) 27 cm (c) 26 cm (d) 28 cm

10. The diagonal of a rectangle is 17 cm long and its perimeter is 46 cm. The areas (cm^2) of the rectangle is:

एक आयत का विकर्ण 17 सेमी लंबा है और इसका परिमाप 46 सेमी है। आयत का क्षेत्रफल (cm^2) है:

SSC CHSL 06/06/2022 (Afternoon)

- (a) 120 (b) 125 (c) 115 (d) 130

11. If the adjacent sides of a rectangle, whose perimeter is 66 m, are in the ratio 5:6 then what will be the area of the rectangle?

यदि एक आयत, जिसका परिमाप 66 मीटर है, की आसन्न भुजाएँ 5:6 के अनुपात में हैं, तो आयत का क्षेत्रफल क्या होगा?

SSC MTS 19/07/2022 (Afternoon)

- (a) 270m^2 (c) 230m^2
(b) 160m^2 (d) 180m^2

12. The length and the breadth of a rectangular cardboard are 40 cm and 35 cm, respectively. If the biggest possible square is cut out from this cardboard, what is the area of the remaining part of the cardboard?

एक आयताकार कार्डबोर्ड की लंबाई और चौड़ाई क्रमशः 40 सेमी और 35 सेमी है। यदि इस कार्डबोर्ड से सबसे बड़ा संभव वर्ग काट दिया जाए, तो कार्डबोर्ड के शेष भाग का क्षेत्रफल क्या है?

SSC MTS 08/07/2022 (Afternoon)

- (a) 175cm^2 (b) 275cm^2
(c) 425cm^2 (d) 325cm^2

13. The length and breadth of a room are 21 m and 16 m respectively. If the length of the longest rod that can be placed in the room is 29 m, then what is the height of the room?

एक कमरे की लंबाई और चौड़ाई क्रमशः 21 मीटर और 16 मीटर है। यदि कमरे में रखी जा सकने वाली सबसे लंबी छड़ की लंबाई 29 मीटर है, तो कमरे की ऊँचाई कितनी है?

[CDS-2021-II]

- (a) 10 m (b) 11 m (c) 12 m (d) 13 m

14. The perimeter of a rectangular field is 386 m and the difference between its two adjacent sides is 95 m. The side(in m) of a square field, having the same area as that of the rectangle, is:

एक आयताकार मैदान का परिमाप 386 मीटर है और इसकी दो संलग्न भुजाओं के बीच का अंतर 95 मीटर है। एक वर्गाकार मैदान की भुजा (मीटर में), जिसका क्षेत्रफल आयत के क्षेत्रफल के समान है, है:

SSC MTS 6/10/2021 (Morning)

- (a) 64 (b) 84 (c) 74 (d) 82

15. A typist uses a paper of size 32 cm $\times$ 20 cm. He leaves a margin of 2 cm each on all the sides. If he leaves a margin of 1 cm only on all the sides. then

what is the percentage of the increase in the area available for typing (correct to 2 decimal places)?

एक टाइपिस्ट 32 सेमी $\times$ 20 सेमी आकार के एक कागज का उपयोग करता है। वह सभी पक्षों पर 2 सेमी का हाशिया छोड़ता है। यदि वह सभी पक्षों पर केवल 1 सेमी का हाशिया छोड़ता है। तो टाइपिंग के लिए उपलब्ध क्षेत्र में वृद्धि का प्रतिशत क्या है (2 दशमलव स्थानों तक सही)?

SSC MTS 11/10/2021 (Morning)

- (a) 20.54% (b) 82.69%
(c) 17.04% (d) 79.46%

16. The length and breadth of a rectangular field are in the ratio of 7:5. A path 1.5 m wide running all around inside has an area 603m^2 . Find the cost of fencing the path on both sides leaving 4 m gate on one side. At the rate of ₹ 7.5 per meter.

एक आयताकार मैदान की लंबाई और चौड़ाई 7:5 के अनुपात में है। एक 1.5 मीटर चौड़ा पथ जो चारों ओर अंदर की ओर जाता है, का क्षेत्रफल 603m^2 है। एक ओर 4 मी गेट छोड़कर दोनों ओर के पथ पर बाड़ लगाने का व्यय ज्ञात कीजिए। ₹ 7.5 प्रति मीटर की दर से।

- (a) ₹5970 (b) ₹5992.5
(c) ₹5947.5 (d) ₹5985

17. The length of a rectangle is 10 cm more than the side of a square and its breadth is 8 cm less than the side of the square. If the areas of both the rectangle and square are equal, then what will be the perimeter (in cm) of the rectangle?

एक आयत की लंबाई एक वर्ग की भुजा से 10 सेमी अधिक है और इसकी चौड़ाई वर्ग की भुजा से 8 सेमी कम है। यदि आयत और वर्ग दोनों का क्षेत्रफल बराबर हो, तो आयत का परिमाप (सेमी में) क्या होगा?

SSC CHSL 19/4/2021 (Afternoon)

- (a) 164 (b) 160 (c) 156 (d) 144

18. A field is in the shape of a rectangle of length 90 m and breadth 75 m. In one corner of the field, a pit, which is 18 m long, 15 m broad and 6 m deep, has been dug out. The Earth taken out of it is evenly spread over the remaining part of the field. Find the rise in the level of the field?

एक खेत एक आयत के आकार का है जिसकी लंबाई 90 मीटर और चौड़ाई 75 मीटर है। खेत के एक कोने में 18 मीटर लम्बा, 15 मीटर चौड़ा और 6 मीटर गहरा गड्ढा खोदा गया है। इससे निकाली गई मिट्टी मैदान के शेष भाग में समान रूप से फैली हुई है। क्षेत्र के स्तर में वृद्धि ज्ञात कीजिये?

SSC CPO 09/11/2022 (Morning)

- (a) 27 cm (b) 25 cm
(c) 28 cm (d) 24 cm

19. The length of a rectangle is 14 m more than its breadth. If the area of the rectangle is 480 m^2 . Then the length of its diagonal is

एक आयत की लम्बाई उसकी चौड़ाई से 14 मीटर अधिक है। यदि आयत का क्षेत्रफल 480 वर्ग मीटर है। तो उसके विकर्ण की लम्बाई है

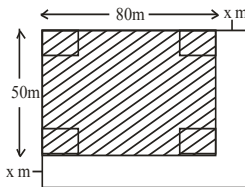
- (a) 28 m (b) 32 m (c) 36 m (d) 34 m
20. If length of a rectangle is increased to its three times and breadth is decreased to its half, then the ratio of the area of given rectangle to the area of new rectangle is:

यदि एक आयत की लंबाई को उसके तीन गुना तक बढ़ा दिया जाता है और उसकी चौड़ाई को आधा कर दिया जाता है, तो दिए गए आयत के क्षेत्रफल का नए आयत के क्षेत्रफल से अनुपात है:

SSC CGL 13/8/2021 (Afternoon)

- (a) 3:2 (b) 3:1 (c) 2:3 (d) 1:3
21. In the given figure, the area of the unshaded region is 35% of the area of the shaded region. What is the value of x
- दी गई आकृति में, अछायांकित क्षेत्र का क्षेत्रफल छायांकित क्षेत्र के क्षेत्रफल का 35% है। x का मूल्य क्या है

SSC MTS 20/10/2021 (Morning)



- (a) 20 (b) 15 (c) 10 (d) 5
22. If the adjacent sides of a rectangle whose perimeter is 60 cm are in the ratio of 3:2, then what will be the area of the rectangle?
- यदि एक आयत जिसका परिमाप 60 सेमी है, की आसन्न भुजाओं का अनुपात 3:2 है, तो आयत का क्षेत्रफल क्या होगा?

SSC CHSL 6/8/2021 (Evening)

- (a) 300 cm^2 (b) 216 cm^2
(c) 60 cm^2 (d) 864 cm^2
23. Length and breadth of the rectangular field are in the ratio 5:2. If the perimeter of the field is 238 m. Find the length of the field.
- एक आयताकार मैदान की लंबाई और चौड़ाई का अनुपात 5:2 है। यदि मैदान का परिमाप 238 मी. मैदान की लंबाई ज्ञात कीजिए।

SSC CHSL 12/10/2020 (Afternoon)

- (a) 85 m (b) 83 m (c) 82 m (d) 84 m
24. If the perimeter of a certain rectangle is 50 units and its area is 150 sq. units, then how many units is the length of its shorter side?
- यदि किसी आयत का परिमाप 50 इकाई है और उसका क्षेत्रफल 150 वर्ग इकाई है, तो उसकी छोटी भुजा की लंबाई कितनी इकाई है?

SSC CGL 7/03/2020 (Afternoon)

- (a) 9 (b) 12 (c) 10 (d) 15
25. The breadth of a rectangular field is two-third of its length. If its area is 864 m^2 , then find the cost of fencing it all around at ₹15/m.

एक आयताकार मैदान की चौड़ाई उसकी लम्बाई की दो-तिहाई है। यदि इसका क्षेत्रफल 864 मी^2 है, तो इसके चारों ओर ₹15/मी की दर से बाड़ लगाने की लागत ज्ञात कीजिए।

SSC CHSL 19/10/2020 (Morning)

- (a) ₹2000 (b) ₹1800
(c) ₹1600 (d) ₹2400
26. The perimeter of a rectangle and a square are 140 m each, the area of the rectangle is 16 m^2 less than that of the square. The length of the rectangle is
- एक आयत और एक वर्ग का परिमाप प्रत्येक 140 मीटर है, आयत का क्षेत्रफल वर्ग के क्षेत्रफल से 16 वर्ग मीटर कम है। आयत की लम्बाई है

- (a) 31 m (b) 39 m (c) 37 m (d) 35 m
27. A rectangular lawn whose length is twice of its breadth is extended by having four semi-circular portions on its sides. What is the total cost (in Rs.) of leveling the entire lawn at the rate of Rs. 100 per square meter if the smaller side of the rectangular lawn is 12 m :

एक आयताकार लॉन जिसकी लम्बाई उसकी चौड़ाई से दुगुनी है, को उसके किनारों पर चार अर्धवृत्ताकार भाग बनाकर बढ़ाया जाता है। 100 रुपये प्रति वर्ग मीटर की दर से पूरे लॉन को समतल करने की कुल लागत (रु. में) क्या है? यदि आयताकार लॉन की छोटी भुजा 12 मीटर है:

SSC CPO 23/11/2020 (Evening)

- (a) 85,320 (b) 86,540
(c) 78,650 (d) 97,625
28. The area of a rectangle is $a^2 - b^2$ and its length is $a + b$, what will be its breadth?
- एक आयत का क्षेत्रफल $a^2 - b^2$ है और इसकी लंबाई $a + b$ है, इसकी चौड़ाई क्या होगी?

SSC CHSL 15/10/2020 (Morning)

- (a) $2ab$ (b) $a + b$ (c) ab (d) $a - b$
29. A rectangular field costs ₹107555.49 for levelling at the rate of ₹2.03 per square meter if the ratio of length to breadth is 9:7. Find the cost of fencing the field at the rate of ₹72.7 per meter.
- एक आयताकार मैदान की लागत ₹2.03 प्रति वर्ग मीटर की दर से समतल करने की लागत ₹107555.49 है यदि लंबाई और चौड़ाई का अनुपात 9:7 है। ₹72.7 प्रति मीटर की दर से खेत की बाड़ लगाने की लागत ज्ञात कीजिए।

- (a) ₹65372.6 (b) ₹67465.6
(c) ₹63217.6 (d) ₹69472.6

Type-12A (Quadrilateral) ANSWER KEY

1	B	2	D	3	C	4	C	5	D	6	C	7	C	8	A
9	C	10	A	11	A	12	A	13	C	14	B	15	A	16	B
17	A	18	B	19	D	20	C	21	C	22	B	23	A	24	C
25	B	26	A	27	B	28	D	29	B						

Type-12A (Quadrilateral) Solution

1. Sol. (b)

Perimeter = 188 cm

$$2(L + B) = 188$$

$$L + B = 94 \text{ and } L - B = 16$$

$$L = \frac{94+16}{2} = \frac{110}{2} = 55 \text{ cm}$$

$$B = 94 - 55 = 39 \text{ cm}$$

So, the area of rectangle

$$= 55 \times 39 = 2145 \text{ cm}^2$$

2. Sol. (d)

Percentage change in area of rectangle

$$= 8 - 10 + \frac{8(-10)}{100} = -2 + (-0.8) = -2.8\%$$

So there is a decrease of 2.8% in the area of the rectangle.

3. Sol. (c)

ATQ, Perimeter of rectangle = perimeter of square

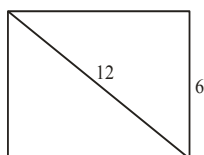
$$2(L + B) = 4a \Rightarrow 2(10 + 8) = 4a$$

$$36 = 4a \Rightarrow a = 9$$

Now, the area of square = $9^2 = 81 \text{ cm}^2$

4. Sol. (c)

In rectangle



Another side -

$$= 12^2 - 6^2 = \sqrt{144 - 36} = \sqrt{108} = 6\sqrt{3}$$

$$\text{Area of rectangle} = l \times b = 6\sqrt{3} \times 6 = 36\sqrt{3}$$

5. Sol. (d)

$$\text{Area of rectangular part} = l \times b = 10560 \text{ m}^2$$

$$\text{Perimeter} = 2(l + b)$$

A.T.Q.

$$\text{Diagonal} + b = 2.2 \times l$$

$$\Rightarrow \text{Diagonal of rectangle} = \sqrt{l^2 + b^2}$$

$$\Rightarrow \sqrt{l^2 + b^2} + b = 2.2l$$

$$\sqrt{l^2 + b^2} = 2.2l - b$$

Squaring both sides

$$l^2 + b^2 = 4.84l^2 + b^2 - 4.4lb$$

$$3.84l^2 = 4.4lb$$

$$\frac{l}{b} = \frac{4.4 \text{ cm}}{3.84 \text{ cm}} = \frac{110}{96}$$

Now,

A.T.Q.

$$2(l + b) = 4a + 12 \Rightarrow 206 \times 2 = 4a + 12$$

$$4a = 400$$

$$a = 100$$

$$\text{Diagonal} = a\sqrt{2} = 100\sqrt{2}$$

6. Sol. (c)

Let the length and width of the rectangle be $3x, 2x$

$$\text{Area of rectangle} = 6x^2$$

$$\text{Now, } \left(\frac{125}{100} \times 3x\right) \times 2x - 6x^2 = 24$$

$$\Rightarrow \frac{15}{2}x^2 - 6x^2 = 24 \Rightarrow x = \sqrt{\frac{24 \times 2}{3}} = 4$$

Width of the rectangle = 8 m

7. Sol. (c)

$$\text{Diagonal}^2 = \text{Length}^2 + \text{Breadth}^2$$

$$\Rightarrow 29^2 = (2x + 9)^2 + (3x + 2)^2$$

$$\Rightarrow 841 = 4x^2 + 81 + 36x + 9x^2 + 4 + 12x$$

$$\Rightarrow 13x^2 + 48x - 756 = 0$$

$$\Rightarrow x = 6, -\frac{126}{13}$$

$$\text{Length} = 2x + 9 = 21, \text{Breadth} = 3x + 2 = 20$$

$$\text{Area} = \text{length} \times \text{Breadth} = 21 \times 20 = 420 \text{ m}^2$$

8. **Sol. (a)**

Area of rectangle = Length $\times$ Breadth

Area of rectangle is directly proportional to product of length and breadth of rectangle.

$$\% \text{ change in area} = 8 + 5 + \frac{8 \times 5}{100} = 13.4\%$$

9. **Sol. (c)**

Perimeter of rectangle -

$$= 2(l + b) = 68 \text{ cm} \Rightarrow l + b = 34 \text{ cm}$$

Area of a rectangle = $l \times b = 240 \text{ cm}^2$ By hit and trial

$$l = 24 \text{ cm and } b = 10 \text{ cm}$$

So length of diagonal -

$$= \sqrt{24 \times 24 + 10 \times 10} = \sqrt{676} = 26 \text{ cm}$$

10. **Sol. (a)**

Let the length and breadth of the rectangle are x and y respectively.

$$\text{Perimeter of rectangle} = 2(x + y)$$

$$46 = 2(x + y) \Rightarrow x + y = 23$$

$$x^2 + y^2 = 17^2 = 289$$

$$(x + y)^2 = x^2 + y^2 + 2xy = 289 + 2xy$$

$$23^2 = 289 + 2xy$$

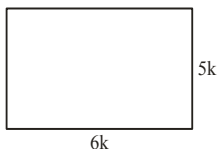
$$529 = 289 + 2xy \Rightarrow 240 = 2xy$$

$$xy = \frac{240}{2} = 120$$

So, the area of rectangle = $xy = 120 \text{ cm}^2$

11. **Sol. (a)**

According to the question,



$$\text{Perimeter of rectangle} = 2(l + b)$$

$$2(6k + 5k) = 66 \text{ (where } k = \text{common factor)}$$

$$\Rightarrow 22k = 66 \Rightarrow k = 3$$

$$l = 18, b = 15$$

$$\text{Area of rectangle} = 15 \times 18 = 270 \text{ m}^2$$

12. **Sol. (a)**

Area of the rectangle -

$$= 40 \times 35 = 1400 \text{ cm}^2$$

We can cut the biggest square by taking side of breadth of rectangle

$$\text{Breadth of rectangle} = 35 \text{ cm}$$

Then area of the square -

$$= 35 \times 35 = 1225 \text{ cm}^2$$

Area of remaining part -

$$= 1400 - 1225 = 175 \text{ cm}^2$$

13. **Sol. (c)**

$$l = 21 \text{ m, } b = 16 \text{ m, length of longest rod} = 29 \text{ m}$$

$$29^2 = 21^2 + 16^2 + h^2$$

$$841 = 441 + 256 + h^2$$

$$h^2 = 144$$

$$h = 12 \text{ m}$$

14. **Sol. (b)**

$$2(l + b) = 386$$

$$\Rightarrow (l + b) = 193 \Rightarrow (l - b) = 95$$

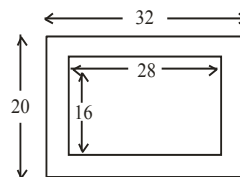
$$2l = 288 \Rightarrow l = 144 \Rightarrow b = 49$$

$$\text{Area of Square} = \text{area of rectangle} = l \times b = 49 \times 144$$

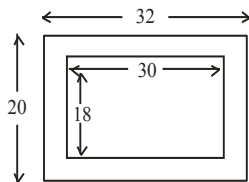
$$\text{Side of square} = \sqrt{49 \times 144} = 84 \text{ m}$$

15. **Sol. (a)**

(Figure 1)



(figure 2)



When margin of 2 cm is left, area available for typing (figure 1)

$$= (32 - 4) \times (20 - 4) = 28 \times 16 = 448 \text{ cm}^2$$

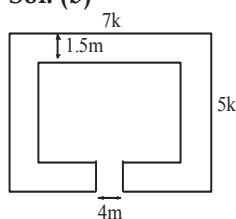
When margin of 1 cm is left, area available for typing (figure 2)

$$= (32 - 2) \times (20 - 2) = 30 \times 18 = 540 \text{ cm}^2$$

So percentage increase in typing area

$$= \frac{540 - 448}{448} \times 100 = \frac{92}{448} \times 100 = 20.54\%$$

16. Sol. (b)



Let length be $7k$ and Breadth be $5k$

$$\text{Area of path} = 7k \times 5k - (7k - 3)(5k - 3)$$

$$= 603$$

$$\Rightarrow 36k - 9 = 603$$

$$\Rightarrow 36k = 612 \Rightarrow 17$$

$$\text{Length} = 7k = 119 \text{ m}$$

$$\text{Breadth} = 5k = 85 \text{ m}$$

$$\text{Outer perimeter} = 2(L + B) - 4$$

$$= 2(204) - 4 = 404 \text{ m}$$

$$\text{Inner perimeter} = 2[(L - 3) + (B - 3)] - 4$$

$$= 2(204 - 6) - 4 = 2(198) - 4 = 396 - 4 = 392 \text{ m}$$

$$\text{Total perimeter} = 404 + 392 + 3 = 799 \text{ m}$$

$$\text{Cost of fencing} = \text{Perimeter} \times \text{cost}$$

$$= 799 \times 7.5 = ₹5992.5$$

17. Sol. (a)

Let side of square = a

Length of rectangle = $a + 10$

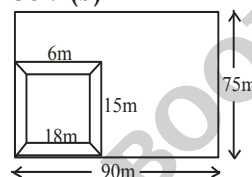
$$\text{ATQ, } a \times a = (a + 10) \times (a - 8)$$

$$2a - 80 = 0 \Rightarrow a = 40 \text{ cm}$$

Length and breadth of rectangle are = 50 cm and 32 cm

$$\text{Perimeter of rectangle} = 2(50 + 32) = 164 \text{ cm.}$$

18. Sol. (b)



Let the rise in the level of the field be h .

$$\text{The area of field} = 90 \times 75 = 6750 \text{ m}^2$$

$$\text{Area of pit} = 18 \times 15 = 270 \text{ m}^2$$

$$\text{Area of the remaining part of the field} = 6750 - 270 = 6480 \text{ m}^2$$

ATQ,

$$\begin{aligned} \text{Volume of earth taken out} &= \text{Volume of earth spread over remaining part of field} \\ 270 \times 6 &= 6480 \times h, 1620 = 6480h \end{aligned}$$

$$h = \frac{1620}{6480} = \frac{1}{4} \text{ m} = 25 \text{ cm}$$

19. Sol. (d)

Let the length of the rectangle be L then its breadth be $L - 14$

$$\text{Area} = \text{Length} \times \text{Breadth}$$

$$= (L) \times (L - 14)$$

$$\Rightarrow 480 = L^2 - 14L$$

$$\Rightarrow L^2 - 14L - 480 = 0$$

$$\Rightarrow L = 30, -16$$

$$\text{Length} = 30 \text{ m, Breadth} = 16 \text{ m}$$

$$\text{Diagonal} = \sqrt{30^2 + 16^2} = 34 \text{ m}$$

20. Sol. (c)

$$\text{Old length : new length} = x : 3x$$

$$\text{Old breadth : new breadth} = 2y : y$$

$$\text{Area of rectangle} = l \times b$$

$$\text{Old area : new area} = 2xy : 3xy = 2 : 3$$

21. Sol. (c)

$$\text{Area of shaded region} = 80 \times 50 = 4000 \text{ m}^2$$

So, area of unshaded region

$$= \frac{35}{100} \times 4000 = 1400 \text{ m}^2$$

$$\text{Total area} = (80 + x) \times (50 + x)$$

$$4000 + 1400 = 4000 + 130x + x^2$$

$$x^2 + 130x - 1400 = 0$$

$$x^2 + 140x - 10x - 1400 = 0$$

$$x(x + 140) - 10(x + 140) = 0$$

$$x \neq -140, \text{ so } x = 10$$

22. Sol. (b)

Ratio of length to breadth = 3:2

$$2(3x + 2x) = 60 \Rightarrow x = 6$$

$$\text{Length} = 3x = 3 \times 6 = 18$$

$$\text{Breadth} = 2x = 2 \times 6 = 12$$

$$\text{Area of the rectangle} = 18 \times 12 = 216 \text{ cm}^2$$

23. Sol. (a)

$$\text{Perimeter of rectangle} = 2(L + B)$$

$$\text{Let length} = 5x \text{ and Breadth} = 2x$$

$$\text{So, } 2(5x + 2x) = 238 \Rightarrow x = 17$$

$$\text{Length} = 17 \times 5 = 85 \text{ m}$$

24. Sol. (c)

Let 'l' be the length and 'b' be the breadth of a rectangle.

$$2(l + b) = 50 \Rightarrow l + b = 25 \text{ \& } l \times b = 150$$

$$l = 15 \text{ and } b = 10 \text{ satisfy the above equation.}$$

$$\Rightarrow \text{Shorter side} = 10$$

25. Sol. (b)

$$\text{Let, length} = 3x, \text{ breadth} = 2x$$

$$3x \times 2x = 864 \Rightarrow x = 12$$

$$\text{Length} = 36 \text{ cm, Breadth} = 24 \text{ cm}$$

$$\text{Perimeter} = 2(36 + 24) = 120 \text{ cm}$$

$$\text{Cost of fencing} = 120 \times 15 = 1800$$

26. Sol. (a)

$$\text{Side length of square} = \frac{140}{4} = 35 \text{ m}$$

$$\text{Area of square} = (35)^2 = 1225 \text{ m}^2$$

$$\text{Area of rectangle} = 1225 - 16 = 1209 \text{ m}^2$$

Let length of rectangle be 'L' and breadth be 'B'

$$\text{Perimeter of rectangle} = 2(L + B) \Rightarrow 140 = 2(L + B)$$

$$\Rightarrow L + B = 70 \quad \dots (i)$$

$$\text{And, area} = L \times B = 1209 \text{ m}^2$$

$$(L - B)^2 = (L + B)^2 - 4L \times B$$

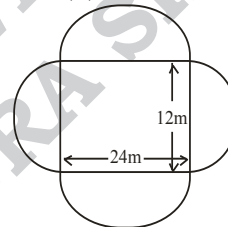
$$= 4900 - 4836 = 64$$

$$\Rightarrow L - B = 8 \quad \dots (ii)$$

From eq. (i) and (ii)

$$L = 39 \text{ m and } B = 31 \text{ m}$$

27. Sol. (b)



Total area of rectangular lawn

$$= 24 \times 12 + \pi R^2 + \pi r^2 \text{ (Where } R = \text{radius of bigger semicircle and } r = \text{radius of smaller semicircle)}$$

$$\text{Area} = 288 + 3.14 \times (12^2 + 6^2)$$

$$= 288 + 565.2 = 853.2 \text{ m}^2$$

$$\text{Cost} = 853.2 \times 100 = 85320$$

28. Sol. (d)

$$\text{Area of rectangle} = a^2 - b^2 \text{ (a + b) } \times \text{breadth}$$

$$= (a + b)(a - b) \Rightarrow \text{breadth} = (a - b)$$

29. Sol. (b)

$$\text{Area of rectangular field} = \frac{107555.49}{2.03} = 52983 \text{ m}^2$$

Let length be 9k and breadth be 7k Then

$$\text{Area} = 9k \times 7k = 52983, k^2 = 841 \Rightarrow k = 29$$

$$\text{Perimeter} = 2(\text{length} + \text{breadth})$$

$$= 2(9k + 7k) = 2(16k) = 928 \text{ m}$$

$$\text{Cost of fencing} = \text{perimeter} \times \text{cost}$$

$$= 928 \times 72.7 = ₹67465.6$$

Type-12B (Square)

1. The area of a square is 144 cm^2 . What is the length of each of its diagonals?
एक वर्ग का क्षेत्रफल 144 सेमी^2 है। इसके प्रत्येक विकर्ण की लंबाई क्या है?

SSC MTS 2023 (Morning)

- (a) $14\sqrt{2} \text{ cm}$ (b) $6\sqrt{2} \text{ cm}$
(c) $12\sqrt{2} \text{ cm}$ (d) 12 cm

2. If the length of a diagonal of a square is $(a + b)$, then the area of the square is:
यदि एक वर्ग के विकर्ण की लंबाई $(a + b)$ है, तो वर्ग का क्षेत्रफल है:

SSC CGL 13/04/2022 (Morning)

- (a) $a^2 + b^2$ (b) $\frac{1}{2}(a^2 + b^2) + ab$
(c) $a^2 + b^2 + 2ab$ (d) $\frac{1}{2}(a^2 + b^2)$

3. The area of square is $4x^2 - 12x + 9$, which of the following will be the side of the square?
वर्ग का क्षेत्रफल $4x^2 - 12x + 9$ है, निम्न में से कौन वर्ग की भुजा होगी?

SSC CHSL 03/06/2022 (Afternoon)

- (a) $(2x + 3)$ (b) $(2x - 3)$
(c) $(3x - 2)$ (d) $(3x + 2)$

4. Find the cost of paving a square field where diagonal is 10 m at the rate of ₹2.7 per m^2 .
₹2.7 प्रति वर्ग मीटर की दर से 10 मीटर विकर्ण वाले वर्गाकार खेत को पक्का करने की लागत ज्ञात कीजिए।

SSC CGL 23/8/2021 (Afternoon)

- (a) 7:2 (b) 14:11
(c) 7:11 (d) 121:44

14. A square park has area 4356 m^2 . Taking its one round is same as taking one round of another circular park. Find the area of the circular park
एक वर्गाकार पार्क का क्षेत्रफल 4356 वर्ग मीटर है। इसका एक चक्कर लगाना दूसरे वर्तुलाकार पार्क का एक चक्कर लगाने के समान है। वृत्ताकार पार्क का क्षेत्रफल ज्ञात कीजिए

SSC MTS 13/10/2021 (Afternoon)

- (a) 11088 m^2 (b) 5544 m^2
(c) 22176 m^2 (d) 1386 m^2

15. Find the area of shaded region side of the square AECD is 10 cm.

- (a) 155.98 cm^2 (c) 163.85 cm^2
(b) 179.68 cm^2 (d) 145.92 cm^2

6. The length of each side of a square is twice the radius of a circle. If the radius of the circle is 7 cm, then what is the difference between the areas of the square and the circle? [use $\pi = 22/7$]
एक वर्ग की प्रत्येक भुजा की लंबाई एक वृत्त की त्रिज्या की दोगुनी है। यदि वृत्त की त्रिज्या 7 सेमी है, तो वर्ग और वृत्त के क्षेत्रफल में कितना अंतर है? [$\pi = 22/7$ का प्रयोग करें]

SSC MTS 07/07/2022 (Morning)

- (a) 44 cm^2 (b) 46 cm^2
(c) 42 cm^2 (d) 48 cm^2

7. The diagonal of the square is $8\sqrt{2} \text{ cm}$. Find the diagonal of another square whose area is triple that of the first square.

वर्ग का विकर्ण $8\sqrt{2}$ सेमी है। दूसरे वर्ग का विकर्ण ज्ञात कीजिए जिसका क्षेत्रफल पहले वर्ग के क्षेत्रफल का तिगुना है।

SSC CGL 06/12/2022 (4th Shift)

- (a) $8\sqrt{5} \text{ cm}$ (b) $8\sqrt{3} \text{ cm}$
(c) $8\sqrt{2} \text{ cm}$ (d) $8\sqrt{6} \text{ cm}$

8. A square of side p is taken. A rectangle is cut out from this square such that the length of one side of the rectangle is equal to half of the length of one side of the square and the length of another side of the rectangle is equal to $\frac{1}{3}$ of the length of the first side of the rectangle.

SSC MTS 11/10/2021 (Morning)

- (a) 2,500 (c) 87,500
(b) 7,000 (d) 3,500

19. There is a square field whose side is 44 m. A square flower bed is prepared in its centre having a path all round the flower bed. The total cost of laying the flower bed and gravelling the path at Rs.2.75 and Rs.1.50 per square metre respectively, is Rs.4904. Find the width of gravel path.

यहाँ एक वर्ग क्षेत्र जिसकी भुजा 44 मी है। एक वर्गाकार फुलवारी को केन्द्र में इस प्रकार बनाया जाता है कि उसके चारों ओर एक पथ बनाया गया है। फुलवारी लगाने तथा पथ पर रोड़ी लगाने की क्रमशः 2.75 रुपये और 1.50 रुपये की दर पर कुल कीमत 4904 रुपये है। रोड़ी पथ की चौड़ाई क्या है?

- (a) 3 cm (b) 4 cm
(c) 10 cm (d) 2 cm

20. The perimeter of a square is half the perimeter of a rectangle. The perimeter of the square is 40 m. If its breadth is two-thirds of its length, then what is the area of the rectangle?

एक वर्ग का परिमाण एक आयत का परिमाण आधा होता है। वर्ग का परिमाण 40 मीटर है। यदि इसकी चौड़ाई इसकी लंबाई की दो-तिहाई है, तो आयत का क्षेत्रफल कितना है?

SSC CPO 25/11/2020 (Morning)

- (a) 321 (b) 196 (c) 400 (d) 384

21. Given that five concentric squares. If the area of the circle inside the smaller square is 77 sq. units and the distance between the corresponding corners of consecutive squares is 1.5 units. Find the difference in the areas of the outermost and innermost squares.

पांच संकेन्द्रीय वर्ग दिए गए हैं। यदि छोटे वर्ग के अंदर वृत्त का क्षेत्रफल 77 वर्ग इकाई तथा क्रमागत वर्गों के संगत कोनों के बीच की दूरी 1.5 इकाई है। बाह्य तथा आंतरिक वर्गों के क्षेत्रफलों का अन्तर क्या होगा?

- (a) 1254 sq unit (b) 10080 sq unit
(c) 877 sq unit (d) 240 sq unit

22. The diagonal of a square A is $(a + b)$ units. What is the area (in square units) of the square drawn on the diagonal of square B whose area is twice the area of square A?

एक वर्ग A का विकर्ण $(a + b)$ इकाई है। वर्ग B के विकर्ण पर खींचे गए वर्ग का क्षेत्रफल (वर्ग इकाइयों में) क्या है जिसका क्षेत्रफल वर्ग A के क्षेत्रफल का दोगुना है?

SSC CGL 5/03/2020 (Morning)

- (a) $(a + b)^2$ (b) $2(a + b)^2$
(c) $4(a + b)^2$ (d) $8(a + b)^2$

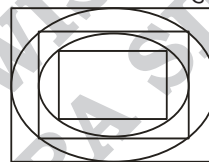
23. The ratio of the areas of two squares is 16:1. Find the ratio between their perimeters.

दो वर्गों के क्षेत्रफल का अनुपात 16:1 है। उनके परिमाणों का अनुपात ज्ञात कीजिए।

SSC CHSL 15/10/2020 (Afternoon)

- (a) 8:1 (b) 3:1 (c) 4:1 (d) 12:1

24. In the given figure, the ratio of the area of the largest square to that of the smallest square is: दी गई आकृति में, सबसे बड़े वर्ग के क्षेत्रफल का सबसे छोटे वर्ग के क्षेत्रफल से अनुपात है:



SSC CHSL 14/10/2020 (Afternoon)

- (a) 4:1 (b) $\sqrt{2}:1$ (c) 3:1 (d) 2:1

Type-12B (Square) ANSWER KEY

1	C	2	B	3	B	4	B	5	D	6	C	7	D	8	C
9	D	10	C	11	C	12	A	13	B	14	B	15	A	16	C
17	C	18	B	19	D	20	D	21	D	22	B	23	C	24	A

Type-12B (Square) Solution

1. Sol. (c)

Area of square = 144

Side of square = $\sqrt{144} = 12$ cm

Diagonal of square = $\sqrt{2} \times 12 = 12\sqrt{2}$ cm

2. Sol. (b)

Length of square

$$= \frac{\text{Diagonal}}{\sqrt{2}} = \frac{(a+b)}{\sqrt{2}}$$

$$\text{So, Area of square} = \left[\frac{(a+b)}{\sqrt{2}} \right]^2$$

$$= \frac{a^2 + b^2 + 2ab}{2} = \frac{1}{2}(a^2 + b^2) + ab$$

3. Sol. (b)

$$\text{Area of square} = 4x^2 - 12x + 9 = (2x)^2 - 2 \times 2x \times$$

$$3 + 3^2 = (2x - 3)^2$$

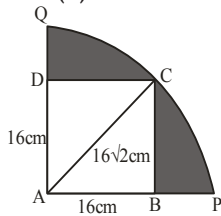
$$\text{Side of the square} = \sqrt{(2x - 3)^2} = 2x - 3$$

4. Sol. (b)

$$\text{Area of square field} = \frac{D^2}{2} = \frac{100}{2} = 50 \text{ m}^2$$

$$\text{Cost of paving} = 50 \text{ m}^2 \times 2.7 = ₹540$$

5. Sol. (d)



$$\text{Area of square} = (\text{Side})^2 = 16^2 = 256 \text{ cm}^2$$

$$\begin{aligned} \text{Diagonal of square} &= \sqrt{2} \times \text{Side} \\ &= 16\sqrt{2} \text{ cm} \end{aligned}$$

Here, diagonal of square is the radius for the quadrant,

$$\begin{aligned} \text{So, area of the quadrant} &= \frac{1}{4} \times \pi r^2 \\ &= \frac{1}{4} \times 3.14 \times 16\sqrt{2} \times 16\sqrt{2} = 401.92 \text{ cm}^2 \end{aligned}$$

Now, Area of shaded portion

$$= \text{Area of quadrant} - \text{area of square}$$

$$\Rightarrow 401.92 \text{ cm}^2 - 256 \text{ cm}^2 = 145.92 \text{ cm}^2$$

6. Sol. (c)

$$\text{Length of each side of a square} = 2 \times 7 = 14 \text{ cm}$$

$$\text{Area of square} = 14^2 = 196 \text{ cm}^2$$

$$\text{Area of circle} = \frac{22}{7} \times 7 \times 7 = 154 \text{ cm}^2$$

So, the difference in area

$$= 196 - 154 = 42 \text{ cm}^2$$

7. Sol. (d)

$$\text{Diagonal of the first square} = 8\sqrt{2}$$

$$\text{Side of the first square} = \frac{8\sqrt{2}}{\sqrt{2}} = 8 \text{ cm}$$

$$\text{Area of the square} = 8 \times 8 = 64 \text{ cm}^2$$

$$\text{Area of the new square} = 64 \times 3 = 192 \text{ cm}^2$$

$$\text{Side of the new square} = \sqrt{192} = 8\sqrt{3} \text{ cm}$$

$$\text{Diagonal of the new square}$$

$$= 8\sqrt{3} \times \sqrt{2} = 8\sqrt{6} \text{ cm}$$

8. Sol. (c)

$$\text{Given length of side of square} = p$$

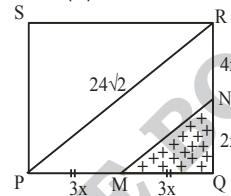
$$\text{So, length of rectangle} = \frac{p}{2}$$

$$\text{Breadth of rectangle} = \frac{p}{6}$$

Now, required area = area of square - area of rectangle

$$= p^2 - \frac{p^2}{12} = \frac{11p^2}{12}$$

9. Sol. (d)



$$\text{Area of } \triangle MQN = \frac{1}{2} \times 2x \times 3x = 48$$

$$3x^2 = 48$$

$$x^2 = 16, x = 4$$

$$PR = 24\sqrt{2} \text{ cm}$$

10. Sol. (c)

For a square $D^2 = 2a^2$ where D is the length of the diagonal and 'a' is the side length of the square

$$\Rightarrow \frac{(7-x)^2}{2} = 2 \times \frac{(5x+1)^2}{4}$$

$$\Rightarrow 49 + x^2 - 14x = 25x^2 + 1 + 10x$$

$$\Rightarrow 24x^2 + 24x - 48 = 0$$

$$\Rightarrow x^2 + x - 2 = 0$$

$$\Rightarrow x = 1, -2$$

$$\text{Side length of the square} = \frac{5+1}{2} = 3$$

$$\text{Area of the square} = (\text{side})^2 = 3^2 = 9$$

11. Sol. (c)

$$\text{Radius} = 5 \text{ cm}$$

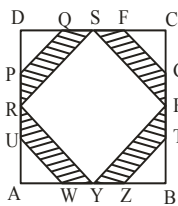
$$\text{Diameter} = \text{diagonal of the square} = 10 \text{ cm}$$

$$\sqrt{2}a = 10 \text{ cm}, a = 5\sqrt{2}$$

$$\text{Area} = (5\sqrt{2})^2 = 50 \text{ cm}^2$$

12. Sol. (a)

$$\begin{aligned} \text{Shaded area} &= (\text{area of } \triangle DRS - \text{area of } \triangle DPQ) + \\ &(\text{area of } \triangle CSH - \text{area of } \triangle CFG) + (\text{area of } \triangle HBY - \\ &\text{area of } \triangle TBZ) + (\text{area of } \triangle RAY - \text{area of } \triangle AWU) \end{aligned}$$



$$\Rightarrow 4 \times (\text{area of } \triangle DRS) - 4 \times (\text{area of } \triangle PDQ)$$

$$\Rightarrow 4 \times \left(\frac{1}{2} \times \text{base} \times \text{height} \right) - 4 \times$$

$$\left(\frac{1}{2} \times \text{base} \times \text{height} \right)$$

$$\Rightarrow 4 \times \left(\frac{1}{2} \times 5 \times 5 \right) - 4 \times \left(\frac{1}{2} \times 3 \times 3 \right)$$

$$\Rightarrow 32 \text{ cm}^2$$

13. Sol. (b)

$$\text{Circumference of the circle} = 2\pi r = 44 \text{ cm}$$

$$\text{Side of the square} = a = \frac{44}{4} = 11 \text{ cm}$$

$$\text{Ratio of area} = \pi r^2 : a^2$$

$$\Rightarrow \frac{22}{7} \times 7 \times 7 : 11 \times 11 = 14 : 11$$

14. Sol. (b)

$$\text{Side of square park} = \sqrt{4356} = 66 \text{ m}$$

$$\text{Perimeter of square park}$$

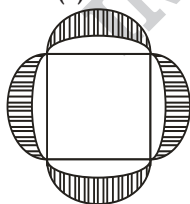
$$= \text{Circumference of circular park}$$

$$4 \times (66) = 2 \times \frac{22}{7} \times r \Rightarrow r = 42 \text{ m}$$

$$\text{So, area of circular park} = \pi r^2$$

$$= \frac{22}{7} \times (42)^2 = 5544 \text{ m}^2$$

15. Sol. (a)



$$\text{Area of shaded region} = \text{Area of square} = 10^2 =$$

$$100 \text{ cm}^2$$

16. Sol. (c)

Let the length of the diagonal of the larger square

be D then,

$$\Rightarrow \frac{D^2}{2} - \frac{(D-8)^2}{2} = 400 \text{ m}^2$$

$$\Rightarrow D^2 - D^2 - 64 + 16D = 800 \text{ m}^2$$

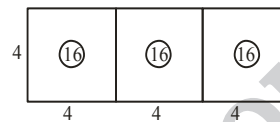
$$\Rightarrow 16D = 864 \Rightarrow D = 54 \text{ m}$$

$$D = \sqrt{2}a \Rightarrow 54 = \sqrt{2}a$$

$$a = 27\sqrt{2} \text{ m}$$

17. Sol. (c)

$$\text{Each side of the square} = \sqrt{16} = 4 \text{ cm}$$



Clearly, the breadth of the rectangle is 4 cm while

the length of the rectangle is $3 \times 4 = 12 \text{ cm}$

$$\text{Perimeter of the rectangle} = 2(l + b) = 2(4 + 12) =$$

$$32 \text{ cm.}$$

18. Sol. (b)

Let the side of square field = x

$$\text{Area of square field}$$

$$= \frac{130000}{52} = 2500 \text{ m}^2$$

$$x^2 = 2500 \Rightarrow x = 50 \text{ m}$$

$$\text{Cost of fencing its boundary} = 4x \times 35$$

$$= 4(50) \times 35 = ₹7,000$$

19. Sol. (d)



Let the width of gravel path = x m

$$\text{Each side of flower bed} = (44 - 2x)$$

$$\text{Area of square field} = 44 \times 44 = 1936 \text{ m}^2$$

$$\text{Area of flower bed} = (44 - 2x)^2 \text{ m}^2$$

$$\text{Area of gravel bed} = \text{Area of field} - \text{Area of flower bed}$$

$$= 1936 - (44 - 2x)^2$$

$$= (176x - 4x^2) \text{ m}^2$$

$$\text{Cost of laying the flower bed} = \text{Area} \times \text{Rate}$$

$$\text{per sq. mt.} = (44 - 2x)^2 \times \frac{275}{100} = 11(22 - x)^2$$

$$\text{Cost of gravelling path} = (176x - 4x^2) \times \frac{150}{100}$$

$$= 6(44 - x^2)$$

$$11(22 - x^2) + 6(44x - x^2) = 4904$$

$$x^2 - 44x + 84 = 0$$

$$(x - 2)(x - 42) = 0$$

$$x = 2, x = 42$$

Width of gravel path = 2 m

20. Sol. (d)

Perimeter of square = 40 m

Perimeter of rectangle = $2 \times 40 = 80$ m

Let length of rectangle = $3x$

Breadth of rectangle = $2x$

Total perimeter of rectangle

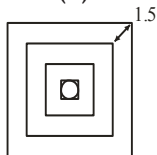
$$= 2(3x + 2x) \Rightarrow 10x = 80 \Rightarrow x = 8$$

length of rectangle = 24 m

Breadth of rectangle = 16 m

$$\text{area of rectangle} = 24 \times 16 = 384 \text{ m}^2$$

21. Sol. (d)



Given, 5 concentric squares

Let radius of circle be r

Diameter of circle = side of innermost square

$$\pi r^2 = 77$$

$$\frac{22}{7} \times r^2 = 77, r = \frac{7}{\sqrt{2}}$$

Diagonal of square = 14 units

$$\text{Diagonal of fifth square} = 14 + 2 \times 4 \times 1.5$$

$$= 14 + 12 = 26$$

$$\text{Side of fifth square} = \frac{\text{Diagonal}}{\sqrt{2}} = \frac{26}{\sqrt{2}}$$

$$\text{Diagonal of s.q B} = \sqrt{2}x \times \sqrt{2} = 2x \text{ unit}$$

$$\text{Area of fifth square} = (\text{side})^2 = \left(\frac{26}{\sqrt{2}}\right)^2$$

$$= 338 \text{ sq. units}$$

$$\text{Area of first square} = (\text{side})^2 = \left(\frac{\text{Diagonal}}{\sqrt{2}}\right)^2$$

$$= \left(\frac{14}{\sqrt{2}}\right)^2 = 98 \text{ sq. units}$$

$$\text{Difference} = (338 - 98) = 240 \text{ sq. units}$$

22. Sol. (b)

Let the side of square A = x

$$\text{Diagonal}_A = \sqrt{2}x = (a + b) \text{ units}$$

$$\text{Side of square B} = \sqrt{2}x$$

$$\text{Area of square on diagonal of s.q. B} = (2x)^2$$

$$= 4x^2$$

$$= 4 \times \frac{(a+b)^2}{2}$$

$$= 2(a + b)^2 \text{ s.q. units}$$

23. Sol. (c)

$$\text{Side of the squares} = \sqrt{16} : \sqrt{1} = 4 : 1$$

$$\text{Ratio of perimeter will be} = 4 : 1$$

24. Sol. (a)

Let side of smallest square = 2 unit Then, diameter of circle in which smallest square is inscribed will equal to diagonal of square = $2\sqrt{2}$ unit and this diameter is equal to the side of the middle square.

Now, diameter of outer circle = 4 unit

So side of the largest square = 4 unit

Therefore, the ratio of the area of the largest square to that of the smallest square is 4: 1.

Type-12C (Parallelogram)

1. The base of a parallelogram is twice as long as its corresponding height. If the area of the parallelogram is 144 cm^2 , find the mentioned height (cm)

एक समांतर चतुर्भुज का आधार उसकी संगत ऊंचाई से दोगुना लंबा होता है। यदि समांतर चतुर्भुज का क्षेत्रफल 144 cm^2 है, तो उल्लिखित ऊंचाई (सेमी) ज्ञात कीजिए।

SSC CHSL 2023 (Afternoon)

- (a) $2\sqrt{2}$ (b) $6\sqrt{2}$ (c) $3\sqrt{2}$ (d) $8\sqrt{2}$

2. Find the area of the given quadrilateral.

एक समांतर चतुर्भुज की संलग्न भुजाओं की लंबाई 36 सेमी और 27 सेमी है। यदि छोटी भुजाओं के बीच की दूरी 12 सेमी है, तो बड़ी भुजाओं के बीच की दूरी है:

- (a) 10 cm (b) 12 cm (c) 16 cm (d) 9 cm

13. D_1 and D_2 are diagonals of a parallelogram whose one of the angle measures 135° . if $D_1 = 12 \text{ m}$, $D_2 = 14 \text{ m}$ and the sum of two consecutive sides is 20 m, then find the area of the parallelogram.

D_1 और D_2 एक समांतर चतुर्भुज के विकर्ण हैं जिसका एक कोण 135° मापता है। यदि $D_1 = 12$ मीटर, $D_2 = 14$ मीटर और दो क्रमागत भुजाओं का योग 20 मीटर है, तो समांतर चतुर्भुज का क्षेत्रफल ज्ञात कीजिए।

- (a) $\frac{115}{2} \text{ m}^2$ (b) 115 m^2 (c) $115\sqrt{2} \text{ m}^2$ (d) $\frac{115}{\sqrt{2}} \text{ m}^2$

14. ABCD is a parallelogram with $\angle ABC = 60^\circ$. If the longer diagonal is of length 7 cm and the area of the parallelogram is $\frac{15\sqrt{3}}{2} \text{ cm}^2$, then the perimeter of the parallelogram (in cm) is :

ABCD एक समांतर चतुर्भुज है जिसमें $\angle ABC = 60^\circ$ है। यदि लंबे विकर्ण की लम्बाई 7 सेमी और समांतर चतुर्भुज का क्षेत्रफल $\frac{15\sqrt{3}}{2}$ वर्ग सेमी, तो समांतर चतुर्भुज का परिमाप क्या होगा (सेमी में)

- (a) 14 cm (b) 15 cm (c) 16 cm (d) 18 cm

15. All the four sides of parallelogram are of equal length. The diagonal are in the ratio 1 : 2. If the sum of the lengths of the diagonals is 12 cm, then what is the area of the parallelogram?

समांतर चतुर्भुज की चारों भुजाएँ समान लंबाई की हैं। विकर्णों का अनुपात 1 : 2 है। यदि विकर्णों की लंबाई का योग 12 सेमी है, तो समांतर चतुर्भुज का क्षेत्रफल क्या है?

5. The area of a parallelogram ABCD is 300 cm^2 . The distance between AB and CD is 20 cm and the distance between BC and AD is 30 cm. What is the perimeter (in cm) of the parallelogram?

एक समांतर चतुर्भुज ABCD का क्षेत्रफल 300 वर्ग सेमी है। AB और CD के बीच की दूरी 20 सेमी और BC और AD के बीच की दूरी 30 सेमी है। समांतर चतुर्भुज का परिमाप (सेमी में) क्या है?

SSC MTS 5/10/2021 (Evening)

- (a) 60 (b) 50 (c) 40 (d) 100

PQRS एक समांतर चतुर्भुज है और इसका क्षेत्रफल 300 वर्ग सेमी है। भुजा PQ को X तक इस प्रकार बढ़ाया गया है कि $PQ = QX$ है। यदि XS, QR को Y पर प्रतिच्छेद करता है, तो त्रिभुज SYR का क्षेत्रफल (cm^2 में) क्या है?

- (a) 75 (b) 50 (c) 120 (d) 100

18. ABCD is a parallelogram in which diagonals AC and BD intersect at O. If E, F, G and H are the mid-points of AO, DO, CO and BO respectively, then the ratio of the perimeter of the quadrilateral EFGH to the perimeter of parallelogram ABCD is

ABCD एक समांतर चतुर्भुज है जिसमें विकर्ण AC और BD परस्पर बिंदु O पर प्रतिच्छेद करते हैं। यदि E, F, G और H क्रमशः AO, DO, CO और BO के मध्य-बिंदु हैं, तो चतुर्भुज EFGH के परिमाप का समांतर चतुर्भुज ABCD के परिमाप का अनुपात है

- (a) 1:4 (b) 2:3 (c) 1:2 (d) 1:3

19. A diagonal of a quadrilateral is 40 cm. The length of the perpendicular to the opposite ends is 7.5 cm and 8.6 cm. What is the area of quadrilateral?

एक चतुर्भुज का एक विकर्ण 40 सेमी है। विपरीत सिरों के लंब की लंबाई 7.5 सेमी और 8.6 सेमी है। चतुर्भुज का क्षेत्रफल कितना होता है?

SSC CPO 14/03/2019 (Evening)

- (a) 434 (b) 322 (c) 368 (d) 28

20. Let S be the parallelogram obtained by joining the mid-points of the parallelogram T. Consider the following statements:

मान लीजिए कि S, समांतर चतुर्भुज T के मध्य-बिंदुओं को मिलाकर प्राप्त किया गया समांतर चतुर्भुज है। निम्नलिखित कथनों पर विचार करें:

- The ratio of area of T to that of S is 2 : 1
T और S के क्षेत्रफल का अनुपात 2:1 है।
- The perimeter of S is half of the sum of diagonals of T.
S का परिमाप T के विकर्णों के योग का आधा है।

Which of the above staff of the sum of diagonals of T.

उपरोक्त में से कौन सा कर्मचारी T के विकर्णों के योग का है।

[CDS-2018-II]

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Type-12C (Parallelogram) ANSWER KEY															
1	B	2	D	3	B	4	B	5	B	6	A	7	D	8	B
9	B	10	C	11	A	12	D	13	C	14	C	15	C	16	D
17	A	18	C	19	B	20	A								

Type-12C (Parallelogram) Solution

1. **Sol. (b)**

Let the height = x , base = $2x$

Area of parallelogram = base $\times$ height

$$144 = 2x \times x \Rightarrow 72 = x^2 \Rightarrow x = 6\sqrt{2}$$

2. **Sol. (d)**

Area of given quadrilateral = Area ($\triangle DCA$) +

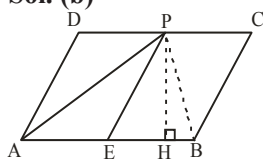
Area ($\triangle BAC$)

$$\Rightarrow \frac{1}{2} \times AC[DE + BF]$$

$$\Rightarrow \frac{1}{2} \times 8[2 + 4]$$

$$\Rightarrow 24 \text{ cm}^2.$$

3. **Sol. (b)**



Join PB , and let PH be the altitudes on AB

$$\text{area } (\triangle APE) = \frac{1}{2} AE \times PH \quad \dots (i)$$

$$\text{ar}(\square ABCD) = AB \times PH \quad \dots (ii)$$

$$\Rightarrow \frac{37}{\text{ar}(\square ABCD)} = \frac{\frac{1}{2} \left(\frac{AB}{2} \right) \times PH}{AB \times PH} \quad (\because AE = EB)$$

$$\Rightarrow \text{ar}(ABCD) = 4 \times 37 \text{ m}^2 = 148 \text{ m}^2$$

4. **Sol. (b)**

Let side length are $5k$ and $7k$

Then area of parallelogram = side $\times$ height

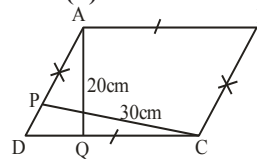
$$\Rightarrow 1715 = 7k \times 5 \Rightarrow k = 49$$

Area of parallelogram = side $\times$ height

$$\Rightarrow 1715 = 5k \times h \Rightarrow 1715 = 5 \times 49 \times h$$

$$\Rightarrow h = 7 \text{ m}$$

5. **Sol. (b)**



According to question,

Area of parallelogram = Base $\times$ Altitude

For base AD ,

$$\Rightarrow AD = 10 \text{ cm,}$$

$$BC = AD = 10 \text{ cm}$$

Similarly, for base CD,

$$300 = CD \times AQ \Rightarrow 300 = CD \times 20$$

$$\Rightarrow CD = 15 \text{ cm, } AB = CD = 15 \text{ cm}$$

$$\text{So, perimeter} = AB + BC + CD + AD$$

$$= 10 + 15 + 10 + 15 = 50 \text{ cm}$$

6. Sol. (a)

Short-Trick:

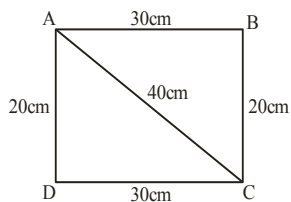
$$D_1^2 + D_2^2 = 2(S_1^2 + S_2^2)$$

$$= 2(9 + 100) = 218$$

7. Sol. (d)

Let ABCD is a || gm area of $\square ABCD = 2 \times \text{area}$

of $\triangle ADC$ For area of ($\triangle ADC$)



$$a = 20 \text{ cm, } b = 30 \text{ cm, } c = 40 \text{ cm}$$

$$S = \frac{a+b+c}{2} = \frac{20+30+40}{2} = 45 \text{ cm}$$

area ($\triangle ADC$)

$$= \sqrt{S(S-a)(S-b)(S-c)}$$

$$= \sqrt{45(45-20)(45-30)(45-40)}$$

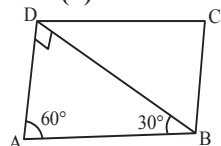
$$= \sqrt{45 \times 25 \times 15 \times 5}$$

$$= 75\sqrt{15} \text{ cm}^2$$

$$\text{ar}(\square ABCD) = 2 \times 75\sqrt{15}$$

$$= 150\sqrt{15} \text{ cm}^2$$

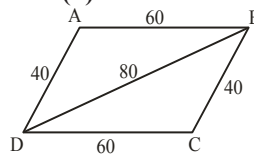
8. Sol. (b)



$$\cos 30^\circ = \frac{BD}{AB} = \frac{\sqrt{3}x}{2x} = \frac{\sqrt{3}}{2}$$

$$BD^2 = \frac{3}{4} AB^2$$

9. Sol. (b)



$$S(\triangle ABD) = \frac{60+80+40}{2} = 90$$

$$\text{ar}(\triangle ABD)$$

$$= \sqrt{90(90-60)(90-40)(90-80)}$$

$$= \sqrt{90 \times 30 \times 50}$$

$$= 300\sqrt{15} \text{ m}^2$$

$$\text{ar}(\square ABCD) = 2 \times \text{ar}(\triangle ABD)$$

$$= 600\sqrt{15} \text{ m}^2$$

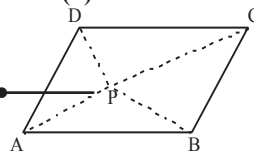
10. Sol. (c)

Area of parallelogram

$$= \text{Base} \times \text{Height}$$

$$= 8.06 \times 2.08 = 16.76 \text{ cm}^2$$

11. Sol. (a)



For the given parallelogram

$$\text{ar}(\triangle APB) + \text{ar}(\triangle CPD) =$$

$$\text{ar}(\triangle APB) + \text{ar}(\triangle BPC)$$

$$\Rightarrow 17 \text{ m}^2 + 29 \text{ m}^2$$

$$\text{ar}(\triangle APD) + 19 \text{ m}^2$$

$$\Rightarrow \text{Area}(\triangle APD) = 27 \text{ m}^2$$

12. Sol. (d)

Area of parallelogram = base $\times$ height

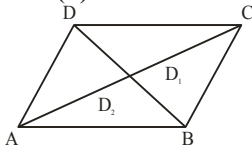
$$= 27 \times 12 = 324 \text{ sq. cm.}$$

Again,

$$324 = 36 \times h$$

$$\Rightarrow h = \frac{324}{36} = 9 \text{ cm}$$

13. Sol. (d)



For the given parallelogram

$$AC^2 + BD^2 = 2(AB^2 + BC^2)$$

$$AB^2 + BC^2 = \frac{14^2 + 12^2}{2}$$

$$AB^2 + BC^2 = 170$$

$$AB + BC = 20 \text{ (given)}$$

On squaring both sides

$$AB^2 + BC^2 + 2AB \times BC = 400$$

$$2AB \times BC = 230$$

$$AB \times BC = 115$$

$$\text{Area of parallelogram} = AB \times BC \times \sin \theta$$

$$= 115 \times \sin 135^\circ = \frac{115}{\sqrt{2}} \text{ m}^2$$

14. Sol. (c)

Let $AB = a$, $AD = b$

$$\text{Area of parallelogram} = ab \sin 60^\circ$$

$$= \frac{ab\sqrt{3}}{2} = \frac{15\sqrt{3}}{2} \Rightarrow ab = 15$$

by cosine rule,

$$\cos 120^\circ = \frac{a^2 + b^2 - 49}{2ab}$$

$$\frac{-1}{2} = \frac{a^2 + b^2 - 49}{2 \times 15}$$

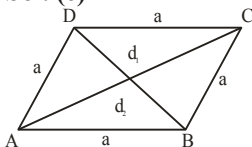
$$a^2 + b^2 = 34$$

$$ab = 15$$

$$a = 3 \text{ or } 5, b = 5 \text{ or } 3$$

$$\text{Perimeter} = 2(a + b) = 2(3 + 5) = 16 \text{ cm.}$$

15. Sol. (c)



All sides are same for the parallelogram

$\therefore$ It is a rhombus

$$\text{Now } d_1 + d_2 = 12 \text{ cm and } d_2 = 2 d_1$$

$$\Rightarrow d_1 = 4 \text{ cm and } d_2 = 8 \text{ cm}$$

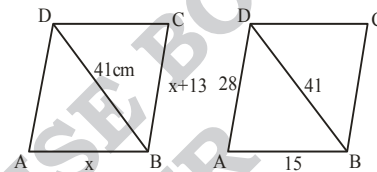
$$\text{Area} = \frac{1}{2} d_1 d_2 = \frac{1}{2} \times 4 \times 8 = 16 \text{ cm}^2$$

16. Sol. (d)

Given,

Perimeter of parallelogram = $86x$ and length of one side is 13 m. more than other side

Length of diagonal = 41 m.



Let length of one side be x

$$\text{Perimeter} = 2(l + b) = 2(x + x + 13) = 86$$

$$2x = 43 - 13$$

$$\Rightarrow 2x = 30$$

$$x = 15$$

Now,

Area of parallelogram = area of 2 triangles formed by drawing diagonal

$$\text{Let, Semi perimeter (S)} = \frac{a+b+c}{2}$$

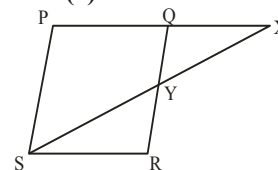
$$= \frac{28+15+41}{2} = 42 \text{ cm}$$

$$\Delta = \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \sqrt{42 \times (42 - 41) \times (42 - 15)(42 - 28)} = 126 \text{ m}^2$$

$$\text{Area of parallelogram} = 2 \times 126 = 252 \text{ m}^2$$

17. Sol. (a)



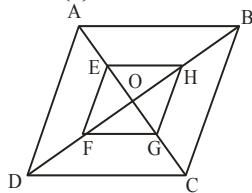
$$\text{Area of parallelogram PQRS} = 300$$

Area of triangle SRQ = 150. If PQ is equal to QX then line Passing from Y i.e SX always divide QR is equal Parts.

So, Area of $\triangle SRY$ is half of Area of $\triangle SRQ$

$$\text{Area of } \triangle SRY \text{ is } \frac{150}{2} = 75 \text{ cm}^2$$

18. Sol. (c)



In $\triangle OBC$,

H and G are the midpoints of OB and OC

$$\therefore HG = \frac{1}{2}BC \text{ similarly, } FG = \frac{1}{2}CD$$

$$EF = \frac{1}{2}AD, \text{ and } HE = \frac{1}{2}AB$$

on adding,

$$HE + HG + FG + EF$$

$$= \frac{1}{2}(AB + BC + CD + AD)$$

Perimeter of EFGH.

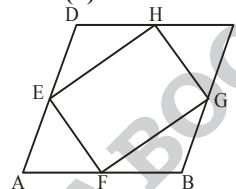
$$= \frac{1}{2} \times \text{perimeter of } ABCD$$

$$\frac{\text{perimeter of } EFGH}{\text{perimeter of } ABCD} = \frac{1}{2}$$

19. Sol. (b)

$$\text{Area} = 20 \times (7.5 + 8.6) = 322 \text{ cm}^2$$

20. Sol. (a)



By symmetry area of $\triangle EHD = \triangle BFG = \triangle$

$$AEF = \triangle CHG$$

$$= \frac{1}{8} \text{ of area of Parallelogram } ABCD.$$

$$\therefore \text{Area of } EFGH = \frac{1}{2} \text{ of area of } ABCD.$$

$$\text{Ratio} = \frac{\text{Area of } ABCD}{\text{Area of } EFGH} = \frac{2}{1}$$

But, Perimeter of EFGH = $\frac{1}{2} \times$ (Perimeter of ABCD)

Type-12D (Trapezium)

1. The parallel sides of an isosceles trapezium are 20 cm and 34 cm. If the one of the nonparallel sides has length 25 cm, what is the area (in cm^2) of the trapezium?

एक समद्विबाहु समलंब चतुर्भुज की समानांतर भुजाएं 20 cm और 34 cm हैं। यदि गैर-समानांतर भुजाओं में से एक की लंबाई 25 cm है, तो समलंब चतुर्भुज का क्षेत्रफल (cm^2 में) ज्ञात करें।

**DP Head Constable 2023
(Shift- 01)**

- (a) 729 (b) 675 (c) 648 (d) 596

2. Find the area of a trapezium whose parallel sides are of length 15 cm and 20 cm, respectively, and whose distance between the parallel sides is 12 cm. एक समलंब का क्षेत्रफल ज्ञात कीजिए जिसकी समानांतर भुजाओं की लंबाई क्रमशः 15 सेमी और 20 सेमी है, और जिसकी समानांतर भुजाओं के बीच की दूरी 12 सेमी है।

SSC MTS 06/07/2022 (Evening)

- (a) 280 cm^2 (b) 210 cm^2
(c) 360 cm^2 (d) 120 cm^2

3. ABCD is a trapezium in which AB is parallel to DC. Let E and F be the midpoints on AD and BC respectively. If $EF = 10 \text{ cm}$ and $AB - DC = 4 \text{ cm}$, then, what is the value of $AB \times DC$?

ABCD एक समलंब है जिसमें AB, DC के समांतर हैं। माना E और F क्रमशः AD और BC के मध्य बिंदु हैं। यदि $EF = 10$ सेमी और $AB - DC = 4$ सेमी है, तो $AB \times DC$ का मान क्या है?

[CDS-2022-I]

- (a) 84 square cm (b) 96 square cm
(c) 100 square cm (d) 108 square cm

4. Find the area of a trapezium having height 7 cm and the length of parallel sides 8 cm and 12 cm. एक समलंब का क्षेत्रफल ज्ञात कीजिए जिसकी ऊँचाई 7 सेमी और समानांतर भुजाओं की लंबाई 8 सेमी और 12 सेमी है।

Graduate Level 03/08/2022 (Shift - 3)

- (a) 100 cm^2 (b) 35 cm^2
(c) 70 cm^2 (d) 140 cm^2

5. The area of a trapezium shaped field is 1785 square feet. The distance between the two parallel sides is 35 feet and one of the parallel sides is 42 feet long. What is the length of the other parallel side?

एक समलंब आकार के मैदान का क्षेत्रफल 1785 वर्ग फुट है। दो समानांतर भुजाओं के बीच की दूरी 35 फीट है और समानांतर भुजाओं में से एक की लंबाई 42 फीट है। दूसरी समांतर भुजा की लंबाई क्या है?

SSC CPO 11/11/2022 (Evening)

- (a) 60ft (b) 35ft (c) 40ft (d) 65ft

6. ABCD is a trapezium with $AB \parallel CD$, E and F midpoints of AD and BC respectively if the length of $EF = 17 \text{ m}$ and the distance between AB and CD is 19 m, then find the area of trapezium ABCD.

ABCD एक ट्रैपेज़ियम है जिसमें $AB \parallel CD$, E और F क्रमशः AD और BC के मध्य बिंदु हैं यदि $EF = 17$ मीटर की लंबाई और AB और CD के बीच की दूरी 19 मीटर है, तो ट्रैपेज़ियम ABCD का क्षेत्रफल पाएं।

- (a) 233 m^2 (b) 323 m^2
(c) 332 m^2 (d) 232 m^2

7. The lengths of two parallel sides of a trapezium are 6 cm and 8 cm. If the height of the trapezium be 4 cm, then its area is

एक समलंब की दो समानांतर भुजाओं की लंबाई 6 सेमी और 8 सेमी है। यदि समलंब की ऊँचाई 4 सेमी हो, तो उसका क्षेत्रफल है

- (a) 28 cm^2 (b) 56 cm^2
(c) 30 cm^2 (d) 36 cm^2

8. In trapezium ABCD, $AB \parallel DC$, $AB = 9 \text{ cm}$, $DC = 15 \text{ cm}$ and the distance between AB and DC is 4 cm. F and G are the mid-points of AD and BC, respectively. DA and CB are produced to meet at point E. What is the area (in cm^2) of $\triangle EFG$?

समलंब ABCD में, $AB \parallel DC$, $AB = 9 \text{ cm}$ और $DC = 15 \text{ cm}$ है तथा AB और DC के बीच की दूरी 4 cm है। F और G क्रमशः AD और BC के मध्य बिंदु हैं। DA और CB को आगे बढ़ाया जाता है जो E मिलती हैं। $\triangle EFG$ का क्षेत्रफल (cm^2 में) क्या होगा?

ICAR Assistant 29/07/2022 (Shift-03)

- (a) 45 (b) 48 (c) 40 (d) 36

9. The parallel sides of a trapezium are in a ratio 2:3 and their shortest distance is 12 cm. If the area of the trapezium is 480 sq. cm., the longer of the parallel sides is of length:

एक समलम्ब की समानांतर भुजाएँ 2:3 के अनुपात में हैं और उनकी न्यूनतम दूरी 12 सेमी है। यदि समलम्ब का क्षेत्रफल 480 वर्ग मीटर है। सेमी, समानांतर भुजाओं की लंबाई लंबाई की है:

- (a) 56 cm (b) 36 cm (c) 42 cm (d) 48 cm

10. The area of a trapezium shaped field is 1785 square feet. The distance between the two parallel sides is 35 feet and one of the parallel sides is 42 feet long. What is the length of the other parallel side?

एक समलंब आकार के मैदान का क्षेत्रफल 1785 वर्ग फुट है। दो समानांतर भुजाओं के बीच की दूरी 35 फीट है और समानांतर भुजाओं में से एक की लंबाई 42 फीट है। दूसरी समांतर भुजा की लंबाई क्या है?

SSC MTS 18/07/2022 (Afternoon)

- (a) 60 feet (b) 35 feet
(c) 65 feet (d) 40 feet

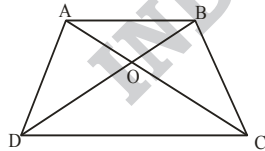
11. ABCD is an isosceles trapezium with $AB \parallel CD$. E and F are midpoints of AD and BC respectively if the length of $EF = 12$ cm and distance between AB and CD is 5 cm, then find the length of diagonal of ABCD.

ABCD एक समद्विबाहु समलंब है जिसमें $AB \parallel CD$ है। E और F क्रमशः AD और BC के मध्य बिंदु हैं यदि EF की लंबाई = 12 सेमी और AB और CD के बीच की दूरी 5 सेमी है, तो ABCD के विकर्ण की लंबाई ज्ञात कीजिए।

- (a) 12 cm (b) 13 cm (c) 17 cm (d) 15 cm

12. In the given figure, if $AB \parallel CD$, $AO = 4$ cm; $OC = (4x - 2)$ cm; $OD = (2x + 4)$ cm; $OB = (x + 1)$ cm, then the value of x is:

दी गई आकृति में, यदि $AB \parallel CD$, $AO = 4$ cm; $OC = (4x - 2)$ cm; $OD = (2x + 4)$ cm; $OB = (x + 1)$ cm हैं, तो x का मान ज्ञात कीजिए।



DP Head Constable 13/10/2022 (Shift- 03)

- (a) 0.5 (c) 1 (b) 2 (d) 3

13. The area of a field in the shape of a trapezium measure 1440 m^2 . The perpendicular distance between its parallel sides is 24 m. If the ratio of the parallel sides is 5:3, the length of the longer parallel side is:

समलंब के आकार के एक खेत का क्षेत्रफल 1440 वर्ग मीटर है। इसकी समांतर भुजाओं के बीच लम्बवत् दूरी 24 मीटर है। यदि समानांतर भुजाओं का अनुपात 5:3 है, तो लंबी समानांतर भुजा की लंबाई है:

- (a) 75 m (b) 45 m (c) 120 m (d) 60 m

14. ABCD is a trapezium with $AB \parallel CD$, $\angle DAB = 45^\circ$, $\angle CBA = 60^\circ$, $CB = 4$ cm and $DC = 5$ cm. find the area of trapezium ABCD.

ABCD एक समलंब है जिसमें $AB \parallel CD$, $\angle DAB = 45^\circ$, $\angle CBA = 60^\circ$, $CB = 4$ सेमी और $DC = 5$ सेमी है। समलंब ABCD का क्षेत्रफल ज्ञात कीजिए।

- (a) $(3 + 6\sqrt{3})\text{cm}^2$ (b) $(12 + 6\sqrt{3})\text{cm}^2$
(c) $(4 + 8\sqrt{3})\text{cm}^2$ (d) $(6 + 12\sqrt{3})\text{cm}^2$

15. The area of trapezium, whose parallel sides are 25 cm and 19 cm long, is 330 cm^2 . The distance between the sides (in cm) is:

ट्रेपेज़ियम का क्षेत्रफल, जिसकी समानांतर भुजाएँ 25 सेमी और 19 सेमी लंबी हैं, 330 सेमी² है। भुजाओं के बीच की दूरी (सेमी में) है:

SSC MTS 02/11/2021 (Afternoon)

- (a) 10 (b) 12 (c) 30 (d) 15

16. In a trapezium, one diagonal divides the other in the ratio 2:9. If the length of the larger of the two parallel sides is 45 cm, then what is the length (in cm) of the other side?

एक समलंब में, एक विकर्ण दूसरे को 2:9 के अनुपात में विभाजित करता है। यदि दो समांतर भुजाओं में से बड़ी की लंबाई 45 सेमी है, तो दूसरी भुजा की लंबाई (सेमी में) क्या है?

- (a) 10 (b) 5 (c) 18 (d) 14

17. The two parallel sides of a trapezium are 27 cm and 13 cm respectively. If the height of the trapezium is 8 cm, then what is its area in m^2 ?

एक समलम्ब की दो समानांतर भुजाएँ क्रमशः 27 सेमी और 13 सेमी हैं। यदि समलम्ब की ऊँचाई 8 सेमी है, तो इसका क्षेत्रफल m^2 में क्या है?

SSC CPO 9/12/19 (Morning)

- (a) 0.016 (c) 0.056 (b) 0.032 (d) 0.32

18. The length of the parallel side of a trapezium are 51 cm and 21 cm and that of each of the other two side is 39 cm. What is the area of trapezium?

एक समलम्ब चतुर्भुज की भुजाएँ जो सामानांतर हैं की लम्बाई 51 सेमी और 21 सेमी है तथा बड़ी दो भुजाओं में प्रत्येक की लम्बाई 39 सेमी है तो समलम्ब चतुर्भुज का क्षेत्रफल क्या है?

- (a) 452 (b) 1206 (c) 1296 (d) 1260

19. ABCD is a quadrilateral with $AC = 29$ cm, and the lengths of perpendiculars from B and D on AC are 13 cm and 17 cm respectively, then the area of ABCD is

ABCD एक चतुर्भुज है जिसमें $AC = 29$ सेमी है, और B और D से AC पर डाले गए लंबों की लंबाई क्रमशः 13 सेमी और 17 सेमी है, तो ABCD का क्षेत्रफल है

- (a) 534 cm^2 (b) 453 cm^2
(c) 435 cm^2 (d) 543 cm^2
20. A field is in the shape of a trapezium whose parallel sides are 200 m and 400 m long, whereas each of the other two sides is 260 m long. what is the area (in m^2) of the field?
एक खेत समलंब के आकार का है जिसकी समानांतर भुजाएँ 200 मीटर और 400 मीटर लंबी हैं, जबकि अन्य दो भुजाएँ 260 मीटर लंबी हैं। मैदान का क्षेत्रफल (मीटर² में) क्या है?
SSC CPO 11/12/19 (Morning)
- (a) 48000 (b) 52000
(c) 72000 (d) 60000
21. ABCD is a trapezium, where AB is parallel to DC if $AB = 4 \text{ cm}$, $BC = 3 \text{ cm}$, $CD = 7 \text{ cm}$ and $DA = 2 \text{ cm}$, then what is the area of trapezium?
ABCD एक समलम्ब चतुर्भुज है जहाँ AB, DC के समान्तर है यदि $AB = 4$ सेमी, $BC = 3$ सेमी $CD = 7$ सेमी और $DA = 2$ सेमी है तब समलम्ब चतुर्भुज का क्षेत्रफल क्या है?
(a) $\frac{22\sqrt{2}}{3} \text{ cm}^2$ (b) $22\sqrt{\frac{3}{2}} \text{ cm}^2$
(c) $22\sqrt{3} \text{ cm}^2$ (d) $\frac{22\sqrt{3}}{2} \text{ cm}^2$
22. Consider a trapezium ABCD, in which AB is parallel to CD and AD is perpendicular to AB. If the trapezium has an incircle which touches AB at E and CD at F, where $EB = 25 \text{ cm}$ and $FC = 16 \text{ cm}$, then what is the diameter of the circle?
एक समलंब ABCD पर विचार करें, जिसमें AB, CD के समांतर है और AD, AB के लंबवत है। यदि ट्रेपेज़ियम में एक अंतःवृत्त है जो AB को E पर और CD को F पर स्पर्श करता है, जहाँ $EB = 25$ सेमी और $FC = 16$ सेमी है, तो वृत्त का व्यास क्या है?
[CDS-2019-II]
- (a) 16 cm (c) 36 cm (b) 25 cm (d) 40 cm

23. The sides AD, BC of a trapezium ABCD are parallel and the diagonals AC and BD meet at O. If the area of triangle AOB is 3 cm^2 and the area of triangle BDC is 8 cm^2 , then what is the area of triangle AOD?

एक समलंब ABCD की भुजाएँ AD, BC समानांतर हैं और विकर्ण AC और BD O पर मिलते हैं। यदि त्रिभुज AOB का क्षेत्रफल 3 cm^2 और त्रिभुज BDC का क्षेत्रफल 8 cm^2 है, तो त्रिभुज AOD का क्षेत्रफल क्या है?

[CDS-2019-II]

- (a) 8 cm^2 (b) 5 cm^2
(c) 3.6 cm^2 (d) 1.8 cm^2
24. ABCD is an isosceles trapezium with $AB \parallel CD$ if $AB:BC:CD = 5:4:3$ and $AC = 124 \text{ cm}$, then find the area of the trapezium.
ABCD एक समद्विबाहु समलंब है, जिसमें $AB \parallel CD$ है यदि $AB:BC:CD = 5:4:3$ और $AC = 124$ सेमी है, तो समलम्ब का क्षेत्रफल ज्ञात कीजिए।
(a) $1849\sqrt{15} \text{ cm}^2$ (b) $1894\sqrt{15} \text{ cm}^2$
(c) $1948\sqrt{15} \text{ cm}^2$ (d) $1984\sqrt{15} \text{ cm}^2$
25. The parallel sides of a trapezium are 20 cm and 10 cm and its non-parallel sides are equal to each other. If its area is 180 cm^2 , then what is the length (in cm) of each non parallel side?
एक समलम्ब की समानांतर भुजाएँ 20 सेमी और 10 सेमी हैं और इसकी असमानांतर भुजाएँ एक दूसरे के बराबर हैं। यदि इसका क्षेत्रफल 180 cm^2 है, तो प्रत्येक असमानांतर भुजा की लंबाई (सेमी में) क्या है?

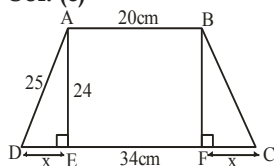
SSC CHSL 4/07/2019 (Morning)

- (a) 11 (b) 13 (c) 12 (d) 15

Type-12d (Trapezium) ANSWER KEY															
1	C	2	B	3	B	4	C	5	A	6	B	7	A	8	C
9	D	10	A	11	B	12	D	13	A	14	D	15	D	16	A
17	A	18	C	19	C	20	C	21	A	22	D	23	D	24	D
25	B														

Type-12D (Trapezium) Solution

1. Sol. (c)



$$\Rightarrow 2x + 20 = 34$$

$$\Rightarrow 2x = 14 \Rightarrow x = 7$$

$\Rightarrow$ In $\triangle AED$

$$\Rightarrow (25)^2 = (AE)^2 + (x)^2$$

$$\Rightarrow 625 - 49 = (AE)^2$$

$$\Rightarrow 576 = (AE)^2$$

$$\Rightarrow 24 \text{ cm} = AE$$

Smart Approach:-

You can find directly 'AE' by the triplet (7,24,25)

$$\Rightarrow \text{Area of trapezium} \Rightarrow \frac{1}{2} \times AE(AB + DC)$$

$$\Rightarrow \frac{1}{2} \times 24(20 + 34)$$

$$\Rightarrow 12 \times 54 \Rightarrow 648 \text{ cm}^2.$$

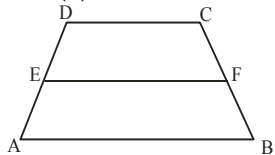
2. Sol. (b)

Area of trapezium

$$= \frac{1}{2} \times (\text{sum of parallel side}) \times \text{height}$$

$$= \frac{1}{2} \times 12 \times (15 + 20) = 6 \times 35 = 210 \text{ cm}^2$$

3. Sol. (b)



$$EF = \frac{1}{2} (AB + DC)$$

$$AB + DC = 20 \quad \dots (i)$$

$$AB - DC = 4 \quad \dots (ii)$$

From (i) & (ii)

$$AB = 12, DC = 8$$

$$AB \times DC = 96 \text{ cm}$$

4. Sol. (c)

Given, Height of the trapezium = 7 cm and parallel sides are 8 cm and 12 cm

Now, Area of the trapezium

$$= \frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$$

$$= \frac{1}{2} \times (8 + 12) \times 7$$

$$= \frac{1}{2} \times 20 \times 7 = 70 \text{ cm}^2$$

5. Sol. (a)

Given, area of the trapezium = 1785sq. feet.

Height of the trapezium = 35 feet, length of one parallel side = 42 feet.

Let the length of the other parallel side be x feet.

Area of trapezium

$$= \frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$$

$$\Rightarrow \frac{1}{2} \times (x + 42) \times 35 = 1785$$

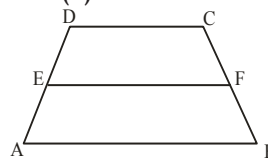
$$\Rightarrow 35x + 1470 = 3570$$

$$\Rightarrow 35x = 3570 - 1470$$

$$\Rightarrow 35x = 2100 \Rightarrow x = 60$$

Hence, the length of the other side is 60 feet.

6. Sol. (b)



$$EF = \frac{AB + DC}{2} = 17$$

$$\text{Area of ABCD} = \frac{1}{2} (AB + DC) \times \text{height}$$

$$= 17 \times 19 = 323 \text{ m}^2$$

7. Sol. (a)

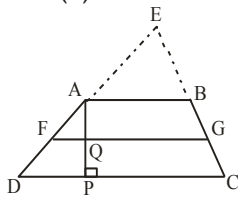
Area of trapezium

$$= \frac{1}{2} (\text{sum of parallel sides}) \times \text{height}$$

$$= \frac{1}{2} (6 + 8) \times 4 = \frac{1}{2} \times 14 \times 4$$

$$= 28 \text{ cm}^2$$

8. Sol. (b)



Given $AB \parallel DC$, $AP = 4 \Rightarrow PQ = 2$

Since F and G are mid-point

$\Rightarrow AB \parallel DC \parallel FG$

Also, $FG = \frac{1}{2}(9 + 15) \Rightarrow 12 \text{ cm}$

In $\triangle EFG$ and $\triangle EDC$,

These triangles are similar (By AAA)

$$\Rightarrow \frac{12}{15} = \frac{h}{h+2}$$

(Where h is the height of triangle)

$$\Rightarrow 4h + 8 = 5h \Rightarrow h = 8$$

$$\therefore \text{Area of } \triangle EFG = \frac{1}{2} \times \text{base} \times \text{height}$$

$$\Rightarrow \frac{1}{2} \times FG \times h$$

$$= \frac{1}{2} \times 12 \times 8 = 48$$

9. Sol. (d)

Let the parallel sides be $2x$ and $3x$

$$\Rightarrow \text{area} = \frac{1}{2}(2x + 3x) \times 12 = 480$$

$$5x = 80$$

$$x = 16$$

$\Rightarrow$ Longer parallel side

$$= 16 \times 3 = 48 \text{ cm}$$

10. Sol. (a)

$$1785 = \frac{1}{2}(42 + x)35$$

$$\Rightarrow x = 102 - 42 = 60 \text{ feet}$$

11. Sol. (b)

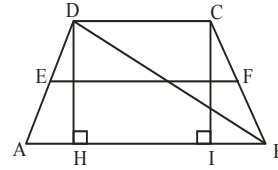
Let DH and CI be the perpendiculars on AB

$$AH = IB = \frac{AB - CD}{2}$$

$$BH = CD + \frac{AB - CD}{2}$$

$$BH = \frac{AB + CD}{2} = EF = 12$$

($\because AD = CB$)



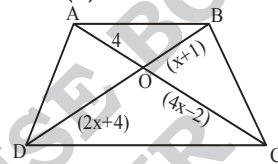
In $\triangle HDB$, $BD^2 = DH^2 + HB^2$

$$\Rightarrow 5^2 + 12^2 = 13^2$$

$$BD = 13$$

$$BD = AC = 13 \text{ cm}$$

12. Sol. (d)



$$AO = 4 \text{ cm}, OC = (x+1) \text{ cm},$$

$$OD = (2x+4) \text{ cm}, OB = (x+1) \text{ cm},$$

$$\Rightarrow \frac{AO}{OC} = \frac{BO}{OD}$$

[$\because$ The diagonal of a Trapezium divide each other proportionally]

$$\Rightarrow \frac{4}{4x-2} = \frac{x+1}{2x+4}$$

$$\Rightarrow 8x + 16 = 4x^2 + 4x - 2x - 2$$

$$\Rightarrow 4x^2 - 6x - 18 = 0$$

$$\Rightarrow 2x^2 - 3x - 9 = 0$$

$$\Rightarrow 2x^2 - 6x + 3x - 9 = 0$$

$$\Rightarrow 2x(x-3) + 3(x-3) = 0$$

$$\Rightarrow (x-3)(2x+3) = 0$$

$$\Rightarrow x = 3 \text{ or } x = \frac{-3}{2}$$

13. Sol. (a)

Ratio of parallel sides = 5:3

Let sides are $5x$ and $3x$

$$\frac{1}{2}(\text{sum of parallel sides}) \times \text{perpendicular distance} = 1440 \text{ m}^2$$

$$\frac{1}{2}(5x + 3x) \times 24 = 1440$$

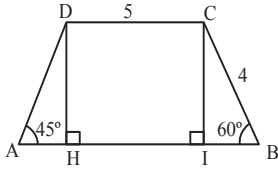
$$4x \times 24 = 1440$$

$$x = \frac{1440}{4 \times 24} = 15 \text{ m}$$

$$\text{Length of longer side} = 5x = 5 \times 15 = 75 \text{ m}$$

14. Sol. (d)

Let DH and CI be the perpendiculars to AB In $\triangle CIB$



$$\sin 60^\circ = \frac{CI}{CB}$$

$$\Rightarrow \frac{\sqrt{3}}{2} = \frac{CI}{4}$$

$$\Rightarrow CI = 2\sqrt{3}$$

And

$$\cos 60^\circ = \frac{IB}{CB}$$

$$\Rightarrow \frac{1}{2} = \frac{IB}{4} \Rightarrow IB = 2$$

In $\triangle DHA$

$$AH = DH = CI = 2\sqrt{3} (\because \angle DAH = 45^\circ)$$

Area of the trapezium ABCD

$$= \frac{1}{2} (AB + CD) \times DH$$

$$= \frac{1}{2} [(7 + 2\sqrt{3}) + 5] \times 2\sqrt{3} = (12 + 2\sqrt{3})\sqrt{3}$$

$$= (6 + 12\sqrt{3})\text{m}^2$$

15. Sol. (d)

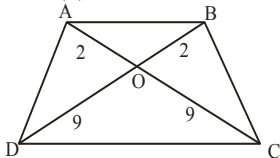
Area of trapezium = $\frac{1}{2}$ (sum of parallel sides) $\times$ (distance between parallel sides).

$$330 = \frac{1}{2} \times (25 + 19) \times d$$

$$330 = \frac{1}{2} \times 44 \times d$$

$$\text{So, } d = \frac{330}{22}, d = 15 \text{ cm}$$

16. Sol. (a)



$\triangle AOB \sim \triangle DOC$

$$\therefore \frac{AO}{OC} = \frac{OB}{OD} = \frac{AB}{CD} = \frac{2}{9}$$

$$\frac{AB}{CD} = \frac{2 \times 5}{9 \times 5} \rightarrow \frac{10}{45}$$

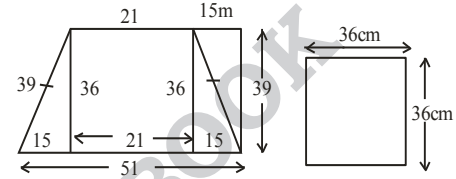
17. Sol. (a)

Area of trapezium

$$= \frac{1}{2} (\text{sum of two parallel sides}) \times \text{height}$$

$$= \frac{1}{2} (27 + 13) \times 8 = 160 \text{ cm}^2 = 0.016 \text{ m}^2$$

18. Sol. (c)

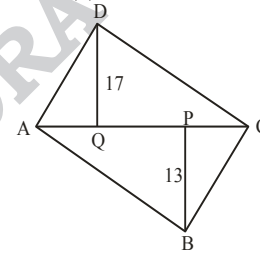


$$\text{Area} = \frac{1}{2} \times (21 + 51) \times 36$$

$$= \frac{1}{2} \times 72 \times 36$$

$$= 36 \times 36 = 1296 \text{ cm}^2$$

19. Sol. (c)



Area of quadrilateral ABCD

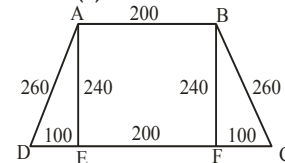
Area of quadrilateral ABCD

$$= \frac{1}{2} \times AC \times BP + \frac{1}{2} \times AC \times DQ$$

$$= \frac{1}{2} \times 29 \times (13 + 17)$$

$$= 29 \times 15 = 435 \text{ m}^2$$

20. Sol. (c)



In $\triangle ADE$, by Pythagoras theorem

$$\Rightarrow 260^2 - 100^2 = AE^2$$

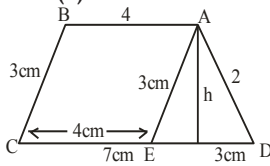
$$\Rightarrow 360 \times 160 = AE^2$$

$$\Rightarrow AE = 6 \times 4 \times 100 \Rightarrow AE = 240$$

$$\text{Area of trapezium} = \frac{1}{2} \times (200 + 400) \times$$

$$240 = 600 \times 120 = 72000$$

21. Sol. (a)



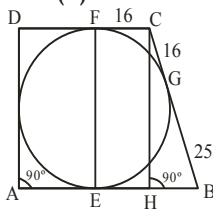
Apply Heros Formulas

$$\text{Area of } \triangle AED = \sqrt{4 \times 1 \times 1 \times 2} = 2\sqrt{2}$$

$$2\sqrt{2} = \frac{1}{2} \times 3 \times h \Rightarrow h = \frac{4\sqrt{2}}{3} \text{ cm}$$

$$\text{Area of Trapezium} = \frac{1}{2} \cdot (4 + 7) \cdot \frac{4\sqrt{2}}{3} = \frac{22\sqrt{2}}{3} \text{ cm}^2$$

22. Sol. (d)



From tangent properties

$$CF = CG = 16$$

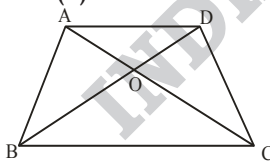
$$BE = BG = 25$$

$$\therefore BC = 16 + 25 = 41 \text{ cm}$$

From $\triangle BCH$,

$$\begin{aligned} CH &= \text{diameter} = \sqrt{(41)^2 - (9)^2} \\ &= \sqrt{1681 - 81} = \sqrt{1600} = 40 \text{ cm} \end{aligned}$$

23. Sol. (d)



$$\text{Area}(\triangle ABC) = \text{Area}(\triangle DBC)$$

$$\text{Area}(\triangle AOB + \triangle BOC) = \text{Area}(\triangle DOC + \triangle BOC)$$

$$\text{Area } \triangle BOC = 8 - 3 = 5 \text{ cm}^2 \text{ and Area } (\triangle DOC) = 3$$

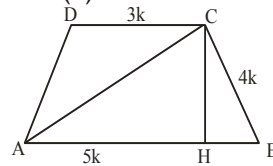
$$\text{Now, } \frac{\text{Area}(\triangle AOB)}{\text{Area}(\triangle BOC)} = \frac{3}{5} = \frac{1/2 \times AO \times \text{Length}}{1/2 \times CO \times \text{Length}}$$

$$\Rightarrow \frac{AO}{CO} = \frac{3}{5}$$

$$\frac{\text{Area of } (\triangle AOD)}{\text{Area of } (\triangle BOC)} = \left(\frac{AO}{CO}\right)^2 = \frac{9}{25}$$

$$\text{Area } (\triangle AOD) = \frac{9 \times 5}{25} = 1.8 \text{ cm}^2$$

24. Sol. (d)



Let CH be perpendicular to AB

And $AB = 5k$, $BC = 4k$ and $CD = 3k$

$$\text{In } \triangle CHB, CH^2 = (CB)^2 - (BH)^2$$

$$\Rightarrow CH^2 = (4k)^2 - (k)^2$$

$$\Rightarrow CH^2 = 15k^2 \Rightarrow CH = \sqrt{15}k$$

$$\text{In } \triangle ACH, AC^2 = AH^2 + CH^2$$

$$\Rightarrow (124)^2 = (4k)^2 + 15k^2$$

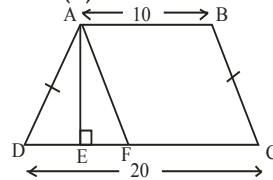
$$\Rightarrow (124)^2 = 31k^2 \Rightarrow k^2 = \frac{(124)^2}{31}$$

$$\text{Area of trapezium} = \frac{1}{2} (AB + CD) \times CH$$

$$= \frac{1}{2} (8k) \times \sqrt{15}k = 4\sqrt{15}k^2$$

$$= 4\sqrt{15} \times \frac{(124)^2}{31} = 1984\sqrt{15} \text{ cm}^2$$

25. Sol. (b)



Let ABCD be the given trapezium. And AE be its height.

$$\text{Area of trapezium} = \frac{1}{2} \times (a + b)h$$

$$180 = \frac{1}{2} \times (20 + 10)AE$$

$$AE = 12 \text{ cm Draw AF} \parallel BC$$

$$\Rightarrow AB = FC = 10 \text{ cm and AF = BC}$$

$$\Rightarrow DF = DC - FC = 20 - 10 = 10 \text{ cm}$$

$$\text{In } \triangle ADF, AF = AD \dots (AD = BC, \text{ given})$$

$$DE = EF = \frac{DF}{2} = 5 \text{ cm}$$

(Perpendicular drawn on the base of an isosceles triangle)

$$AF^2 = AE^2 + EF^2, AF = \sqrt{AE^2 + EF^2} = \sqrt{12^2 + 5^2} = 13$$

Type-12E (Rhombus)

1. The length of each side of a rhombus is 10 cm. If the length of one of its diagonals is 16 cm, then what is the area of the rhombus?

एक समचतुर्भुज की प्रत्येक भुजा की लंबाई 10 सेमी है। यदि इसके एक विकर्ण की लंबाई 16 सेमी है, तो समचतुर्भुज का क्षेत्रफल क्या है?

SSC MTS 2023 (Evening)

- (a) 108 cm^2 (c) 128 cm^2
(b) 112 cm^2 (d) 96 cm^2

2. The diagonal of a rhombus is 8 cm and its area is 48 cm^2 , then the length of each side of the rhombus is:

एक समचतुर्भुज का विकर्ण 8 सेमी है और इसका क्षेत्रफल 48 cm^2 है, तो समचतुर्भुज की प्रत्येक भुजा की लंबाई है:

SSC CHSL 06/06/2022 (Afternoon)

- (a) $\sqrt{13}$ (b) $2\sqrt{13}$
(c) $6\sqrt{13}$ (d) $5\sqrt{13}$

3. ABCD is a quadrilateral. The length of diagonal AC is 24 cm. The sum of perpendiculars drawn from vertex B and D on the diagonal AC is 10 cm. What is the area of the quadrilateral?

ABCD एक चतुर्भुज है। विकर्ण AC की लंबाई 24 सेमी है। शीर्ष B और D से विकर्ण AC पर खींचे गए लंबों का योग 10 सेमी है। चतुर्भुज का क्षेत्रफल क्या है?

SSC CGL Tier II 08/08/2022

- (a) 240 cm^2 (c) 120 cm^2
(b) 180 cm^2 (d) 90 cm^2

4. The larger diagonal of a rhombus is 150% of its smaller diagonal, and its area is 432 cm^2 . Find the length (in cm) of the side of the rhombus?

एक समचतुर्भुज का बड़ा विकर्ण उसके छोटे विकर्ण का 150% है, और इसका क्षेत्रफल 432 cm^2 है। समचतुर्भुज की भुजा की लंबाई (सेमी में) ज्ञात कीजिए?

SSC MTS 14/07/2022 (Evening)

- (a) $8\sqrt{13}$ (b) $4\sqrt{13}$ (c) $6\sqrt{13}$ (d) $2\sqrt{13}$

5. ABCD is a rhombus with $\angle A = 60^\circ$, P is a point on CD such that $BP \perp CD$ if $BP = 18 \text{ m}$, then find the area of the rhombus.

ABCD एक समचतुर्भुज है जिसमें $\angle A = 60^\circ$, P, CD पर एक बिंदु इस प्रकार है कि $BP \perp CD$ यदि $BP = 18 \text{ मीटर}$ है, तो समचतुर्भुज का क्षेत्रफल ज्ञात कीजिए।

- (a) $216\sqrt{2} \text{ m}^2$ (b) $216\sqrt{3} \text{ m}^2$
(c) $216\sqrt{5} \text{ m}^2$ (d) $216\sqrt{4} \text{ m}^2$

6. The perimeter of a rhombus is 40 m, and the measure of one of the angles is 60° , then find the area of the rhombus.

एक समचतुर्भुज का परिमाप 40 मीटर है और एक कोण की माप 60° है, तो समचतुर्भुज का क्षेत्रफल ज्ञात कीजिए।

- (a) $50\sqrt{3} \text{ m}^2$ (b) $100\sqrt{3} \text{ m}^2$
(c) $25\sqrt{3} \text{ m}^2$ (d) $200\sqrt{3} \text{ m}^2$

7. The lengths of the diagonals of a rhombus are 16 cm and 30 cm, respectively. What is the perimeter of the rhombus?

एक समचतुर्भुज के विकर्णों की लंबाई क्रमशः 16 सेमी और 30 सेमी है। समचतुर्भुज का परिमाप क्या है?

SSC MTS 19/07/2022 (Afternoon)

- (a) 68 cm (b) 76 cm
(c) 72 cm (d) 80 cm

8. The perimeter of a rhombus is 44 m, if one of the diagonals is 12 m long, then find the length of the other diagonal.

एक समचतुर्भुज का परिमाप 44 मीटर है, यदि एक विकर्ण की लंबाई 12 मीटर है, तो दूसरे विकर्ण की लंबाई ज्ञात कीजिए।

- (a) $3\sqrt{85} \text{ m}$ (b) $2\sqrt{85} \text{ m}$
(c) $\sqrt{85} \text{ m}$ (d) $2\sqrt{95} \text{ m}$

9. The area of a rhombus is 256 sq. cm . and one of its diagonal is twice the other in length. Then length of its larger diagonal is

एक समचतुर्भुज का क्षेत्रफल 256 वर्ग सेमी है। और इसका एक विकर्ण दूसरे विकर्ण की लंबाई का दुगुना है। तो इसके बड़े विकर्ण की लंबाई है

- (a) 32 cm (b) 48 cm
(c) 36 cm (d) 24 cm

10. Length of each side of a rhombus is 13 cm and one of the diagonals is 24 cm. What is the area (in cm^2) of the rhombus?

एक समचतुर्भुज की प्रत्येक भुजा की लंबाई 13 सेमी और एक विकर्ण की लंबाई 24 सेमी है। समचतुर्भुज का क्षेत्रफल (सेमी² में) क्या है?

SSC CGL 13/8/2021 (Morning)

- (a) 240 (b) 60
(c) 300 (d) 120

11. The perimeter of a rhombus is '2p' unit and the sum of the lengths of its diagonals is 'm' unit, then the area of the rhombus is

एक समचतुर्भुज का परिमाण '2p' इकाई है और इसका विकर्ण की लंबाई का योग 'm' इकाई है, तो समचतुर्भुज का क्षेत्रफल है

- (a) $m^2 - p^2$ (b) $\frac{m^2 - p^2}{2}$
(c) $\frac{m^2 - p^2}{4}$ (d) $2(m^2 - p^2)$

12. One diagonal of a rhombus is $8\sqrt{3}$ cm. If the other diagonal is equal to its side, then the area of rhombus is:

एक समचतुर्भुज का एक विकर्ण $8\sqrt{3}$ सेमी है। यदि दूसरा विकर्ण उसकी भुजा के बराबर है, तो समचतुर्भुज का क्षेत्रफल है:

SSC CHSL 12/04/2021 (Morning)

- (a) $12\sqrt{3}$ (b) $24\sqrt{3}$
(c) $16\sqrt{3}$ (d) $32\sqrt{3}$

13. The two diagonals of a rhombus are respectively, 14 cm and 48 cm. The perimeter of the rhombus is equal to:

एक समचतुर्भुज के दो विकर्ण क्रमशः 14 सेमी और 48 सेमी हैं। रोम्बस की परिधि इसके बराबर है:

SSC CHSL 11/07/2019 (Morning)

- (a) 120 (b) 160
(c) 80 (d) 100

14. A rhombus of the side 28 cm has one angle of 60° . What is the length of the larger diagonal?

28 सेमी भुजा वाले एक समचतुर्भुज का एक कोण 60° है। बड़े विकर्ण की लंबाई क्या है?

SSC CHSL 4/8/2021 (Afternoon)

- (a) $28(1 + \sqrt{3})$ cm (b) $28\sqrt{2}$ cm
(c) 28 cm (d) $28\sqrt{3}$ cm

15. The area of a rhombus is 216 cm^2 and the length of its one diagonal is 24 cm. The perimeter (in cm) of the rhombus is

एक समचतुर्भुज का क्षेत्रफल 216 cm^2 है और इसके एक विकर्ण की लंबाई 24 सेमी है। समचतुर्भुज का परिमाण (सेमी में) है

- (a) 52 (b) 60
(c) 120 (d) 100

16. What is the area of a rhombus (in cm^2) whose side is 10 cm and the smallest diagonal is 12 cm?

एक समचतुर्भुज (cm^2 में) का क्षेत्रफल क्या है जिसकी भुजा 10 सेमी है और सबसे छोटा विकर्ण 12 सेमी है?

SSC CHSL 9/07/2019 (Afternoon)

- (a) 120 (b) 192
(c) 96 (d) 50

17. ABCD is a rhombus with each side being equal to 8 cm. If $BD = 10 \text{ cm}$, $AC = 2\sqrt{x} \text{ cm}$, what is the value of $\sqrt{x + 10}$?

ABCD एक समचतुर्भुज है जिसकी प्रत्येक भुजा 8 सेमी के बराबर है। यदि $BD = 10$ सेमी, $AC = 2\sqrt{x}$ सेमी, $\sqrt{x + 10}$ का मान क्या है?

SSC CHSL 11/07/2019 (Afternoon)

- (a) $2\sqrt{3}$ (b) $3\sqrt{2}$
(c) 7 (d) 5

18. The two diagonals of a rhombus are of lengths 55 cm and 48 cm. If P is the perpendicular height of the rhombus, then which one of the following is correct?

एक समचतुर्भुज के दो विकर्णों की लंबाई 55 सेमी और 48 सेमी है। यदि P समचतुर्भुज की लम्बवत् ऊँचाई है, तो निम्नलिखित में से कौन-सा एक सही है?

- (a) $36 \text{ cm} < p < 37 \text{ cm}$ (b) $35 \text{ cm} < p < 36 \text{ cm}$
(c) $34 \text{ cm} < p < 35 \text{ cm}$ (d) $33 \text{ cm} < p < 34 \text{ cm}$

19. The perimeter of a rhombus is 60 cm and one of its diagonal is 24 cm. The area of the rhombus is

एक समचतुर्भुज का परिमाण 60 सेमी है और इसका एक विकर्ण 24 सेमी है। समचतुर्भुज का क्षेत्रफल है

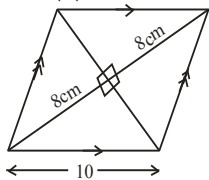
- (a) 432 sq.cm (b) 216 sq.cm
(c) 108 sq.cm (d) 206 sq.cm

Type-12E (Rhombus) ANSWER KEY

1	D	2.	B	3	C	4	C	5	B	6	(*)	7	A	8	B
9	A	10	D	11	C	12.	D	13	D	14	D	15	B	16	C
17	C	18	A	19	B										

Type-12E (Rhombus) Solution

1. Sol. (d)



$$D_2 = 2 \times 6 = 12 \text{ cm}$$

$$\text{Area of rhombus} = \frac{1}{2} \times 16 \times 12 = 96 \text{ cm}^2$$

2. Sol. (b)

Diagonal of rhombus (D_1) = 8 cm

$$\text{Area of rhombus} = \frac{1}{2} \times 8 \times D_2$$

$$48 = 4 \times D_2 \Rightarrow D_2 = \frac{48}{4} = 12 \text{ cm}$$

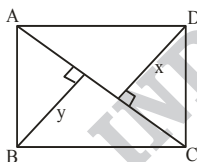
Now, side of rhombus

$$= \sqrt{\left(\frac{8}{2}\right)^2 + \left(\frac{12}{2}\right)^2} = \sqrt{16 + 36}$$

$$= \sqrt{52} = 2\sqrt{13} \text{ cm}$$

3. Sol. (c)

Let the length of the perpendicular drawn from point D to AC and point B to AC be x and y respectively. According to the question,



So, area of quadrilateral

$$= \text{Area of } \triangle ABC + \text{Area of } \triangle ADC$$

$$= \frac{1}{2} \times AC \times y + \frac{1}{2} \times AC \times x$$

$$= \frac{1}{2} \times AC \times (x + y)$$

$$= \frac{1}{2} \times 24 \times (10) = 120 \text{ cm}^2$$

4. Sol. (c)

Let the smaller diagonal be x and larger diagonal

$$\text{be } \frac{150}{100}x = \frac{3}{2}x$$

$$\Rightarrow 432 = \frac{1}{2} \times \frac{3}{2}x^2$$

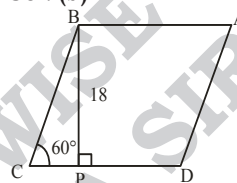
$$\Rightarrow x = \sqrt{\frac{432 \times 4}{3}} = 24 \text{ cm}$$

$$\text{So, } d_1 = 24 \text{ cm and } d_2 = 36 \text{ cm}$$

Side of the rhombus

$$= \sqrt{12^2 + 18^2} = 6\sqrt{13}$$

5. Sol. (b)

In $\triangle CBP$

$$\sin 60^\circ = \frac{BP}{BC} \Rightarrow BC = \frac{BP}{\sin 60^\circ} = \frac{18}{\frac{\sqrt{3}}{2}} = 12\sqrt{3}$$

$$\text{Area of rhombus} = CD \times BP = 12\sqrt{3} \times 18 = 216\sqrt{3}$$

6. Sol. (a)

$$\text{Side length of rhombus} = \frac{40}{4} = 10 \text{ m}$$

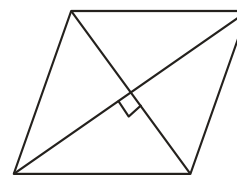
$$\text{Area of rhombus} = 2 \left(\frac{\sqrt{3}}{4} (\text{side})^2 \right)$$

$$= 2 \times \frac{\sqrt{3}}{4} \times 10^2 = 50\sqrt{3} \text{ m}^2$$

7. Sol. (a)

We know that in rhombus diagonals bisect at 90°

By Pythagoras:

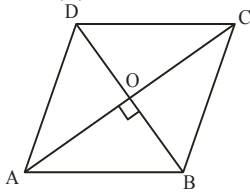


$$\Rightarrow 8^2 + 15^2 = \text{side}^2 \Rightarrow \text{Side}^2 = 289$$

$$\Rightarrow \text{Side} = \sqrt{289} \Rightarrow 17$$

$$\text{Perimeter of rhombus} = 4 \times 17 = 68 \text{ cm}$$

8. Sol. (b)



$$AB = \frac{44m}{4} = 11 \text{ m}$$

In triangle AOB

$$AO^2 + OB^2 = AB^2$$

$$\Rightarrow AO^2 + 6^2 = 11^2$$

$$\Rightarrow AO = \sqrt{85}$$

$$AC = 2AO = 2\sqrt{85} \text{ m}$$

9. Sol. (a)

Let the diagonal of rhombus

$$d_1 = x \text{ \& } d_2 = 2x$$

$$\text{Area of rhombus} = \frac{1}{2} d_1 d_2$$

$$256 = \frac{1}{2} (x)(2x)$$

$$16 = x$$

$$\text{Longer diagonal} = 2x = 2(16) = 32 \text{ cm}$$

10. Sol. (d)

Short trick

$$4a^2 = (d_1^2 + d_2^2) \Rightarrow 4 \times 169 = (576 + d_2^2)$$

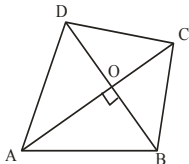
$$D_2 = \sqrt{100} = 10 \text{ cm}$$

$$\text{Area of rhombus} = \frac{1}{2} \times 24 \times 10 = 120 \text{ cm}^2$$

11. Sol. (c)

Let lengths of Diagonals be D_1 and D_2

$$\text{Side length of rhombus} = \frac{2p}{4} = \frac{p}{2}$$



$$D_1 + D_2 = m \quad (\text{given})$$

On squaring both sides

$$\Rightarrow D_1^2 + D_2^2 + 2D_1D_2 = m^2 \quad \dots (i)$$

And

$$\Rightarrow D_1^2 + D_2^2 = p^2 \quad \dots (ii)$$

From eq. (i) and (ii)

$$2D_1D_2 = m^2 - p^2$$

$$\Rightarrow D_1D_2 = \frac{m^2 - p^2}{2}$$

$$\text{Area of diagonal} = \frac{1}{2} D_1D_2 = \frac{m^2 - p^2}{4}$$

12. Sol. (d)

Let the other diagonal = a

So, side = a

In a rhombus,

$$4a^2 = d_1^2 + d_2^2 \Rightarrow 4a^2 = (8\sqrt{3})^2 + a^2$$

$$a^2 = 64, a = 8$$

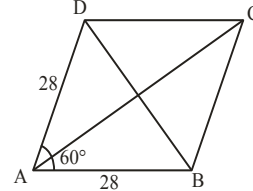
$$\text{Area of the rhombus} = \frac{1}{2} \times 8 \times 8\sqrt{3} = 32\sqrt{3} \text{ cm}^2$$

13. Sol. (d)

Perimeter of rhombus

$$= 2\sqrt{d_1^2 + d_2^2} = 2\sqrt{14^2 + 48^2} = 100$$

14. Sol. (d)



According to the diagram

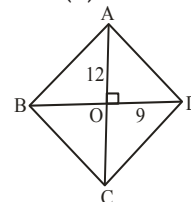
$\angle BAD = 60^\circ$ and $\angle ABC = 120^\circ$ (adjacent angle sum up to 180°)

$$\angle BAC = \angle ACB = 30^\circ$$

In $\triangle ABC$, angles are of $120^\circ, 30^\circ$ and 30° and in this type of triangle, ratio of the sides is $1:\sqrt{3}:1$

If 1 unit = 28 then $\sqrt{3}$ unit = $28\sqrt{3}$ unit

15. Sol. (b)



$$d_1 = 24 \text{ cm}$$

$$\frac{1}{2} \times d_1 \times d_2 = 216$$

$$\frac{1}{2} \times 24 \times d_2 = 216$$

$$d_2 = \frac{216 \times 2}{24} = 18 \text{ cm}$$

$$OA = \frac{1}{2} \times d_1 = \frac{1}{2} \times 24 = 12 \text{ cm}$$

Diagonals of Rhombus bisect each other at right angle

$$OD = \frac{1}{2} \times d_2 = \frac{1}{2} \times 18 = 9 \text{ cm}$$

Now,

In Right $\triangle AOD$

$$AD^2 = AO^2 + OD^2$$

$$= 12^2 + 9^2 = 144 + 81 = 225$$

$$AD = \sqrt{225} = 15 \text{ cm}$$

$$\text{Perimeter of Rhombus} = 4 \times AD = 4 \times 15 = 60 \text{ cm}$$

16. Sol. (c)

We know that

$$a^2 = \left(\frac{d_1}{2}\right)^2 + \left(\frac{d_2}{2}\right)^2$$

Where a = side of the rhombus and d_1, d_2 be the diagonals of the rhombus.

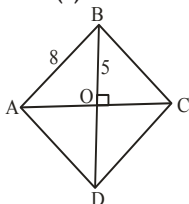
$$\Rightarrow 10^2 = \left(\frac{12}{2}\right)^2 + \left(\frac{d_2}{2}\right)^2$$

$$\Rightarrow \frac{d_2}{2} = \sqrt{10^2 - 6^2} = 8 \Rightarrow d_2 = 16$$

$$\text{Area of the rhombus} = \frac{1}{2} \times d_1 \times d_2$$

$$= \frac{1}{2} \times 12 \times 16 = 96 \text{ cm}$$

17. Sol. (c)



$$BO = \frac{BD}{2} = \frac{10}{2} = 5$$

$$AO = \frac{AC}{2} = \frac{2\sqrt{x}}{2} = \sqrt{x}$$

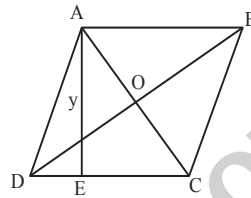
$$\text{Now, } AB^2 = AO^2 + BO^2$$

$$\Rightarrow 8^2 = (\sqrt{x})^2 + 5^2 \Rightarrow x = 39$$

18. Sol. (a)

$$\text{Area of rhombus} = \frac{1}{2} \times d_1 \times d_2$$

$$= \frac{1}{2} \times 55 \times 48 = 1320 \text{ cm}^2$$



$$\text{Area of rhombus} = \text{Base} \times \text{Height}$$

$$= DC \times AE$$

$$\Rightarrow DC \times AE = 1320$$

$$\Rightarrow P^2 = \sqrt{OC^2 - DC^2} = 1320$$

$$\Rightarrow p^2 \sqrt{\left(\frac{55}{2}\right)^2 + \left(\frac{43}{2}\right)^2} = 1320$$

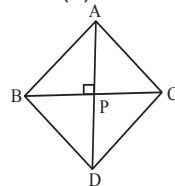
$$\Rightarrow OD = \frac{1}{2} BD \text{ and } OC = \frac{1}{2} AC$$

$$= p^2 \frac{5229}{4} = 1320$$

$$\Rightarrow p = \frac{1325}{36.5} = 36.16$$

$$36 \text{ cm} < p < 37 \text{ cm}$$

19. Sol. (b)



$$ABCD \text{ is a rhombus, } AB = \frac{60}{4} = 15 \text{ cm}$$

$$(\because \text{Perimeter} = 60 \text{ cm})$$

$$AD = 24, AP = 12$$

[Diagonals of rhombus bisect perpendicularly]

$$\text{In } \triangle APB, AB = 15, AP = 12$$

$$\therefore BP = 9$$

(By Pythagoras theorem)

$$BC = 9 \times 2 = 18$$

$$\text{Area of rhombus} = \frac{1}{2} \times \text{diagonal}_1 \times \text{diagonal}_2$$

$$\Rightarrow \frac{1}{2} \times 18 \times 24 = 216 \text{ sq cm}$$

Type-13 (Circle and Semi-Circle)

1. What is the radius of a circular field whose area is equal to the sum of the area of three smaller circular fields of radii 8 m, 9 m and 12 m respectively?

एक वृत्ताकार क्षेत्र की त्रिज्या क्या है जिसका क्षेत्रफल क्रमशः 8 मी, 9 मी और 12 मी त्रिज्या वाले तीन छोटे वृत्ताकार क्षेत्रों के क्षेत्रफल के योग के बराबर है?

SSC MTS 2023 (Morning)

- (a) 20 m (b) 21 m (c) 29 m (d) 17 m

2. A circle of radius 25 cm has a chord of length 48 cm. What is the length of the perpendicular drawn from the centre of the circle to the chord?
25 सेमी त्रिज्या वाले एक वृत्त की जीवा की लंबाई 48 सेमी है। वृत्त के केंद्र से जीवा पर डाले गए लंब की लंबाई क्या है?

[CDS - 2022-I]

- (a) 5 cm (b) 5.5 cm
(c) 6.5 cm (d) 7 cm

3. A goat is tied with a 10.5 m-long rope to one corner of a plot which is in the shape of an equilateral triangle each side of which is 16 m long. Find the area that the goat can graze on.
एक भूखंड के एक कोने में एक बकरी को 10.5 मीटर लंबी रस्सी से बांधा गया है, जो एक समबाहु त्रिभुज के आकार का है, जिसकी प्रत्येक भुजा 16 मीटर लंबी है। उस क्षेत्र का पता लगाएं जिस पर बकरी चर सकती है।

SSC MTS 05/07/2022 (Morning)

- (a) 62.25 m² (b) 53.5 m²
(c) 57.75 m² (d) 51.75 m²

4. A chord of a circle of radius 21 cm makes a right angle at the center. Find the area of major segment (take $\pi = \frac{22}{7}$) closest to nearest integer.
21 सेमी त्रिज्या वाले एक वृत्त की जीवा केंद्र पर समकोण बनाती है। निकटतम पूर्णांक के निकटतम प्रमुख खंड का क्षेत्रफल ज्ञात करें ($\pi = 22/7$ लें)।

Higher Secondary 03/08/2022 (Shift - 4)

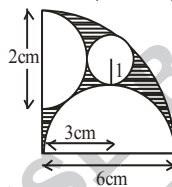
- (a) 1360 cm² (b) 1436 cm²
(c) 1260 cm² (d) 1160 cm²

5. The area of a sector of a circle is 308 cm², with the central angle measuring 45°. The radius of the circle is:
एक वृत्त के एक खंड का क्षेत्रफल 308 सेमी² है, जिसके केंद्रीय कोण की माप 45° है। वृत्त की त्रिज्या है:

SSC CGL 03/12/2022 (4th Shift)

- (a) 14 cm (b) 21 cm
(c) 7 cm (d) 28 cm

6. In the given fig. radius of quadrant is 6cm find the area of shaded region?
दिये गये चित्र में, चतुर्थांश की त्रिज्या 6 सेमी है तो छायांकित भाग का क्षेत्रफल ज्ञात करें।



- (a) 1.5π (b) 2π (c) 1.75π (d) 1.25π

7. Find the area (cm²) of the sector of a circle of radius 7 cm with a central angle of 90°
90° के केंद्रीय कोण के साथ 7 सेमी त्रिज्या वाले एक वृत्त के त्रिज्यखण्ड का क्षेत्रफल (सेमी²) ज्ञात कीजिए।

SSC CHSL 30/05/2022 (Afternoon)

- (a) 38.50 (b) 35 (c) 20.67 (d) 28

8. What is the length of the arc of a circle whose radius is 35 cm and arc subtends an angle of 36° at the centre of the circle?
उस वृत्त के चाप की लंबाई क्या है जिसकी त्रिज्या 35 सेमी है और चाप वृत्त के केंद्र पर 36° का कोण अंतरित करता है?
[Use = 22/7]

SSC CHSL 10/06/2022 (Morning)

- (a) 44 (b) 22 (c) 10 (d) 220

9. If the area and perimeter of a quarter-circle are, 'A' m² and 'p' m respectively, then find A:p². (Use, $\pi = \frac{22}{7}$)

यदि एक चौथाई वृत्त का क्षेत्रफल और परिमाप क्रमशः 'A' m² और 'p' m है, तो A:p² ज्ञात कीजिए। (उपयोग करें, $\pi = 22/7$)

- (a) 77:1288 (c) 77:1250
(b) 77:1272 (d) 77:1284

10. The difference between the areas of two concentric circles is 264 cm². What is the difference between the square of their radius? (use $\pi = \frac{22}{7}$)

दो संकेन्द्रित वृत्तों के क्षेत्रफलों का अंतर 264 सेमी² है। उनकी त्रिज्या के वर्ग के बीच कितना अंतर है? (उपयोग $\pi = 22/7$)

SSC CGL Tier II 08/08/2022

- (a) 70 cm² (b) 140 cm²
(c) 84 cm² (d) 64 cm²

11. The area of a sector of a circle is 66 cm^2 and the angle of the sector is 60° . Find the radius of the circle.

एक वृत्त के एक त्रिज्यखंड का क्षेत्रफल 66 सेमी^2 है और त्रिज्यखंड का कोण 60° है। वृत्त की त्रिज्या ज्ञात कीजिए।

SSC CGL 03/12/2022 (1st Shift)

- (a) $5\sqrt{15} \text{ cm}$ (b) $6\sqrt{14} \text{ cm}$
(c) $7\sqrt{19} \text{ cm}$ (d) $3\sqrt{14} \text{ cm}$

12. A smaller circle touches a bigger circle internally and also passes through the centre 'O' of the bigger circle. If the area of the smaller circle is 192 cm^2 , the area of the bigger circle (in cm^2) is :

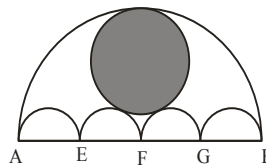
एक छोटा वृत्त एक बड़े वृत्त को आंतरिक रूप से स्पर्श करता है और बड़े वृत्त के केंद्र 'O' से होकर भी गुजरता है। यदि छोटे वृत्त का क्षेत्रफल 192 सेमी^2 है, तो बड़े वृत्त का क्षेत्रफल (सेमी² में) है:

SSC MTS 05/07/2022 (Evening)

- (a) 768 (b) 384 (c) 1024 (d) 720

13. In the given fig AB, AE, EF, FG and GB are semi circle $AB = 56 \text{ cm}$ and $AE = EF = GB = 48$, what is the area (in cm^2) of the shaded region?

दिये गये चित्र में, AB, AE, EF, FG और GB अर्धवृत्त है जहाँ $AB = 56 \text{ cm}$ और $AE = EF = FG = GB$ है तब छायांकित भाग का क्षेत्रफल क्या होगा?

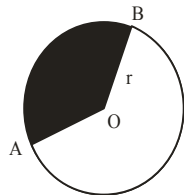


- (a) 414.46 (b) 382.82
(c) 406.48 (d) 394.24

14. In the given figure, the length of arc AB is equal to twice the length of radius r of the circle. Find the area of sector OAB in terms of the radius r .

दी गई आकृति में, चाप AB की लंबाई वृत्त की त्रिज्या r की लंबाई के दोगुने के बराबर है। त्रिज्या r के पदों में त्रिज्यखंड OAB का क्षेत्रफल ज्ञात कीजिए।

SSC CPO 09/11/2022 (Morning)



- (a) $3r$ (b) $2r$ (c) πr^2 (d) r^2

15. What is the radius of the circle inscribed in a triangle whose sides are 4 cm , 7.5 cm and 8.5 cm ?

4 सेमी, 7.5 सेमी और 8.5 सेमी भुजाओं वाले त्रिभुज में अंकित वृत्त की त्रिज्या क्या है?

[CDS-2022-I]

- (a) 1.5 cm (b) 2 cm (c) 2.5 cm (d) 3 cm

16. If the perimeter of a semicircle is ' P ', then find the area of the semicircle. (Use $\pi = \frac{22}{7}$)

यदि एक अर्धवृत्त का परिमाप ' P ' है, तो अर्धवृत्त का क्षेत्रफल ज्ञात कीजिए। (उपयोग $\pi = \frac{22}{7}$)

- (a) $\frac{77P^2}{648}$ (b) $\frac{77P^2}{1286}$ (c) $\frac{77P^2}{1296}$ (d) $\frac{77P^2}{646}$

17. The radius of a circular wheel of a toy car is 56 mm . In how many revolutions can it cover a distance of 176 m ? [use $\pi = \frac{22}{7}$]

एक खिलौना कार के एक वृत्ताकार पहिए की त्रिज्या 56 मिमी है। वह कितने चक्कर में 176 सेमी की दूरी तय कर सकता है? [$\pi = \frac{22}{7}$ का प्रयोग करें]

SSC MTS 13/07/2022 (Morning)

- (a) 6 (b) 3 (c) 5 (d) 4

18. As shown in the given figure, inside the large semicircle, three semicircles (with equal radii) are drawn so that their diameters all sit on the large semicircle's diameter. What is the ratio between the unshaded and shaded areas?

जैसा कि दी गई आकृति में दिखाया गया है, बड़े अर्धवृत्त के अंदर, तीन अर्धवृत्त (समान त्रिज्या वाले) खींचे गए हैं ताकि उनके सभी व्यास बड़े अर्धवृत्त के व्यास पर बैठ जाएं। छायांकित और छायांकित क्षेत्रों के बीच का अनुपात क्या है?



SSC CPO 09/11/2022 (Evening)

- (a) 4:3 (b) 1:2 (c) 2:1 (d) 3:4

19. The ratio of the outer and the inner circumference of a circular path is 5:4. If the path is 50 metres wide, then what is the radius of the inner circle?

एक वृत्ताकार पथ की बाहरी और भीतरी परिधि का अनुपात 5:4 है। यदि पथ 50 मीटर चौड़ा है, तो आंतरिक वृत्त की त्रिज्या क्या है?

SSC CGL 2022, 06/12/2022 (3rd Shift)

- (a) 250 metres (b) 300 metres
(c) 200 metres (d) 210 metres

20. Three circles, each having radius equal to 4 cm , are drawn with the vertices of an equilateral triangle as the centres. If the length of each side of the triangle is equal to 8 cm , then what is the area (in

cm^2) of the portion of the triangle that is NOT covered by the sectors of the circles?

एक समबाहु त्रिभुज के शीर्षों को केंद्र मानकर तीन वृत्त खींचे गए हैं, जिनमें से प्रत्येक की त्रिज्या 4 सेमी है। यदि त्रिभुज की प्रत्येक भुजा की लंबाई 8 सेमी के बराबर है, तो त्रिभुज के उस भाग का क्षेत्रफल (सेमी² में) क्या है जो वृत्तों के क्षेत्रों द्वारा कवर नहीं किया गया है?

SSC MTS 18/10/2021 (Evening)

- (a) $16(2\sqrt{3} - \pi)$ (b) $8(2\sqrt{3} - \pi)$
(c) $8\left(2\sqrt{3} - \frac{\pi}{2}\right)$ (d) $16\left(2\sqrt{3} - \frac{\pi}{2}\right)$

21. The circumference of a circle is ' $a\pi$ ' units and the area of the circle is ' $b\pi$ ' square units. If $a:b$ is equal to 4:5, then the radius of the circle is:

एक वृत्त की परिधि ' $a\pi$ ' इकाई है और वृत्त का क्षेत्रफल ' $b\pi$ ' वर्ग इकाई है। यदि $a:b$ बराबर 4:5 है, तो वृत्त की त्रिज्या है:

SSC CHSL 6/8/2021 (Evening)

- (a) 3 cm (b) 2.5 cm (c) 5 cm (d) 2 cm

22. Find the cost of fencing a sectorial field nine times with wire whose arc makes 60° at the centre and has area $231 m^2$ if the cost of wire is ₹15 per meter. यदि तार की लागत ₹ 15 प्रति मीटर है, तो एक वृत्तखंडीय क्षेत्र को तार से नौ बार घेरने की लागत ज्ञात कीजिए, जिसका चाप केंद्र पर 60° बनाता है और क्षेत्रफल 231 वर्ग मीटर है।

- (a) ₹ 8820 (b) ₹ 8360

- (c) ₹ 8280 (d) ₹ 8640

23. A field is in the form of a circle. The cost of fencing around it at ₹11 per metre is ₹2,420. What is the area ($in m^2$) of the field? (Use $= 22/7$)

एक क्षेत्र एक वृत्त के रूप में है। इसके चारों ओर ₹11 प्रति मीटर की दर से बाड़ लगाने की लागत ₹2,420 है। खेत का क्षेत्रफल (वर्ग मीटर में) क्या है? (उपयोग $\pi=22/7$)

SSCMTS 12/10/2021 (Morning)

- (a) 3850 (b) 4500 (c) 4250 (d) 2700

24. A horse racecourse is in the form of an annular ring whose outer and inner circumferences are 748 m and 396 m, respectively. The width (in m) of the racecourse is: ($\pi = 22/7$)

एक घुड़दौड़ का मैदान एक कुंडलाकार वलय के रूप में है जिसकी बाहरी और भीतरी परिधि क्रमशः 748 मीटर और 396 मीटर है। रेसकोर्स की चौड़ाई (मीटर में) है: ($\pi=22/7$)

SSC MTS 22/10/2021 (Morning)

- (a) 176 (b) 88 (c) 56 (d) 28

25. Find the area of the ring of two concentric circles, in which the bigger circle has a chord of length 8 cm that is tangent to the smaller circle.

दो संकेंद्रित वृत्तों के वलय का क्षेत्रफल ज्ञात कीजिए, जिसमें बड़े वृत्त की जीवा 8 सेमी लंबी है जो छोटे वृत्त की स्पर्श रेखा है।

- (a) $64\pi cm^2$ (b) $4\pi cm^2$

- (c) $16\pi cm^2$ (d) $8\pi cm^2$

26. Two circles of radii 10 cm and 12 cm intersect each other and the length of their common chord is 16 cm. What is the distance (in cm) between their centres?

10 सेमी और 12 सेमी त्रिज्या वाले दो वृत्त परस्पर प्रतिच्छेद करते हैं और उनकी उभयनिष्ठ जीवा की लंबाई 16 सेमी है। उनके केंद्रों के बीच की दूरी (सेमी में) कितनी है?

SSC MTS 20/10/2021 (Afternoon)

- (a) $6 + 3\sqrt{5}$ (b) $6 + 4\sqrt{5}$

- (c) $6 + 5\sqrt{5}$ (d) $6 + 2\sqrt{5}$

27. A bicycle wheel has a radius of 42 cm. It makes 40 revolutions in 25 seconds. What is its speed (in kmph, up to one decimal place)?

एक साइकिल के पहिये की त्रिज्या 42 सेमी है। यह 25 सेकंड में 40 चक्कर लगाती है। इसकी गति क्या है (किमी प्रति घंटे में, एक दशमलव स्थान तक)?

SSC CHSL 16/4/2021 (Morning)

- (a) 3.5 (b) 11.6 (c) 15.2 (d) 9.5

28. There is a circular park of diameter 'd'. A circular path of uniform width 'x' metre is made outside the park. The area of the circular path outside the park is

व्यास 'd' का एक वृत्ताकार पार्क है। पार्क के बाहर एकसमान चौड़ाई 'x' मीटर का एक वृत्ताकार पथ बनाया गया है। पार्क के बाहर वृत्ताकार पथ का क्षेत्रफल है

SSC CPO 13/12/19 (Evening)

- (a) $\pi x(x + d)$ (b) $\pi x(x + 2d)$

- (c) $\pi x\left(x + \frac{d}{2}\right)$ (d) $\pi x(2x + d)$

29. The area of a circle is increases by ' A ' m^2 if the radius of a circle is increased by 14 m, The radius of the original circle will be

एक वृत्त का क्षेत्रफल ' A ' m^2 से बढ़ जाता है यदि एक वृत्त की त्रिज्या 14 m बढ़ा दी जाए, तो मूल वृत्त की त्रिज्या होगी

- (a) $\frac{A-182}{14} m$ (b) $\frac{A-196}{28} m$

- (c) $\frac{A-168}{7} m$ (d) $\frac{A-176}{14} m$

30. The radius of a circular park is 23 m. It has inside all around it a 4 m wide path. Find the cost of paving the path at the rate of ₹500/ m^2 .

एक वृत्ताकार पार्क की त्रिज्या 23 मीटर है। इसके अंदर चारों तरफ 4 मीटर चौड़ा रास्ता है। ₹ 500/m² की दर से पथ बनाने की लागत ज्ञात कीजिए।

SSC MTS 27/10/2021 (Morning)

- (a) ₹2,10,000 (c) ₹ 2,60,000
(b) ₹2,64,000 (d) ₹2,40,000

31. In a circular field there is a rectangular tank of (130 m × 110 m). If the area of left portion is 20350 m² then find the radius of field?

एक वृत्ताकार मैदान में एक माप वाला आयताकार टैंक है यदि टैंक का क्षेत्रफल 20350 है तब मैदान की त्रिज्या होगी?

- (a) 96 (b) 105 (c) 122 (d) 108

32. What is the radius (in m) of a circle whose area is $2\frac{17}{30}$ times the sum of the areas of two triangles whose sides are 20 cm, 21 cm and 29 cm, and 11 cm, 60 cm and 61 cm (Use $\pi = 22/7$)

उस वृत्त की त्रिज्या (सेमी में) क्या है जिसका क्षेत्रफल दो त्रिभुजों के क्षेत्रफलों के योग का $2\frac{17}{30}$ गुना है, जिनकी भुजाएँ 20 सेमी, 21 सेमी और 29 सेमी, और 11 सेमी, 60 सेमी और 61 सेमी हैं (प्रयोग करें) $\pi = 22/7$

SSC MTS 6/10/2021 (Evening)

- (a) 21 (b) 14 (c) 17.5 (d) 24.5

33. The radius of circum-circle of a right angled triangle is 10 cm and the altitude drawn to the hypotenuse is 8 cm. What is the area of the triangle?

एक समकोण त्रिभुज के परिवृत्त की त्रिज्या 10 सेमी है और कर्ण पर खींची गई ऊँचाई 8 सेमी है। त्रिभुज का क्षेत्रफल कितना है?

[CDS-2021-II]

- (a) 60 cm² (b) 80 cm²
(c) 100 cm² (d) 120 cm²

34. The inner circumference of a circular path enclosed between two concentric circles is 264 m. The uniform width of the circular path is 3 m. What is the area (in m², to the nearest whole number) of the path? (Use $\pi = 22/7$)

दो संकेंद्रित वृत्तों के बीच परिवृत्त वृत्ताकार पथ की आंतरिक परिधि 264 मीटर है। वृत्ताकार पथ की एकसमान चौड़ाई 3 मी है। पथ का क्षेत्रफल (m² में, निकटतम पूर्ण संख्या तक) क्या है? ($\pi=22/7$ का प्रयोग करें)

SSC CGL 20/4/2022 (Morning)

- (a) 696 (b) 756 (c) 820 (d) 948

35. A man is running at a speed of 20 km/hr. What is time taken by a man to cover one round of a circular garden of radius 35 cm.

एक व्यक्ति 20 km/hr की चाल से दौड़ता है तो ज्ञात करे व्यक्ति को एक वृत्ताकार पार्क जिसकी त्रिज्या 35 m है, को पार करने में कितना समय लगेगा ?

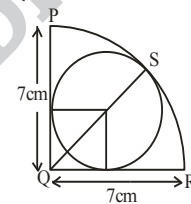
- (a) 412 sec (b) 336 sec
(c) 376 sec (d) 396 sec

36. An archery target has three regions formed by two concentric circles. If radii of the concentric circles are in the ratio of 1:3:5, then find the ratio of the area of three regions.

एक तीरंदाजी लक्ष्य में दो संकेंद्रित वृत्तों द्वारा निर्मित तीन क्षेत्र होते हैं। यदि संकेंद्रित वृत्तों की त्रिज्याएँ 1:3:5 के अनुपात में हैं, तो तीन क्षेत्रों के क्षेत्रफल का अनुपात ज्ञात कीजिए।

- (a) 1:4:16 (b) 1:3:9
(c) 1:8:25 (d) 1:8:16

37. In the given fig. PQR is a quadrant whose radius is 7cm. A circle is inscribed in the quadrant as shown in the figure. What is the area (in cm²) of the circle? दिये गये चित्र में, एक चतुर्थांश है जिसकी त्रिज्या 7 सेमी है एक वृत्त चतुर्थांश के अंदर बताया गया है तब इस वृत्त का क्षेत्रफल होगा-



- (a) 385 - 221√2 (b) 308 - 154√2
(c) 154 - 77√2 (d) 462 - 308√2

38. A 5 cm long perpendicular is drawn from the centre of a circle to a 24 cm long chord. Find the diameter of the circle.

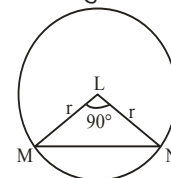
एक वृत्त के केंद्र से एक 24 सेमी लंबी जीवा पर 5 सेमी लम्बा लंब खींचा जाता है। वृत्त का व्यास ज्ञात कीजिए।

SSC CHSL 17/03/2020 (Morning)

- (a) 32 cm (b) 13 cm
(c) 30 cm (d) 26 cm

39. In the figure, L is the centre of the circle, and ML is the perpendicular to LN. If the area of the triangle MLN is 36, then the area of the circle is:

आकृति में, L वृत्त का केंद्र है, और ML, LN के लंबवत है यदि त्रिभुज MLN का क्षेत्रफल 36 है, तो वृत्त का क्षेत्रफल है:



SSC CHSL 12/10/2020 (Afternoon)

- (a)
- 70π
- (b)
- 72π
- (c)
- 66π
- (d)
- 68π

40. Out of 4 identical balls of radius r , 3 balls are placed on a plane such that each ball touches the other two balls. The 4th ball is placed on them such that this ball touches all the three balls. What is the distance of centre of 4th ball from the plane?
त्रिज्या r की 4 समान गेंदों में से 3 गेंदों को एक समतल पर इस प्रकार रखा जाता है कि प्रत्येक गेंद अन्य दो गेंदों को छूती है। चौथी गेंद उन पर इस प्रकार रखी जाती है कि यह गेंद तीनों गेंदों को स्पर्श करती है। चौथी गेंद के केंद्र की समतल से दूरी कितनी है?

[CDS-2020-I]

- (a) $2\frac{\sqrt{2}}{3}r$ unit (b) $\frac{\sqrt{3}+2\sqrt{2}}{\sqrt{2}}r$ unit
(c) $\frac{r}{3-2\sqrt{2}}$ unit (d) $\frac{\sqrt{3}+2\sqrt{2}}{\sqrt{3}}r$ unit

41. The area of the largest triangle that can be inscribed in a semicircle of radius 4 cm in square centimetres is
वर्ग सेंटीमीटर में त्रिज्या 4 सेमी के अर्धवृत्त में अंकित किए जा सकने वाले सबसे बड़े त्रिभुज का क्षेत्रफल है

SSC CHSL 15/10/2020 (Evening)

- (a) 16 (b) 14 (c) 12 (d) 18

42. A circular park whose diameter is 210 m has a 5 m wide path running around it (on the outside). What is the area (in m^2) of the path?
एक वृत्ताकार पार्क जिसका व्यास 210 मीटर है, के चारों ओर (बाहर की तरफ) एक 5 मीटर चौड़ा रास्ता है। पथ का क्षेत्रफल (मीटर² में) क्या है?

SSC CPO 11/12/19 (Morning)

- (a) 1100π (b) 1050π
(c) 1075π (d) 1020π

43. The area of a sector of a circle with central angle 60 is A. The circumference of the circle is C. Then A is equal to:
केंद्रीय कोण 60 वाले एक वृत्त के त्रिज्यखंड का क्षेत्रफल A है। वृत्त की परिधि C है। तब A बराबर है:

SSC CHSL 10/07/2019 (Evening)

- (a) $\frac{c^2}{6\pi}$ (b) $\frac{c^2}{18\pi}$ (c) $\frac{c^2}{24\pi}$ (d) $\frac{c^2}{4\pi}$

44. From a point P which is at a distance of 10 cm from the centre O of a circle of radius 6 cm, a pair of tangents PQ and PR to the circle at point Q and R respectively, are drawn. Then the area (in sq cm) of the quadrilateral PQOR is equal to:
एक बिंदु P से, जो 6 सेमी त्रिज्या वाले एक वृत्त के केंद्र O से 10 सेमी की दूरी पर है, क्रमशः बिंदु Q और R पर वृत्त पर दो

स्पर्श रेखाएँ PQ और PR खींची जाती हैं। तब चतुर्भुज PQOR का क्षेत्रफल (वर्ग सेमी में) इसके बराबर है:

SSC CPO 12/12/19 (Evening)

- (a) 30 (b) 40 (c) 24 (d) 48

45. If radius of outer circle is 8cm then find area of shaded region?
यदि बाहरी वृत्त की त्रिज्या 8 सेमी है तो छायांकित भाग का क्षेत्रफल ज्ञात करें?



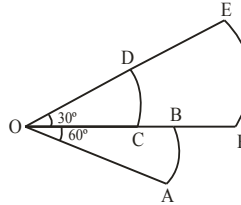
- (a) $100\frac{4}{7}$ (b) $108\frac{2}{7}$
(c) $98\frac{2}{7}$ (d) None

46. If a wheel has diameter 42 cm, then how far does the wheel go (in metres) in 12 revolutions?
 $\pi = 22/7$
यदि एक पहिये का व्यास 42 सेमी है, तो पहिया 12 चक्कर में कितनी दूर (मीटर में) जाता है? ($\pi=22/7$)

SSC CPO 23/11/2020 (Evening)

- (a) 17.64 (b) 15.84 (c) 23.27 (d) 21.45

47. Find the perimeter of the given figure, AB, CD and EF are arcs of concentric circles whose centre is O. If OC = 9 m, OB = 12 m, OF = 17 m $\angle AOC = 60^\circ$ and $\angle FOE = 30^\circ$. (Use $\pi=22/7$)
दी गई आकृति का परिमाप ज्ञात कीजिए, AB, CD और EF संकेंद्रित वृत्तों के चाप हैं जिनका केंद्र O है। यदि OC = 9 मीटर, OB = 12 मीटर, OF = 17 मीटर $\angle AOC = 60^\circ$ और $\angle FOE = 30^\circ$ है। ($\pi=22/7$ का प्रयोग करें)



- (a) $68\frac{2}{7}m$ (b) $65\frac{3}{7}m$
(c) $66\frac{3}{7}m$ (d) $63\frac{4}{7}m$

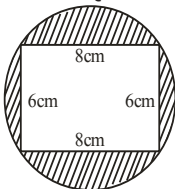
48. Two circles touch internally. The sum of their areas is $136\pi cm^2$ and distance between their centres is 4 cm. What are the radii of the circles?
दो वृत्त आंतरिक रूप से स्पर्श करते हैं। उनके क्षेत्रों का योग 136π सेमी² है और उनके केंद्रों के बीच की दूरी 4 सेमी है। वृत्तों की त्रिज्याएँ क्या हैं?

[CDS-2020-I]

- (a) 11 cm, 7 cm (b) 10 cm, 6 cm
(c) 9 cm, 5 cm (d) 8 cm, 4 cm

49. What is the approximate area of the shaded region in the figure given ?

दी गई आकृति में छायांकित क्षेत्र का लगभग क्षेत्रफल क्या है?

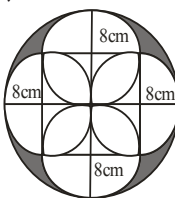


[CDS-2020-I]

- (a) 15.3 cm^2 (b) 25.5 cm^2
(c) 28.4 cm^2 (d) 30.5 cm^2

50. The radius of larger circle is 8 cm. then find area of shaded region?

बड़े वृत्त की त्रिज्या 8 सेमी है तो छायांकित भाग का क्षेत्रफल ज्ञात करें-



- (a) $36\frac{4}{7}$ (b) $36\frac{9}{7}$
(c) $35\frac{8}{5}$ (d) $36\frac{8}{7}$

51. The radii of three concentric circles are in the ratio of 4:5:7. What is the ratio of the area between the two inner circles to that between the two outer circles ?

तीन संकेंद्रित वृत्तों की त्रिज्याएँ 4:5:7 के अनुपात में हैं। दो आंतरिक वृत्तों के बीच के क्षेत्रफल का दो बाहरी वृत्तों के बीच के क्षेत्रफल से अनुपात क्या है?

SSC CGL 6/06/2019 (Evening)

- (a) 4:7 (b) 5:9 (c) 4:5 (d) 3:8

52. The Circumferences of three circles are $16\pi \text{ cm}$, $18\pi \text{ cm}$ and $24\pi \text{ cm}$ respectively. then find the circumference of the circle which has an area equal to the sum of areas of three circles.

तीन वृत्तों की परिधियाँ क्रमशः $16\pi \text{ cm}$, $18\pi \text{ cm}$ और $24\pi \text{ cm}$ हैं। तो उस वृत्त की परिधि ज्ञात कीजिए जिसका क्षेत्रफल तीन वृत्तों के क्षेत्रफलों के योग के बराबर है।

- (a) $34\pi \text{ cm}$ (b) $32\pi \text{ cm}$
(c) $17\pi \text{ cm}$ (d) $26\pi \text{ cm}$

53. A circle circumscribes a rectangle whose sides are in the ratio 4:3. If the perimeter of the rectangle is 56 cm, then what is the area (In square cm) of the circle?

एक वृत्त एक आयत के परिगत है जिसकी भुजाएँ 4:3 के अनुपात में हैं। यदि आयत का परिमाप 56 सेमी है, तो वृत्त का क्षेत्रफल (वर्ग सेमी में) क्या है?

SSC CHSL 3/07/2019 (Morning)

- (a) 70π (b) 96π (c) 90π (d) 100π

54. One - quarter of a circular pizza of diameter 28 cm was removed from the whole pizza. What is the perimeter (in cm) of the remaining pizza? ($\pi = 22/7$)

पूरे पिज्जा में से 28 सेंटीमीटर व्यास वाले एक वृत्ताकार पिज्जा का एक-चौथाई हिस्सा निकाल लिया गया। शेष पिज्जा का परिमाप (सेमी में) क्या है? ($\pi=22/7$)

SSC CHSL 4/8/2021 (Morning)

- (a) 88 (b) 94 (c) 80 (d) 66

Type-13 (Circle and Semi-Circle) ANSWER KEY

1	D	2	D	3	C	4	C	5	D	6	A	7	A	8	B
9	B	10	C	11	D	12	A	13	D	14	D	15	A	16	C
17	C	18	B	19	C	20	B	21	B	22	D	23	A	24	C
25	C	26	B	27	C	28	A	29	B	30	B	31	B	32	A
33	B	34	C	35	D	36	D	37	D	38	D	39	B	40	D
41	A	42	C	43	C	44	D	45	A	46	B	47	B	48	B
49	D	50	A	51	D	52	A	53	D	54	B				

Type-13 (Circle and Semi-Circle) Solution

1. Sol. (d)

Area of large field = area of three smaller field

$$\Rightarrow \pi R^2 = \pi 8^2 + \pi 9^2 + \pi 12^2$$

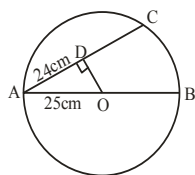
$$\Rightarrow \pi R^2 = \pi(8^2 + 9^2 + 12^2)$$

$$\Rightarrow R^2 = 64 + 81 + 144$$

$$\Rightarrow \text{Radius (R)} = \sqrt{289} \Rightarrow 17\text{m}$$

2. Sol. (d)

In triangle ADO,



$$AO^2 - AD^2 = OD^2 \Rightarrow (25)^2 - (24)^2 = OD^2$$

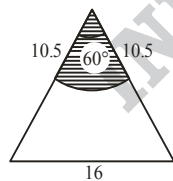
$$625 - 576 = OD^2 \Rightarrow 49 = OD^2$$

$$OD = 7 \text{ cm.}$$

So, the length of the perpendicular drawn from the centre of the circle to the chord is 7 cm.

3. Sol. (c)

As it is given that plot is in the shape of an equilateral triangle then, the grazed area is part of circle of radius 10.5 m. so, angle is 60°

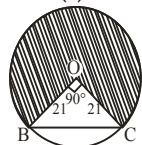


Hence, required area

$$= \frac{60^\circ}{360^\circ} \times \frac{22}{7} \times 10.5 \times 10.5$$

$$= \frac{2425.5}{42} = 57.75 \text{ m}^2$$

4. Sol. (c)



Area of minor sector (OBC)

$$= \frac{90}{360} \times \frac{22}{7} \times 21 \times 21 = 346.5 \text{ cm}^2$$

Area of $\triangle OBC$

$$= \frac{1}{2} \times 21 \times 21 = 220.5 \text{ cm}^2$$

Area of minor segment

$$= 346.5 - 220.5 = 126 \text{ cm}^2$$

Now, area of major segment = area of circle - area of minor segment

$$= \frac{22}{7} \times 21^2 - 126 = 1386 - 126 = 1260 \text{ cm}^2$$

Short Trick:- Area of major segment area of major

$$\text{sector} + \text{area of triangle Required area} :- \frac{270}{360} \times \frac{22}{7} \times 21 \times 21 + \frac{1}{2} \times 21 \times 21$$

$$\text{Required area} :- \frac{21}{2} (99 + 21) = 60 \times 21 = 1260 \text{ cm}^2$$

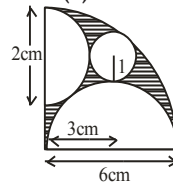
5. Sol. (d)

$$\text{Area of sector} = \frac{\theta^\circ}{360^\circ} \times \pi r^2$$

$$308 = \frac{45^\circ}{360^\circ} \times \frac{22}{7} \times r^2$$

$$r^2 = \frac{308 \times 56}{22} = 14 \times 56 \Rightarrow r = 28 \text{ cm}$$

6. Sol. (a)



Area of shaded region

$$= 9\pi - \left(\pi + \frac{9\pi}{2} + \frac{4\pi}{2} \right)$$

$$= 8\pi - \frac{13\pi}{2} = \frac{3\pi}{2}$$

$$= 1.5\pi$$

7. Sol. (a)

Area of Sector

$$= \frac{\pi r^2 \theta}{360} = \frac{\frac{22}{7} \times 7^2 \times 90}{360} = 38.5 \text{ cm}^2$$

8. Sol. (b)

Length of the arc

$$= \frac{\theta}{360} \times 2\pi r = \frac{36}{360} \times 2 \times \frac{22}{7} \times 35$$

$$= 22 \text{ cm}$$

9. Sol. (b)

Perimeter of quarter circle = $\frac{\pi r}{2} + 2r$

$$\Rightarrow p = r \left(\frac{25}{7} \right) \Rightarrow r = \frac{7p}{25}$$

Area of quarter circle = $\frac{\pi r^2}{4}$

$$\Rightarrow A = \frac{\pi}{4} \times \left(\frac{7}{25} \right)^2 p^2$$

$$\Rightarrow \frac{A}{p^2} = \frac{77}{1250}$$

10. Sol. (c)

Let the radius of the inner and outer circle be r and R respectively. According to the question,

Difference between the areas of two concentric

circles = 264 cm^2

$$\Rightarrow \pi R^2 - \pi r^2 = 264$$

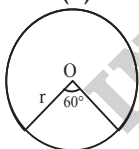
$$\Rightarrow \pi(R^2 - r^2) = 264$$

$$\Rightarrow \frac{22}{7} \times (R^2 - r^2) = 264$$

$$\Rightarrow R^2 - r^2 = 84 \text{ cm}^2$$

So, option (c) is the correct answer.

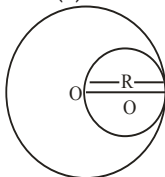
11. Sol. (d)

Area of sector = $\frac{\theta}{360} \times \pi r^2$

$$66 \text{ cm}^2 = \frac{60}{360} \times \frac{22}{7} \times r^2$$

$$r^2 = \frac{66 \times 6 \times 7}{22} = 3 \times 6 \times 7 \Rightarrow r = 3\sqrt{14} \text{ cm}$$

12. Sol. (a)



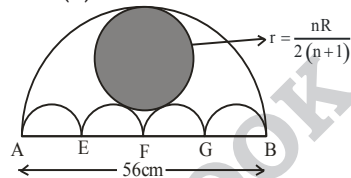
Area of the smaller circle = 192

$$\pi r^2 = 192 \Rightarrow \pi \times \left(\frac{R}{2} \right)^2 = 192$$

$$\pi R^2 = 192 \times 4 = 768$$

So, area of the bigger circle = 768 cm^2

13. Sol. (d)

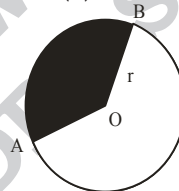


$$r = \frac{\pi R}{2(n+1)} = \frac{4 \times 28}{2 \times 5} = \frac{56}{5}$$

Area of shaded region

$$= \pi \frac{56}{5} \times \frac{56}{5} = \frac{22}{7} \times \frac{56}{5} \times \frac{56}{5} = 394.24$$

14. Sol. (d)



Area of sector OAB

$$= \frac{\text{length of arc} \times \text{radius}}{2} = \frac{2r \times r}{2} = r^2$$

15. Sol. (a)

In-radius (r) = $\frac{\Delta}{S}$

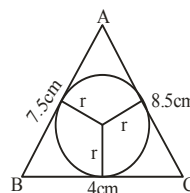
$$\text{Here, } S = \frac{7.5+8.5+4}{2} = 10 \text{ cm}$$

$$\text{and } \Delta = \sqrt{10 \cdot (10 - 8.5) \cdot (10 - 7.5)(10 - 4)}$$

$$= \sqrt{10 \times 1.5 \times 2.5 \times 6}$$

$$= 5 \times 3 = 15 \text{ cm}$$

$$\therefore r = \frac{15}{10} = 1.5 \text{ cm}$$



16. Sol. (c)

Perimeter of semicircle = $\pi r + 2r$

$$\Rightarrow P = r \left(\frac{36}{7} \right) \Rightarrow r = \frac{7P}{36}$$

$$\text{Area of semicircle} = \frac{\pi r^2}{2}$$

$$= \frac{1}{2} \times \frac{22}{7} \times \frac{7P}{36} \times \frac{7P}{36} = \frac{77}{1296} P^2$$

17. **Sol. (c)**

Let wheel rotates n number of times

$$\text{Distance} = n \times 2\pi r$$

$$\Rightarrow 176 = n \times 2 \times \frac{22}{7} \times \frac{56}{10} \Rightarrow n = 5$$

18. **Sol. (b)**

Let the radius of each of the smaller semicircle be r

Then, the diameter of larger semicircle = $6r$

The area of larger semicircle

$$= \frac{\pi}{2} \times \left(\frac{6r}{2}\right)^2 = 4.5\pi r^2$$

The area of unshaded region

$$= 3 \times \frac{1}{2} \pi \times r^2$$

$$\text{The required ratio} = 1.5\pi r^2 : \pi r^2 (4.5 - 1.5)$$

$$= 1.5\pi r^2 : 3\pi r^2 = 1 : 2$$

19. **Sol. (c)**

Circumference of circle = $2\pi r$ Ratio of circumference of circle is directly proportional to ratio of radius of circle.

$$R : r = 5 : 4$$

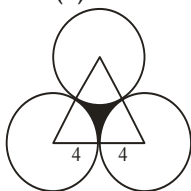
Width of path

$$= (\text{outer radius} - \text{inner radius}) = 1 \text{ unit}$$

According to question, 1 unit = 50 m

Then, Inner radius (r) = 200 m

20. **Sol. (b)**



Required area = Area of equilateral triangle - Area of 3 sectors with angle 60° Area of equilateral triangle

$$= \frac{\sqrt{3}}{4} a^2 = \frac{\sqrt{3}}{4} \times 8 \times 8 = 16\sqrt{3} \text{ cm}^2$$

Area of three sectors with central angle 60° and radius 4 cm

$$= 3 \times \frac{60}{360} \times \pi \times 4 \times 4 = 8\pi$$

$$\text{Required area} = 16\sqrt{3} - 8\pi = 8(2\sqrt{3} - \pi)$$

21. **Sol. (b)**

Circumference of a circle = $a\pi$

$$2\pi r = a\pi \Rightarrow 2r = a$$

$$\text{Area} = b\pi \Rightarrow \pi r^2 = b\pi \Rightarrow b = r^2$$

$$a : b = 2r : r^2 \text{ or } 2 : r$$

$$\Rightarrow 4 : 5 = 2 : r \Rightarrow r = 2.5 \text{ cm}$$

22. **Sol. (d)**

$$\text{Area of sector} = \frac{\pi R^2 \theta}{360^\circ} = \frac{\pi R^2 60^\circ}{360^\circ} = \frac{\pi R^2}{6} = 231$$

$$\Rightarrow \pi R^2 = 1386 \Rightarrow R = 21 \text{ m}$$

$$\text{Perimeter of the sector} = \frac{2\pi R \theta}{360^\circ} + 2R$$

$$= \frac{2\pi R 60^\circ}{360^\circ} + 2R = \frac{2\pi R}{6} + 2R = 22 + 42 = 64 \text{ m}$$

$$\text{Length of wire needed} = 64 \times 9 = 576 \text{ m}$$

$$\text{Cost of wire} = 576 \times 15 = ₹8640$$

23. **Sol. (a)**

Circumference of circular

$$\text{field} = \frac{2420}{11} = 220 \text{ m}$$

$$2\pi r = 220$$

$$2 \times \frac{22}{7} \times r = 220, r = 35 \text{ m}$$

$$\text{Area of field} = \pi r^2$$

$$= \frac{22}{7} \times (35)^2 = 3850 \text{ m}^2$$

24. **Sol. (c)**

Let the radius of the outer circumference be ' R ' and the radius of the inner circumference be ' r '.

$$\text{Now, } 2\pi R = 748 \text{ m.}$$

$$2 \times \frac{22}{7} \times R = 748$$

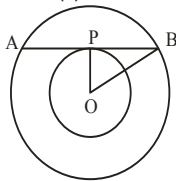
$$R = \frac{748 \times 7}{22 \times 2}, R = 119 \text{ m}$$

$$\text{Again, } 2\pi r = 396 \text{ m.}$$

$$2 \times \frac{22}{7} \times r = 396 \Rightarrow r = \frac{396 \times 7}{22 \times 2} = 63 \text{ m.}$$

$$\text{Width of the track} = (R - r) = (119 - 63) = 56 \text{ m.}$$

25. Sol. (c)



Let the radii be R_1 and R_2

In $\triangle OPB$

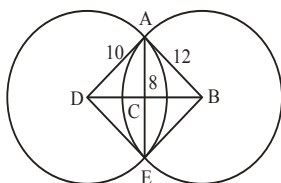
$$PB^2 = (OB)^2 - (OP)^2$$

$$\Rightarrow 4^2 = R_2^2 - R_1^2$$

$$\text{Area of the ring} = \pi(R_2^2 - R_1^2) = 16\pi$$

26. Sol. (b)

Let AE be the common chord, so $AC = \frac{16}{2} = 8$ cm



$$BC = \sqrt{12^2 - 8^2} = \sqrt{80} = 4\sqrt{5} \text{ cm}$$

$$CD = \sqrt{10^2 - 8^2} = \sqrt{36} = 6 \text{ cm}$$

$$\text{Distance between their centers} = 6 + 4\sqrt{5} \text{ cm}$$

27. Sol. (c)

Radius of bicycle = 0.42 m

Distance travelled in 25 seconds

$$= 2\pi r \times 40 = 2 \times \frac{22}{7} \times 0.42 \times 40$$

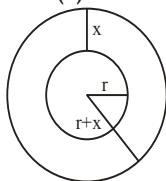
$$= 105.6 \text{ m, Speed of bicycle (in m/s)}$$

$$= \frac{105.6}{25} = 4.224$$

Speed of bicycle (in kmph)

$$= 4.224 \times \frac{18}{5} = 15.2$$

28. Sol. (a)



$$\text{Area of the path} = \pi[r+x]^2 - \pi[r]^2$$

$$= \pi \times (r+x+r) \times (r+x-r)$$

$$= \pi x(x+d)$$

29. Sol. (b)

Let the radius of the circle be R Then

$$\Rightarrow (R+14)^2 - R^2 = A$$

$$\Rightarrow R^2 + 14^2 + 28R - R^2 = A$$

$$\Rightarrow 28R = A - 14^2$$

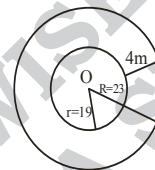
$$R = \frac{A-196}{28} \text{ m}$$

30. Sol. (b)

Let R be the radius of outer circle, and r be the radius of inner circle so $R = 23$ m

Path width = 4 m, so $r = R - 23$

$$4 = 23 - r \Rightarrow r = 19 \text{ m}$$



$$\text{So total area to be paved} = \pi R^2 - \pi r^2$$

$$= \pi(R^2 - r^2) = \pi(23^2 - 19^2)$$

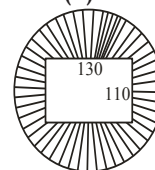
$$= \frac{22}{7} (529 - 361)$$

$$= \frac{22}{7} (168) = 22(24) = 528\text{m}^2$$

So the cost of paving the path at the rate of rs.

$$500/\text{m}^2 = \text{Area} \times \text{Rate} = 528 \times 500 = \text{Rs. } 264000$$

31. Sol. (b)



$$\pi r^2 = 20350 + 130 \times 110$$

Short Trick $\rightarrow$ Answer should be multiply of 7

32. Sol. (a)

Triangle with sides 20, 21 and 29 form a triplet so it is a right triangle with perpendicular and base as 20 and 21.

$$\text{Area} = \frac{1}{2} \times 20 \times 21 = 210$$

Triangle with sides 11, 60 and 61 also forms a triplet so it is also a right triangle with perpendicular and base as 11 and 60.

$$\text{Area} = \frac{1}{2} \times 11 \times 60 = 330.$$

Sum of area of these two triangles

$$= (210 + 330) = 540 \text{ cm}^2$$

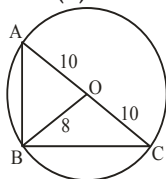
$$\text{Area of the circle} = 2 \frac{17}{30} \times 540$$

$$= \frac{77}{30} \times 540 = 18 \times 77 \text{ cm}^2$$

$$\frac{22}{7} \times r^2 = 18 \times 77$$

$$\Rightarrow r^2 = 441, r = 21 \text{ cm}.$$

33. Sol. (b)



$$\text{Area of triangle} = \frac{1}{2} \times 20 \times 8 = 80 \text{ cm}^2$$

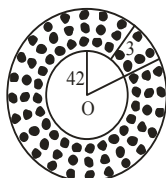
34. Sol. (c)

Take inner radius = r Outer radius = $R = (r + 3)$

According to the question $2\pi r = 264\text{m}$

$$r = \frac{264 \times 7}{22 \times 2} = 42\text{m}$$

$$R = (r + 3) = 42 + 3 = 45\text{m}$$



$$\text{Area of path} = \pi(R^2 - r^2)$$

$$\frac{22}{7}(R + r)(R - r)$$

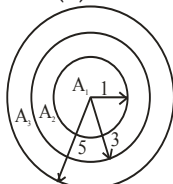
$$= \frac{22}{7}(87\text{m} \times 3\text{m}) = 820.28 \approx 820 \text{ m}^2$$

35. Sol. (d)

$$C = 2\pi R = 2 \times \frac{22}{7} \times 350 = 44 \times 50$$

$$\text{Time} = \frac{44 \times 50}{20 \times 5} \times 18 = 396\text{sec}$$

36. Sol. (d)



Let radii of circles be $k, 3k$ and $5k$

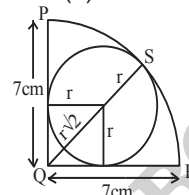
$$A_1 = \pi(k)^2 = \pi k^2$$

$$A_2 = \pi(3k)^2 - \pi(k)^2 = 8\pi k^2$$

$$A_3 = \pi(5k)^2 - \pi(3k)^2 = 16\pi k^2$$

$$A_1 : A_2 : A_3 = \pi k^2 : 8\pi k^2 : 16\pi k^2 = 1 : 8 : 16$$

37. Sol. (d)



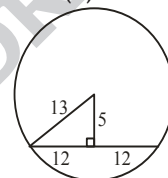
$$r\sqrt{2} + r = 7$$

$$r = \frac{7}{\sqrt{2}+1} = 7(\sqrt{2}-1)$$

$$\text{Area} = 154(\sqrt{2}-1)^2$$

$$= 154(3 - 2\sqrt{2}) = 462 - 308\sqrt{2}$$

38. Sol. (d)



Radius = 13 cm

Diameter = $2 \times 13 = 26 \text{ cm}$

39. Sol. (b)

Area of the triangle MLN

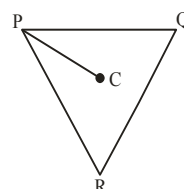
$$= \frac{1}{2} \times r^2 \Rightarrow 36 \Rightarrow r = 6\sqrt{2}$$

$$\text{Area} = \pi r^2 = \pi(6\sqrt{2})^2 = 72\pi$$

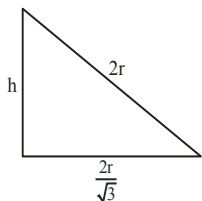
40. Sol. (d)

The centre of three lower balls form an equilateral triangle. Let C be the centroid of this triangle. C is at the distance of $\frac{2r}{\sqrt{3}}$ from each vertex of lower ball.

Let h = height of centre of 4th ball from C .



$$\text{then, } h = \sqrt{(2r)^2 - \left(\frac{2r}{\sqrt{3}}\right)^2} = 2r\sqrt{\frac{2}{3}}$$

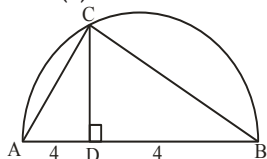


$\therefore$ height of centre of 4th ball from plane

$$= h + r = 2r\sqrt{\frac{2}{3}} + r$$

$$= r\left(\frac{2\sqrt{2} + \sqrt{3}}{\sqrt{3}}\right) \text{ units}$$

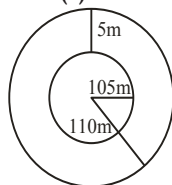
41. Sol. (a)



$$AD = DB = CD = 4\text{cm, } AB = 8\text{ cm}$$

$$\text{Area of triangle} = \frac{1}{2} \times 8 \times 4 = 16\text{ cm}^2$$

42. Sol. (c)



$$\text{Area of the path} = \pi(R^2 - r^2)$$

$$= \pi(110^2 - 105^2) = 1075\pi\text{ m}^2$$

43. Sol. (c)

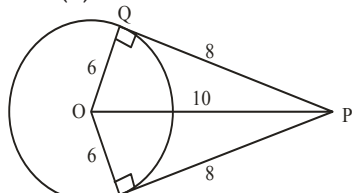
Circumference of the circle (C)

$$= 2\pi r \Rightarrow r = \frac{C}{2\pi}$$

$$\text{Area of the sector (A)} = \frac{60}{360} \times \pi \times r^2$$

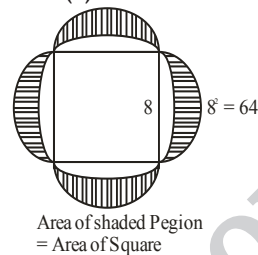
$$\Rightarrow \frac{1}{6} \times \pi \times \left(\frac{C}{2\pi}\right)^2 = \frac{C^2}{24\pi}$$

44. Sol. (d)



$$\text{Area of PQOR} = 2 \times \frac{1}{2} \times 6 \times 8 = 48\text{sq. cm}$$

45. Sol. (a)



Area of Shaded Region Area of semicircle formed on the side of square with 3 cm + 4 leaves

$$\Rightarrow 64 + \frac{4}{7} \times 4^2 \times 4$$

$$\Rightarrow 64 \left(1 + \frac{4}{7}\right)$$

$$\Rightarrow \frac{64 \times 11}{7} = \frac{704}{7} = 100\frac{4}{7}\text{ cm}^2$$

46. Sol. (b)

$$\text{Diameter} = 42\text{ cm, Radius} = 21\text{ cm}$$

Distance travelled in 1 revolution

$$= 2\pi r = 132\text{ cm}$$

Distance travelled in 12 revolutions

$$= 132 \times 12 = 1584\text{ cm} = 15.84\text{ m}$$

47. Sol. (b)

$$\text{Length of arc } \widehat{AB} = \frac{2\pi(12)}{360^\circ} \times 60^\circ = 4\pi\text{ m}$$

$$\text{Length of arc } \widehat{EF} = \frac{2\pi(17)}{360^\circ} \times 30^\circ = \frac{17}{6}\pi\text{ m}$$

$$\text{Length of arc } \widehat{DC} = \frac{2\pi(9)}{360^\circ} \times 30^\circ = \frac{3}{2}\pi\text{ m}$$

$$\widehat{AB} + \widehat{EF} + \widehat{DC} = 4\pi + \frac{17}{6}\pi + \frac{3}{2}\pi = 10\pi\text{ m}$$

Perimeter of the figure

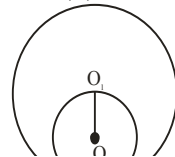
$$= OA + \widehat{AB} + BF + \widehat{FE} + DE + \widehat{DC} + OC$$

$$= 12 + \widehat{AB} + 5 + \widehat{FE} + 8 + \widehat{DC} + 9$$

$$= 34 + \widehat{AB} + \widehat{FE} + \widehat{DC}$$

$$= 34 + 10\pi = 65\frac{3}{7}\text{ m}$$

48. Sol. (b)



$$\pi r_1^2 + \pi r_2^2 = 136\pi$$

$$r_1^2 + r_2^2 = 136 \quad \dots (i)$$

$$r_1 - r_2 = 4 \quad \dots (ii)$$

from equation (i) and (ii)

$$(r_1 - r_2)^2 = r_1^2 + r_2^2 - 2r_1 \cdot r_2$$

$$\Rightarrow 16 = 136 - 2r_1 \cdot r_2$$

$$r_1 \cdot r_2 = 60$$

Again from equation (ii)

$$(r_1 + r_2)^2 = r_1^2 + r_2^2 + 2r_1 \cdot r_2$$

$$(r_1 + r_2)^2 = 136 + 120$$

$$(r_1 + r_2)^2 = 256$$

$$\therefore r_1 + r_2 = 16$$

From equation (ii) and (iii) we get

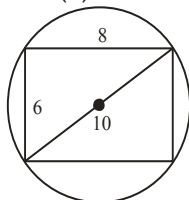
$$r_1 + r_2 = 16$$

$$r_1 - r_2 = 4$$

$$r_1 = 10$$

$$r_2 = 6$$

49. Sol. (d)



$$\text{Area of circle} = \pi r^2$$

$$= \pi(\sqrt{3^2 + 4^2})^2 = \pi(\sqrt{25})^2 = 25\pi$$

$$\text{Area of rectangle} = a \times b = 6 \times 8$$

$$\therefore \text{Reqd. Area} = \pi \times 5^2 - 6 \times 8$$

$$= 25\pi - 48 = 30.5 \text{ cm}^2$$

50. Sol. (a)

$$\text{Area of shaded Region} = \pi \cdot 8^2 - 8^2 - 2\pi \cdot 4^2$$

$$= 32\pi - 64$$

$$= 32\left(\frac{22}{7} - 2\right) = \frac{32 \times 8}{7} = 36\frac{4}{7}$$

51. Sol. (d)

$$\text{Area of circle is } \propto r^2.$$

$$\Rightarrow \text{Area of three circles will be } 4^2, 5^2, 7^2 \text{ Desired}$$

52. Sol. (a)

Let the radii of the circles be r_1, r_2, r_3 and R

$$2\pi r_1 = 16\pi \Rightarrow r_1 = 8 \text{ cm}$$

$$2\pi r_2 = 18\pi \Rightarrow r_2 = 9 \text{ cm}$$

$$2\pi r_3 = 24\pi \Rightarrow r_3 = 12 \text{ cm}$$

Now

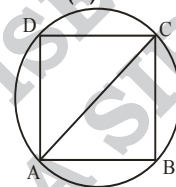
$$\pi R^2 = \pi r_1^2 + \pi r_2^2 + \pi r_3^2$$

$$\Rightarrow \pi R^2 = 64\pi + 81\pi + 144\pi$$

$$\Rightarrow R^2 = 289 \Rightarrow R = 17$$

$$\text{Length of circumference} = 2\pi R = 34\pi \text{ cm}$$

53. Sol. (d)



Let the sides be 4 units and 3 units.

According to the question

$$2(4 \text{ unit} + 3 \text{ unit}) = 56$$

$$1 \text{ unit} = 4 \text{ cm}, 4 \text{ unit} = 16 \text{ cm}, 3 \text{ unit} = 12 \text{ cm}$$

Diagonal of Rectangle = Diameter of circle

$$= \sqrt{AB^2 + BC^2} = \sqrt{16^2 + 12^2} = 20 \text{ cm}$$

$$\text{Radius of the circle} = \frac{20}{2} = 10 \text{ cm}$$

$$\text{Area of circle} = \pi r^2 = \pi 10^2 = 100\pi$$

54. Sol. (b)

$$\text{Diameter} = 28 \text{ cm}$$

$$\text{Radius} = 14 \text{ cm}$$

$$\text{Perimeter of circular pizza} = 2\pi r = 88 \text{ cm}$$

Perimeter of circular part of one - quarter

$$= \frac{1}{4} \times 88 \text{ cm} = 22 \text{ cm}$$

Perimeter of the circular part of remaining pizza

$$= (88 - 22) = 66 \text{ cm}$$

Perimeter of remaining pizza = Perimeter of the

circular part + $2 \times r$

$$= 66 + 28 = 94 \text{ cm}$$

Type-14 (Polygon)

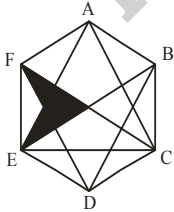
1. ABCDEF is a regular hexagon. Side of the hexagon is 36 cm. What is the area of the triangle ABC ?
ABCDEF एक नियमित षट्भुज है। षट्भुज की भुजा 36 सेमी है। त्रिभुज ABC का क्षेत्रफल क्या है?

SSC CGL Tier-2 2023

- (a) $324\sqrt{3} \text{ cm}^2$ (b) $360\sqrt{3} \text{ cm}^2$
(c) $240\sqrt{3} \text{ cm}^2$ (d) $192\sqrt{3} \text{ cm}^2$
2. The area of a regular hexagon of side $2\sqrt{3} \text{ cm}$ is :
 $2\sqrt{3}$ सेमी भुजा वाले एक नियमित षट्भुज का क्षेत्रफल है:
(a) $18\sqrt{3} \text{ cm}^2$ (b) $12\sqrt{3} \text{ cm}^2$
(c) $36\sqrt{3} \text{ cm}^2$ (d) $27\sqrt{3} \text{ cm}^2$
3. Find the area of a regular hexagon whose side length 14 cm.
एक नियमित षट्भुज का क्षेत्रफल ज्ञात कीजिए जिसकी भुजा की लंबाई 14 सेमी है।
(a) $293\sqrt{3} \text{ cm}^2$ (b) $296\sqrt{3} \text{ cm}^2$
(c) $294\sqrt{3} \text{ cm}^2$ (d) $298\sqrt{3} \text{ cm}^2$
4. If the ratio of an external angle and an internal angle of a regular polygon is 1:5, then what is the number of sides in the polygon?
यदि एक समबहुभुज के एक बाहरी कोण और एक आंतरिक कोण का अनुपात 1:5 है, तो बहुभुज में भुजाओं की संख्या कितनी है?

SSC MTS 22/07/2022 (Afternoon)

- (a) 24 (b) 22 (c) 12 (d) 30
5. Find the ratio of shaded area to unshaded area?
छायांकित क्षेत्र का अछायांकित क्षेत्र के क्षेत्रफल से अनुपात क्या है?



- (a) $\frac{1}{8}$ (b) $\frac{1}{9}$ (c) $\frac{1}{10}$ (d) $\frac{1}{12}$
6. ABCDE is a regular pentagon O is a point inside the pentagon such that AOB is an equilateral triangle. What is $\angle OEA$?

ABCDE एक सम पंचभुज है O इसके अंदर एक बिंदु इस प्रकार है कि AOE समबाहु त्रिभुज है तब $\angle OEA$ का मान क्या होगा ?

- (a) 66 (b) 48 (c) 54 (d) 72

7. If the area of a regular hexagon is $108\sqrt{3} \text{ cm}^2$, its perimeter (in cm) is:

यदि एक नियमित षट्भुज का क्षेत्रफल $108\sqrt{3}$ सेमी² है, तो इसका परिमाप (सेमी में) है:

SSC CPO 15/03/2019 (Evening)

- (a) $36\sqrt{2}$ (b) $42\sqrt{3}$ (c) $28\sqrt{3}$ (d) 24

8. What is the magnitude (in radian) of the interior angle of a regular pentagon?

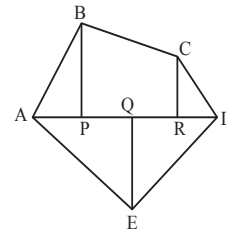
एक नियमित पंचभुज के आंतरिक कोण का परिमाण (रेडियन में) क्या है?

[CDS-2020-II]

- (a) $\frac{\pi}{5}$ (b) $\frac{2\pi}{5}$ (c) $\frac{3\pi}{5}$ (d) $\frac{4\pi}{5}$

9. The length diagonal AD of pentagon ABCDE as shown in the given figure is 44 m and the lengths perpendicular from B, C and E on AD are 24 m 16 m and 15 m respectively if AB = 25 m and CD = 20 m. Find the area of the pentagon?

दिए गए आंकड़े में दिखाए गए पेंटगोन ABCDE की लंबाई विकर्ण AD 44 मीटर है और AD पर B, C और E से लंबवत क्रमशः 24 मीटर 16 मीटर और 15 मीटर हैं यदि AB = 25 मीटर और CD = 20 मीटर है। पंचभुज का क्षेत्रफल ज्ञात कीजिये?



- (a) 1226 m^2 (b) 1010 m^2
(c) 1100 m^2 (d) 1001 m^2

10. Find the length of smallest diagonal of a regular hexagon whose side length is 'a'.

एक नियमित षट्भुज के सबसे छोटे विकर्ण की लंबाई ज्ञात कीजिए जिसकी भुजा की लंबाई 'a' है।

- (a) a (b) 2a (c) $\frac{2a}{3}$ (d) $\sqrt{3}a$

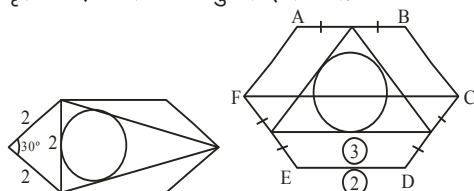
11. The sum of all the interior angles of a regular polygon is four times the sum of its exterior angles. The polygon is :
एक नियमित बहुभुज के सभी आंतरिक कोणों का योग इसके बाहरी कोणों के योग का चार गुना है। बहुभुज है:

[SSC-2018]

- (a) hexagon (b) triangle
(c) decagon (d) nonagon

12. Two Congruent regular hexagon are shown below than find the ratio cut of area of circle inside them as shown in figure?

निचे दो सर्वांगसम सम षट्भुज दिये गये हैं उनके अंदर स्थित वृत्तों के क्षेत्रफलों का अनुपात ज्ञात करें?



- (a) 3:2 (b) 4:3 (c) $2:\sqrt{3}$ (d) 2:1

13. The number of sides of two regular polygons are in the ratio 5:4. The difference between their interior angles is 9° . Consider the following statements :

दो नियमित बहुभुजों की भुजाओं की संख्या का अनुपात 5:4 है। उनके आंतरिक कोणों के बीच का अंतर 9° है। निम्नलिखित कथनों पर विचार करें:

- One of them is a pentagon and the other is a rectangle.
उनमें से एक पंचभुज है और दूसरा आयत है।
- One of them is a decagon and the other is an octagon.
उनमें से एक दशभुज है और दूसरा अष्टभुज है।
- The sum of their exterior angle is 720° .
उनके बाह्य कोणों का योग 720° होता है।

Which of the above statements is/are correct?

उपरोक्त कथनों में से कौन-सा/से सही है/हैं?

[CDS-2018-II]

- (a) 1 only (b) 2 only
(c) 1 and 3 (d) 2 and 3

14. 8 interior angle of a polygon is 165° each and remaining interior angle are 168° each. Find number of diagonal in polygon?

एक बहुभुज में 8 आंतरिक कोण में से प्रत्येक की माप 165° है तथा बचे हुये प्रत्येक आंतरिक कोण का मान 168° है तो उस बहुभुज के विकर्णों की संख्या क्या होगी?

- (a) 350 (b) 464 (c) 275 (d) 405

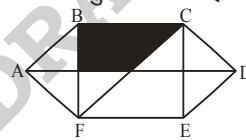
15. PQIRST is a regular pentagon. If PR and QT intersects each other at X, then what is the value (in degrees) of $\angle TXR$?

PQRST एक नियमित पंचभुज है। यदि PR और QT परस्पर X पर प्रतिच्छेद करते हैं, तो $\angle TXR$ का मान (डिग्री में) क्या है?

- (a) 98 (b) 90 (c) 72 (d) 108

16. In the given figure, ABCDEF is a regular hexagon whose side is 12 cm. What is the shaded area (in cm^2)?

दी गई आकृति में, ABCDEF एक नियमित षट्भुज है जिसकी भुजा 12 सेमी है। छायांकित क्षेत्र (सेमी² में) क्या है?



- (a) $54\sqrt{3}$ (b) $36\sqrt{3}$ (c) $48\sqrt{3}$ (d) $52\sqrt{3}$

17. The corner of a square of side 'a' are cut away so as from a regular hexagon. What is the side of the octagon?

'a' भुजा वाले एक वर्ग के कोनों को नियमित षट्भुज की तरह काट दिया जाता है। अष्टभुज की भुजा क्या है?

[CDS-2019-I]

- (a) $a(\sqrt{2} - 1)$ (b) $a(\sqrt{3} - 1)$
(c) $\frac{a}{\sqrt{2}+2}$ (d) $\frac{a}{3}$

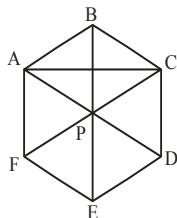
Type-14 (Polygon) ANSWER KEY

1	A	2	A	3	C	4	C	5	A	6	A	7	A	8	C
9	B	10	D	11	C	12	B	13	D	14	A	15	D	16	A
17	A														

Type-14 (Polygon) Solution

1. Sol. (a)

According to the question,



As ABCDEF is a regular hexagon,

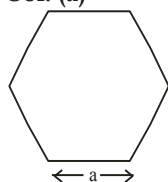
$$\text{Area of } \square ABCP = 2 \times \frac{\sqrt{3}}{4} \times (\text{side})^2$$

$$= 2 \times \frac{\sqrt{3}}{4} \times 36^2 = 648\sqrt{3} \text{ cm}^2$$

So, area of $\triangle ABC = \frac{1}{2} \times \text{Area of } \square ABCP$

$$= \frac{1}{2} \times 648\sqrt{3} = 324\sqrt{3} \text{ cm}^2$$

2. Sol. (a)



A regular hexagon consists of 6 equilateral triangle

area of regular hexagon

$$= 6 \times \frac{\sqrt{3}}{4} (\text{side})^2$$

$$= 6 \times \frac{\sqrt{3}}{4} a^2$$

$$= 6 \times \frac{\sqrt{3}}{4} \times (2\sqrt{3})^2$$

$$= 6 \times \frac{\sqrt{3}}{4} \times 12 = 18\sqrt{3} \text{ cm}^2$$

3. Sol. (c)

$$\text{Area of regular hexagon} = 6 \times \frac{\sqrt{3}}{4} (\text{side})^2$$

$$= 6 \times \frac{\sqrt{3}}{4} \times 14^2 = 294\sqrt{3} \text{ cm}^2$$

4. Sol. (c)

Ratio of an external angle and an internal angle

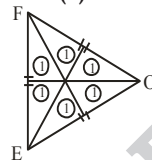
$$= 1:5$$

As per question,

$$x + 5x = 180 \Rightarrow x = 30$$

$$\text{Number of sides} = \frac{360}{30} = 12$$

5. Sol. (a)

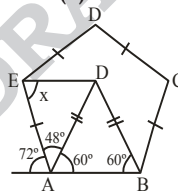


$$\frac{4}{6} = \frac{2}{3}$$

$$\frac{\text{shaded}}{\text{Total}} = \frac{2}{3 \times 6} = \frac{1}{9}$$

$$\frac{\text{Shaded}}{\text{Unshaded}} = \frac{1}{8}$$

6. Sol. (a)



$$48 + 2x = 180$$

$$2x = 132$$

$$x = 66^\circ$$

7. Sol. (a)

ATQ,

$$\frac{3\sqrt{3}}{2} \times a^2 = 108\sqrt{3} \Rightarrow a = 6\sqrt{2}$$

$$\therefore \text{Perimeter} = 6 \times 6\sqrt{2} = 36\sqrt{2} \text{ cm}$$

8. Sol. (c)

Interior angle of polygon of n sides

$$= \frac{(n-2) \times \pi}{n}$$

Here, n = 5

$$\text{Interior angle} = \frac{(5-2)\pi}{5} = \frac{3\pi}{5}$$

9. Sol. (b)

In $\triangle APB$

$$AP^2 = AB^2 - BP^2 = 25^2 - 24^2 = 7^2$$

$$\Rightarrow AP = 7 \text{ m}$$

In $\triangle CRD$

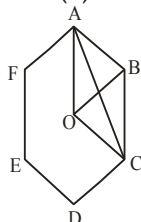
$$RD^2 = CD^2 - CR^2 = 20^2 - 16^2 = 12^2$$

$$\Rightarrow RD = 12 \text{ m}$$

$$PR = AD - AP - RD = 44 - 7 - 12 = 25 \text{ m}$$

$$\begin{aligned} \text{Area of pentagon} &= \text{ar}(\triangle ABP) + \text{ar}(\triangle CRD) + \text{ar}(\triangle AED) + \text{ar}(\triangle PBCR) \\ &= \frac{1}{2} \times 7 \times 24 + \frac{1}{2} \times 12 \times 16 + \frac{1}{2} \times 44 \times 15 + \frac{1}{2} (24 + 16) \times 25 \\ &= 84 + 96 + 330 + 500 = 1010 \text{ m}^2 \end{aligned}$$

10. Sol. (d)



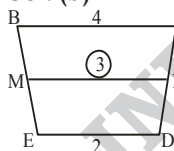
Join AO, OB and OC. AOCB is a rhombus with AOB and OBC are equilateral triangles.

$$AC = 2 \times (\text{height of triangle AOB})$$

$$\Rightarrow AC = 2 \times \frac{\sqrt{3}}{2} a \Rightarrow AC = \sqrt{3}a$$

11. Sol. (c)

12. Sol. (b)



$$\text{Side} = 2\sqrt{3}:3$$

$$2:\sqrt{3}$$

$$\text{Area} = 4:3 \quad [\text{after squaring}]$$

$$MN \text{ mid point} = \frac{4+2}{2} = 3$$

13. Sol. (d)

Statement-I, Number given of pentagon = 5

$$\text{Each exterior angle} = \frac{360^\circ}{5} = 72^\circ$$

$$\text{Each interior angle} = 180^\circ - 72^\circ = 108^\circ$$

Similarly,

$$\text{Each interior angle of rectangle} = 90^\circ$$

$$\text{So, difference of interior angles} = 108^\circ - 90^\circ = 18^\circ$$

It is not correct

Statement 2

$$\text{Interior angle of decagon} = \frac{360^\circ}{10} = 36^\circ$$

$$\text{Also, interior angle of octagon} = \frac{360^\circ}{8} = 45^\circ$$

$$\text{So, difference of interior angle} = 45^\circ - 36^\circ = 9^\circ$$

It is correct

Statement 3

$$\text{Sum of all exterior angles of a polygon} = 360^\circ$$

$$\text{For 2 polygons, it is } 2 \times 360^\circ = 720^\circ$$

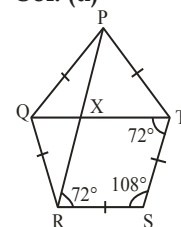
It is also correct

14. Sol. (a)

$$\begin{array}{r|rr} 1=8 & 20 & \\ \hline 165^\circ & 168 & \\ \hline 15 & 12 & \\ \hline 120 & 240 & \end{array} \xrightarrow{\times 20} \Sigma E = 360$$

$$\begin{aligned} \text{Number of diagonal} &= \frac{n(n-3)}{2} \\ &= \frac{28 \times 25}{2} \\ &= 350 \end{aligned}$$

15. Sol. (d)



Sum of angles of pentagon

$$= (n-2) 180^\circ$$

$$= 3 \times 180^\circ = 540^\circ$$

$$\text{Each angle} = \frac{540^\circ}{5} = 108^\circ$$

In $\triangle PQT$,

$$\angle QPT = 108^\circ$$

$$\angle PQT + \angle PTQ + \angle QPT = 180^\circ$$

$$2\angle PTQ + 108^\circ = 180^\circ \quad [\because \angle PQT = \angle PTQ]$$

$$\angle PTQ = 36^\circ$$

$$\text{Thus } \angle PTQ = \angle PQT = 36^\circ$$

$$\angle QTS = 108^\circ - 36^\circ = 72^\circ$$

$$\angle QPR = \angle QRP = 36^\circ$$

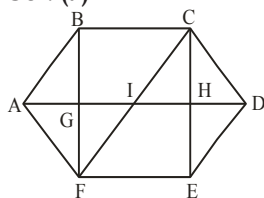
$$\angle PRS = 72^\circ$$

In quadrilateral TSRX

Sum of all angles are 360°

$$\text{So, } \angle TXR = 108^\circ$$

16. Sol. (a)



$$\text{Area of } \triangle BIC = \frac{\sqrt{3}}{4} \times 12 \times 12$$

$$= 36\sqrt{3}$$

$$\text{Area of } \triangle BIA = 36\sqrt{3}$$

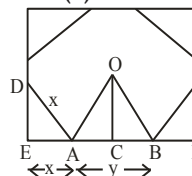
$$\text{Area of } \triangle BGI$$

$$= \frac{36\sqrt{3}}{2} = 18\sqrt{3}$$

$$\text{Area of shaded region}$$

$$= 36\sqrt{3} + 18\sqrt{3} = 54\sqrt{3} \text{ cm}^2$$

17. Sol. (a)



Let the side of octagon = x cm

For regular octagon, each internal angle

$$= \frac{2(8-2) \times 90^\circ}{8} = \frac{6 \times 90^\circ}{8} = 135^\circ$$

$$\therefore \angle BAD = 135^\circ$$

$$\text{Then, } \angle DAE = 45^\circ$$

In $\triangle AED$, $AE = DE$

$$x^2 = (AE)^2 + (DE)^2 = AE = \frac{x}{\sqrt{2}}$$

$$= y = \frac{x}{\sqrt{2}}$$

By symmetry $AE = BF = y$

$$\text{Now, } EA + AB + BF = a \quad (\text{Side of square})$$

$$y + x + y = a$$

$$2y + x = a$$

$$x = \frac{a}{\sqrt{2}+1} = a(\sqrt{2}-1)$$

Type-15 (Mixed)

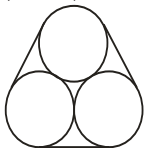
1. The side length of an equilateral triangle whose area is equal to the area of a square whose side length 'a' is

एक समबाहु त्रिभुज की भुजा की लंबाई जिसका क्षेत्रफल एक वर्ग के क्षेत्रफल के बराबर है जिसकी भुजा की लंबाई 'a' है

- (a) $2\sqrt{3}a$ (b) $4\sqrt{3}a$
(c) $2(3)^{-1/4}a$ (d) $2(3)^{1/4}a$

2. Three circles of diameter 10 cm each are bound together by a rubber band as shown in the figure the length of the rubber band (in cm) if it is stretched is

10 सेमी व्यास के तीन वृत्त एक रबर बैंड द्वारा एक साथ बंधे हुए हैं जैसा कि चित्र में दिखाया गया है कि रबर बैंड की लंबाई (सेमी में) यदि इसे खींचा जाता है



- (a) 30 (b) $30 + 10\pi$
(c) 10π (d) $60 + 20\pi$

3. An equilateral triangle of side x is inscribed in a circle of radius y. Which one of the following is correct?

भुजा x का एक समबाहु त्रिभुज त्रिज्या y के एक वृत्त में अंकित है। निम्नलिखित में से कौन सा एक सही है?

[CDS-2022-I]

- (a) $2y = x$ (b) $2y = \sqrt{3}x$
(c) $\sqrt{3}y = 2x$ (d) $\sqrt{3}y = x$

4. If the perimeters of a circle with radius 'r' and a square with side length 'a' are equal, then find r : a. (Use $\pi = 22/7$)

यदि त्रिज्या 'r' वाले वृत्त और भुजा लंबाई 'a' वाले वर्ग के परिमाप बराबर हों, तो r : a ज्ञात कीजिए। ($\pi = 22/7$ का प्रयोग करें)

- (a) 7:22 (b) 7:11
(c) 14:11 (d) 21:22

5. If the circumference of a circle is equal to the perimeter of a square and the radius of the given circle is positive, then which of the following options is correct?

यदि एक वृत्त की परिधि एक वर्ग के परिमाप के बराबर है और दिए गए वृत्त की त्रिज्या धनात्मक है, तो निम्नलिखित में से कौन सा विकल्प सही है?

SSC MTS 2023 (Evening)

- (a) Area of the circle > Area of the square
(b) Area of the circle $\geq$ Area of the square
(c) Area of the circle < Area of the square
(d) Area of the circle = Area of the square

6. The area of a trapezium shaped field is 1785 square feet. The distance between the two parallel sides is 35 feet and one of the parallel sides is 42 feet long. What is the length of the other parallel side?

एक समलंब आकार के मैदान का क्षेत्रफल 1785 वर्ग फुट है। दो समानांतर भुजाओं के बीच की दूरी 35 फीट है और समानांतर भुजाओं में से एक की लंबाई 42 फीट है। दूसरी समानांतर भुजा की लंबाई क्या है?

SSC CPO 11/11/2022 (Evening)

- (a) 60ft (b) 35ft (c) 40ft (d) 65ft

7. If the length of certain rectangle is decreased by 4 cm and breadth is increased by 2 cm, it would result in a square of the same area. What is the perimeter of the original rectangle?

यदि किसी आयत की लंबाई 4 सेमी कम कर दी जाए और चौड़ाई 2 सेमी बढ़ा दी जाए, तो इसका परिणाम समान क्षेत्रफल का एक वर्ग हो जाएगा। मूल आयत का परिमाप क्या है?

SSC CGL 06/12/2022 (1st Shift)

- (a) 15 cm (b) 24 cm (c) 20 cm (d) 10 cm

8. Two identical circles each of radius 30 cm intersect each other such that the circumference of each one passes through the center of the other. What is the area of the intersecting region?

30 सेमी त्रिज्या वाले दो समान वृत्त एक दूसरे को इस प्रकार प्रतिच्छेद करते हैं कि प्रत्येक की परिधि दूसरे के केंद्र से होकर गुजरती है। प्रतिच्छेदी क्षेत्र का क्षेत्रफल क्या है?

SSC CGL 03/12/2022 (4th Shift)

- (a) $400\pi - 250\sqrt{3} \text{ cm}^2$ (b) $300\pi - 150\sqrt{3} \text{ cm}^2$
(c) $500\pi - 350\sqrt{3} \text{ cm}^2$ (d) $600\pi - 450\sqrt{3} \text{ cm}^2$

9. Two wires of length 'L' each are bent in the shape of a circle and an equilateral triangle, then which shape covers more area and by how much than the other. (Use $\frac{\sqrt{3}}{\pi} = .55$)

लम्बाई 'L' के दो तारों को एक वृत्त और एक समबाहु त्रिभुज के आकार में मोड़ा जाता है, तो कौन-सी आकृति दूसरे की तुलना में अधिक क्षेत्रफल घेरती है। ($\sqrt{3}/\pi = .55$ का प्रयोग करें)

- (a) Triangle by 28% (b) Triangle by 55%
(c) Circle by 55% (d) Circle by 65%

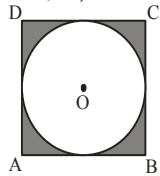
10. Two circles with centre A and B and radius 2 units touch each other externally at 'C'. A third circle with centre 'C' and radius '2' units meets other two at D and E. Then the area of the quadrilateral ABDE is

केंद्र A और B और 2 इकाई त्रिज्या वाले दो वृत्त एक-दूसरे को 'C' पर बाहरी रूप से स्पर्श करते हैं, केंद्र 'C' और त्रिज्या '2' इकाई वाला तीसरा वृत्त अन्य दो को D और E पर मिलता है। फिर चतुर्भुज ABDE का क्षेत्रफल है

- (a) $2\sqrt{2}$ sq. units (b) $3\sqrt{3}$ sq. units
(c) $3\sqrt{2}$ sq. units (d) $2\sqrt{3}$ sq. units

11. In the given figure, ABCD is a square and O is the centre of the circle that touches all sides of the square internally what fraction of the given figure is shaded. (Use $= \frac{22}{7}$)

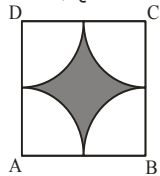
दी गई आकृति में, ABCD एक वर्ग है और O उस वृत्त का केंद्र है जो वर्ग के सभी पक्षों को आंतरिक रूप से स्पर्श करता है, दी गई आकृति का कितना अंश छायांकित है। (उपयोग $= 22/7$)



- (a) $\frac{3}{14}$ (b) $\frac{4}{11}$ (c) $\frac{4}{7}$ (d) $\frac{11}{28}$

12. What fraction of the given figure is shaded, where ABCD is a square and A, B, C and D are also centres of four equal quarter circles? (Use $= \frac{22}{7}$)

दी गई आकृति के कितने भाग को छायांकित किया गया है, जहाँ ABCD एक वर्ग है और A, B, C और D भी चार बराबर चौथाई वृत्तों के केंद्र हैं? (उपयोग $= 22/7$)



- (a) $\frac{4}{11}$ (b) $\frac{4}{7}$ (c) $\frac{3}{14}$ (d) $\frac{11}{28}$

13. If the difference of areas of the circumcircle and incircle of an equilateral triangle is 'p', then the side length of the equilateral triangle is यदि एक समबाहु त्रिभुज के परिवृत्त और अंतःवृत्त के क्षेत्रफलों का अंतर 'p' है, तो समबाहु त्रिभुज की भुजा की लंबाई है

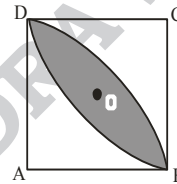
- (a) $2\sqrt{\frac{p}{\pi}}$ (b) $2\sqrt{\frac{\pi}{p}}$ (c) $\sqrt{\frac{2\pi}{p}}$ (d) $\sqrt{\frac{2p}{\pi}}$

14. What is the area between a square of side 10 cm and two inverted semi-circular, crosssections each of radius 5 cm inscribed in the square?

10 सेमी भुजा वाले एक वर्ग और 5 सेमी त्रिज्या वाले दो उल्टे अर्धवृत्ताकार, अनुप्रस्थ काट वाले वर्ग के बीच का क्षेत्रफल क्या है?

- (a) 17.5 cm^2 (b) 18.5 cm^2
(c) 20.5 cm^2 (d) 21.5 cm^2

15. What fraction of the given figure is shaded, where ABCD is a square, and A and C are centres of two equal quarter-circles? (Use $= \frac{22}{7}$)



- (a) $\frac{4}{11}$ (b) $\frac{11}{28}$ (c) $\frac{4}{7}$ (d) $\frac{3}{14}$

16. Find the area of an equilateral triangle whose perimeter is equal to the perimeter of a semicircle whose area is 'A'. (Use $\pi = \frac{22}{7}$)

एक समबाहु त्रिभुज का क्षेत्रफल ज्ञात कीजिए जिसका परिमाप उस अर्धवृत्त के परिमाप के बराबर है जिसका क्षेत्रफल 'A' है। ($\pi = 22/7$ का प्रयोग करें)

- (a) $\frac{36\sqrt{3}}{77} A$ (b) $\frac{18\sqrt{3}}{77} A$
(c) $\frac{54\sqrt{3}}{77} A$ (d) $\frac{72\sqrt{3}}{77} A$

17. The area of a triangular field whose sides are 65 m, 72 m and 97 m is equal to the area of a rectangular park whose sides are in the ratio of 5:13. What is the perimeter (in m) of the rectangular park?

एक त्रिभुजाकार मैदान का क्षेत्रफल जिसकी भुजाएँ 65 मीटर, 72 मीटर और 97 मीटर हैं, एक आयताकार पार्क के क्षेत्रफल के बराबर है जिसकी भुजाएँ 5:13 के अनुपात में हैं। आयताकार पार्क का परिमाप (मीटर में) क्या है?

SSC CHSL 19/4/2021 (Morning)

- (a) 108 (b) 180 (c) 216 (d) 144

18. From four corners of a square sheet of side 4 cm four pieces each in the shape of arc of a circle with radius 2 cm are cut out. The area of the remaining portion is:

4 सेमी भुजा वाली एक वर्गाकार शीट के चारों कोनों से 2 सेमी त्रिज्या वाले एक वृत्त के चाप के आकार के चार टुकड़े काटे गए हैं। शेष भाग का क्षेत्रफल है:

- (a) $(8 - \pi)$ sq. cm (b) $(16 - 4\pi)$ sq. cm
(c) $(16 - 8\pi)$ sq. cm (d) $(4 - 2\pi)$ sq. cm

19. If r_1 and r_2 are the inradius and circumradius of an equilateral triangle, then $r_1:r_2 = ?$

अगर r_1 and r_2 एक समबाहु त्रिभुज की अंतर्त्रिज्या और परित्रिज्या हैं, तो $r_1:r_2 = ?$

- (a) 1:2 (b) $1:\sqrt{3}$ (c) $\sqrt{3}:2$ (d) 1:4

20. A wire is bent to form a square of area 169 cm^2 . If the same wire is bent to form a circle, then what is its area in cm^2 ? (to the nearest whole number)

एक तार को मोड़कर 169 सेमी² क्षेत्रफल का एक वर्ग बनाया जाता है। यदि उसी तार को एक वृत्त बनाने के लिए मोड़ा जाता है, तो उसका क्षेत्रफल सेमी² में क्या है? (निकटतम पूर्ण संख्या के लिए)

SSC CHSL 13/4/2021 (Afternoon)

- (a) 215 (b) 227 (c) 532 (d) 531

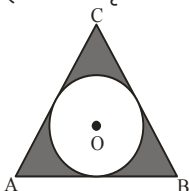
21. X and Y are centres of circles of radii 7 m and 6 m respectively. Z is the centre of a circle which touches both the circles if $XY = 28$ m, then find the area of the circle with centre Z . (given $\angle XZY = 90^\circ$, Use $\pi = \frac{22}{7}$)

X और Y क्रमशः 7 मीटर और 6 मीटर त्रिज्या वाले वृत्तों के केंद्र हैं। Z एक वृत्त का केंद्र है जो दोनों वृत्तों को स्पर्श करता है यदि $XY = 28$ मीटर है, तो केंद्र Z वाले वृत्त का क्षेत्रफल ज्ञात कीजिए। (दिया गया है $\angle XZY = 90^\circ$, $\pi = \frac{22}{7}$ का प्रयोग करें)

- (a) 1386 m^2 (b) 962.5 m^2
(c) 616 m^2 (d) 346.5 m^2

22. Find the area of the shaded region where ABC is an equilateral triangle with side length 12 cm and O is the centre of its incircle.

छायांकित क्षेत्र का क्षेत्रफल ज्ञात कीजिए जहाँ ABC एक समबाहु त्रिभुज है जिसकी भुजा की लंबाई 12 सेमी है और O इसके अंतःवृत्त का केंद्र है।



- (a) $8(2\sqrt{3} - \pi) \text{ cm}^2$ (b) $12(2\sqrt{3} - \pi) \text{ cm}^2$
(c) $6(3\sqrt{3} - \pi) \text{ cm}^2$ (d) $12(3\sqrt{3} - \pi) \text{ cm}^2$

23. In a rectangular park having dimensions 60 m $\times$ 40 m, two circular flower beds with radius 7 m are developed. What is the area of the remaining portion of the park (in m^2)

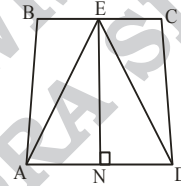
60 मी $\times$ 40 मी विमाओं वाले एक आयताकार पार्क में 7 मी त्रिज्या वाली दो वृत्ताकार फूलों की बगियाँ विकसित की गई हैं। पार्क के शेष भाग का क्षेत्रफल कितना है (मीटर² में)

SSC CHSL 6/8/2021 (Morning)

- (a) 1196 (b) 1749 (c) 2092 (d) 2246

24. ABCD is a trapezium with AD and BC parallel sides. The ratio of the area of ABCD to that of $\triangle AED$ is

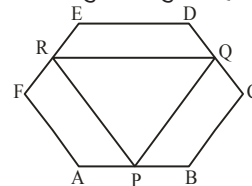
ABCD एक समलम्ब है जिसकी भुजाएँ AD और BC समान्तर हैं। ABCD और $\triangle AED$ के क्षेत्रफल का अनुपात है



- (a) $\frac{AD}{BC}$ (b) $\frac{BE}{EC}$ (c) $\frac{AD+BE}{AD+CE}$ (d) $\frac{AD+BC}{AD}$

25. In the given figure, ABCDEF is a regular hexagon of side 12 cm P, Q and R are the mid points of the sides AB, CD and EF respectively. What is the area (in cm^2) of triangle PQR ?

दी गई आकृति में, ABCDEF भुजा 12 सेमी का एक नियमित षट्भुज है, P, Q और R क्रमशः AB, CD और EF भुजाओं के मध्य बिंदु हैं। त्रिभुज PQR का क्षेत्रफल (सेमी² में) क्या है?



- (a) $27\sqrt{6}$ (b) $81\sqrt{3}$ (c) $54\sqrt{3}$ (d) $54\sqrt{6}$

26. A triangle PQR is a right angled triangle at Q . E and F are the mid points of QR and PR respectively. What will be the ratio of the area of quadrilateral PQEF to the area of triangle PQR. एक त्रिभुज PQR, Q पर एक समकोण त्रिभुज है। E और F क्रमशः QR और PR के मध्य बिंदु हैं। चतुर्भुज PQEF के क्षेत्रफल का त्रिभुज PQR के क्षेत्रफल से अनुपात क्या होगा?

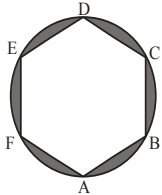
SSC CHSL 19/10/2020 (Morning)

- (a) $\frac{2}{3}$ (b) $\frac{3}{4}$ (c) $\frac{3}{2}$ (d) $\frac{4}{3}$

27. The sides of a triangle are 24 cm, 26 cm and 10 cm. At each of its vertices, circles of radius 4.2 cm are drawn. What is the area (in cm^2) of the triangle, excluding the portion covered by the sectors of the circle?
एक त्रिभुज की भुजाएँ 24 सेमी, 26 सेमी और 10 सेमी हैं। इसके प्रत्येक शीर्ष पर 4.2 सेमी त्रिज्या के वृत्त खींचे गए हैं। वृत्त के त्रिज्यखंडों द्वारा कवर किए गए भाग को छोड़कर, त्रिभुज का क्षेत्रफल (सेमी² में) क्या है?

SSC CPO 23/11/2020 (Morning)

- (a) 27.72 (b) 120 (c) 105.86 (d) 92.28
28. Find the area of the shaded region where $ABCDEF$ is a regular hexagon inside a circle whose radius is 14 cm.
छायांकित क्षेत्र का क्षेत्रफल ज्ञात कीजिए जहाँ $ABCDEF$ 14 सेमी त्रिज्या वाले एक वृत्त के अंदर एक नियमित षट्भुज है।



- (a) $14^2(2\pi - 3\sqrt{3})\text{cm}^2$ (b) $72(2\pi - 3\sqrt{3})\text{cm}^2$
(c) $64(2\pi - 3\sqrt{3})\text{cm}^2$ (d) $98(2\pi - 3\sqrt{3})\text{cm}^2$
29. Consider the following statements :
निम्नलिखित कथनों पर विचार करें:



- (a) 50% (c) 75% (b) 25% (d) 60%
37. If the four equal circles of radius 3 cm touch each other externally, then the area of the region bounded by the four circles is:
यदि 3 सेमी त्रिज्या वाले चार समान वृत्त एक दूसरे को बाह्य रूप से स्पर्श करते हैं, तो चारों वृत्तों से घिरे क्षेत्र का क्षेत्रफल है:
(a) $4(9 - \pi)\text{sq. cm}$ (b) $9(4 - \pi)\text{sq. cm}$
(c) $5(6 - \pi)\text{sq. cm}$ (d) $6(5 - \pi)\text{sq. cm}$
38. Find the perimeter of a semicircle whose area is equal to the area of an equilateral triangle whose perimeter is 'p'.
एक अर्धवृत्त का परिमाण ज्ञात कीजिए जिसका क्षेत्रफल एक समबाहु त्रिभुज के क्षेत्रफल के बराबर है जिसका परिमाण 'p' है।
(a) $\frac{(2\pi)^{1/2}(3)^{1/4}}{11}p$ (b) $\frac{(2\pi)^{1/2}(3)^{3/4}}{11}p$
(c) $\frac{(2\pi)^{1/2}(3)^{3/4}}{14}p$ (d) $\frac{(2\pi)^{1/2}(3)^{5/4}}{11}p$

- (a) 7 cm^2 (c) 14 cm^2
(b) 28 cm^2 (d) 21 cm^2

31. The sides of a triangle are 24 cm, 45 cm and 51 cm. At each of its vertices, circles of radius 10.5 cm are drawn. What is the area of the triangle, excluding the portion covered by sectors of the circles?
एक त्रिभुज की भुजाएँ 24 सेमी, 45 सेमी और 51 सेमी हैं। इसके प्रत्येक शीर्ष पर 10.5 सेमी त्रिज्या के वृत्त खींचे गए हैं। वृत्तों के त्रिज्यखंडों द्वारा कवर किए गए भाग को छोड़कर, त्रिभुज का क्षेत्रफल क्या है?

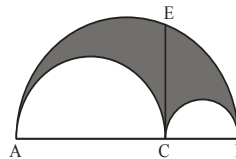
SSC CPO 13/03/2019 (Evening)

- (a) 244.75 cm^2 (b) 366.75 cm^2
(c) 464.75 cm^2 (d) 327.75 cm^2

32. In the given figure, $ABCDEF$ is a regular hexagon whose side is 6 cm. APF , QAB , DCR and DES are equilateral triangles. What is the area (in cm^2) of the shaded region?
दी गई आकृति में, $ABCDEF$ एक नियमित षट्भुज है जिसकी भुजा 6 सेमी है। APF , QAB , DCR और DES समबाहु त्रिभुज हैं। छायांकित क्षेत्र का क्षेत्रफल (सेमी² में) क्या है?

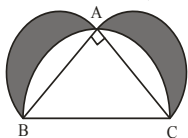


- (a) $12\pi\text{cm}$ (c) $16\pi\text{cm}$
(b) $14\pi\text{cm}$ (d) $18\pi\text{cm}$
41. Find the area of the shaded region of the given figure where AB, BC and AC are the diameters of semicircles, $CE \perp AB$, and $CE = 6\text{ m}$.
दी गई आकृति के छायांकित भाग का क्षेत्रफल ज्ञात कीजिए जहाँ AB, BC और AC अर्धवृत्तों के व्यास हैं, $CE \perp AB$, और $CE = 6$ मीटर।



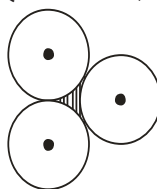
- (a) $12\pi\text{m}^2$ (b) $9\pi\text{m}^2$
(c) $6\pi\text{m}^2$ (d) None
42. In the given figure, $\triangle ABC$ is a right angled triangle, right angled at A. Semi-circles are drawn on the sides AB, BC and AC . Then the area of shaded portion is equal to which one of the following?

दा गि जाकृत म, $\triangle ABC$ एक समकोण त्रिभुज ह, जिसका कोण A समकोण है। भुजाओं AB, BC और AC पर अर्धवृत्त खींचे गए हैं। तब छायांकित भाग का क्षेत्रफल निम्नलिखित में से किसके बराबर होता है?



- (a) Area of $\triangle ABC$
 (b) 2 times the area of $\triangle ABC$
 (c) Area of semi-circle ABC
 (d) None of the above

43. Three circles of equal radius a cm touch each other. The area of the shaded region is :
 समान त्रिज्या 'a' सेमी वाले तीन वृत्त एक दूसरे को स्पर्श करते हैं। छायांकित क्षेत्र का क्षेत्रफल है:



- (a) $\left(\frac{\sqrt{3}+\pi}{2}\right)a^2 \text{sq. cm}$ (b) $\left(\frac{6\sqrt{3}-\pi}{2}\right)a^2 \text{sq. cm}$
 (c) $(\sqrt{3}-\pi)a^2 \text{sq. cm}$ (d) $\left(\frac{2\sqrt{3}-\pi}{2}\right)a^2 \text{sq. cm}$

Type-15 (Mixed) ANSWER KEY

1	C	2	B	3	D	4	B	5	A	6	A	7	C	8	D
9	D	10	B	11	A	12	C	13	A	14	D	15	C	16	A
17	C	18	B	19	A	20	A	21	C	22	D	23	C	24	D
25	B	26	B	27	D	28	D	29	C	30	B	31	B	32	C
33	B	34	C	35	D	36	C	37	B	38	(*)	39	B	40	A
41	B	42	A	43	D									36	C

Type-15 (Mixed) Solution

1. **Sol. (c)**
Let side length of an equilateral triangle be x Then,

area of the equilateral triangle = $\frac{\sqrt{3}}{4}x^2$ And

Area of the square = a^2

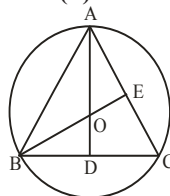
From question

$$\Rightarrow \frac{\sqrt{3}}{4}x^2 = a^2 \Rightarrow x^2 = \frac{4a^2}{\sqrt{3}}$$

$$\Rightarrow x = 2a(3)^{-1/4}$$

2. **Sol. (b)**
Length of rubber band = $3d + 2\pi r = 30 + 10\pi$

3. **Sol. (d)**



$\triangle ABC$ is an equilateral triangle, such that

$$AB = BC = CA = x$$

$$AD = \sqrt{x^2 - \left(\frac{x}{2}\right)^2} = \frac{\sqrt{3}}{2}x$$

$$\text{Circum radius } AO = \frac{2}{3} \times AD = \frac{2}{3} \times \frac{\sqrt{3}}{2}x = \frac{x}{\sqrt{3}} = y$$

$$x = \sqrt{3} \cdot y$$

4. Sol. (b)

Perimeter of circle = $2\pi r$

Perimeter of square = $4a$

From question

$$2\pi r = 4a$$

$$\Rightarrow \frac{r}{a} = \frac{2}{\pi} \Rightarrow \frac{r}{a} = \frac{7}{11}$$

5. Sol. (a)

According to question, Circumference of circle = perimeter of square,

$$2\pi r = 4a \Rightarrow r = \frac{2a}{\pi}$$

$$\text{Area of circle} = \pi r^2$$

$$= \pi \times \left(\frac{2a}{\pi}\right)^2 = \frac{4a^2}{\pi} = \frac{14}{11} \times a^2$$

$$\text{Area of square} = a^2$$

Hence, we can see that the area of a circle is more than the area of a square.

6. Sol. (a)

Given, area of the trapezium = 1785sq. feet.

Height of the trapezium = 35 feet, length of one parallel side = 42 feet.

Let the length of the other parallel side be x feet.

Area of trapezium

$$= \frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$$

$$\Rightarrow \frac{1}{2} \times (x + 42) \times 35 = 1785$$

$$\Rightarrow 35x + 1470 = 3570$$

$$\Rightarrow 35x = 3570 - 1470$$

$$\Rightarrow 35x = 2100 \Rightarrow x = 60$$

Hence, the length of the other side is 60 feet.

7. Sol. (c)

Let the length of rectangle is ' l ' and breadth of rectangle is ' b '

$$\text{Area of rectangle} = \text{length} \times \text{breadth} = l \times b$$

$$(\text{Area of rectangle}) = (lb) \dots (i)$$

According to question,

(Area of resulting square)

$$= (l - 4) \times (b + 2) \dots (ii)$$

Side of square are equal, so

$$l - 4 = b + 2 \Rightarrow l - b = 6 \dots (iii)$$

Equating e.q. (i) and e.q. (ii), we get $(lb) = lb +$

$$2l - 4b - 8$$

$$l - 2b = 4$$

From e.q. (iii) and e.q. (iv), we get

$$b = 2, l = 8$$

So, Perimeter of the original rectangle

$$= 2(8 + 2) = 20 \text{ cm}$$

8. Sol. (d)

$$\text{Area of shaded region} = r^2 \left(\frac{2}{3}\pi - \frac{\sqrt{3}}{2} \right)$$

$$\text{Area} = 900 \left(\frac{2}{3}\pi - \frac{\sqrt{3}}{2} \right)$$

$$= (600\pi - 450\sqrt{3})\text{cm}^2$$

9. Sol. (d)

Let the radius of circle be ' r ' and the side length of equilateral triangle be ' a '. For circle

$$2\pi r = L \Rightarrow r = \frac{L}{2\pi}$$

$$\text{Area of circle} = \pi r^2 = \frac{\pi L^2}{4\pi^2} = \frac{L^2}{4\pi}$$

For equilateral triangle

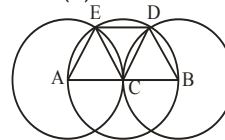
$$3a = L \Rightarrow a = \frac{L}{3}$$

$$\text{Area of an equilateral triangle} = \frac{\sqrt{3}}{4} a^2 = \frac{\sqrt{3}}{4} \times \frac{L^2}{9}$$

$$\frac{\text{Area of circle}}{\text{Area of triangle}} = \frac{\frac{L^2}{4\pi}}{\frac{\sqrt{3}L^2}{36}} = \frac{3\sqrt{3}}{\pi} \approx 1.65$$

Hence the area of circle is 65% more than the area of triangle.

10. Sol. (b)

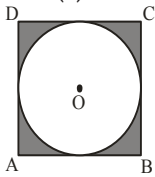


$$\text{Area} (\square ABDE) = 3 \times \text{ar}(\triangle AEC)$$

$$= 3 \times \frac{\sqrt{3}}{4} (2)^2 \text{ (AEC is equilateral triangle)}$$

$$= 3\sqrt{3} \text{ square units}$$

11. Sol. (a)

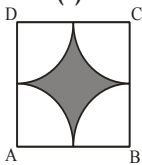


Let the side length of square $ABCD$ be 'a'. Area of

shaded region = $a^2 - \frac{\pi a^2}{4}$, Fraction of shaded

$$\text{region} = \frac{a^2(1 - \frac{\pi}{4})}{a^2} = \frac{1 - \frac{\pi}{4}}{1} = \frac{4 - \pi}{4}$$

12. Sol. (c)



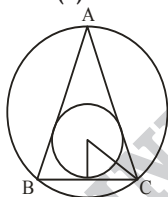
Let the side length of square $ABCD$ be: Area of the shaded region

$$= a^2 - 4 \times \frac{\pi(\frac{a}{2})^2}{4}$$

$$= a^2 - \frac{\pi a^2}{4} = a^2(1 - \frac{\pi}{4})$$

$$\text{Fraction of shaded region} = \frac{a^2(1 - \frac{\pi}{4})}{a^2} = \frac{4 - \pi}{4}$$

13. Sol. (a)

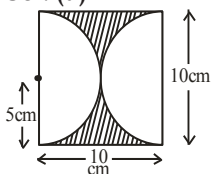


Area of circumcircle - area of incircle

$$= \frac{\pi(BC)^2}{4}$$

$$\Rightarrow P = \frac{\pi(BC)^2}{4} \Rightarrow BC = 2\sqrt{\frac{P}{\pi}}$$

14. Sol. (d)

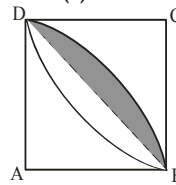


Area between square and semi-circles

= Area of square - 2 Area of semi-circle

$$= (10)^2 - \frac{22}{7} \times (5)^2 = 100 - 78.5 = 21.5 \text{ cm}^2$$

15. Sol. (c)



Area of required shaded region = 2 (area of given shaded region)

Area of required shaded region

$$= 2 \left(\frac{\pi a^2}{4} - \frac{a^2}{2} \right)$$

$$= \frac{\pi a^2}{2} - a^2 = a^2 \left(\frac{\pi}{2} - 1 \right) = \frac{a^2(\pi - 2)}{2}$$

$$\text{Fraction of shaded region} = \frac{\frac{a^2(\pi - 2)}{2}}{a^2} = \frac{\pi - 2}{2}$$

16. Sol. (a)

Let the radius of semicircle be 'r' and side length of equilateral triangle be 'a'

$$\text{Area of semicircle} = \frac{\pi r^2}{2}$$

$$\Rightarrow A = \frac{\pi r^2}{2} \Rightarrow r^2 = \frac{2A}{\pi}$$

$$\text{Perimeter of semicircle} = \pi r + 2r = r(\pi + 2)$$

$$\text{Perimeter of equilateral triangle} = 3a$$

From question

$$\Rightarrow 3a = r(\pi + 2) \Rightarrow a = \frac{r}{3}(\pi + 2)$$

$$\text{Area of an equilateral triangle} = \frac{\sqrt{3}}{4} a^2$$

$$= \frac{\sqrt{3}}{4} \frac{r^2}{9} (\pi + 2)^2 = \frac{\sqrt{3}}{4} \times \frac{2A}{9\pi} (\pi + 2)^2$$

$$= \frac{\sqrt{3}}{36} \times \frac{7}{11} \times \frac{36}{7} \times \frac{36}{7} A = \frac{36\sqrt{3}}{77} A$$

17. Sol. (c)

65 m, 72 m and 97 m are triplets of a right-angled triangle.

So area of triangular park

$$= \frac{1}{2} \times 65 \times 72 = 2340$$

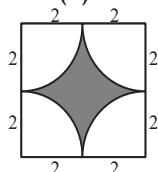
Let sides of the rectangle be $5x$ and $13x$.

$$\text{Area of rectangle} = 65x^2$$

$$\text{ATQ, } 65x^2 = 2340, x = 6$$

Perimeter of rectangle = $2(5x + 13x) = 36x = 216m$

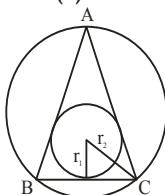
18. Sol. (b)



Area of shaded region

$$= (4)^2 - \pi(2)^2 = (16 - 4\pi)cm^2$$

19. Sol. (a)



$$r_1 = \text{inradius} = \frac{BC}{2\sqrt{3}}$$

$$r_2 = \text{circumradius} = \frac{BC}{\sqrt{3}}$$

$$r_1 : r_2 = 1 : 2$$

20. Sol. (a)

Area of the square = $a^2 = 169$.

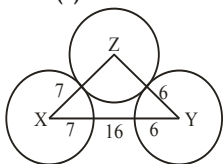
So, $a = 13$, Perimeter = $4a = 4 \times 13 = 52$

Circumference of the circle = $2\pi r = 52$

$$r = \frac{7}{44} \times 52 = \frac{91}{11}$$

$$\begin{aligned} \text{Area} &= \pi r^2 = \frac{22}{7} \times \frac{91}{11} \times \frac{91}{11} \\ &= \frac{2366}{11} = 215.09 \approx 215 \text{ cm}^2 \end{aligned}$$

21. Sol. (c)



Let the radius of circle with centre Z be r Then

For $\triangle XYZ$

$$(XY)^2 = (XZ)^2 + (ZY)^2$$

$$\Rightarrow (7 + r)^2 + (6 + r)^2 = (29)^2$$

$$\Rightarrow 2r^2 + 26r - 756 = 0$$

$$\Rightarrow r^2 + 13r - 378 = 0 \Rightarrow r = 14, -27$$

Area of circle = $\pi r^2 = 616 \text{ m}^2$

22. Sol. (d)

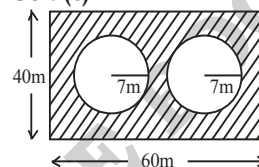
Radius of incircle of an equilateral triangle

$$r = \frac{AB}{2\sqrt{3}} = \frac{12}{2\sqrt{3}} = 2\sqrt{3} \text{ cm}$$

$$\text{Area of shaded region} = \frac{\sqrt{3}}{4} \times AB^2 - \pi r^2 = \frac{\sqrt{3}}{4} \times$$

$$12^2 - \pi(2\sqrt{3})^2 = 12(3\sqrt{3} - \pi)cm^2$$

23. Sol. (c)



Area of the rectangular park

$$= 60 \text{ m} \times 40 \text{ m} = 2400 \text{ m}^2$$

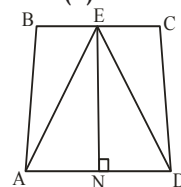
Area of circular flower beds

$$= 2 \times \pi r^2 = 2 \times \frac{22}{7} \times 7 \times 7 = 308 \text{ m}^2$$

Area of the remaining portion of the park =

$$2400 - 308 = 2092 \text{ m}^2$$

24. Sol. (d)



Let $EN \perp AD$

$$\text{area of } \triangle AED = \frac{1}{2} \times EN \times AD$$

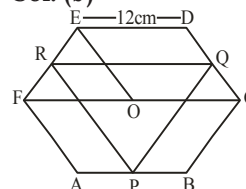
area of trapezium ABCD

$$= \frac{1}{2} (AD + BC) \times EN$$

$$\frac{\text{ar}(ABCD)}{\text{ar}(AED)} = \frac{\frac{1}{2}(AD+BC) \times EN}{\frac{1}{2} \times EN \times AD}$$

$$\therefore \frac{\text{ar}(ABCD)}{\text{ar}(AED)} = \frac{AD+BC}{AD}$$

25. Sol. (b)



So, If

$$OF = OE = ED$$

$$\text{So, } FC = 24 \text{ cm}$$

So, RQ

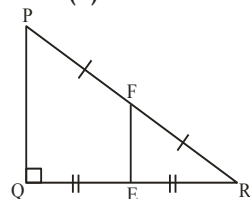
$$= \frac{FC + ED}{2} = \frac{36}{2} = 18 \text{ cm}$$

$$RQ = 18 \text{ cm}$$

$$\text{Area of } \Delta = \frac{\sqrt{3}}{4} \times 18 \times 18$$

$$= 81\sqrt{3} \text{ cm}^2$$

26. Sol. (b)

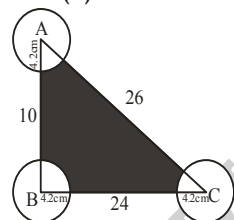


$$QE : ER = 1 : 1$$

$$QR = 2 \text{ unit}$$

$$\frac{\text{Area of quadrilateral PQEF}}{\text{Area of triangle PQR}} = \frac{2^2 - 1}{2^2} = \frac{3}{4}$$

27. Sol. (d)



Since we know that (10, 24, 26) is a pythagorean triplet so we can easily find out the area of the triangle to be

$$= \frac{1}{2} \times \text{base} \times \text{height}$$

$$= \frac{1}{2} \times 24 \times 10 = 120$$

So the area of the triangle will be equal to 120.

At each vertices a circle of radius 4.2 cm is drawn

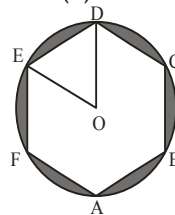
so the total area of circle will be $= \frac{1}{2} \times \text{area of a circle}$ (as the sum of angles of a triangle is equal to 180°)

$$\text{Area of circle} = \frac{1}{2} \times \pi \times 4.2 \times 4.2 = 27.72$$

Area of triangle excluding the portion covered by

$$\text{circle} = 120 - 27.72 = 92.28 \text{ cm}^2$$

28. Sol. (d)



Join OE and OD

ΔEOD is an equilateral triangle

$$\text{So } OE = ED = OD = 14 \text{ cm}$$

Area of shaded region

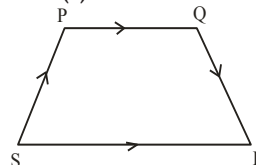
$$= \pi(OE)^2 - 6 \times \frac{\sqrt{3}}{4} \times (ED)^2$$

$$= (OE)^2 \left(\pi - \frac{3\sqrt{3}}{2} \right)$$

$$= \frac{(14)^2}{2} (2\pi - 3\sqrt{3})$$

$$= 98(2\pi - 3\sqrt{3}) \text{ cm}^2$$

29. Sol. (c)



I. let PQRS is a trapezium,

$$\text{So } \angle R = \angle S = x \text{ (let)}$$

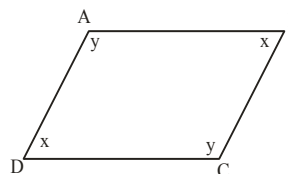
$$\therefore \angle P = 180^\circ - \angle S = 180^\circ - x \{ \because PQ \parallel RS \}$$

$$\angle Q = 180^\circ - x$$

$$\therefore \angle P + \angle R = 180^\circ - x + x = 180^\circ$$

Thus, PQRS is cyclic.

II. ABCD is cyclic parallelogram with $AB \parallel CD$ and $AD \parallel BC$.



Considering angles

$$A = C = y \text{ (Property of parallelogram) and}$$

$$B = D = x$$

Also since it is cyclic

$$A + C = B + D = 180 \text{ degrees}$$

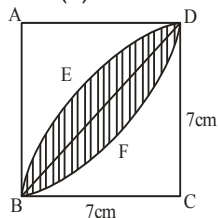
$$\text{So } x = y = 90 \text{ degrees}$$

And also opposite sides are equal in a parallelogram

Thus $ABCD$ is a rectangle.

Hence, both statement I and II are correct.

30. Sol. (b)



$$\text{Area of curve BCDE} = \frac{1}{4}\pi(7)^2 = \frac{22}{7 \times 4} \times 7 \times 7 =$$

$$\frac{77}{2} \text{ cm}^2$$

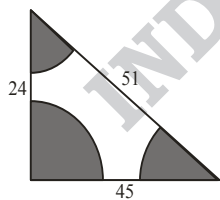
$$\text{Area of } \triangle BCD = \frac{1}{2} \times 7 \times 7 = \frac{49}{2} \text{ cm}^2$$

Required area of shaded region = Area of curve BEDF

$$= 2 \left(\frac{77}{2} - \frac{49}{2} \right) = 2 \left(\frac{28}{2} \right) = 28 \text{ cm}^2$$

31. Sol. (b)

Given triangle is a right angled triangle:



$$\text{Area of triangle} = \frac{1}{2} \times 24 \times 45 = 540$$

Area of all sectors of the circle covering the triangle

$$= \frac{180}{360} \times \frac{22}{7} \times 10.5 \times 10.5 = 173.25$$

Therefore, Area of triangle excluding the portion covered = $540 - 173.25 = 366.75 \text{ sq. cm}$

32. Sol. (c)

$$\text{Area of Hexagon} = 6 \times \frac{\sqrt{3}}{4} (6)^2 = 54\sqrt{3} \text{ cm}^2$$

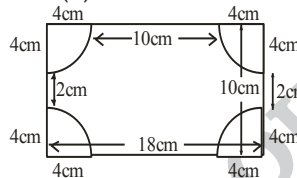
Area of one part of Hexagon

$$= \frac{54}{6} \sqrt{3} = 9\sqrt{3}$$

$$\text{Required area} = 54\sqrt{3} + 2 \times 9\sqrt{3}$$

$$72\sqrt{3} \text{ cm}^2$$

33. Sol. (b)



Remaining perimeter

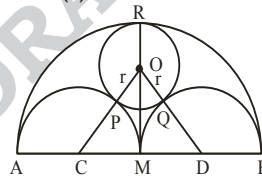
$$= \left(\frac{2\pi r}{4} \right) 4 + 10 + 2 + 10 + 2$$

$$= 2 \times 3.14 \times 4 + 24$$

$$= 25.12 + 24 = 49.12 \text{ cm}$$

$$= 49.1 \text{ cm (approx)}$$

34. Sol. (c)



Given, $AB = 2a$, $AM = a$

$$\text{and } AC = CM = MD = BD = \frac{a}{2}$$

$$\text{Now, } OC = OP + PC = OP + CM$$

$$= r + \frac{a}{2} \text{ and}$$

$$OD = OQ + QD = OQ + MD = r + \frac{a}{2}$$

So, $\triangle OCD$ is an isosceles triangle. ($\because OC = OD$)

$$\Rightarrow \angle OMC = 90^\circ$$

In $\triangle OMC$,

$$OC^2 = OM^2 + CM^2$$

$$\Rightarrow \left(r + \frac{a}{2} \right)^2 = (a - r)^2 + \left(\frac{a}{2} \right)^2$$

$$\Rightarrow r^2 + \frac{a^2}{4} + ar$$

$$= a^2 + r^2 - 2ar + \frac{a^2}{4}$$

$$\therefore r = \frac{a}{3}$$

Sol. (d)

We know that

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CO-ORDINATE GEOMETRY

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Type-1 (Co-Ordinate Geometry)

1. The graphs of the equations $4x + \frac{1}{3}y = \frac{8}{3}$ and $\frac{1}{2}x + \frac{3}{4}y + \frac{5}{2} = 0$ and intersect at a point P . The point P also lies on the graph of the equation:
समीकरण $4x + \frac{1}{3}y = \frac{8}{3}$ और $\frac{1}{2}x + \frac{3}{4}y + \frac{5}{2} = 0$ के ग्राफ़ एक बिंदु P पर प्रतिच्छेद करते हैं। बिंदु P भी समीकरण के ग्राफ़ पर स्थित है:

SSC CGL Tier II 29/01/2022

- (a) $4x - y + 7 = 0$ (b) $x - 3y - 12 = 0$
(c) $3x - y - 7 = 0$ (d) $x + 2y - 5 = 0$
2. Find the slope of line passing through the points (2,8) and (6,9).
बिंदु (2,8) और (6,9) से गुजरने वाली रेखा का ढलान ज्ञात करें।
(a) 5 (b) -5 (c) .25 (d) -.25

3. Find the distance of point $A(p - \frac{1}{p}, 2)$ from the origin ($0 < p < 1$)
मूल बिंदु ($0 < p < 1$) से बिंदु $A(p - \frac{1}{p}, 2)$ की दूरी ज्ञात करें
(a) $\frac{1}{p}\sqrt{p^2 + 1}$ (b) $\frac{1}{p}\sqrt{p^2 - 1}$
(c) $\frac{1}{p} + p$ (d) $\sqrt{p^2 + \frac{1}{p^2}}$

4. What is the area (in unit squares) of the triangle enclosed by the graphs of $2x + 5y = 12$, $x + y = 3$ and the x -axis?
 $2x + 5y = 12$, $x + y = 3$ और x -अक्ष के ग्राफ़ से घिरे त्रिभुज का क्षेत्रफल (इकाई वर्गों में) क्या है?

SSC CGL Tier II 03/02/2022

- (a) 2.5 (b) 3.5 (c) 3 (d) 4
5. The graphs of the equations $7x + 11y = 3$ and $8x + y = 15$ intersect at the point P , which also lies on the graph of the equation.
समीकरण $7x + 11y = 3$ और $8x + y = 15$ के ग्राफ़ बिंदु P पर प्रतिच्छेद करते हैं, जो समीकरण के ग्राफ़ पर भी स्थित है।

SSC CGL Tier II 03/02/2022

- (a) $2x + y = 2$ (b) $2x - y = 1$
(c) $3x + 5y = 1$ (d) $3x + 2y = 3$
6. A line segment is of length 10 and one end is at the point (2, -3); if the abscissa of the other end is 10 then the ordinate of the other end can be
एक रेखाखंड की लंबाई 10 है और इसका एक सिरा बिंदु (2, -3) पर है; यदि दूसरे सिरे का भुज 10 है तो दूसरे सिरे की कोटि हो सकती है

(i) 3 (ii) -6 (iii) -9

- (a) Both i and ii (b) Both i and iii
(c) Both ii and iii (d) None of these

7. What is the equation of the line perpendicular to the line $2x + 3y + 6 = 0$ and having y -intercept 3?
रेखा $2x + 3y + 6 = 0$ पर लंबवत और y -प्रतिच्छेद 3 वाली रेखा का समीकरण क्या है?

- (a) $3x - 2y - 6 = 0$ (b) $3x - 2y + 6 = 0$
(c) $2x - 3y + 6 = 0$ (d) $2x - 3y - 6 = 0$

8. If coordinates of three points A, B and C are $(am^2, 2am)$, $(\frac{a}{m^2}, \frac{2a}{m})$ and $(a, 0)$ respectively, then find the value of $\frac{1}{AC} + \frac{1}{BC}$

यदि तीन बिंदुओं A, B और C के निर्देशांक क्रमशः $(am^2, 2am)$, $(\frac{a}{m^2}, \frac{2a}{m})$ और $(a, 0)$ हैं, तो $\frac{1}{AC} + \frac{1}{BC}$ का मान ज्ञात कीजिए। इसा पूर्व

- (a) $\frac{1}{2}$ (b) $\frac{1}{a}$ (c) $\frac{1}{2a}$ (d) $\frac{1}{am}$

9. The three vertices of $\triangle ABC$ are (2,4), $B(-3,2)$, $C(4,2)$. The area is :
 $\triangle ABC$ के तीन शीर्ष (2, 4), $B(-3, 2)$, $C(4, 2)$ हैं। क्षेत्र है:

- (a) 7 sq. units (b) 9 sq. units
(c) 14 sq. units (d) 10 sq. units

10. Find the distance between orthocentre and circumcentre of a triangle formed by the line $\frac{x}{a} + \frac{y}{b} = 1$ and the axes

रेखा $\frac{x}{a} + \frac{y}{b} = 1$ और अक्षों से बने त्रिभुज के लंबकेंद्र और परिकेंद्र के बीच की दूरी ज्ञात करें

- (a) $\sqrt{a^2 + b^2}$ (b) $(a + b)$
(c) $\frac{a+b}{2}$ (d) $\frac{\sqrt{a^2 + b^2}}{2}$

11. Find the area of triangle formed by lines $8x - 3y = 24$, x axis and y -axis

रेखाओं $8x - 3y = 24$, x अक्ष और y -अक्ष से बने त्रिभुज का क्षेत्रफल ज्ञात करें

- (a) 12 sq. units (b) 6 sq. units
(c) 18 sq. units (d) 9 sq. units

12. Find a point on the y -axis which is equidistant from the points A (6,5) and B(-4,3)

Y -अक्ष पर एक बिंदु खोजें जो बिंदु A (6, 5) और B(-4, 3) से समान दूरी पर हो

- (a) (0,9) (b) (9,0)
(c) (3,0) (d) (4,0)
13. Find the area of triangle of lines $\frac{x}{6} + \frac{y}{7} = 1, -\frac{x}{4} + \frac{y}{7} = 1$ and x-axis.
रेखाओं $\frac{x}{6} + \frac{y}{7} = 1, -\frac{x}{4} + \frac{y}{7} = 1$ और x-अक्ष के त्रिभुज का क्षेत्रफल ज्ञात कीजिए।
(a) 30 sq. units (b) 35 sq. units
(c) 70 sq. units (d) 60 sq. units
14. A(-5,-3) and B(-1,5) are endpoints of a line segment AB. M is a point on AB such that AM : 3MB, then find the distance of MN where coordinates of point N are (1,2).
A(-5,-3) और B(-1,5) एक रेखा खंड AB के अंतिम बिंदु हैं। M, AB पर एक बिंदु है जैसे कि AM: 3MB, तो MN की दूरी ज्ञात करें जहां बिंदु N के निर्देशांक (1) हैं, (2).
(a) $\sqrt{5}$ (b) $\sqrt{3}$ (c) $\sqrt{10}$ (d) $\sqrt{13}$
15. If $x = \alpha$ and $y = \beta$ is the solution of the pair of equations $mx + ny = m^2$ and $nx + my = n^2$, where $m \neq n$, then what is the value of $(\alpha - \beta)$?
यदि $x = \alpha$ और $y = \beta$ समीकरण युग्म $mx + ny = m^2$ और $nx + my = n^2$ का हल है, $m \neq n$ है, तो $(\alpha - \beta)$ का मान क्या होगा?
ICAR Assistant 29/07/2022 (Shift-01)
(a) $m + n$ (b) $m - n$
(c) $m^2 + n^2$ (d) $m^2 - n^2$
16. The area of the triangle formed by the lines $5x + 7y = 35, 4x + 3y = 12$ and x-axis is :
रेखाओं $5x + 7y = 35, 4x + 3y = 12$ x-अक्ष द्वारा निर्मित त्रिभुज का क्षेत्रफल है:
(a) $\frac{160}{13}$ sq. unit (b) $\frac{150}{13}$ sq. unit
(c) $\frac{140}{13}$ sq. unit (d) 10 sq. unit
17. In what ratio does the point T(x,0) divides segment joining the point S(-4,-1) and (1,4)?
बिंदु T(x, 0) बिंदु S(-4, -1) और (1,4) से जुड़ने वाले खंड को किस अनुपात में विभाजित करता है?
(a) 4:1 (b) 1:4 (c) 1:2 (d) 2:1
18. If the points A(4,3) and B(x,5) are on the circle with centre (2,3), find the value of x.
यदि बिंदु A(4, 3) और B(x, 5) केंद्र (2, 3) वाले वृत्त पर हैं, तो x का मान ज्ञात करें।
(a) 1 (b) 3 (c) 2 (d) -2
19. The equation of a line passing through the point (4, 4) and cutting off intercepts on the axis whose sum is 18 ?

बिंदु (4, 4) से गुजरने वाली और अक्ष पर अंतःखंड काटने वाली एक रेखा का समीकरण जिसका योग 18 है?

- (a) $x + 2y - 12 = 0$ but not $2x + y - 12 = 0$
(b) neither $x + 2y - 12 = 0$ nor $2x + y - 12 = 0$
(c) $2x + y - 12 = 0$ but not $x + 2y - 12 = 0$
(d) $x + 2y - 12 = 0$ or $2x + y - 12 = 0$
20. If $x = \alpha$ and $y = \beta$ satisfy the pair of equations $\frac{15}{x} + \frac{2}{y} = 17, \frac{1}{x} + \frac{1}{y} = \frac{36}{5}$, then which of the following equations are also satisfied by $x = \alpha$ and $y = \beta$ also satisfy which of the following equations?
यदि $x = \alpha$ और $y = \beta$ समीकरणों $\frac{15}{x} + \frac{2}{y} = 17, \frac{1}{x} + \frac{1}{y} = \frac{36}{5}$ को संतुष्ट करते हैं, तो $x = \alpha$ और $y = \beta$ निम्नलिखित में से और किस समीकरण को संतुष्ट करते हैं।
ICAR Assistant 29/07/2022 (Shift-03)
(a) $3x + 7y = 21$ (b) $2x - 7y = 9$
(c) $2x + 7y = 9$ (d) $3x - 7y = 2$
21. What is the reflection of the point (5,-3) in the line = 3?
रेखा = 3 में बिंदु (5,-3) का प्रतिबिंब क्या है?
SSC CGL Tier II 18/11/2020
(a) (5,-6) (b) (-5,3)
(c) (5,9) (d) (5,3)
22. Find the equation of a straight line which passes through the point (2,-3) and is such that the portion intercepted between the axes is divided by the point in the ratio of 1:3
उस सीधी रेखा का समीकरण ज्ञात कीजिए जो बिंदु (2,-3) से होकर गुजरती है और इस प्रकार है कि अक्षों के बीच का अंतःखंड भाग 1:3 के अनुपात में बिंदु से विभाजित होता है
(a) $2x + 9y + 23 = 0$ (b) $2x - 9y - 31 = 0$
(c) $9x - 2y - 24 = 0$ (d) $9x + 2y - 12 = 0$
23. What is the equation of a circle with centre of origin and radius is 6 cm?
मूल केंद्र और त्रिज्या 6 सेमी वाले वृत्त का समीकरण क्या है?
SSC CHSL 17/03/2020 (Evening)
(a) $x^2 + y^2 - x - y = 36$
(b) $x^2 + y^2 - x = 36$
(c) $x^2 + y^2 - y = 36$
(d) $x^2 + y^2 - 36 = 0$
24. If A(-2,1), B(2,3) and C(-2,-4) are three points, find the angle between BA and BC.
यदि A(-2,1), B(2,3) और C(-2,-4) तीन बिंदु हैं, तो BA और BC के बीच का कोण ज्ञात कीजिए।

- (a) $\tan^{-1}\left(\frac{3}{5}\right)$ (b) $\tan^{-1}\left(\frac{2}{3}\right)$
 (c) $\tan^{-1}\left(\frac{3}{2}\right)$ (d) None of these
25. The vertices of a triangle are $\left(\alpha\beta, \frac{1}{\alpha\beta}\right)$, $\left(\beta\gamma, \frac{1}{\beta\gamma}\right)$ and $\left(\gamma\alpha, \frac{1}{\gamma\alpha}\right)$ where α, β and γ are the roots of equation $p^3 - 2p^2 + 3p - 4 = 0$, the coordinates of the centroid of that triangle are
 एक त्रिभुज के शीर्ष हैं $\left(\alpha\beta, \frac{1}{\alpha\beta}\right)$, $\left(\beta\gamma, \frac{1}{\beta\gamma}\right)$ और $\left(\gamma\alpha, \frac{1}{\gamma\alpha}\right)$ जहाँ α, β और γ समीकरण $p^3 - 2p^2 + 3p - 4 = 0$ के मूल हैं, उस त्रिभुज के केन्द्रक के निर्देशांक हैं
 (a) $\left(1, \frac{1}{2}\right)$ (b) $\left(1, \frac{1}{3}\right)$
 (c) $\left(1, \frac{1}{5}\right)$ (d) $\left(1, \frac{1}{6}\right)$
26. The area of a triangle is 5 two of its vertices are (2,1) and (3, -2). The third vertex lies on $y = x + 3$. Find the third vertex.
 एक त्रिभुज का क्षेत्रफल 5 है, इसके दो शीर्ष (2,1) और (3,-2) हैं। तीसरा शीर्ष $y = x + 3$ पर स्थित है। तीसरा शीर्ष खोजें।
 (a) $\left(\frac{7}{2}, \frac{13}{2}\right)$ (b) $\left(\frac{-3}{2}, \frac{3}{2}\right)$
 (c) Neither (a) nor (b) (d) Both (a) and (b)
27. The graph of the linear equation $3x - 2y = 8$ and $4x + 3y = 5$ intersect at the point (α, β) . What is the value of $(2\alpha - \beta)$?
 रेखिक समीकरण $3x - 2y = 8$ और $4x + 3y = 5$ का ग्राफ बिंदु (α, β) पर प्रतिच्छेद करता है। $(2\alpha - \beta)$ का मान क्या है?
 SSC CGL Tier II 16/11/2020
 (a) 4 (b) 6 (c) 3 (d) 5
28. Find the equation of median PS of a $\triangle PQR$ whose coordinates of vertices are $P(-2,2)$, $Q(-8,-4)$ and $R(-2,-3)$ where S is on side PQ
 $\triangle PQR$ के माध्य PS का समीकरण ज्ञात कीजिए जिसके शीर्षों के निर्देशांक $P(-2,2)$, $Q(-8,-4)$ और $R(-2,-3)$ हैं जहाँ S पक्ष PQ पर है
 (a) $6x - 11y + 34 = 0$
 (b) $6x + 11y - 34 = 0$
- (c) $11x - 6y + 34 = 0$
 (d) $11x + 6y - 34 = 0$
29. Given a $\triangle PQR$ with vertices $P(2, 3)$, $Q(-3,7)$ and $R(-1, -3)$. The equation of median PM is :
 शीर्षों $P(2, 3)$, $Q(-3,7)$ और $R(-1,-3)$ के साथ $\triangle PQR$ दिया गया है। माध्यिका PM का समीकरण है:
 (a) $x - y + 10 = 0$ (b) $x - 4y - 10 = 0$
 (c) $x - 4y + 10 = 0$ (d) None of these
30. What is the area (in square units) of the triangular region enclosed by the graphs of the equations $x + y = 3$, $2x + 5y = 12$ and the x axis?
 समीकरण $x + y = 3$, $2x + 5y = 12$ और x अक्ष के ग्राफ से घिरे त्रिकोणीय क्षेत्र का क्षेत्रफल (वर्ग इकाइयों में) क्या है?
 SSC CGL Tier II (13/09/2019)
 (a) 2 (b) 3 (c) 4 (d) 6
31. α and β are the roots of the quadratic equation $x^2 - x - 1 = 0$. What is the value of $\alpha^8 + \beta^8$?
 α और β द्विघात समीकरण $x^2 - x - 1 = 0$ के मूल हैं। $\alpha^8 + \beta^8$ का मान क्या है?
 (a) 47 (b) 54 (c) 59 (d) 68
32. The graphs of the equations $2x + 3y = 11$ and $x - 2y + 12 = 0$ intersects at $P(x_1, y_1)$ and the graph of the equation $x - 2y + 12 = 0$ intersects the x -axis at $Q(x_2, y_2)$. What is the value of $(x_1 - x_2 + y_1 + y_2)$?
 समीकरण $2x + 3y = 11$ और $x - 2y + 12 = 0$ का ग्राफ $P(x_1, y_1)$ पर प्रतिच्छेद करता है और समीकरण $x - 2y + 12 = 0$ का ग्राफ x -अक्ष को $Q(x_2, y_2)$ पर प्रतिच्छेद करता है। $(x_1 - x_2 + y_1 + y_2)$ का मान क्या है?
 SSC CGL Tier II 12/09/2019
 (a) 13 (b) -11 (c) 15 (d) -9
33. Find the in center of a triangle whose three vertices are $A = (0, 0)$, $B = (5, 12)$ $C = (9, 12)$
 उस त्रिभुज का केंद्र ज्ञात कीजिए जिसके तीन शीर्ष $A = (0, 0)$, $B = (5, 12)$ $C = (9, 12)$ हैं
 (a) (7.5, 8) (b) (3, 4)
 (c) (2, 5) (d) (6, 10.5)

Type 1 (Co-ordinate Geometry) Answer Key

1	(c)	2	(c)	3	(c)	4	(c)	5	(c)	6	(a)	7	(b)
8	(b)	9	(a)	10	(d)	11	(a)	12	(a)	13	(b)	14	(c)
15	(a)	16	(a)	17	(b)	18	(c)	19	(d)	20	(b)	21	(c)
22	(c)	23	(d)	24	(b)	25	(d)	26	(c)	27	(d)	28	(c)
29	(c)	30	(b)	31.	(a)	32	(c)	33	(d)				

Type-1 (Co-Ordinate Geometry) Solution

1. Sol. (c)

$$4x + \frac{1}{3}y = \frac{8}{3}$$

Multiplying by 3 we get,

$$12x + y = 8 \quad \dots(i)$$

$$\frac{1}{2}x + \frac{3}{4}y + \frac{5}{2} = 0$$

Multiplying by 4 we get,

$$2x + 3y + 10 = 0 \quad \dots(ii)$$

Multiplying (1) by 3 and subtracting from (2) we get,

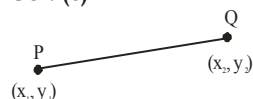
$$-34x = -34, \Rightarrow x = 1,$$

Putting $x = 1$ in $-(1)$

$$\text{we get } 12 + y = 8, \Rightarrow y = -4$$

Checking these values of x and y we find only option (c) satisfies these values.

2. Sol. (c)



$$\text{Slope of line } m = \frac{y_2 - y_1}{x_2 - x_1}$$

P(2,8) and Q(6,9)

$$\text{Slope } m = \frac{9-8}{6-2} = \frac{1}{4} = .25$$

3. Sol. (c)

$$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{\left(p - \frac{1}{p} - 0\right)^2 + (2 - 0)^2}$$

$$= \sqrt{p^2 + \frac{1}{p^2} - 2 + 4}$$

$$= \sqrt{\left(p + \frac{1}{p}\right)^2}$$

$$= \pm \left(p + \frac{1}{p}\right)$$

$$= p + \frac{1}{p} \quad (\text{Distance cannot be negative})$$

4. Sol. (c)

Intersection point of $2x + 5y = 12$ and $x + y = 3$ is

$$(1,2)$$

Intersection point of $2x + 5y = 12$ and $y = 0$ is

$$(6,0)$$

Intersection point of $x + y = 3$ and $y = 0$ is (3,0)

$$\text{Area of triangle} = \frac{1}{2}[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)]$$

$$\Rightarrow \frac{1}{2}[1(0 - 0) + 6(0 - 2) + 3(2 - 0)]$$

$$\Rightarrow \left| \frac{1}{2}[-12 + 6] \right| = 3 \text{ cm}^2$$

5. Sol. (c)

$$7x + 11y = 3 \quad \dots(i)$$

$$8x + y = 15 \quad \dots(ii)$$

On solving eqn. (i) and (ii), we get

$$y = -1 \text{ and } x = 2$$

If we put the obtained value of x and y in options given, then only option (c) gets satisfied.

6. Sol. (a)

Abscissa $\rightarrow$ x-coordinateOrdinate $\rightarrow$ y-coordinateLet ordinate of the endpoint be p Then,Coordinates of the endpoint be $(10, p)$

Now

$$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$\Rightarrow 10 = \sqrt{(10 - 2)^2 + (p - (-3))^2}$$

$$\Rightarrow 100 = 64 + p^2 + 9 + 6p$$

$$\Rightarrow p^2 + 6p - 27 = 0$$

$$\Rightarrow p^2 + 9p - 3p - 27 = 0$$

$$\Rightarrow p(p + 9) - 3(p + 9) = 0$$

$$\Rightarrow (p - 3)(p + 9)$$

$$p = 3, p = -9$$

7. Sol. (b)

Given equation $2x + 3y + 6 = 0$

$$\Rightarrow 3y = -2x - 6 \Rightarrow y = -\frac{2}{3}x - 2$$

So, slope of this equation is $-\frac{2}{3}$

The slope of the equation which is perpendicular to this line is $\frac{3}{2}$ ($\because m_1 m_2 = -1$)

So, equation of line with slope $\frac{3}{2}$ and y-intercept 3 is given by

$$y = mx + c$$

$$\Rightarrow y = \frac{3}{2}x + 3$$

$$\Rightarrow 2y = 3x + 6$$

$$3x - 2y + 6 = 0$$

8. Sol. (b)

$$AC = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(a - am^2)^2 + (0 - 2am)^2}$$

$$= \sqrt{a^2 + a^2 m^4 - 2a^2 m^2 + 4a^2 m^2}$$

$$= \sqrt{(a + am^2)^2} = a + am^2$$

$$BC = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{\left(a - \frac{a}{m^2}\right)^2 + \left(0 - \frac{2a}{m}\right)^2}$$

$$= \sqrt{a^2 + \frac{a^2}{m^4} - \frac{2a^2}{m^2} + \frac{4a^2}{m^4}}$$

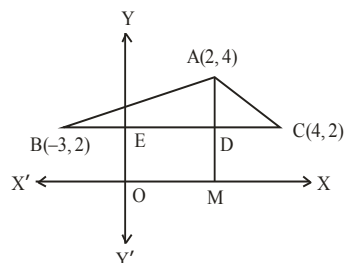
$$= \sqrt{\left(a + \frac{a}{m^2}\right)^2} = \left(a + \frac{a}{m^2}\right)$$

$$\frac{1}{AC} + \frac{1}{BC} = \frac{1}{a + am^2} + \frac{1}{a + \frac{a}{m^2}} = \frac{1+m^2}{a(1+m^2)} = \frac{1}{a}$$

9. Sol. (a)

Draw $AM \perp x$ -axis meeting BC at D .

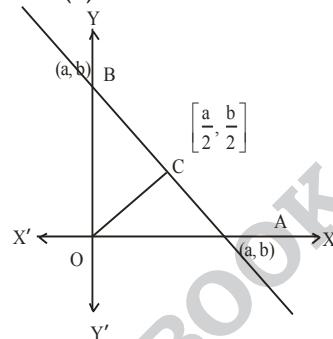
Now, $BC = BE + EC = 3 + 4 = 7$ units



and $AD = AM - DM = 4 - 2 = 2$ units

$$\therefore \text{ar}(\triangle ABC) = \frac{1}{2} \times 2 \times 7 = 7 \text{ sq. unit}$$

10. Sol. (d)



OAB is a right angle triangle so orthocenter of $\triangle OAB$ is at $(0, 0)$ and circumcentre will be at midpoint of AB

$$C = \left(\frac{a+0}{2}, \frac{0+b}{2}\right)$$

$$C = \left(\frac{a}{2}, \frac{b}{2}\right)$$

Now

$$OC = \sqrt{\left(\frac{a}{2} - 0\right)^2 + \left(\frac{b}{2} - 0\right)^2}$$

$$OC = \sqrt{\left(\frac{a}{2}\right)^2 + \left(\frac{b}{2}\right)^2}$$

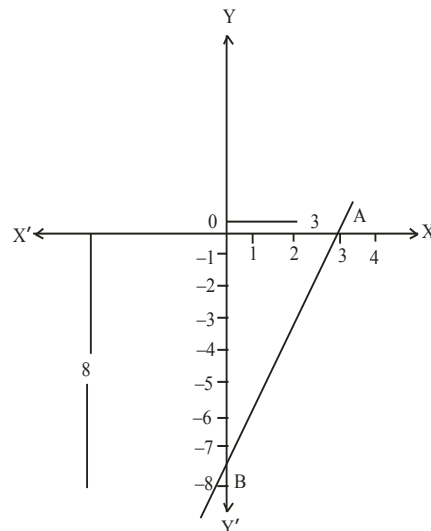
$$OC = \frac{1}{2} \sqrt{a^2 + b^2}$$

11. Sol. (a)

$$8x - 3y = 24$$

$$\frac{x}{3} - \frac{y}{8} = 1$$

$$\frac{x}{3} + \frac{y}{-8} = 1$$



Area of $\triangle OAB$

$$= \frac{1}{2} \times 8 \times 3 = 12 \text{ Sq. units}$$

12. Sol. (a)

Let the required point be P (O, y)

$$\therefore PA = PB$$

$$= \sqrt{(0-6)^2 + (y-5)^2}$$

$$= \sqrt{(0-4)^2 + (y-3)^2}$$

$$\Rightarrow 36 + (y-5)^2 = 16 + (y-3)^2$$

$$\Rightarrow 36 + y^2 - 10y + 25$$

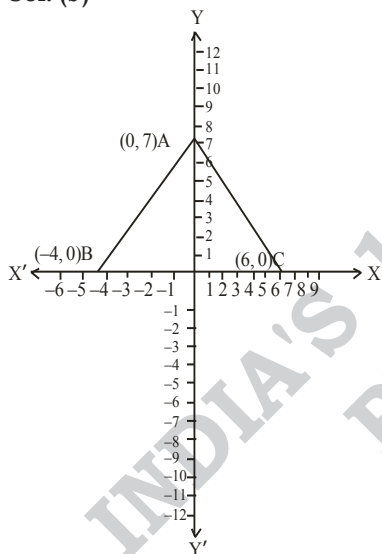
$$\Rightarrow 16 + y^2 - 6y + 9$$

$$\Rightarrow 4y = 36$$

$$\Rightarrow y = 9$$

$\therefore$ Required point is (0,9).

13. Sol. (b)



$$\frac{x}{6} + \frac{y}{7} = 1, \quad \frac{x}{-4} + \frac{y}{7} = 1 \text{ and}$$

x-axis

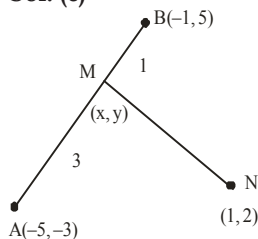
$$BC = 4 + 6 = 10 \text{ unit}$$

$$AO = 7 \text{ units}$$

$$\text{Area of triangle} = \frac{1}{2} \times BC \times OA = \frac{1}{2} \times 10 \times 7 = 35$$

units

14. Sol. (c)



Let the coordinates of M are (x, y)

Then,

$$M = \left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n} \right)$$

Here $m = 3, n = 1, (x_1, y_1) = (-5, 3)$ and $(x_2, y_2) = (-1, 5)$

$$M = \left(\frac{3(-1) + 1(-5)}{3+1}, \frac{3(5) + 1(3)}{3+1} \right) = (-2, 3)$$

Now

$$MN = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(1 - (-2))^2 + (2 - 3)^2}$$

$$= \sqrt{(3)^2 + (-1)^2}$$

$$= \sqrt{10}$$

15. Sol. (a)

If $x = \alpha$ and $y = \beta$ are the solution of the pair of equation then these satisfy the equation.

$$m\alpha + n\beta = m^2 \quad \dots (i)$$

$$n\alpha \pm m\beta = n^2 \quad \dots (ii)$$

$$(m-n)\alpha - (m-n)\beta = m^2 - n^2$$

$$(m-n) - (\alpha - \beta) = m^2 - n^2$$

$$(\alpha - \beta) = m + n$$

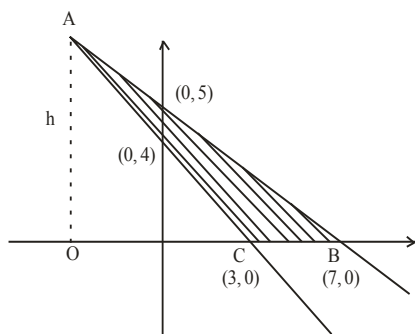
16. Sol. (a)

$$5x + 7y = 35$$

$$\text{or } \frac{x}{7} + \frac{y}{5} = 1 \quad \dots (i)$$

$$\text{and } 4x + 3y = 12$$

$$\text{or } \frac{x}{3} + \frac{y}{4} = 1 \quad \dots (ii)$$



$\therefore$ Base of $\triangle ABC = BC = 7 - 3 = 4$ unit

let height (OA) = h

from (i) and (ii) we get $y = \frac{80}{13}$

$\therefore$ ar($\triangle ABC$)

$$= \frac{1}{2} \times 4 \times \frac{80}{13} = \frac{160}{13} \text{ sq. unit}$$

17. Sol. (b)



Let the ratio of ST : TU be $\lambda : 1$

Then,

$$T = \left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n} \right)$$

Here $m = \lambda, n = 1, (x_1, y_1) = (-4, -1)$ and $(x_2, y_2) = (1, 4)$

y-coordinate of point T

$$= \left(\frac{\lambda(4) + 1(-1)}{\lambda + 1} \right) = 0$$

$$\Rightarrow 4\lambda - 1 = 0 \Rightarrow \lambda = \frac{1}{4}$$

So ST : TU = 1 : 4

18. Sol. (c)

OA = OB = radius

$$= \sqrt{(4-2)^2 + (3-3)^2}$$

$$= \sqrt{(x-2)^2 + (5-3)^2}$$

$$\Rightarrow (x-2)^2 = 0$$

$$\Rightarrow x = 2$$

19. Sol. (d)

Let a line $\frac{x}{a} + \frac{y}{b} = 1$

Given, $a + b = 18$... (i)

Passing through (4, 4)

$$\text{It means } \frac{4}{a} + \frac{4}{b} = 1$$

$$\Rightarrow ab = 4(a + b) = 72$$

$$(a - b)^2 = (a + b)^2 - 4ab$$

$$= (18)^2 - 4 \times 72$$

$$= 324 - 288 = 36$$

$$a - b = \pm 6$$

On solving equation (i) and (ii) $(a, b) = (12, 6)$ or $(6, 12)$

$$\text{Line will be } \frac{x}{12} + \frac{y}{6} = 1$$

$$\Rightarrow x + 2y = 12$$

Or,

$$\frac{x}{6} + \frac{y}{12} = 1$$

$$\Rightarrow 2x + y = 12$$

20. Sol. (b)

$$\frac{15}{\alpha} + \frac{2}{\beta} = 17 \quad \dots (i)$$

$$8 \left(\frac{15}{\alpha} + \frac{2}{\beta} = \frac{36}{5} \right) \times 2$$

$$\Rightarrow \frac{2}{\alpha} + \frac{2}{\beta} = \frac{72}{5} \quad \dots (ii)$$

$$(i) - (ii) \Rightarrow \frac{15}{\alpha} + \frac{2}{\beta} = 17$$

$$\frac{-2}{\alpha} - \frac{2}{\beta} = \frac{-72}{5}$$

$$\frac{13}{\alpha} = \frac{13}{5} \Rightarrow \alpha = 5$$

$$\Rightarrow \frac{1}{5} + \frac{1}{\beta} = \frac{36}{5} \Rightarrow \frac{1}{\beta} = \frac{35}{5} \Rightarrow \beta = \frac{1}{7}$$

Now put $x = 5$ & $y = \frac{1}{7}$ in option and check

Which option satisfy it.

Option (b) i.e., $2x - 7y = 9$

21. Sol. (c)

$y = 3$ is parallel to x axis so on reflection x axis will not change

Perpendicular distance of $(5, -3)$ from $y = 3 = 6$ units

6 units on the other side of the line $(y = 3) = 3 + 6 = 9$

So the point = $(5, 9)$

22. Sol. (c)

Let the equation of straight line be $\frac{x}{a} + \frac{y}{b} = 1$

The line meets the x-axis at A(a, 0) and y-axis at B(0, b)

The coordinates of the point that divides the line joining A(a, 0) and B(0, b) in the ratio 1:3

$$P = \left(\frac{1(0)+3(a)}{1+3}, \frac{1(b)+3(0)}{1+3} \right) = \left(\frac{3a}{4}, \frac{b}{4} \right)$$

It is given that point (3,2) divides the AB in 1:3 therefore

$$\frac{3a}{4} = 2 \text{ and } \frac{b}{4} = -3$$

$$a = \frac{8}{3}, b = -12$$

So, the equation of required line

$$\Rightarrow \frac{x}{\frac{8}{3}} + \frac{y}{-12} = 1$$

$$9x - 2y - 24 = 0$$

23. Sol. (d)

Center = (0, 0) and radius = 4 cm

Equation of circle

$$\Rightarrow (x-0)^2 + (y-0)^2 = (4)^2$$

$$x^2 + y^2 = 16 \Rightarrow x^2 + y^2 - 16 = 0$$

24. Sol. (b)

Let m_1 and m_2 be the slope of BA and BC respectively. Then

$$m_1 = \frac{3-1}{2-(-2)} = \frac{1}{2}$$

and

$$m_2 = \frac{-4-3}{-2-2} = \frac{7}{4}$$

Let θ be the angle between BA and BC. Then

$$\tan \theta = \left| \frac{m_2 - m_1}{1 + m_1 m_2} \right|$$

$$= \left| \frac{\frac{7}{4} - \frac{1}{2}}{1 + \frac{1}{2} \times \frac{7}{4}} \right| = \pm \frac{2}{3}$$

$$\Rightarrow \theta = \tan^{-1} \left(\frac{2}{3} \right)$$

25. Sol. (d)

Coordinates of the centroid of with vertices at

(x_1, y_1) , (x_2, y_2) and (x_3, y_3) are

$$C = \left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3} \right)$$

$$= \left(\frac{a\beta + \beta\gamma + \gamma\alpha}{3}, \frac{\frac{1}{a\beta} + \frac{1}{\beta\gamma} + \frac{1}{\gamma\alpha}}{3} \right)$$

$$= \left(\frac{a\beta + \beta\gamma + \gamma\alpha}{3}, -\frac{\alpha + \beta + \gamma}{3\alpha\beta\gamma} \right)$$

α, β and γ are roots of equation $p^2 + q^2 + 3p -$

$$4 = 0$$

$$\alpha + \beta + \gamma = \frac{-2}{1} = 2$$

$$\alpha\beta + \beta\gamma + \gamma\alpha = \frac{3}{1} = 3$$

$$\alpha\beta\gamma = \frac{(-4)}{1} = 4$$

Putting these values in above eqn we get

$$C = \left(\frac{3}{3}, \frac{2}{3(4)} \right) = \left(1, \frac{1}{6} \right)$$

26. Sol. (c)

Area of $\Delta = 5$ sq unit.

$$= \frac{1}{2} [(x-4+3y) - (2y+3-2x)] = 5$$

$$= \frac{1}{2} |3x + y - 7| = 5$$

$$= 3x + y - 7 = \pm 10$$

$$= 3x + y - 17 = 0 \text{ or } 3x + y + 3 = 0$$

It is given that vertex (x,y) lies on $y = x + 3$

$$\text{By } 3x + y - 17 = 0 \text{ and } y = x + 3 \Rightarrow x = \frac{7}{2} \text{ and } y = \frac{13}{2}$$

$$\text{By } 3x + y + 3 = 0 \text{ and } y = x + 3 \Rightarrow x = \frac{-3}{2} \text{ and } y = \frac{3}{2}$$

$$\text{Co-ordinates are } \left(\frac{7}{2}, \frac{13}{2} \right) \text{ or } \left(\frac{-3}{2}, \frac{3}{2} \right)$$

27. Sol. (d)

$$3x - 2y = 8 \text{ and } 4x + 3y = 5$$

On solving both the eq.

$$\alpha = 2, \beta = -1 \Rightarrow (2\alpha - \beta) = 5$$

28. Sol. (c)

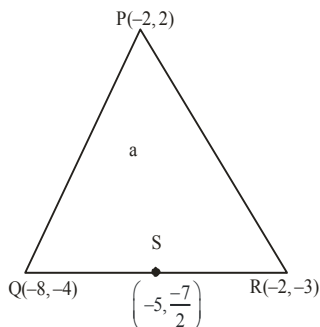
The midpoint of QR is S

$$S = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

$$= \left(\frac{-8-2}{2}, \frac{-4-3}{2} \right) = \left(-5, \frac{-7}{2} \right)$$

Now equation of line through two points P(-2,2)

and Q $\left(-5, \frac{-7}{2} \right)$ is



$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$$

$$\Rightarrow y - 2 = \frac{\frac{-7}{2} - 2}{-5 - (-2)}(x - (-2))$$

$$\Rightarrow y - 2 = \frac{11}{6}(x + 2)$$

$$\Rightarrow 6y - 12 = 11x + 22$$

$$11x - 6y + 34 = 0$$

29. Sol. (c)

Clearly, M is the mid-point of QR.

Co-ordinates of M are

$$\left(\frac{-3-1}{2}, \frac{7-3}{2}\right)$$

i.e. M(-2, 2)

Now, find the equation of the line joining P(2, 3)

and M(-2, 2)

Required equation is,

$$(y - 3) = \frac{2-3}{-2-2}(x - 2)$$

$$\Rightarrow y - 3 = \frac{1}{4}(x - 2)$$

$$\Rightarrow 4y - 12 = x - 2$$

$$\Rightarrow x - 4y + 10 = 0$$

30. Sol. (b)

In $x + y = 3$

$$x = 0 \Rightarrow y = 3$$

$$\text{put } y = 0 \Rightarrow x = 3$$

Line formed by the equation will be AB

In $2x + 5y = 12$

$$\text{put } x = 0 \Rightarrow y = 2.4$$

$$\text{put } y = 0 \Rightarrow x = 6$$

Line formed by the equation will be CD AB and CD will intersect at point E.

$$\text{Given, } x + y = 3 \quad \dots(i)$$

$$\text{and } 2x + 5y = 12 \quad \dots(ii)$$

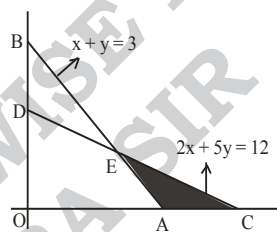
Multiply equation (1) by 2 and subtract it from equation (2)

$$\Rightarrow 3y = 6 \Rightarrow y = 2$$

Put the value of y in any of the equations

$$x + 2 = 3 \Rightarrow x = 1$$

$$\text{So, } E(x, y) = (1, 2)$$



Area formed by the equations

$x + y = 3$, $2x + 5y = 12$ and the x axis is the shaded region or $\triangle EAC$

$$\text{Now, } AC = OC - OA = 6 - 3 = 3$$

Height of the triangle will be the y coordinate of point E = 2

$$\text{Required area} = \frac{1}{2} \times \text{base} \times \text{Height} = \frac{1}{2} \times 3 \times 2 = 3 \text{ square units.}$$

31. Sol. (a)

$$\text{Given, } x^2 - x - 1 = 0$$

$$\text{Then, } \alpha + \beta = \frac{-b}{a} = 1$$

$$\alpha \times \beta = \frac{c}{a} = -1$$

$$\beta = \frac{-1}{\alpha}$$

from (1),

$$\alpha - \frac{1}{\alpha} = 1$$

Squaring both sides,

$$= \alpha^2 + \frac{1}{\alpha^2} = (1)^2 + 2 = 3$$

$$\text{and } \alpha^4 + \frac{1}{\alpha^4} = (3)^2 - 2 = 7$$

$$\text{and } \alpha^8 + \frac{1}{\alpha^8} = (7)^2 - 2 = 49$$

$$-2 = 47$$

32. Sol. (c)

Given,

$$2x + 3y = 11$$

$$\text{and } x - 2y + 12 = 0$$

$$2y - x = 12$$

Multiply equation (2) by 2 and add it in equation

(1)

$$\Rightarrow 7y = 35 \Rightarrow y = 5 \text{ and } x = -2$$

$$\Rightarrow P(x_1, y_1) = (-2, 5)$$

Now,

$$x - 2y + 12 = 0$$

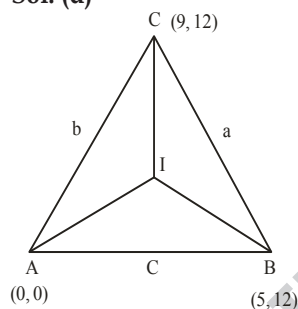
$$\text{At } x \text{ axis } y = 0 \Rightarrow x = -12$$

$$Q(x_2, y_2) = (-12, 0)$$

$$(x_1 - x_2 + y_1 + y_2)$$

$$\Rightarrow \{-2 - (-12) + 5 + 0\} = 15$$

33. Sol. (d)



$$a = BC = \sqrt{(9-5)^2 + (12-12)^2} = \sqrt{16} = 4$$

$$b = AC = \sqrt{(9-0)^2 + (12-0)^2}$$

$$= \sqrt{81 + 144} = \sqrt{225} = 15$$

$$c = AB = \sqrt{(5-0)^2 + (12-0)^2}$$

$$= \sqrt{25 + 144} = \sqrt{169} = 13$$

Coordinates of incentre

$$= \left(\frac{4 \times 0 + 15 \times 5 + 13 \times 9}{4 + 15 + 13}, \frac{4 \times 0 + 15 \times 12 + 13 \times 12}{4 + 15 + 13} \right)$$

$$= \left(\frac{75 + 117}{32}, \frac{180 + 156}{32} \right)$$

$$= \left(\frac{192}{32}, \frac{336}{32} \right) = (6, 10.5)$$

Type-1 (Co-Ordinate Geometry)

1. What is the area (in unit squares) of the region enclosed by the graphs of the equations $2x - 3y + 6 = 0$, $4x + y = 16$ and $y = 0$?
समीकरण $2x - 3y + 6 = 0$, $4x + y = 16$ और $y = 0$ के ग्राफ से घिरे क्षेत्र का क्षेत्रफल (इकाई वर्गों में) क्या है?
SSC CGL Tier II 2023
(a) 11.5 (b) 14
(c) 10.5 (d) 12
2. Find a point on the y-axis which is equidistant from the points A (6, 5) and B(-4, 3)
Y-अक्ष पर एक बिंदु खोजें जो बिंदु A (6, 5) और B(-4, 3) से समान दूरी पर हो
(a) (0, 9) (b) (9, 0)
(c) (3, 0) (d) (4, 0)
3. Find the value of p if the distance between point A(p, 2) and B(3, 4) be 8
यदि बिंदु A(p, 2) और B(3, 4) के बीच की दूरी 8 है तो p का मान ज्ञात कीजिए
(a) $3 \pm 2\sqrt{5}$ (b) $3 \pm 2\sqrt{7}$
(c) $2 \pm 3\sqrt{5}$ (d) $3 \pm 2\sqrt{15}$
4. Find the distance of point A $(p - \frac{1}{p}, 2)$ from the origin ($0 < p < 1$)
मूल बिंदु ($0 < p < 1$) से बिंदु A $(p - \frac{1}{p}, 2)$ की दूरी ज्ञात करें
(a) $\frac{1}{p}\sqrt{p^2 + 1}$ (b) $\frac{1}{p}\sqrt{p^2 - 1}$
(c) $\frac{1}{p} + p$ (d) $\sqrt{p^2 + \frac{1}{p^2}}$
5. Find the area of triangle formed by lines $8x - 3y = 24$, x axis and y - axis
रेखाओं $8x - 3y = 24$, x-अक्ष और y-अक्ष से बने त्रिभुज का क्षेत्रफल ज्ञात करें
(a) 12 sq. units (b) 6 sq. units
(c) 18 sq. units (d) 9 sq. units
6. Find the slope of line passing through the points (2, 8) and (6, 9).
बिंदु (2, 8) और (6, 9) से गुजरने वाली रेखा का ढलान ज्ञात करें।
(a) 5 (b) -5
(c) .25 (d) -25
7. Find the area of triangle of lines $\frac{x}{6} + \frac{y}{7} = 1$, $-\frac{x}{4} + \frac{y}{7} = 1$ and x-axis.
रेखाओं $\frac{x}{6} + \frac{y}{7} = 1$, $-\frac{x}{4} + \frac{y}{7} = 1$ और x-अक्ष के त्रिभुज का क्षेत्रफल ज्ञात कीजिए।
(a) 30 sq. units (b) 35 sq. units
(c) 70 sq. units (d) 60 sq. units
8. The graphs of the equations $7x + 11y = 3$ and $8x + y = 15$ intersect at the point P, which also lies on the graph of the equation.
समीकरण $7x + 11y = 3$ और $8x + y = 15$ के ग्राफ बिंदु P पर प्रतिच्छेद करते हैं, जो समीकरण के ग्राफ पर भी स्थित है।
SSC CGL Tier II 03/02/2022
(a) $2x + y = 2$ (b) $2x - y = 1$
(c) $3x + 5y = 1$ (d) $3x + 2y = 3$
9. Point A(-3, 2) and B(5, 4) are the end points of a line segment, find the Co-ordinates of the mid points of the line Segment.
बिंदु A(-3, 2) और B(5, 4) एक रेखा खंड के अंतिम बिंदु हैं, रेखा खंड के मध्य बिंदुओं के निर्देशांक ज्ञात करें।
(a) $(\frac{3}{2}, 1)$ (b) $(\frac{2}{3}, 0)$
(c) 1, 3 (d) (2, 3)
10. Find the area of quadrilateral formed by joining points (4, 2), (8, 2), (4, 10) and (8, 14).
बिंदुओं (4, 2), (8, 2), (4, 10) तथा (8, 14) को मिलाने से बने चतुर्भुज का क्षेत्रफल ज्ञात कीजिए।
(a) 5Sq. units (b) 10Sq. units
(c) 25Sq. units (d) 32sq. units
11. Find the equation of the line which cuts off intercepts 2 and 3 on the axis.
उस रेखा का समीकरण ज्ञात कीजिए जो अक्ष पर अंतःखंड 2 और 3 को काटती है।
(a) $9x - 7y = 6$ (b) $3x - 2y = 5$
(c) $4x - 3y = 7$ (d) $3x + 2y = 6$
12. If $\alpha + \beta + \gamma = \alpha\beta + \beta\gamma + \gamma\alpha$, then what is $(1 - \alpha)(1 - \beta)(1 - \gamma)$ equal to?
यदि $\alpha + \beta + \gamma = \alpha\beta + \beta\gamma + \gamma\alpha$, तो $(1 - \alpha)(1 - \beta)(1 - \gamma)$ किसके बराबर है?
[CDS-2021-II]
(a) $1 - \alpha\beta\gamma$ (b) $1 + \alpha\beta\gamma$
(c) $\alpha^2 + 2\beta$
(d) $(\alpha - \beta)(\beta - \gamma)(\gamma - \alpha)$

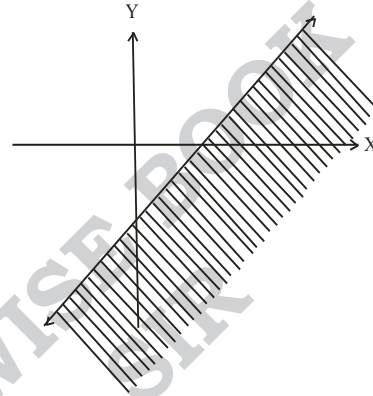
13. Find the distance between points A $(2a, 2b)$ and B $(2a, -2c)$.
बिंदु A $(2a, 2b)$ और B $(2a, -2c)$ के बीच की दूरी ज्ञात करें।
(a) $b - c$ (b) $2\sqrt{4a^2 + b^2 + c^2}$
(c) $b + c$ (d) $2(b + c)$
14. The pair of linear equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ in two variables represents pair straight lines which are intersecting, if :
रेखिक समीकरणों की जोड़ी $a_1x + b_1y + c_1 = 0$ तथा $a_2x + b_2y + c_2 = 0$ दो चर में जोड़ी सीधी रेखाओं का प्रतिनिधित्व करती है जो प्रतिच्छेद कर रही हैं, यदि:
(a) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ (b) $\frac{a_1}{a_2} = \frac{b_1c_1}{b_2c_2}$
(c) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ (d) $\frac{a_1}{a_2} \neq \frac{c_1}{c_2} = \frac{b_1}{b_2}$
15. Find the distance between pair of points $(8, 0)$ and $(0, 6)$:
बिंदुओं की जोड़ी $(8, 0)$ और $(0, 6)$ के बीच की दूरी ज्ञात करें:
(a) 9 (b) 8
(c) -10 (d) 10
16. Find the area of quadrilateral intercepted by straight lines $x + y = 2$, $3x + 4y = 24$ between the axis
अक्ष के बीच सीधी रेखाओं $x + y = 2$, $3x + 4y = 24$ द्वारा अंतःखंडित चतुर्भुज का क्षेत्रफल ज्ञात करें
(a) 22 sq. units (b) 20 sq. units
(c) 18 sq. unit (d) 16 sq. units
17. The graph of the equation $x = a(a \neq 0)$ is a.....
समीकरण $x = a(a \neq 0)$ का ग्राफ a..... है
SSC CGL Tier II 08/08/2022
(a) line parallel to x axis
(b) line parallel to y axis
(c) line at an angle of 45 degree to y axis
(d) line at an angle of 45 . degree to x-axis
18. Find p if the point $X(p, p + 2)$ is equidistance from points $A(-4, -6)$ and $B(6, 8)$
यदि बिंदु $X(p, p+2)$ बिंदु $A(-4, -6)$ और $B(6, 8)$ से समान दूरी पर है तो p ज्ञात करें
(a) -1 (b) $-\frac{1}{3}$
(c) $\frac{1}{4}$ (d) $-\frac{1}{6}$
19. What is the area (in unit squares) of the triangle enclosed by the graphs of $2x + 5y = 12$, $x + y = 3$ and the x-axis?

$2x + 5y = 12$, $x + y = 3$ और x-अक्ष के ग्राफ से घिरे त्रिभुज का क्षेत्रफल (इकाई वर्गों में) क्या है?

SSC CGL Tier II 03/02/2022

- (a) 2.5 (b) 3.5
(c) 3 (d) 4

20. The shaded region represents :
छायांकित क्षेत्र दर्शाता है:



- (a) $y \geq x$ (b) $y \leq -x$
(c) $y \leq x$ (d) $y \geq -x$

21. The reflection of a point in the 4th quadrant 6 unit away from the x-axis and 7 units away from the y-axis in the x-axis is
4^{वें} चतुर्थांश में x-अक्ष से 6 इकाई दूर और y-अक्ष से 7 इकाई दूर एक बिंदु का x-अक्ष में प्रतिबिंब है
(a) $(7, -6)$ (b) $(-7, 6)$
(c) $(-6, -7)$ (d) $(6, 7)$
22. Find the equation of the line through the intersection of the lines $3x + 4y = 7$ and $x - y + 2 = 0$ having slope 3 .
ढलान 3 वाली रेखाओं $3x + 4y = 7$ और $x - y + 2 = 0$ के प्रतिच्छेदन से गुजरने वाली रेखा का समीकरण ज्ञात कीजिए।
(a) $4x - 3x + 4y = 7$ (b) $21x - 7y + 16 = 0$
(c) $8x + y + 8 = 0$ (d) none of these
23. Equation $xy = 0$ represents the equation of समीकरण $xy = 0$ का समीकरण दर्शाता है
(a) Parabola (b) Ellipse
(c) Hyperbola (d) None of these
24. For what value of p lines $5x + 7y = 14$ and $px + 3y = 12$ will be parallel to each other
 p के किस मान के लिए रेखाएँ $5x + 7y = 14$ और $px + 3y = 12$ एक दूसरे के समानांतर होंगी
(a) $\frac{7}{15}$ (b) $\frac{15}{7}$
(c) $\frac{13}{7}$ (d) $\frac{7}{13}$

25. The graph of the linear equation $3x - 2y = 8$ and $4x + 3y = 5$ intersect at the point (α, β) . What is the value of $(2\alpha - \beta)$?

रेखिक समीकरण $3x - 2y = 8$ और $4x + 3y = 5$ का ग्राफ बिंदु (α, β) पर प्रतिच्छेद करता है। $(2\alpha - \beta)$ का मान क्या है?

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- (a) 4 (b) 6
(c) 3 (d) 5

26. The midpoints of the sides of a triangle are $(5, 0)$, $(5, 12)$ and $(0, 12)$, then the coordinates the orthocentre of this triangle are

एक त्रिभुज की भुजाओं के मध्यबिंदु $(5, 0)$, $(5, 12)$ और $(0, 12)$ हैं, तो इस त्रिभुज के लंबकेंद्र के निर्देशांक हैं

- (a) $(0, 0)$ (b) $(10, 0)$
(c) $(0, 2a)$ (d) $(10, 2a)$

27. $2x - ky + 7 = 0$ and $6x - 12y + 15 = 0$ has no solution for

$2x - ky + 7 = 0$ और $6x - 12y + 15 = 0$ का कोई समाधान नहीं है

- (a) $k = -1$ (b) $k = -4$
(c) $k = 4$ (d) $k = 1$

28. Find the coordinates of points that are located at a distance of 6 units on the y -axis from the point $(3, 1)$

बिंदु $(3, 1)$ से y -अक्ष पर 6 इकाइयों की दूरी पर स्थित बिंदुओं के निर्देशांक ज्ञात करें

- (a) $(0, 1 + \sqrt{27})$ and $(0, 1 - \sqrt{27})$
(b) $(0, 1 - \sqrt{17})$ and $(0, 1 + \sqrt{17})$
(c) $(0, 2 - \sqrt{17})$ and $(0, 2 + \sqrt{17})$
(d) $(0, 2 - \sqrt{27})$ and $(0, 2 + \sqrt{27})$

29. Find the length of x -intercept by the circle $x^2 + y^2 - 4x + 3y - 4 = 0$.

वृत्त $x^2 + y^2 - 4x + 3y - 4 = 0$ द्वारा x -अवरोधन की लंबाई ज्ञात कीजिए।

- (a) $\sqrt{63}$ (b) $\sqrt{61}$
(c) $\sqrt{65}$ (d) $\sqrt{67}$

30. What is the reflection of the point $(5, -3)$ in the line $y = 3$?

रेखा $y = 3$ में बिंदु $(5, -3)$ का प्रतिबिंब क्या है?

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- (a) $(5, -6)$ (b) $(-5, 3)$
(c) $(5, 9)$ (d) $(5, 3)$

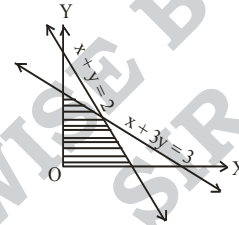
31. If two lines $px + qy + r = 0$ and $ax + by + c = 0$ are perpendicular to each other, then which of following relation is true?

यदि दो रेखाएँ $px + qy + r = 0$ और $ax + by + c = 0$ एक दूसरे के लंबवत हैं, तो निम्नलिखित में से कौन सा संबंध सत्य है?

- (a) $pq + ab = 0$ (b) $pb + aq = 0$
(c) $pa + qb = 0$ (d) $pq - ab = 0$

32. The shaded region in the given figure is the solution set of the inequalities :

दिए गए चित्र में छायांकित क्षेत्र असमानताओं का समाधान सेट है:



- (a) $x + y \leq 2, x + 3y \geq 3, x \geq 0, y \geq 0$
(b) $x + y \geq 2, x + 3y \geq 3, x \geq 0, y \geq 0$
(c) $x + y \geq 2, x + 3y \leq 3, x \geq 0, y \geq 0$
(d) $x + y \leq 2, x + 3y \leq 3, x \geq 0, y \geq 0$

33. The points $A(7, 3)$, $B(6, 6)$, $C(3, 5)$ and $D(4, 8)$ are the vertices of a.....

बिंदु $A(7, 3)$, $B(6, 6)$, $C(3, 5)$ और $D(4, 8)$ a के शीर्ष हैं...

- (a) Square (b) Rectangle
(c) Parallelogram (d) Rhombus

34. The coordinates of the centroid of a triangle ABC are $(2, 2)$. What are the coordinates of the vertex C if the coordinates of A and B are $(7, -1)$ and $(1, 2)$ respectively?

त्रिभुज ABC के केन्द्रक के निर्देशांक $(2, 2)$ हैं। यदि A और B के निर्देशांक क्रमशः $(7, -1)$ और $(1, 2)$ हैं तो शीर्ष C के निर्देशांक क्या हैं?

- (a) $(-2, 5)$ (b) $(2, 5)$
(c) $(-2, -5)$ (d) $(2, -5)$

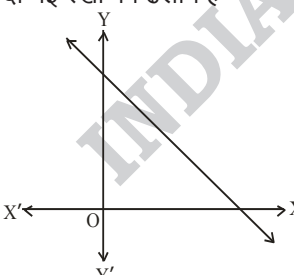
35. The x -intercept of the graph $7x - 3y = 2$ is

ग्राफ $7x - 3y = 2$ का x -अवरोधन है

- (a) $\frac{3}{4}$ (b) $\frac{3}{7}$
(c) $\frac{2}{5}$ (d) $\frac{2}{7}$

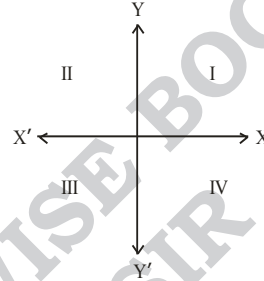
36. Find the area of the region formed by the lines $2x = 3y$, $2x = 3y - 5$, $3x = 2y$ and $3x = 2y + 5$

रेखाओं $2x = 3y$, $2x = 3y - 5$, $3x = 2y$ तथा $3x = 2y + 5$ से बने क्षेत्र का क्षेत्रफल ज्ञात कीजिए।

- (a) 3 sq. unit (b) 4 sq. unit
(c) 5 sq. unit (d) 6 sq. unit
37. Find the co-ordinates of the incentre of the triangle whose vertices are the points $(4, -2)$, $(5, 5)$ and $(-2, 4)$.
उस त्रिभुज के अंतःकेंद्र के निर्देशांक ज्ञात कीजिए जिसके शीर्ष बिंदु $(4, -2)$, $(5, 5)$ और $(-2, 4)$ हैं।
(a) $(\frac{7}{3}, \frac{2}{3})$ (b) $(\frac{5}{2}, \frac{5}{2})$
(c) $(\frac{6}{5}, 5)$ (d) None of these
38. For triangle PQR , find the equation of the altitude PS if coordinates of P, Q and R are $(1, 2)$, $(2, -1)$ and $(0, 5)$ respectively.
त्रिभुज PQR के लिए, ऊँचाई PS का समीकरण ज्ञात करें यदि P, Q और R के निर्देशांक क्रमशः $(1, 2)$, $(2, -1)$ और $(0, 5)$ हैं।
(a) $x - 3y = -7$ (b) $x + 3y = -5$
(c) $x - 3y = -5$ (d) $x + 3y = -7$
39. Find the equation of a line which passes through the point $(5, 6)$ and has intercepts on the axes equal in magnitude but opposite in sign.
उस रेखा का समीकरण ज्ञात कीजिए जो बिंदु $(5, 6)$ से होकर गुजरती है और अक्षों पर अंतःखंड परिमाण में बराबर लेकिन चिह्न विपरीत हैं।
(a) $x + y = 11$ (b) $x + y = 5$
(c) $x + y = 6$ (d) $x - y + 1 = 0$
40. The slope of the given line is दी गई रेखा का ढलान है
- 
- (a) positive (b) negative
(c) undefined (d) Zero
41. Three lines $px + qy + r = 0$, $qx + ry + p = 0$ and $rx + py + q = 0$ are concurrent if
तीन रेखाएँ $px + qy + r = 0$, $qx + ry + p = 0$ तथा $rx + py + q = 0$ समवर्ती हैं यदि
(a) $p + q + r = 0$
(b) $p^2 + q^2 + r^2 = pr + qr + qp$
(c) $p^3 + q^3 + r^3 = 3pqr$

(d) none of these

42. Distance of the point $(7, 24)$ from the origin is :
मूल बिंदु से बिंदु $(7, 24)$ की दूरी है:
(a) 24 (b) 25
(c) -25 (d) 22
43. If $ab > 0$ and the point (a, b) lies in the third quadrant in which the point $(-b, -a)$ lies is :
यदि $ab > 0$ और बिंदु (a, b) तीसरे चतुर्थांश में स्थित है जिसमें बिंदु $(-b, -a)$ स्थित है:



- (a) I (b) II
(c) III (d) IV
44. The equation of a straight line which passes through the midpoint of the two points $(3, 5)$ and $(4, 7)$ and the point $(2, 3)$ is
एक सीधी रेखा का समीकरण जो दो बिंदुओं $(3, 5)$ और $(4, 7)$ और बिंदु $(2, 3)$ के मध्य बिंदु से होकर गुजरती है
(a) $y - 2x = 1$ (b) $y + x = 1$
(c) $2x - y = 1$ (d) $2x + y = 1$
45. The graph of the equation $x - 7y = -42$, intersects the y -axis at $P(\alpha, \beta)$ and the graph of $6x + y - 15 = 0$, intersects the x -axis at $Q(\gamma, \delta)$. What is the value of $\alpha + \beta + \gamma + \delta$?
समीकरण $x - 7y = -42$ का ग्राफ, y -अक्ष को $P(\alpha, \beta)$ पर काटता है और $6x + y - 15 = 0$ का ग्राफ, x -अक्ष को $Q(\gamma, \delta)$ पर काटता है। $\alpha + \beta + \gamma + \delta$ का मान क्या है?
SSC CGL Tier II 11/09/2019
(a) $\frac{17}{2}$ (b) 6
(c) $\frac{9}{2}$ (d) 5
46. The coordinates of the incentre of a triangle with vertices at points $(0, 0)$, $(2a, 0)$ and $(a, \sqrt{3}a)$ are बिंदुओं $(0, 0)$, $(2a, 0)$ और $(a, \sqrt{3}a)$ पर शीर्ष वाले त्रिभुज के अंतःकेंद्र के निर्देशांक हैं
(a) $(a, \sqrt{3}a)$ (b) $(a, \frac{\sqrt{3}a}{2})$
(c) $(a, \frac{a}{3})$ (d) $(a, \frac{\sqrt{3}a}{3})$

47. The equation of a line passing through the point (4, 4) and cutting off intercepts on the axis whose sum is 18 ?
बिंदु (4, 4) से गुजरने वाली और अक्ष पर अंतःखंड काटने वाली एक रेखा का समीकरण जिसका योग 18 है?
(a) $x + 2y - 12 = 0$
but not $2x + y - 12 = 0$
(b) neither $x + 2y - 12 = 0$
nor $2x + y - 12 = 0$
(c) $2x + y - 12 = 0$
but not $x + 2y - 12 = 0$
(d) $x + 2y - 12 = 0$
or $2x + y - 12 = 0$
48. If the point (x, y) is equidistant from the points $(a + b, b - a)$ and $(a - b, a + b)$ then = ?
यदि बिंदु (x, y) बिंदु $(a+b, b-a)$ और $(a-b, a+b)$ से समान दूरी पर है तो = ?
(a) a^2y (b) ay^2
(c) ay (d) a^2y^2
49. Find the points on the y -axis where the perpendicular distance from the line $4x - 3y = 12$ is 3
य-अक्ष पर वे बिंदु खोजें जहाँ रेखा $4x-3y=12$ से लंबवत दूरी 3 है
(a) $(0, 1)(0, 7)$ (b) $(0, -1)(0, 7)$
(c) $(0, 1)(0, -7)$ (d) $(0, -1)(0, -7)$
50. What is the area (in square units) of the triangular region enclosed by the graphs of the equations $x + y = 3$, $2x + 5y = 12$ and the x axis?
समीकरण $x + y = 3$, $2x + 5y = 12$ और x अक्ष के ग्राफ़ से घिरे त्रिकोणीय क्षेत्र का क्षेत्रफल (वर्ग इकाइयों में) क्या है?
SSC CGL Tier II (13/09/2019)
(a) 2 (b) 3
(c) 4 (d) 6
51. The equation of circle with centre $(1, -2)$ and radius 4 cm is :
केंद्र $(1, -2)$ और त्रिज्या 4 सेमी वाले वृत्त का समीकरण है:
SSC CHSL 17/03/2020 (Afternoon)
(a) $x^2 + y^2 + 2x - 4y = 16$
(b) $x^2 + y^2 - 2x + 4y = 16$
(c) $x^2 + y^2 + 2x - 4y = 11$
(d) $x^2 + y^2 - 2x + 4y = 11$
52. The new coordinates of point $P(a, b)$ when the origin is shifted to the point $(a - c, b)$ are
जब मूल बिंदु को बिंदु $(a-c, b)$ पर स्थानांतरित किया जाता है तो बिंदु $P(a, b)$ के नए निर्देशांक होते हैं
(a) $(0, b)$ (b) $(c, 2b)$
(c) $(c, 0)$ (d) $(2a - c, 2b)$
53. Find the area of $4x + 3y = 12$; $5x + 7y = 35$. On x -axis
 $4x + 3y = 12$; $5x + 7y = 35$ का क्षेत्रफल ज्ञात कीजिए।
 x -अक्ष है
(a) $\frac{160}{13}$ sq. units (b) $\frac{80}{13}$ sq. units
(c) $\frac{40}{13}$ sq. units (d) $\frac{150}{13}$ sq. units
54. Find the equation of a straight line that is equidistant from points $A(5, -1)$ and $B(-1, 7)$
उस सीधी रेखा का समीकरण ज्ञात कीजिए जो बिंदु $A(5, -1)$ और $B(-1, 7)$ से समान दूरी पर है
(a) $4x - 3y + 6 = 0$ (b) $4x + 3y - 6 = 0$
(c) $3x - 4y + 6 = 0$ (d) $3x + 4y - 6 = 0$
55. The slope of the line $3x + 7y + 8 = 0$ is :
रेखा का ढलान $3x + 7y + 8 = 0$ है:
(a) 3 (b) 7
(c) $-\frac{3}{7}$ (d) $\frac{3}{7}$
56. If the system of equations $7x + ky = 27$ and $kx + 7y = 19$ have unique solution, then which one of the following is correct?
यदि समीकरण $7x + ky = 27$ और $kx + 7y = 19$ की प्रणाली का अद्वितीय समाधान है, तो निम्नलिखित में से कौन सा सही है?
[CDS 2021-II]
(a) $k \neq 7$ (b) $k \neq 13$
(c) $k = 7$ (d) $k = 13$
57. In what ratio does the x -axis divide the line segment joining points $P(-3, 7)$ and $Q(3, -5)$
बिंदु $P(-3, 7)$ और $Q(3, -5)$ को जोड़ने वाले रेखाखंड को x -अक्ष किस अनुपात में विभाजित करता है
(a) 3:5 (b) 2:5
(c) 7:5 (d) 3:7
58. What is the area (in sq. units) of the triangle formed by the graph of the equation $2x + 5y - 12 = 0$, $x + y = 3$ and $y = 0$?
समीकरण $2x + 5y - 12 = 0$, $x + y = 3$ और $y = 0$ के ग्राफ़ से बने त्रिभुज का क्षेत्रफल (वर्ग इकाइयों में) क्या है?
SSC CGL Tier II 15/11/2020
(a) 6 (b) 5

- (c) 3 (d) 2
59. The line $4x - 9y = 11$ meets y axis at the point :
रेखा $4x - 9y = 11$ बिंदु पर y अक्ष से मिलती है:
- (a) $(-\frac{11}{9}, 0)$ (b) $(0, -\frac{11}{9})$
- (c) $(0, \frac{11}{4})$ (d) $(0, -\frac{11}{4})$
60. The solution of linear inequalities $x + y \geq 5$ and $x - y \leq 3$ lies
रैखिक असमानताओं $x + y \geq 5$ और $x - y \leq 3$ का समाधान निहित है
- [CDS 2018-II]
- (a) Only in the first quadrant
- (b) In the first and second quadrants
- (c) In the second and third quadrants
- (d) In the third and fourth quadrants
61. A line segment is of length 10 and one end is at the point $(2, -3)$; if the abscissa of the other end is 10 then the ordinate of the other end can be
एक रेखाखंड की लंबाई 10 है और इसका एक सिरा बिंदु $(2, -3)$ पर है; यदि दूसरे सिरे का भुज 10 है तो दूसरे सिरे की कोटि हो सकती है
- (i) 3
- (ii) -6
- (iii) -9
- (a) Both i and ii (b) Both i and iii
- (c) Both ii and iii (d) None of these
62. The graphs of the equations $2x + 3y = 11$ and $x - 2y + 12 = 0$ intersects at $P(x_1, y_1)$ and the

graph of the equation $x - 2y + 12 = 0$ intersects the x -axis at $Q(x_2, y_2)$. What is the value of $(x_1 - x_2 + y_1 + y_2)$?

समीकरण $2x + 3y = 11$ और $x - 2y + 12 = 0$ का ग्राफ $P(x_1, y_1)$ पर प्रतिच्छेद करता है और समीकरण $x - 2y + 12 = 0$ का ग्राफ x -अक्ष को $Q(x_2, y_2)$ पर प्रतिच्छेद करता है $(x_1 - x_2 + y_1 + y_2)$ का मान क्या है?

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- (a) 13 (b) -11
- (c) 15 (d) -9
63. The area of the triangle with vertices $A(0, 8)$, $O(0, 0)$ and $B(5, 0)$ is
शीर्ष $A(0, 8)$, $O(0, 0)$ और $B(5, 0)$ वाले त्रिभुज का क्षेत्रफल है
- (a) 8 sq. unit (b) 13 sq. unit
- (c) 20 sq. unit (d) 40 sq. unit
64. The point of intersection of the graphs of the equations $3x - 5y = 19$ and $3y - 7x + 1 = 0$ is $P(\alpha, \beta)$. What is the value of $(3\alpha - \beta)$?
समीकरण $3x - 5y = 19$ और $3y - 7x + 1 = 0$ के ग्राफ का प्रतिच्छेदन बिंदु $P(\alpha, \beta)$ है। $(3\alpha - \beta)$ का मान क्या है?
- SSC CGL Tier II 12/09/2019
- (a) -2 (b) -1
- (c) 1 (d) 0
65. What is the equation of the line perpendicular to the line $2x + 3y + 6 = 0$ and having y -intercept 3 ?
रेखा $2x + 3y + 6 = 0$ के लंबवत और y - प्रतिच्छेद 3 वाली रेखा का समीकरण क्या है?
- (a) $3x - 2y - 6 = 0$ (b) $3x - 2y + 6 = 0$
- (c) $2x - 3y + 6 = 0$ (d) $2x - 3y - 6 = 0$

Type 2 (Co-ordinate Geometry) Answer Key

1	(b)	2	(a)	3	(d)	4	(c)	5	(a)	6	(c)	7	(b)
8	(c)	9	(c)	10	(d)	11	(d)	12	(a)	13	(d)	14	(a)
15	(d)	16	(a)	17	(b)	18	(d)	19	(c)	20	(c)	21	(d)
22	(b)	23	(*)	24	(b)	25	(d)	26	(a)	27	(c)	28	(b)
29	(c)	30	(c)	31.	(c)	32	(d)	33	(d)	34	(a)	35	(d)
36	(c)	37	(b)	38	(c)	39	(d)	40	(b)	41	(a)	42	(b)
43	(c)	44	(c)	45	(a)	46	(d)	47	(d)	48	(c)	49	(c)
50	(b)	51	(d)	52	(c)	53	(a)	54	(b)	55	(c)	56	(a)
57	(c)	58	(c)	59	(b)	60	(b)	61	(b)	62	(c)	63	(c)
64	(b)	65	(b)										

Type-2 (Co-Ordinate Geometry) Solution

1. Sol. (b)

Intersection point of $2x - 3y + 6 = 0$ and $4x + y =$

16 is (3, 4)

Intersection point of $2x - 3y + 6 = 0$ and $y = 0$ is

(-3, 0)

Intersection point of $4x + y = 16$ and $y = 0$ is (4, 0)Area of triangle = $\frac{1}{2}[x_1(y_2 - y_3) + x_2(y_3 - y_1) +$ $x_3(y_1 - y_2)]$

$$\Rightarrow \frac{1}{2}[3(0 - 0) - 3(0 - 4) + 4(4 - 0)]$$

$$\Rightarrow \frac{1}{2}[12 + 16] = 14 \text{ cm}^2$$

2. Sol. (a)

Let the required point be P (0, y).

 $\therefore PA = PB$

$$= \sqrt{(0 - 6)^2 + (y - 5)^2}$$

$$= \sqrt{(0 - 4)^2 + (y - 3)^2}$$

$$\Rightarrow 36 + (y - 5)^2 = 16 + (y - 3)^2$$

$$\Rightarrow 36 + y^2 - 10y + 25$$

$$\Rightarrow 16 + y^2 - 6y + 9$$

$$\Rightarrow 4y = 36$$

$$y = 9$$

Required point is (0, 9).

3. Sol. (d)

$$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$\Rightarrow 8 = \sqrt{(3 - p)^2 + (4 - 2)^2}$$

$$\Rightarrow p^2 + 9 - 6p + 4 = 64$$

$$\Rightarrow p^2 - 6p - 51 = 0$$

$$p = \frac{6 \pm \sqrt{4^2 - 4(1)(-51)}}{2}$$

$$p = \frac{6 \pm \sqrt{240}}{2}$$

$$p = 3 \pm \sqrt{60}$$

$$p = 3 \pm 2\sqrt{15}$$

4. Sol. (c)

$$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{\left(p - \frac{1}{p} - 0\right)^2 + (2 - 0)^2}$$

$$= \sqrt{p^2 + \frac{1}{p^2} - 2 + 4}$$

$$= \sqrt{\left(p + \frac{1}{p}\right)^2}$$

$$= \pm \left(p + \frac{1}{p}\right)$$

$$= p + \frac{1}{p} \text{ (Distance cannot be negative)}$$

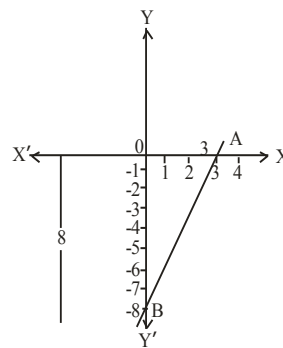
(Distance cannot be negative)

5. Sol. (a)

$$8x - 3y = 24$$

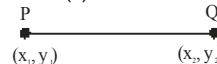
$$\frac{x}{3} - \frac{y}{8} = 1$$

$$\frac{x}{3} + \frac{y}{-8} = 1$$

Area of $\triangle OAB$

$$= \frac{1}{2} \times 8 \times 3 = 12 \text{ Sq. units}$$

6. Sol. (c)

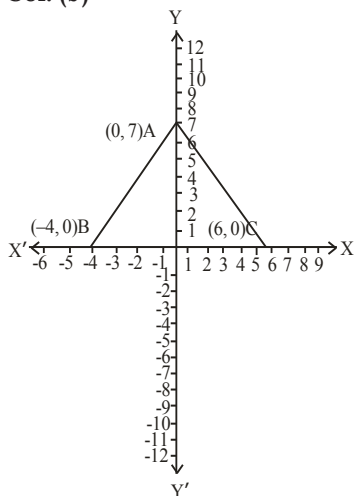


$$\text{Slope of line } m = \frac{y_2 - y_1}{x_2 - x_1}$$

P(2, 8) and Q(6, 9)

$$\text{Slope } m = \frac{9 - 8}{6 - 2} = \frac{1}{4} = .25$$

7. Sol. (b)



$$\frac{x}{6} + \frac{y}{7} = 1, \quad \frac{x}{-4} + \frac{y}{7} = 1 \text{ and x-axis}$$

$$BC = 4 + 6 = 10 \text{ unit}$$

$$AO = 7 \text{ units}$$

$$\text{Area of triangle} = \frac{1}{2} \times BC \times OA$$

$$= \frac{1}{2} \times 10 \times 7 = 35 \text{ units}$$

8. Sol. (c)

$$7x + 11y = 3 \quad \dots (i)$$

$$8x + y = 15 \quad \dots (ii)$$

On solving eqn. (1) and (2), we get $y = -1$ and

$$x = 2$$

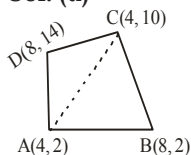
If we put the obtained value of x and y in options given, then only option (c) gets satisfied.

9. Sol. (c)

Co-ordinates of Mid-points

$$\text{of AB} = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right) = \left(\frac{-3 + 5}{2}, \frac{2 + 4}{2} \right) = 1, 3$$

10. Sol. (d)



Area of Triangle ADC

$$\text{Area of triangle ABC} = \frac{1}{2} [x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)]$$

$$= \frac{1}{2} [4(2 - 10) + 8(10 - 2) + 4(2 - 2)]$$

$$= \frac{1}{2} [-32 + 64] = 16$$

$$\text{Area of } \triangle ADC = \left| \frac{1}{2} [4(10 - 14) + 4(14 - 2) + 8(2 - 10)] \right|$$

$$= \left| \frac{1}{2} [4(-4) + 4(12) + 8(-8)] \right|$$

$$\left| \frac{1}{2} [-16 + 48 - 64] \right|$$

$$\left| \frac{1}{2} (-32) \right| = |16| = 16$$

$$\text{Area of quad. ABCD} = 16 + 16 = 32$$

11. Sol. (d)

$$a = 2, b = 3.$$

$$\frac{x}{a} + \frac{y}{b} = 1$$

$$\Rightarrow \frac{x}{2} + \frac{y}{3} = 1$$

$$\Rightarrow 3x + 2y = 6$$

12. Sol. (a)

$$\alpha + \beta + \gamma = \alpha\beta + \beta\gamma + \gamma\alpha \dots (1)$$

$$(1 - \alpha)(1 - \beta)(1 - \gamma)$$

$$= (1 - \alpha - \beta + \alpha\beta)(1 - \gamma)$$

$$= 1 - \alpha - \beta + \alpha\beta - \gamma + \alpha\gamma + \beta\gamma - \alpha\beta\gamma$$

$$= 1 - (\alpha + \beta + \gamma) + (\alpha\beta + \beta\gamma + \gamma\alpha) - \alpha\beta\gamma$$

$$= 1 - (\alpha\beta + \beta\gamma + \gamma\alpha) + (\alpha\beta + \beta\gamma + \gamma\alpha) -$$

$$\alpha\beta\gamma \text{ (From eq } ^n1)$$

$$= 1 - \alpha\beta\gamma$$

13. Sol. (d)

$$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(2a - 2a)^2 + (-2c - 2b)^2}$$

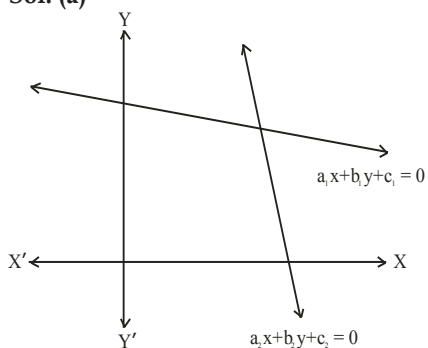
$$= \sqrt{(0)^2 + (2b + 2c)^2} = 2(b + c)$$

Alternate

$$\because \text{x-coordinates are same Distance} = |y_2 - y_1| = |-2c - 2b|$$

$$= 2(b + c)$$

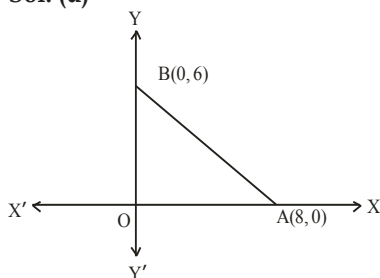
14. Sol. (a)



Given that lines are intersecting i.e. they have unique solution.

$$\therefore \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$$

15. Sol. (d)



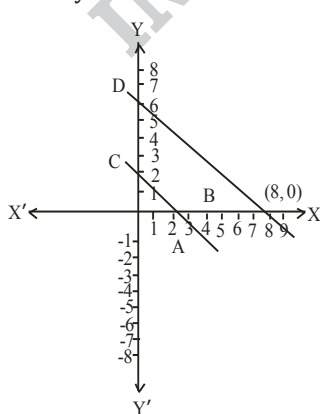
Required distance = AB

$$\begin{aligned} & \sqrt{(OA)^2 + (OB)^2} \\ &= \sqrt{8^2 + 6^2} = 10 \text{ units} \end{aligned}$$

16. Sol. (a)

$$x + y = 2$$

$$3x + 4y = 24$$



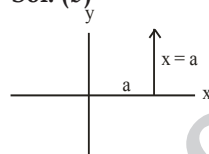
$$\Rightarrow \frac{x}{2} + \frac{y}{2} = 1$$

$$\Rightarrow \frac{x}{8} + \frac{y}{6} = 1$$

Area of quadrilateral = Area of $\triangle OBD$ - Area of $\triangle OAC$

$$\begin{aligned} &= \frac{1}{2} \times 8 \times 6 - \frac{1}{2} \times 2 \times 2 \\ &= 22 \text{ Sq. units} \end{aligned}$$

17. Sol. (b)



The graph of the equation $x = a$ is a line parallel to the y axis.

18. Sol. (d)

$$AX = BX$$

$$\begin{aligned} & \sqrt{(x_1 - x)^2 + (y_1 - y)^2} = \sqrt{(x_2 - x)^2 + (y_2 - y)^2} \\ & \Rightarrow \sqrt{(-4 - p)^2 + (-6 - (p + 2))^2} \\ &= \sqrt{(6 - p)^2 + (8 - (p + 2))^2} \\ & \Rightarrow (p + 4)^2 + (p + 8)^2 = (6 - p)^2 + (6 - p)^2 \\ & \Rightarrow 2p^2 + 24p + 80 = 2p^2 - 24p + 72 \\ & \Rightarrow 48p = -8 \\ & p = -\frac{1}{6} \end{aligned}$$

19. Sol. (c)

Intersection point of $2x + 5y = 12$ and $x + y = 3$ is $(1, 2)$

Intersection point of $2x + 5y = 12$ and $y = 0$ is $(6, 0)$

Intersection point of $x + y = 3$ and $y = 0$ is $(3, 0)$

$$\begin{aligned} & \text{Area of triangle} = \frac{1}{2} [x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)] \\ & \Rightarrow \frac{1}{2} [1(0 - 0) + 6(0 - 2) + 3(2 - 0)] \\ & \Rightarrow \left| \frac{1}{2} [-12 + 6] \right| = 3 \text{ cm}^2 \end{aligned}$$

20. Sol. (c)

Consider any point in the shaded portion let

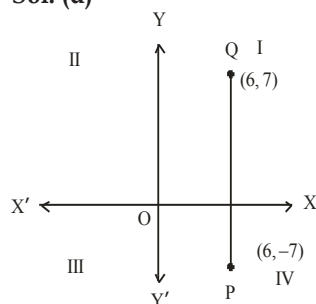
$$(3, -3)$$

$$\text{i.e. } x = 3, y = -3 \Rightarrow -3 < 3 \text{ i.e. } y < x$$

& when $x = 3, y = 3 \Rightarrow 3 = 3$ i.e.

$$y = x \therefore y \leq x$$

21. Sol. (d)



$$P = (6, -7)$$

Reflection of point

$P(a, b)$ in the x-axis is $Q(a, -b)$

$$\text{So } Q = (6, 7)$$

22. Sol. (b)

The intersection point of the lines $3x + 4y - 7 = 0$

and $x - y + 2 = 0$ is,

$$3x + 4y - 7 = 0$$

$$x - y + 2 = 0$$

$x = y - 2$ putting in equation

$$(i) 3y - 6 + 4y - 7 = 0$$

$$y = \frac{13}{7}, x = y - 2 = \frac{13}{7} - 2 = \frac{1}{7}$$

equation of line $y = mx + c$

$m =$ slope of line

$$y = 3x + c \dots (iii)$$

equation (iii) passing through the point $(-\frac{1}{7}, \frac{13}{7})$

$$\frac{13}{7} = \frac{-3}{7} + c$$

$$c = \frac{16}{7} \text{ putting in equation (iii)}$$

$$y = 3x + \frac{16}{7}$$

$$21x - 7y + 16 = 0$$

24. Sol. (b)

Slope of the line $5x + 7y = 14$

$$\frac{-\text{coefficient of } x}{\text{coefficient of } y} = \frac{-5}{7}$$

Slope of the line $px + 3y = 12$

$$\frac{-\text{coefficient of } x}{\text{coefficient of } y} = \frac{-p}{3}$$

Parallel lines have the same slope so,

$$\Rightarrow \frac{-p}{3} = \frac{-5}{7}$$

$$\Rightarrow p = \frac{15}{7}$$

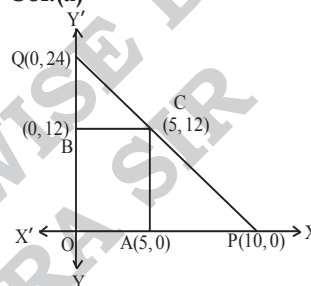
25. Sol. (d)

$3x - 2y = 8$ and $4x + 3y = 5$ On solving both the

eq

$$\alpha = 2, \beta = -1 \Rightarrow (2\alpha - \beta) = 5$$

26. Sol. (a)



A, B, and C are the midpoint of OP, OQ and PQ

respectively and OPQ is a rightangle triangle. So,

orthocentre will lie at O i.e. (0, 0)

27. Sol. (c)

Two linear equations of lines $a_1x + b_1y + c_1 = 0$

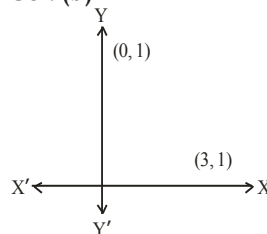
and $a_2x + b_2y + c_2 = 0$ have no solution if $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq$

$$\frac{c_1}{c_2}$$

$$\Rightarrow \frac{2}{6} = \frac{-k}{-12} \neq \frac{7}{-15}$$

$$\Rightarrow \frac{k}{12} = \frac{1}{3} \Rightarrow k = 4$$

28. Sol. (b)



Let point on y-axis be $A(0, y)$

$$AX = 6$$

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = 6$$

$$= \sqrt{(3-0)^2 + (1-y)^2} = 36$$

$$= 9 + y^2 + 1 - 2y = 36$$

$$= y^2 - 2y - 26 = 0$$

$$y = \frac{-2 \pm \sqrt{2^2 - 4(1)(-26)}}{2}$$

$$y = \frac{-2 \pm \sqrt{108}}{2}$$

$$y = 1 \pm \sqrt{27}$$

$$A(0, 1 \pm \sqrt{27})$$

29. Sol. (c)

Length of x-intercept cut by circle $x^2 + y^2 + 2gx +$

$2fy + c = 0$ is given by $d = 2\sqrt{g^2 - c}$

Here $g = \frac{-7}{2}$ and $c = -4$

$$d = 2\sqrt{\left(\frac{-7}{2}\right)^2 - (-4)} = 2\sqrt{\frac{49}{4} + 4} = 2\sqrt{\frac{65}{4}} = \sqrt{65}$$

30. Sol. (c)

$y = 3$ is parallel to x axis so on reflection x axis will

not change Perpendicular distance of $(5, -3)$ from

$y = 3 = 6$ units

6 units on the other side of the line $(y = 3) = 3 +$

$$6 = 9$$

So the point = $(5, 9)$

31. Sol. (c)

$$L_1 = px + qy + r = 0$$

$$L_2 = ax + by + c = 0$$

Since L_1 and L_2 are perpendicular to other so

$$m_1 m_2 = -1$$

$$\left(-\frac{\text{cof ficient of } x}{\text{cof ficient of } y}\right) \times \left(-\frac{\text{coefficient of } x}{\text{coefficiet of } y}\right) = -1$$

$$\Rightarrow \frac{-p}{q} \times \frac{-a}{b} = -1$$

$$\Rightarrow pa = -qb$$

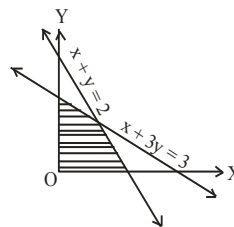
$$pa + qb = 0$$

32. Sol. (d)

Clearly $(0, 0)$ satisfies

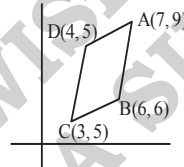
$$x + 3y \leq 3$$

and $(0, 0)$ satisfies $x + y \leq 2$



Clearly, shaded region is the portion common to the line $x + 3y = 3$ & below it and that of the line $x + y = 2$ and below it. So shaded region is the solution set of (d)

33. Sol. (d)



$$AC = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(7 - 3)^2 + (9 - 5)^2}$$

$$= \sqrt{4^2 + 4^2} = 4\sqrt{2}$$

$$BD = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(6 - 4)^2 + (6 - 8)^2}$$

$$= \sqrt{2^2 + (-2)^2} = 2\sqrt{2}$$

Midpoint of AC

$$= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{7+3}{2}, \frac{9+5}{2}\right) = (5, 7)$$

Midpoint of BD

$$= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{6+4}{2}, \frac{6+8}{2}\right) = (5, 7)$$

$$AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(6 - 7)^2 + (6 - 9)^2}$$

$$= \sqrt{(-1)^2 + (-3)^2} = \sqrt{10}$$

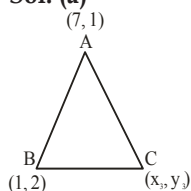
$$BC = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(6 - 3)^2 + (6 - 5)^2}$$

$$= \sqrt{(3)^2 + (1)^2} = \sqrt{10}$$

The adjacent sides are equal and diagonals are bisecting and non-equal so ABCD is a rhombus

34. Sol. (a)



Let coordinates of vertex C = (x, y)

Coordinates centroid of a triangle are given by

$$\left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right) = (2, 2)$$

$$\left(\frac{7+1+x_3}{3}, \frac{-1+2+y_3}{3}\right) = (2, 2)$$

$$\frac{8+x_3}{3} = 2, \quad \frac{1+y_3}{3} = 2$$

$$x_3 = 6 - 8 \quad y_3 = 6 - 1$$

$$x_3 = -2 \quad y_3 = 5$$

$$C(-2, 5)$$

35. Sol. (d)

Given equation is $7x - 3y = 2$

Divide the equation by 2

$$\Rightarrow \frac{7x}{2} - \frac{3y}{2} = 1$$

$$\Rightarrow \frac{x}{\frac{2}{7}} - \frac{y}{\frac{2}{3}} = 1$$

Comparing with the eqn. $\frac{x}{a} + \frac{y}{b} = 1$ x-intercept is $\frac{2}{7}$

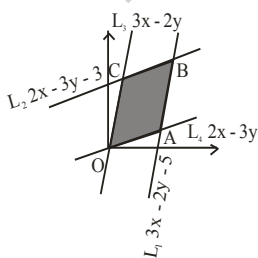
Alternate

Put $y = 0$ in the equation $7x - 3y = 2$

$$\Rightarrow 7x - 3(0) = 2 \Rightarrow x = \frac{2}{7}$$

36. Sol. (c)

Given equation of lines are



$$L_1 = 2x - 3y = 0$$

$$L_2 = 2x - 3y + 5 = 0$$

$$L_3 = 3x - 2y = 0$$

$$L_4 = 3x - 2y - 5 = 0$$

The slope of line L_1 and L_2 and L_3 and L_4 are same

so the bounded region will be parallelogram

From line L_1 and L_3 coordinates of O = (0, 0)From line L_1 and L_4 coordinates of A = (3, 2)From line L_3 and L_2 coordinates of C = (2, 3)Area of $\triangle ABC = 2$ area of $\triangle OAC$

$$= 2 \times \frac{1}{2} \begin{vmatrix} 0 & 0 & 1 \\ 3 & 2 & 1 \\ 2 & 3 & 1 \end{vmatrix}$$

$$= 2 \times \left| \frac{1}{2} [0(2-3) - 3(0-3) + 2(0-2)] \right|$$

$$= 2 \times \left| \frac{1}{2} [9 - 4] \right| = 5 \text{ sq. unit}$$

37. Sol. (b)

Let A = (4, -2), B = (5, 5) and C = (-2, 4)

Then

$$a = BC = \sqrt{(-2-5)^2 + (4-5)^2}$$

$$= 5\sqrt{2}$$

$$b = AC = \sqrt{(4+2)^2 + (-2-4)^2}$$

$$= 6\sqrt{2}$$

$$c = AB = \sqrt{(5-4)^2 + (5+2)^2}$$

$$= 5\sqrt{2}$$

and

$$(x_1, y_1) = (4, -2), (x_2, y_2)$$

$$= (5, 5).$$

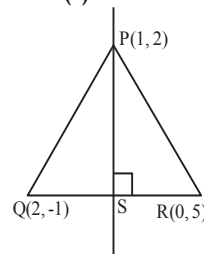
$$(x_3, y_3) = (-2, 4)$$

∴ The coordinates of the incentre of the $\triangle ABC$ are

$$\left(\frac{ax_1 + bx_2 + cx_3}{a+b+c}, \frac{ay_1 + by_2 + cy_3}{a+b+c}\right) = \left(\frac{5}{2}, \frac{5}{2}\right)$$

{ substitute the value of (a, b, c) $\{x_1, x_2, x_3, y_1, y_2$ and $y_3\}$.

38. Sol. (c)



The slope of line segment QR

$$= \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - (-1)}{0 - 2}$$

$$= \frac{x^2}{-2} = -3$$

Slope

of line perpendicular to QR = $\frac{1}{3}$

$$(\because m_1 m_2 = -1)$$

So equation of altitude PS with slope $\frac{1}{3}$ and passes

through P(1, 2) is

$$y - y_1 = m(x - x_1)$$

$$\Rightarrow y - 2 = \frac{1}{3}(x - 1)$$

$$\Rightarrow 3y - 6 = x - 1$$

$$x - 3y = -5$$

39. Sol. (d)

Equation of straight line with equal intercepts but opposite in sign is

$$\frac{x}{a} - \frac{y}{a} = 1$$

The line passes through point (5, 6) so

$$\Rightarrow \frac{5}{a} - \frac{6}{a} = 1$$

$$\Rightarrow \frac{1}{a}(5 - 6) = 1$$

$$\Rightarrow a = -1$$

So, equation of line is

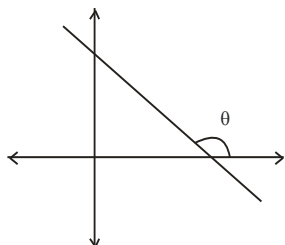
$$\Rightarrow \frac{x}{-1} - \frac{y}{-1} = 1$$

$$x - y + 1 = 0$$

40. Sol. (b)

Slope = $\tan \theta$

Where θ is angle make by line with the positive direction of the x-axis Hence $90^\circ < \theta < 180^\circ$



So, slope will be negative as $\tan \theta$ is negative for

$$90^\circ < \theta < 180^\circ$$

41. Sol. (a)

Three linear equation of lines $a_1x + b_1y + c_1 = 0$

and $a_2x + b_2y + c_2 = 0$ and $a_3x + b_3y + c_3 = 0$ are

concurrent if

$$\text{If } \begin{vmatrix} a_1 & b_1 & 1 \\ a_2 & b_2 & 1 \\ a_3 & b_3 & 1 \end{vmatrix} = \begin{vmatrix} p & q & r \\ q & r & p \\ r & p & q \end{vmatrix} = 0$$

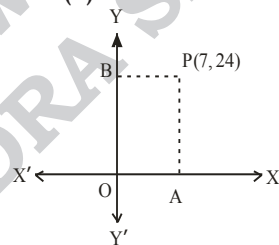
$$\Rightarrow [p(qr - p^2) - q(q^2 - pr) + r(pq - r^2)] = 0$$

$$\Rightarrow [pqr - p^3 - q^3 + pqr + pqr - r^3] = 0$$

$$\Rightarrow [3pqr - (p^3 + q^3 + r^3)] = 0$$

$$\Rightarrow p + q + r = 0$$

42. Sol. (b)

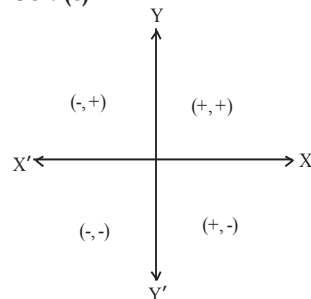


Clearly, $OA = 7, AP = 24$

$$\therefore OP^2 = OA^2 + AP^2 = 7^2 + 24^2 = 625$$

$$\therefore OP = \sqrt{625} = 25$$

43. Sol. (c)



$$ab > 0$$

Hence, a and b are both positive or negative.

$\therefore$ If (a, b) lies in first quadrant, $(-b, -a)$ will lie in third quadrant.

44. Sol. (c)

The midpoint of the two points (3, 5) and (4, 7) is

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right) = \left(\frac{3 + 4}{2}, \frac{5 + 7}{2} \right) = \left(\frac{7}{2}, 6 \right)$$

Now equation of line that passes through two points $(2, 3)$ and $(\frac{7}{2}, 6)$ is

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$$

$$\Rightarrow y - 3 = \frac{6 - 3}{\frac{7}{2} - 2}(x - 2)$$

$$\Rightarrow y - 3 = \frac{3}{\frac{3}{2}}(x - 2)$$

$$\Rightarrow y - 3 = 2(x - 2)$$

$$\Rightarrow y - 3 = 2x - 4$$

45. Sol. (a)

Given,

$$x - 7y = -42$$

And

$$6x + y - 15 = 0$$

On y axis, $x = 0$

Put this value in equation (1)

$$\Rightarrow 0 - 7y = -42 \Rightarrow y = 6$$

$$\Rightarrow P(\alpha, \beta) = (0, 6)$$

On x axis, $y = 0$

On x axis, $y = 0$

Put this value in equation (2)

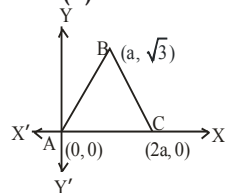
$$\Rightarrow 6x + 0 = 15 \Rightarrow x = \frac{5}{2}$$

$$\Rightarrow Q(\gamma, \delta) = (\frac{5}{2}, 0)$$

$\Rightarrow$ the value of $\alpha + \beta + \gamma + \delta =$

$$0 + 6 + \frac{5}{2} + 0 = \frac{17}{2}$$

46. Sol. (d)



$$AB = \sqrt{(a - 0)^2 + (\sqrt{3}a - 0)^2}$$

$$AB = \sqrt{a^2 + 3a^2} = \sqrt{4a^2} = 2a$$

$$BC = \sqrt{(2a - a)^2 + (0 - \sqrt{3}a)^2}$$

$$BC = \sqrt{a^2 + 3a^2} = \sqrt{4a^2} = 2a$$

$$AC = 2a$$

So ABC is an equilateral triangle, so its centroid and incentre lie at same coordinates.

$$I = \left(\frac{0 + a + 2a}{3}, \frac{0 + \sqrt{3}a + 0}{3} \right)$$

$$I = \left(a, \frac{\sqrt{3}a}{3} \right)$$

47. Sol. (d)

Let a line $\frac{x}{a} + \frac{y}{b} = 1$

Given, $a + b = 18$

Passing through $(4, 4)$

It means $\frac{4}{a} + \frac{4}{b} = 1$

$$\Rightarrow ab = 4(a + b) = 72$$

$$(a - b)^2 = (a + b)^2 - 4ab$$

$$= (18)^2 - 4 \times 72$$

$$= 324 - 288 = 36$$

$$a - b = \pm 6 \dots (ii)$$

On solving equation (i) and (ii)

$$(a, b) = (12, 6) \text{ or } (6, 12)$$

Line will be $\frac{x}{12} + \frac{y}{6} = 1$

$$\Rightarrow x + 2y = 12$$

Or,

$$\frac{x}{6} + \frac{y}{12} = 1$$

$$\Rightarrow 2x + y = 12$$

48. Sol. (c)

Let $P(x, y)$, $Q(a + b, b - a)$ and $R(a - b, a + b)$ are given points.

$$\therefore PQ = PR.$$

$$\Rightarrow \sqrt{\{x - (a + b)\}^2 + \{y - (b - a)\}^2}$$

$$= \sqrt{\{x - (a - b)\}^2 + \{y - (a + b)\}^2}$$

$$\Rightarrow x^2 - 2x(a + b) + (a + b)^2 + y^2$$

$$- 2y(b - a) + (b - a)^2 = x^2 + (a$$

$$-b)^2 - 2x(a-b) + y^2 + (a+b)^2$$

$$-2y(a+b)$$

$$\Rightarrow ax + bx + by - ay = ax - bx +$$

$$ay + by$$

$$\Rightarrow 2bx = 2ay$$

$$\Rightarrow bx = ay$$

49. Sol. (c)

Let the points on y-axis is (0, a) Perpendicular distance of point (0, 0) from the line $4x - 3y - 12 = 0$ is

$$D = \left| \frac{4(0) - 3(a) - 12}{\sqrt{4^2 + 3^2}} \right| = 3$$

$$\Rightarrow \frac{3a+12}{5} = \pm 3$$

$$3a = -27 \text{ or } 3a = 3$$

$$a = -7 \text{ or } a = 1$$

$$(0, -7) \text{ or } (0, 1)$$

50. Sol. (b)

$$\ln x + y = 3$$

$$\text{put } x = 0 \Rightarrow y = 3$$

$$\text{put } y = 0 \Rightarrow x = 3$$

Line formed by the equation will be AB

$$\text{In } 2x + 5y = 12$$

$$\text{put } x = 0 \Rightarrow y = 2.4$$

$$\text{put } y = 0 \Rightarrow x = 6$$

Line formed by the equation will be CD AB and CD will intersect at point E.

$$\text{Given, } x + y = 3$$

$$\text{and } 2x + 5y = 12$$

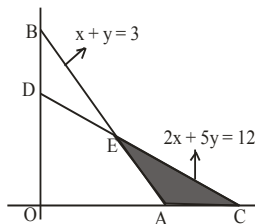
Multiply equation (1) by 2 and subtract it from equation (2)

$$\Rightarrow 3y = 6 \Rightarrow y = 2$$

Put the value of y in any of the equations

$$x + 2 = 3 \Rightarrow x = 1$$

$$\text{So, } E(x, y) = (1, 2)$$



Area formed by the equations $x + y = 3$, $2x + 5y = 12$ and the x axis is the shaded region or $\triangle EAC$

$$\text{Now, } AC = OC - OA = 6 - 3 = 3$$

Height of the triangle will be the y coordinate of point E = 2

$$\begin{aligned} \text{Required area} &= \frac{1}{2} \times \text{base} \times \text{Height} \\ &= \frac{1}{2} \times 3 \times 2 = 3 \text{ square units.} \end{aligned}$$

51. Sol. (d)

Center = (1, -2) and radius = 4 cm Equation of circle

$$\Rightarrow (x-1)^2 + (y+2)^2 = (4)^2$$

$$x^2 + 1 - 2x + y^2 + 4 + 4y = 16$$

$$\Rightarrow x^2 - 2x + y^2 + 4y = 16 - 5$$

$$\Rightarrow x^2 + y^2 - 2x + 4y = 11$$

52. Sol. (c)

Let coordinates of new point (X, Y)

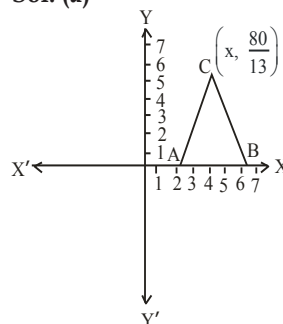
$$X = x - h \quad Y = y - k$$

$$X = (a - (a - c)) \quad Y = (b - b)$$

$$X = c \quad Y = 0$$

Hence new coordinates of the point are (c, 0)

53. Sol. (a)



On x-axis; $y = 0$

$$4x + 3y = 12$$

$$= x = (3, 0) \quad \dots\dots(i)$$

$$5x + 7y = 35$$

$$\Rightarrow x = (7, 0) \dots\dots(ii)$$

$$\Rightarrow x = \frac{80}{13}$$

$$4x + 3y = 12$$

$$5x + 7y = 35$$

$$20x + 15y = 60$$

$$20x + 28y = 140$$

$$\begin{array}{r} - \\ - \\ - \\ \hline -13y = -80 \end{array}$$

Area of $\triangle ABC$

$$= \frac{1}{2} \times 4 \times \frac{80}{13} = \frac{160}{13} \text{ sq. units}$$

$$y = \frac{80}{13}$$

54. Sol. (b)

Let the points on the line be (x, y) Then,

$$AX = BX$$

$$\sqrt{(x-5)^2 + (y-(-1))^2} = \sqrt{(x-(-1))^2 + (y-7)^2}$$

$$\Rightarrow (x-5)^2 + (y+1)^2 = (x+1)^2 + (y-7)^2$$

$$\Rightarrow x^2 - 10x + 25 + y^2 + 2y + 1 = x^2 + 2x + 1 + y^2 -$$

$$14y + 49$$

$$\Rightarrow 12x - 16y + 24 = 0$$

$$3x - 4y + 6 = 0$$

55. Sol. (c)

$$3x + 7y + 8 = 0 \Rightarrow 7y = -3x - 8$$

$$\Rightarrow y = \left(-\frac{3}{7}\right)x - \left(\frac{8}{7}\right)$$

$$\therefore \text{Slope of the line is } = -\frac{3}{7}$$

56. Sol. (a)

$$\text{Unique solution} \Rightarrow \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$$

$$\Rightarrow \frac{7}{k} \neq \frac{k}{7}$$

$$\Rightarrow k^2 \neq 7^2$$

$$k \neq 7$$

57. Sol. (c)

Let the ratio be $\lambda:1$

Then,

The coordinates of required point be

$$R = \left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n} \right)$$

Here $m = \lambda, n = 1, (x_1, y_1) = (-3, 7)$ and $(x_2, y_2) =$

$(3, -5)$

$$R = \left(\frac{\lambda(3) + 1(-3)}{\lambda+1}, \frac{\lambda(-5) + 1(7)}{\lambda+1} \right)$$

Since point R is on the x-axis, y-coordinate must be zero

$$\Rightarrow \frac{-5\lambda+7}{\lambda+1} = 0$$

$$\Rightarrow -5\lambda = -7$$

$$\lambda = \frac{7}{5}$$

So the required ratio is 7:5

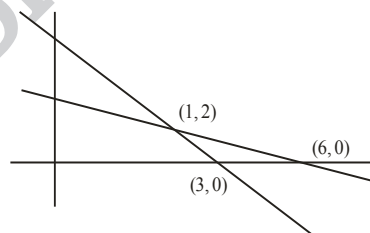
58. Sol. (c)

Points of intersection

By, $2x + 5y - 12 = 0$ and $x + y = 3$ is $(1, 2)$

$y = 0$ and $2x + 5y - 12 = 0$ is $(6, 0)$

$y = 0$ and $x + y = 3$ is $(3, 0)$



Base = 3, Height = 2

$$\text{Area} = \frac{1}{2} \times 3 \times 2 = 3$$

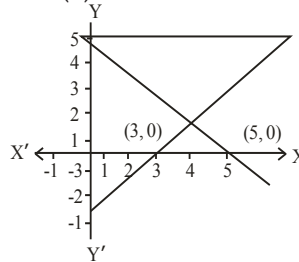
59. Sol. (b)

Equation of y-axis is $x = 0$ put $x = 0$ in $4x - 9y$

$$= 11 \text{ we get } y = -\frac{11}{9}$$

$$\therefore \text{Required point} = \left(0, -\frac{11}{9}\right)$$

60. Sol. (b)



$$x + y \geq 5$$

let first draw graph of $x + y = 5$

put $y = 0$ in (i)

$$x = 5$$

put $x = 0$ in (i)

$$y = 5$$

Checking for $(0, 0)$

$$x + y \geq 5$$

$$0 \geq 5, \text{ which is false}$$

Hence, origin does not lie in $x + y \geq 5$

Now,

$$x - y \leq 3$$

let first drawn graph of $x - y = 3$

put $x = 0$ in (ii)

$$y = -3$$

put $y = 0$ in (ii)

$$x = 3$$

Checking for $(0, 0)$

$$x - y \leq 3$$

$$0 \leq 3, \text{ which is true}$$

Hence, origin lies in $x - y \leq 3$

So, shaded region will be the solution of these linear inequalities lies in the first and second quadrant.

61. Sol. (b)

Abscissa $\rightarrow$ x-coordinate

Ordinate $\rightarrow$ y-coordinate

Let ordinate of the endpoint be p

Then,

Coordinates of the endpoint be $(10, p)$

Now

$$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$\Rightarrow 10 = \sqrt{(10 - 2)^2 + (p - (-3))^2}$$

$$\Rightarrow 100 = 64 + p^2 + 9 + 6p$$

$$\Rightarrow p^2 + 6p - 27 = 0$$

$$\Rightarrow p^2 + 9p - 3p - 27 = 0$$

$$\Rightarrow p(p + 9) - 3(p + 9) = 0$$

$$\Rightarrow (p - 3)(p + 9) = 0$$

$$p = 3, p = -9$$

62. Sol. (c)

Given,

$$2x + 3y = 11 \quad \dots\dots(1)$$

$$\text{and } x - 2y + 12 = 0$$

$$2y - x = 12 \quad \dots\dots(2)$$

Multiply equation (2) by 2 and add it in equation

(1)

$$\Rightarrow 7y = 35 \Rightarrow y = 5 \text{ and } x = -2$$

$$\Rightarrow P(x_1, y_1) = (-2, 5)$$

Now,

$$x - 2y + 12 = 0$$

$$\text{At x axis } y = 0 \Rightarrow x = -12$$

$$Q(x_2, y_2) = (-12, 0)$$

$$(x_1 - x_2 + y_1 + y_2)$$

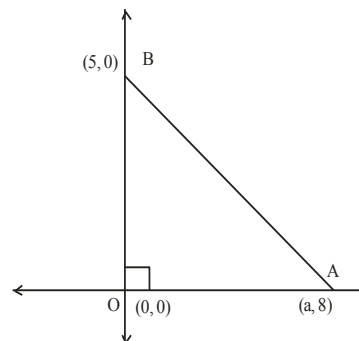
$$\Rightarrow \{-2 - (-12) + 5 + 0\} = 15$$

63. Sol. (c)

Area of $\triangle AOB$

$$= \left| \frac{1}{2} \begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} \right|$$

$$= \left| \frac{1}{2} \begin{vmatrix} 5 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 8 & 1 \end{vmatrix} \right|$$



Area of $\triangle AOB$

$$= \left| \frac{1}{2} [5(0 - 8) - 0(0 - 8) + 0(0 - 0)] \right|$$

$$= \frac{1}{2} \times 5 \times 8 = 20 \text{ sq units}$$

64. Sol.(b)

Given,

$$3x - 5y = 19$$

$$\text{and } 3y - 7x + 1 = 0$$

$$7x - 3y = 1$$

Multiply equation (1) by 3 and equation (2) by 5

and subtract eq (1) from

$$\Rightarrow 26x = -52 \Rightarrow x = -2$$

Put the value of x in any of the equations

$$3(-2) - 5y = 19$$

$$\Rightarrow y = -5 \Rightarrow P(\alpha, \beta) = (-2, -5)$$

$$(3\alpha - \beta) \Rightarrow 3(-2) - (-5) = -1$$

65. Sol. (b)

Given equation $2x + 3y + 6 = 0$

$$\Rightarrow 3y = -2x - 6$$

$$\Rightarrow y = -\frac{2}{3}x - 2$$

So, slope of this equation is $-\frac{2}{3}$ The slope of the equation which is perpendicular to this line is $\frac{3}{2}$ ($\because m_1 m_2 = -1$)So, equation of line with slope $\frac{3}{2}$ and y-intercept 3 is given by

$$y = mx + c \Rightarrow y = \frac{3}{2}x + 3$$

$$\Rightarrow 2y = 3x + 6$$

$$3x - 2y + 6 = 0$$

INDIA'S 1ST TYPE WISE BOOK
PUSHPENDRA SIR

HEIGHT & DISTANCE

INDIA'S 1ST TYPE WISE BOOK
PUSHPENDRA SIR

Type-1 (Height & Distance)

1. The angle of elevation of the top of a tower of height x metre from a point on the ground is found to be 60° . By going y metre away from that point, it becomes 30° . Which one of the following relations is correct?

जमीन पर एक बिंदु से x मीटर ऊंचाई वाले एक टावर के शीर्ष का उन्नयन कोण 60° पाया जाता है। उस बिंदु से y मीटर दूर जाने पर यह 30° हो जाता है। निम्नलिखित में से कौन सा संबंध सही है?

[CDS-2023-I]

- (a) $x = y$ (b) $2x = 3y$
(c) $2x = \sqrt{3}y$ (d) $2y = \sqrt{3}x$

2. A person 1.8 metre tall is $30\sqrt{3}$ metres away from a tower. If the angle of elevation from his eye to the top of the tower is 30 degree, then what is the height (in m) of the tower?

1.8 मीटर लंबा एक व्यक्ति एक टावर से $30\sqrt{3}$ मीटर दूर है। यदि उसकी आंख से टावर के शीर्ष तक उन्नयन कोण 30° डिग्री है, तो टावर की ऊंचाई (मीटर में) क्या है?

SSC CGL Tier- II /2023

- (a) 32.5 (b) 37.8
(c) 30.5 (d) 31.8

3. The distance between the tops of two building of height 53 m and 117 m respectively is 136 m. What will be the distance (in m) between two building?

दो शवन जिनकी ऊँचाई क्रमशः 53 मी० और 117 मी० के शीर्षों के बीच की दूरी 136 मी० है तो उनके पादों के बीच की दूरी क्या है ?

- (a) 100 (b) 120
(c) 125 (d) 105

4. A flag staff on the top of a tower 80 m high subtends an angle $\tan^{-1}\left(\frac{1}{9}\right)$ at a point on the ground 100 m from the foot of the tower. The height of the flagstaff is

80 मीटर ऊँचे एक टावर के शीर्ष पर एक ध्वजदंड टावर के निचले भाग से 100 मीटर की दूरी पर जमीन पर एक बिंदु पर $\tan^{-1}\left(\frac{1}{9}\right)$ कोण बनाता है। ध्वजदंड की ऊंचाई है

- (a) 20 m (b) 30 m
(c) 40 m (d) 25 m

5. The tops of two poles of height 18 m and 30.5 m are connected by a wire. If the wire makes an angle of 30° with the horizontal, what is the length (in m) of the wire?

18 मीटर और 30.5 मीटर ऊंचाई वाले दो खंभों के शीर्ष एक तार से जुड़े हुए हैं यदि तार क्षैतिज के साथ 30° का कोण बनाता है, तो तार की लंबाई (मीटर में) क्या है?

SSC CGL 20/4/2022 (Morning)

- (a) 20 (b) 25
(c) 28 (d) 36

6. The angle of elevation of the top of a tall building from the points M and N at the distances of 72 m and 128 m, respectively, from the base of the building and in the same straight line with it, are complementary. The height of the building (in m) is ?

इमारत के आधार से और उसके साथ एक ही सीधी रेखा में क्रमशः 72 मी और 128 मीटर की दूरी पर बिंदु एम और एन से एक ऊँची इमारत के शीर्ष का उन्नयन कोण पूरक हैं। इमारत की ऊंचाई (मीटर में) है?

SSC CGL 12/04/2022(Afternoon)

- (a) 84 (b) 96
(c) 80 (d) 90

7. A man 50 feet tall casts a shadow 4ft long at the same time when a flag pole casts a shadow 50ft long the height of the flag pole is

6 फीट लंबा एक आदमी उसी समय 4 फीट लंबी छाया बनाता है जब एक झंडे का खंभा 5 फीट लंबी छाया बनाता है तो झंडे के खंभे की ऊंचाई है

- (a) 80 (b) 75
(c) 60 (d) 70

8. An airplane goes 14 km due east and then 48 km due north. How far is it from its initial position?

एक हवाई जहाज़ पूर्व की ओर 14 "किमी और फिर उत्तर की ओर 48 "किमी चलता है। यह अपनी प्रारंभिक स्थिति से कितनी दूर है?

SSC CGL 2022 13/12/2022 (3rd Shift)

- (a) 14 km (b) 48 km
(c) 50 km (d) 28 km

9. from the top of 135 m long tower, the angle of depression of two points P and Q on same side of the base of tower on level ground is θ and ϕ . such that $\tan \theta = 3/4$, and $\sin \phi = 5/\sqrt{89}$. What is the distance between P and Q ?

135 मीटर ऊँचे टावर से दो बिंदुओं P और Q ओ टावर के एक ही ओर स्थित है के अवनमन कोण क्रमशः θ तथा ϕ इस प्रकार है कि $\tan \theta = 3/4$ और $\sin \phi = \frac{5}{\sqrt{89}}$ बिंदुओं P तथा Q के बीच की दूरी क्या है ?

- (a) 32 (b) 40
(c) 36 (d) 42

10. An aeroplane is observed to be approaching the airport. It is a distance of 10 km from the point of observation on the ground and makes an angle of elevation. If the aeroplane is at a height of 8 km above the ground, then which one of the following is correct?

एक हवाई जहाज़ को हवाई अड्डे की ओर आते देखा गया। यह जमीन पर अवलोकन बिंदु से 10 किमी की दूरी पर है और उन्नयन कोण बनाता है। यदि हवाई जहाज़ जमीन से 8 किमी की ऊँचाई पर है, तो निम्नलिखित में से कौन सा सही है?

[CDS-2022-I]

- (a) $0 < \theta < 30^\circ$ (b) $30^\circ < \theta < 45^\circ$
(c) $45^\circ < \theta < 60^\circ$ (d) $60^\circ < \theta < 90^\circ$

11. Two pillars A and B of the same height are on opposite sides of a road which is 40 m wide. The angles of elevation of the tops of the pillars A and B are 30° and 45° , respectively, at a point on the road between the pillars. What is the distance (in m) of the point from the foot of pillar A ?

समान ऊँचाई के दो खंभे A और B एक सड़क के विपरीत दिशा में हैं जो 40 मीटर चौड़ी है। स्तंभों के बीच सड़क पर एक बिंदु पर स्तंभ A और B के शीर्षों का उन्नयन कोण क्रमशः 30° और 45° है। स्तंभ A के पाद से बिंदु की दूरी (मीटर में) क्या है?

SSC CGL Tier II 03/02/2022

- (a) $40(\sqrt{3} - 1)$ (b) $20(2 - \sqrt{3})$
(c) $20(3 - \sqrt{3})$ (d) $39\sqrt{3}$

12. The angle of elevation of the top of a building from the top and bottom of a tree are x and y respectively. If the height of the tree is h metre, then (in metre) the height of the building is

एक पेड़ के ऊपर और नीचे से एक इमारत के शीर्ष का उन्नयन कोण क्रमशः x और y है। यदि पेड़ की ऊँचाई h मीटर है, तो इमारत की ऊँचाई (मीटर में) है

- (a) $\frac{h \cot x}{\cot x + \cot y}$ (b) $\frac{h \cot y}{\cot x + \cot y}$
(c) $\frac{h \cot x}{\cot x - \cot y}$ (d) $\frac{h \cot y}{\cot x - \cot y}$

13. The angle of elevation of a tower from a distance 100 m from its foot is 30° . Height of the tower is

एक टावर के आधार से 100 मीटर की दूरी पर उसका उन्नयन कोण 30° है। टावर की ऊँचाई है

- (a) $\frac{100}{\sqrt{3}}$ m (b) $50\sqrt{3}$ m
(c) $\frac{200}{\sqrt{3}}$ m (d) $100\sqrt{3}$ m

14. The length of the shadow on the ground of a tall tree of height 45 m is $15\sqrt{3}$ m. What is the angle (in degrees) of elevation of the sun?

45 मीटर ऊँचाई वाले एक ऊँचे पेड़ की जमीन पर छाया की लंबाई $15\sqrt{3}$ मीटर है। सूर्य का उन्नयन कोण (डिग्री में) कितना है?

SSC CGL 13/04/2022 (Evening)

- (a) 60° (b) 45°
(c) 90° (d) 30°

15. ABC is a right-angle triangle with $\angle ABC = 90^\circ$. M is a point on AC such that $AM = MC$ and N is a Point on BC such that $\angle NMC = 90^\circ$ if $\angle MNC = \alpha$, $BN = 2$ cm and $NC = 7$ cm, then find the value of $\sin^2 \alpha$.

ABC एक समकोण त्रिभुज है जिसमें $\angle ABC = 90^\circ$ है। M , AC पर एक बिंदु है जैसे कि $AM = MC$ और N , BC पर एक बिंदु है जैसे कि $\angle NMC = 90^\circ$ है यदि $\angle MNC = \alpha$, $BN = 2$ सेमी और $NC = 7$ सेमी, तो $\sin^2 \alpha$ का मान ज्ञात कीजिए।

- (a) $\frac{2}{9}$ (b) $\frac{7}{9}$
(c) $\frac{7}{2}$ (d) $\frac{9}{14}$

16. The foot of a ladder 25 m long is 7 m from the base of the building. If the top of the ladder slips by 4 m, then by how much distance will the foot of the ladder slide?

25 मीटर लंबी एक सीढ़ी का निचला भाग इमारत के आधार से 7 मीटर दूर है। यदि सीढ़ी का शीर्ष 4 मीटर खिसक जाता है, तो सीढ़ी का पाद कितनी दूरी तक खिसकेगा?

SSC CHSL 24/05/2022 (Morning)

- (a) 9 m (b) 7 m
(c) 6 m (d) 8 m

17. A flagstaff on the top of a tower 24 m high subtends an angle $\sec^{-1}\sqrt{2}$ at a point on the ground 45 m from the foot of the tower. The height of the flagstaff is.

24 मीटर ऊंचे एक टावर के शीर्ष पर एक ध्वजदंड, टॉवर के आधार से 45 मीटर की दूरी पर जमीन पर एक बिंदु पर $\sec^{-1}\sqrt{2}$ कोण बनाता है। ध्वजदंड की ऊंचाई है।

- (a) 123.8 m (b) 100 m
(c) 120 m (d) 170 m

18. The distance between two pillars is 120 meters. The height of one pillar is thrice the other. The angles of elevation of their tops from the midpoint of the line connecting their feet are complementary to each other. The height (in meters) of the taller pillar is (Use $\sqrt{3} = 1.732$)

दो खंभों के बीच की दूरी 120 मीटर है। एक खंभे की ऊंचाई दूसरे से तीन गुना ज्यादा है। उनके पैरों को जोड़ने वाली रेखा के मध्य बिंदु से उनके शीर्षों के उन्नयन कोण एक दूसरे के पूरक हैं। ऊंचे स्तम्भ की ऊंचाई (मीटर में) है (Use $\sqrt{3} = 1.732$)

- (a) 34.64 (b) 51.96
(c) 69.28 (d) 103.92

19. From a tower 125 metres high the angle of depression of two objects, which are in horizontal line through the base of the tower are 45° and 30° and they are on the same side of the tower. The distance (in metres) between the objects is

125 मीटर ऊंचे एक टावर से, टावर के आधार से क्षैतिज रेखा में स्थित दो वस्तुओं के अवनमन कोण 45° और 30° हैं और वे टावर के एक ही तरफ हैं। वस्तुओं के बीच की दूरी (मीटर में) है

- (a) $125\sqrt{3}$ m (b) $125(\sqrt{3} - 1)$ m

- (c) $\frac{125}{(\sqrt{3}-1)m}$ (d) $125(\sqrt{3} + 1)m$

20. A vertical tower standing at the corner of a rectangular field subtends angles of 60° and 45° at the two nearer corners. If θ is the angle that the tower subtends at the farthest corner, then what is $\cot \theta$ equal to?

एक आयताकार मैदान के कोने पर खड़ा एक ऊर्ध्वाधर टॉवर दो निकटतम कोनों पर 60° और 45° के कोण बनाता है। यदि θ वह कोण है जिसे टावर सबसे दूर कोने पर अंतरित करता है, तो $\cot \theta$ किसके बराबर है?

[CDS-2021-I]

- (a) $\frac{1}{2}$ (b) 2
(c) $\frac{2}{\sqrt{3}}$ (d) $\frac{4}{\sqrt{3}}$

21. From the top of tower 60 m high, the angle of depression of two objects which are on the horizontal plane and in a line with the foot of the tower are α and β with $\beta > \alpha$. What is the distance between the two objects in meters.

60 मीटर ऊंचे टावर के शीर्ष से, दो वस्तुओं का अवनमन कोण, जो क्षैतिज तल पर हैं और टावर के आधार के साथ एक पंक्ति में हैं, $\beta > \alpha$ के साथ α और β हैं। दो वस्तुओं के बीच की दूरी मीटर में कितनी है?

- (a) $60\sin(\beta - \alpha)\operatorname{cosec} \alpha \operatorname{cosec} \beta$
(b) $60\cos(\beta - \alpha)\sec \alpha \sec \beta$
(c) $60(\cot \alpha + \cot \beta)$
(d) $60(\tan \beta - \tan \alpha)$

22. From a point P , the angle of elevation of a tower is such that its tangent is $3/4$. On walking 560 m towards the tower the tangent of the angle of elevation of the tower becomes $4/3$. What is the height of tower?

एक बिंदु P से, एक टावर का उन्नयन कोण ऐसा है कि स्पर्शज्या $3/4$ है, टावर की ओर 560 मीटर चलने पर टावर के उन्नयन कोण की स्पर्शज्या $4/3$ हो जाती है। टावर की ऊंचाई क्या है?

- (a) 720 (b) 960
(c) 840 (d) 1000

23. A flagpole on the top of a mall building is 75 m high. To an observer at a height of 400 m. the mall building and the pole subtend equal angle Q . if the

height of the mall building is 325 m. Then find the horizontal distance of the observer from the pole?

एक माल भवन के जपर एक ध्वज देड स्थित है जिसकी कचाई 75 मी० है, 400 मी० की ऊँचाई पर स्थित एक व्यक्ति पर माल भवन और ध्वज देड बराबर कोण Q अंतरित करते हैं, यदि माल भवन की ऊँचाई 325 मी० है, तब ध्वज देड और व्यक्ति के बीच क्षैतिज दूरी ज्ञात करें?

- (a) $20\sqrt{10}$ (b) $30\sqrt{5}$
(c) $25\sqrt{10}$ (d) $30\sqrt{10}$

24. A tower standing on a horizontal plane subtends a certain angle at a point 160 m apart from the foot of the tower. on advancing 100 m towards it, the tower is found to subtend an angle twice as before. The height of the tower is

क्षैतिज तल पर खड़ा एक टावर टावर के आधार से 160 मीटर की दूरी पर एक बिंदु पर एक निश्चित कोण बनाता है। इसकी ओर 100 मीटर आगे बढ़ने पर, टावर पहले की तुलना में दोगुना झुकता और कोण बनाता हुआ पाया जाता है। टावर की ऊँचाई है

- (a) 80 m (b) 100 m
(c) 60 m (d) 200 m

25. A pole 23 m long reaches a window which is $3\sqrt{5}$ m above the ground on one side of a street. Keeping its foot at the same point, the pole is turned to the other side of the street to reach a window $4\sqrt{15}$ m high. What is the width (in m) of the street?

23 मीटर लंबा एक खंभा एक खिड़की तक पहुंचता है जो सड़क के एक तरफ जमीन से $3\sqrt{5}$ मीटर ऊपर है। उसी बिंदु पर अपना पैर रखते हुए, खंभे को $4\sqrt{15}$ मीटर ऊंची खिड़की तक पहुंचने के लिए सड़क के दूसरी ओर घुमाया जाता है। सड़क की चौड़ाई (मीटर में) क्या है?

SSC CGL 11/04/2021 (Afternoon)

- (a) 17 (b) 35
(c) 39 (d) 22

26. From an aeroplane just over a river the angles of depression of two palm trees on the opposite bank of the river are found to be 60° and 30° respectively if the breadth of the river is 400 meters, then the height of the aeroplane above the river at that instant is

एक नदी के ठीक ऊपर एक हवाई जहाज से नदी के विपरीत तट पर दो ताड़ के पेड़ों के अवनमन कोण क्रमशः 60° और

30° पाए जाते हैं यदि नदी की चौड़ाई 400 मीटर है, तो हवाई जहाज की ऊँचाई ऊपर है उस क्षण नदी है (take $\sqrt{3} = 1.732$)

- (a) 173.2 meters (b) 346.4 meters
(c) 519.6 meters (d) 692.8 meters

27. A person from the top of a hill observe a vehicle moving towards him at a uniform speed. It takes to min for the angle of depression to change 45° to 60° . After this time required by the vehicle to reach the bottom of the hill is -

एक पहाड़ी की चोटी से एक व्यक्ति एक समान गति से उसकी ओर बढ़ते वाहन का अवलोकन करता है वाहन का अवनमन कोण 45° से 60° बदलने में 10 मिनट लगते हैं इसके बाद वाहन को पहाड़ी के नीचे पहुंचने के लिये कितना समय लगेगा -

- (a) 12 min 20 sec (b) 13 min
(c) 13 min 40 sec (d) 14 min 24 sec

28. From a lighthouse the angles of depression of two ships on opposite sides of the lighthouse are observed to 30° and 45° . If the height of lighthouse is h , what is the distance between the ships?

एक लाइटहाउस से लाइटहाउस के विपरीत दिशा में दो जहाजों के अवनमन कोण 30° और 45° तक देखे जाते हैं। यदि प्रकाशस्तंभ की ऊँचाई h है, तो जहाजों के बीच की दूरी क्या है?

- (a) $(\sqrt{3} + 1)h$ (b) $(\sqrt{3} - 1)h$
(c) $\sqrt{3}h$ (d) $(1 + \frac{1}{\sqrt{3}})h$

29. A and B are standing on the same side of a wall and observe that the angle of elevation to the top of wall are 45° and 60° respectively. if the height of the wall is 50 m, the distance between A and B is

A और B एक दीवार के एक ही तरफ खड़े हैं और वे पाते हैं कि दीवार के शीर्ष के उन्नयन कोण क्रमशः 45° और 60° हैं। यदि दीवार की ऊँचाई 50 मीटर है तो A और B के बीच की दूरी है -

- (a) 1738 m (b) 21.10 m
(c) 25.07 (d) 14.65

30. A ladder 10 m long reaches a point 10 m below the top of a vertical flagstaff. From foot of the ladder, the elevation of top of the flagstaff is 60° . What is the height of flagstaff?

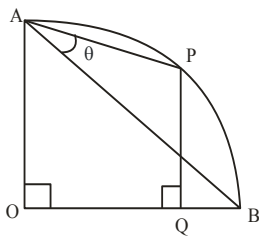
एक 10 "मीटर लंबी सीढ़ी एक ऊर्ध्वाधर झंडे के शीर्ष से 10 मीटर नीचे एक बिंदु पर पहुंचती है। सीढ़ी के निचले भाग से, ध्वजस्तंभ के शीर्ष की ऊंचाई 60° है। ध्वजदंड की ऊंचाई कितनी है?

[CDS-2021-II]

- (a) 12 m (b) 15 m
(c) 16 m (d) 20 m

31. In the given figure, O is the centre of the quarter circle and $OQ = 3PQ$, then find $\tan \theta$.

दिए गए चित्र में, O क्वार्टर वृत्त का केंद्र है और $OQ = 3PQ$ है, तो $\tan \theta$ ज्ञात कीजिए।



- (a) $3 - \sqrt{10}$ (b) $-3 - \sqrt{10}$
(c) $-3 + \sqrt{10}$ (d) Both b and c

32. From the top of a hill 240 m high the angle of depression of the top and of the bottom of a pole are 30° and 60° , respectively. The difference (in m) between the height of the pole and its distance from the hill is :

240 मीटर ऊंची एक पहाड़ी की चोटी से एक खंभे के शीर्ष और नीचे का अवनमन कोण क्रमशः 30° और 60° है। खंभे की ऊंचाई और पहाड़ी से इसकी दूरी के बीच का अंतर (मीटर में) है:

SSC CGL Tier II (16/11/2020)

- (a) $80(2 - \sqrt{3})$ (b) $120(\sqrt{3} - 1)$
(c) $120(2 - \sqrt{3})$ (d) $80(\sqrt{3} - 1)$

33. The angle of elevation of the top of a flagstaff of height 'X' m situated on a tower is α° after moving y m towards the tower the angle of elevation of the bottom of the flagstaff is β , then the height of the tower is

एक टावर पर स्थित 'X' मीटर ऊंचाई वाले ध्वजदंड के शीर्ष का उन्नयन कोण α° है, टावर की ओर y "m चलने के बाद ध्वजदंड के निचले भाग का उन्नयन कोण β है, तो ऊंचाई टावर है

- (a) $\frac{x \tan \alpha - y \tan \beta}{\tan \alpha - \tan \beta}$ (b) $\frac{x \tan \beta - y \tan \alpha}{\tan \alpha - \tan \beta}$

- (c) $\frac{x \tan \alpha + y \tan \beta \tan \alpha}{\tan \alpha - \tan \beta}$ (d) $\frac{x \tan \beta - y \tan \alpha \tan \beta}{\tan \alpha - \tan \beta}$

34. The angles of elevation of the top of a tower from two points situated at distances 36 m and 64 m from its base and in the same straight line with it are complementary. What is the height of the tower?

एक टावर के आधार से 36 मीटर और 64 मीटर की दूरी पर और उसके साथ एक ही सीधी रेखा में स्थित दो बिंदुओं से उसके शीर्ष के उन्नयन कोण पूरक हैं। टावर की ऊंचाई कितनी है?

- (a) 50 m (b) 48 m
(c) 25 m (d) 24 m

35. Two points P and Q are at a distance of x and y (where $y > x$) respectively from the base of a building and on a straight line if the angles of elevation of the top of the building from point P and Q are complementary then what is the height of building?

दो बिंदु P और Q एक इमारत के आधार से क्रमशः x और y (जहाँ $y > x$) की दूरी पर हैं और एक सीधी रेखा पर हैं यदि बिंदु P और Q से इमारत के शीर्ष के उन्नयन कोण पूरक हैं तो इमारत की ऊंचाई क्या है?

[SSC CPO 08/12/2018]

- (a) xy (b) $\sqrt{x/y}$
(c) $\sqrt{y/x}$ (d) $\sqrt{xy}$

36. A ladder leaning against a wall makes an θ with the horizontal ground such that $\cos \theta = \frac{5}{13}$. If the height of the top of the ladder from the wall is 18 m, then what is the distance (in cm) of the foot of the ladder from the wall?

दीवार के सहारे झुकी एक सीढ़ी क्षैतिज जमीन के साथ θ इस प्रकार बनाती है कि $\cos \theta = \frac{5}{13}$ । यदि दीवार से सीढ़ी के शीर्ष की ऊंचाई 18 "मीटर है, तो दीवार से सीढ़ी के पाद की दूरी (सेमी में) क्या है?

SSC CPO 23/11/2020 (Morning)

- (a) 19.5 (b) 13
(c) 7.5 (d) 18

37. A person from the top of a hill observes a vehicle moving towards him at a uniform speed it takes 10 minutes for the angle of depression to change from 45° to 60° after this the time required by the vehicle to reach the bottom of the hill is

एक व्यक्ति पहाड़ी की चोटी से एक वाहन को एक समान गति से उसकी ओर आते हुए देखता है, अवनमन कोण को 45° से 60° में बदलने में 10 मिनट का समय लगता है, इसके बाद वाहन को पहाड़ी के नीचे तक पहुँचने में कितना समय लगता है?

- (a) 12 minutes 20 second
(b) 13 minutes
(c) 13 minutes 40 second
(d) 14 minutes 24 second

38. A ladder 5 m long is placed in a room so as to reach a point 4.8 m high on a wall and on turning the ladder over to the opposite side of the wall without moving the base, it reaches a point 1.4 m high. What is the breadth of the room?

5 मीटर लंबी एक सीढ़ी एक कमरे में इस प्रकार रखी गई है कि वह एक दीवार पर 4.8 मीटर ऊँचे बिंदु तक पहुँचती है और आधार को हिलाए बिना सीढ़ी को दीवार के विपरीत दिशा में मोड़ने पर, यह एक बिंदु 1.4 पर पहुँच जाती है। "मैं ऊँचा हूँ, कमरे की चौड़ाई क्या है?

[CDS-2020-I]

- (a) 5.8 m (b) 6 m
(c) 6.2 m (d) 7.5 m

39. From the top of a tower of height 180 m the angles of depression of two objects on both sides of the tower are 30° and 45° . Then the distance between the objects are

180 मीटर ऊँचाई वाले एक टावर के शीर्ष से टावर के दोनों किनारों पर दो वस्तुओं के अवनमन कोण 30° और 45° हैं। फिर वस्तुओं के बीच की दूरी है

- (a) $180(3 + \sqrt{3})$ m (b) $180(3 - \sqrt{3})$ m
(c) $180(\sqrt{3} - 1)$ m (d) $180(\sqrt{3} + 1)$ m

40. A tree of height 15 m is broken by wind in such a way that its top touches the ground and makes an angle 30° with the ground. What is the height from the ground to the point where tree is broken?

15 मीटर ऊँचाई का एक पेड़ हवा से इस प्रकार टूट जाता है कि उसका शीर्ष जमीन को छूता है और जमीन से 30° का कोण बनाता है। जहाँ पेड़ टूटा है वहाँ जमीन से ऊँचाई कितनी है?

[CDS-2020-I]

- (a) 10 m (b) 7 m

- (c) 5 m (d) 3 m

41. An aeroplane when flying at a height of 5000 m from the ground passes vertically above another aeroplane at an instant, when the angles of elevation of the two aeroplanes from the same point on the ground are 60° and 45° respectively. The vertical distance between the aeroplanes at that instant is

एक हवाई जहाज जमीन से 5000 मीटर की ऊँचाई पर उड़ते समय एक क्षण में दूसरे हवाई जहाज के ऊपर से लंबवत गुजरता है, जब जमीन पर एक ही बिंदु से दोनों हवाई जहाजों का ऊँचाई कोण क्रमशः 60° और 45° होता है। उस क्षण हवाई जहाजों के बीच की ऊर्ध्वाधर दूरी है

- (a) $5000(\sqrt{3} - 1)$ m (b) $5000(3 - \sqrt{3})$ m
(c) $5000\left(1 - \frac{1}{\sqrt{3}}\right)$ m (d) 4500 m

42. P and Q are two points on the ground on either side of a pole. The angles of elevation of the top of the pole as observed from P and Q are 60° and 30° respectively and the distance between them is $84\sqrt{3}$. What is the height (in m) of the pole?

P और Q एक खंभे के दोनों ओर जमीन पर दो बिंदु हैं। P और Q से देखने पर खंभे के शीर्ष का उन्नयन कोण क्रमशः 60° और 30° है और उनके बीच की दूरी $84\sqrt{3}$ है। खंभे की ऊँचाई (मीटर में) क्या है?

SSC CGL TIER II (13/09/2019)

- (a) 63 (b) 73.5
(c) 52.5 (d) 60

43. A 22 m long ladder (whose foot is on the ground) leans against a wall making an angle of 60° with the wall. What is the height (in m) of the point where the ladder touches the wall from the ground?

एक 22 मीटर लंबी सीढ़ी (जिसका पैर जमीन पर है) दीवार से 60° का कोण बनाते हुए दीवार से टिकी हुई है। उस बिंदु की ऊँचाई (मीटर में) क्या है जहाँ सीढ़ी जमीन से दीवार को छूती है?

SSC CPO 11/12/2019 (Evening)

- (a) $\frac{22\sqrt{2}}{3}$ (b) $11\sqrt{2}$
(c) 11 (d) $11\sqrt{3}$

44. Consider a regular hexagon ABCDEF. Two towers are situated at B and C. The angle of elevation from A to the top of the tower at B is 30° and the angle

of elevation. the top of the tower at C is 45° . What is the ratio of the height of towers at B and C ?

एक नियमित षट्भुज ABCDEF पर विचार करें। दो टावर B और C पर स्थित हैं। A से B पर टावर के शीर्ष तक ऊंचाई का कोण 30° है और ऊंचाई का कोण t है। C पर टावर का शीर्ष 45° है। B और C पर टावरों की ऊंचाई का अनुपात क्या है?

[CDS-2019-1]

- (a) $1:\sqrt{3}$ (b) $1:3$
(c) $1:2$ (d) $1:2\sqrt{3}$

45. A pole stands vertically on a road, which goes in the north. South direction P, Q are two points towards the north of the pole, such that $PQ = b$ and the angles of elevation of the top of the pole P, Q are α, β respectively. Then the height of the pole is :

एक सड़क पर एक खंभा लंबवत खड़ा है, जो उत्तर की ओर जाती है। दक्षिण दिशा P, Q खंभे के उत्तर की ओर दो बिंदु हैं, जैसे कि $PQ = b$ और खंभे P, Q के शीर्ष के उन्नयन कोण क्रमशः α, β हैं। तो खंभे की ऊंचाई है:

- (a) $\frac{b}{\tan\beta + \tan\alpha}$ (b) $\frac{b}{\tan\beta - \cot\alpha}$
(c) $\frac{b}{\tan\beta - \tan\alpha}$ (d) $\frac{\beta \tan\alpha}{\tan\beta}$

46. A man is watching from the top of tower a boat speeding away from the tower. The boat makes an angle of depression of 45° with the man's eye when at distance of 60 m from the bottom of tower. After 5 s, the angle of depression becomes 30° . What is the approximate speed of the boat assuming that it is running in still water?

एक आदमी ऊपर से एक नाव को टावर से तेजी से दूर जाते हुए देख रहा है। जब नाव टावर के नीचे से 60 मीटर की दूरी पर होती है तो वह व्यक्ति की आँख से 45° का अवनमन कोण बनाती है। 5 सेकंड के बाद अवनमन कोण 30° हो जाता है। यह मानते हुए कि नाव शांत पानी में चल रही है, इसकी अनुमानित गति क्या है?

- (a) 31.5 km/h (b) 36.5 km/h
(c) 38.5 km/h (d) 40.5 km/h

47. Two stations due south of a leaning tower which leans to the north are respectively. from its foot ($y > x$) If $\alpha = 60^\circ$ and $\beta = 45^\circ$ be the elevation $\alpha = 60^\circ$ and top of the tower from the stations and from these stations to inclination of the tower equals. Horizontal

एक झुके हुए टॉवर के दक्षिण में दो स्टेशन हैं जो झुकता है। क्रमशः उत्तर के वार्ड हैं। इसके पाद से ($y > x$) यदि $\alpha = 60^\circ$ और $\beta = 45^\circ$ है तो ऊंचाई $\alpha = 60^\circ$ होगी और टॉवर के शीर्ष पर इन स्टेशन टॉवर से टियोन और ओआईएस का झुकाव तब कोटी के बराबर होगा। क्षैतिज

- (a) $\frac{\sqrt{3}y-x}{y-x}$ (b) $\frac{\sqrt{3}y+x}{y-x}$
(c) $\frac{\sqrt{3}y+x}{x^2-y^2}$ (d) $\frac{\sqrt{3}y-x}{y^2-x^2}$

48. At a point A, the angle of elevation of a tower is found to be such that its tangent is $\frac{8}{15}$ on walking 380 meters towards the tower the tangent of the angle of elevation is found to be $\frac{24}{7}$. The height of the tower is

एक बिंदु A पर, एक टावर का उन्नयन कोण इस प्रकार पाया जाता है कि उसकी स्पर्शिका $\frac{8}{15}$ है, टावर की ओर 380 मीटर चलने पर उन्नयन कोण का स्पर्शिका $\frac{24}{7}$ पाया जाता है। टावर की ऊंचाई है

- (a) 120 m (b) 240 m
(c) 360 m (d) 480 m

49. The angles of elevation of the tops of two pillars of heights h and $2h$ from a point P on the line joining the feet of the pillars are complementary. If the distances of the foot then which one of the point P are x and y respectively, the following is correct?

खंभों के पैरों को जोड़ने वाली रेखा पर एक बिंदु P से h और $2h$ ऊंचाई वाले दो खंभों के शीर्षों के उन्नयन कोण। यदि फुट की दूरी हो तो बिंदु P में से कौन सा क्रमशः x और y है, निम्नलिखित सही है?

[CDS-2019-II]

- (a) $2h^2 = x^2y$ (b) $2h^2 = xy^2$
(c) $2h^2 = xy$ (d) $2h^2 = x^2y^2$

50. A flagstaff on the top of a tower 18 m high subtends an angle $\operatorname{cosec}^{-1}\left(\frac{2}{\sqrt{3}}\right)$ at a point on the ground 80 m from the foot of the tower. The height of the flagstaff is.

18 मीटर ऊंचे टॉवर के शीर्ष पर एक ध्वजदंड, टॉवर के आधार से 80 मीटर की दूरी पर जमीन पर एक बिंदु पर $\operatorname{cosec}^{-1}\left(\frac{2}{\sqrt{3}}\right)$ कोण बनाता है। ध्वजदंड की ऊंचाई है।

- (a) 238.07 m (b) 270.7 m
(c) 260 m (d) 200 m

51. On the top of a hemispherical dome of radius r , the stands a flag of height h . From a point on the ground elevation of the top of the flag is 30° . After moving distance d towards the dome, when the flag is just visible, the elevation is 45° . The ratio of h to r is equal to

त्रिज्या r के एक अर्धगोलाकार गुंबद के शीर्ष पर h ऊँचाई का एक झंडा खड़ा है। ज़मीन पर एक बिंदु से झंडे के शीर्ष की ऊँचाई 30° है। गुंबद की ओर दूरी d बढ़ने के बाद, जब झंडा

बस दिखाई देता है। ऊँचाई 45° है। h से r का अनुपात बराबर है

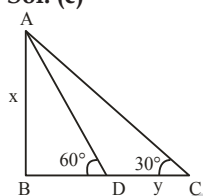
[CDS-2018-1]

- (a) $\sqrt{2} - 1$ (b) $\frac{\sqrt{3}+1}{2\sqrt{2}}$
 (c) $\frac{\sqrt{3}+1}{2\sqrt{2}}d$ (d) $\frac{(\sqrt{3}+1)(\sqrt{2}-1)}{2\sqrt{2}}d$

Type-1 (Height & Distance) ANSWER KEY													
1	(c)	2	(d)	3	(b)	4	(a)	5	(b)	6	(b)	7	(b)
8	(c)	9	(c)	10	(c)	12	(c)	13	(a)	14	(a)	15	*
16	(d)	17.	(a)	18	*	19	(c)	20	(c)	21	(a)	22	(b)
23	(d)	24	(c)	26	(a)	27	(a)	28	(a)	29	(b)	30.	(b)
31	(c)	32	(a)	33.	(d)	34	(b)	35	(d)	36	(c)	37	(c)
38.	(c)	39	(d)	40	(c)	41	(c)	42	(a)	43	(c)	44	(b)
45	(b)	47	(a)	48	(b)	49	(c)	50	(a)	51	(a)		

Type-1 (Height & Distance) Solution

1. Sol. (c)



In $\triangle ABD$,

$$\tan 60^\circ = \frac{AB}{BD} = \sqrt{3} = \frac{x}{BD}$$

$$\Rightarrow BD = \frac{x}{\sqrt{3}}$$

In $\triangle ABC$,

$$\tan 30^\circ = \frac{AB}{BC} = \frac{AB}{BD+DC}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{x}{\frac{x}{\sqrt{3}} + y} \Rightarrow \sqrt{3}x = \frac{x}{\sqrt{3}} + y$$

$$\Rightarrow \sqrt{3}x = \frac{x+\sqrt{3}y}{\sqrt{3}} \Rightarrow 3x = x + \sqrt{3}y$$

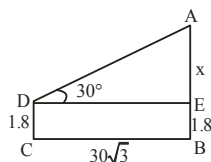
$$2x = \sqrt{3}y$$

2. Sol. (d)

Let the AB be a tower and $AE = x$, so $AB = (1.8 + x)$

$$DE = CB = 30\sqrt{3} \text{ m}$$

According to the question.

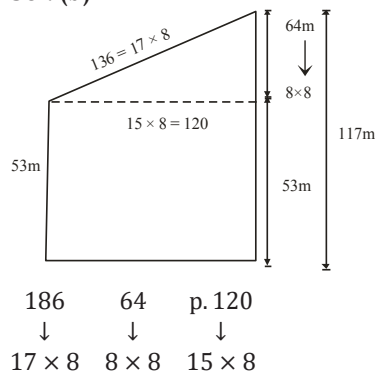


In $\triangle ADE$,

$$\tan 30^\circ = \frac{AE}{DE} \Rightarrow \frac{1}{\sqrt{3}} = \frac{x}{30\sqrt{3}} \Rightarrow x = 30 \text{ m}$$

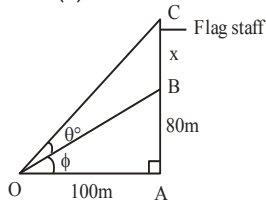
$$\text{So, height of tower} = 1.8 + x = 1.8 + 30 = 31.8 \text{ m}$$

3. Sol. (b)



$$\begin{array}{ccc} 186 & 64 & p. 120 \\ \downarrow & \downarrow & \downarrow \\ 17 \times 8 & 8 \times 8 & 15 \times 8 \end{array}$$

4. Sol. (a)



Given,

$$\tan \theta = \frac{1}{9}$$

$$\tan \phi = \frac{80}{100} = \frac{4}{5}$$

$$\text{Now, } \tan(\theta + \phi) = \frac{80+x}{100}$$

$$\Rightarrow \frac{\tan \theta + \tan \phi}{1 - \tan \theta \tan \phi} = \frac{80+x}{100}$$

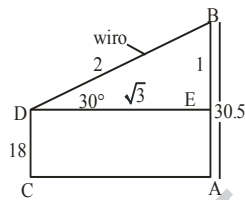
$$\Rightarrow \frac{\frac{1}{9} + \frac{4}{5}}{1 - \frac{1}{9} \times \frac{4}{5}} = \frac{80+x}{100}$$

$$\Rightarrow 80 + x = 100$$

$$\Rightarrow x = 20\text{m}$$

5. Sol. (b)

Let AB and DC be the length of poles which are connected by a wire (BD)



From the following figure. $BE = 30.5 - 18 = 12.5$

Since, $\triangle BED$ is a right triangle

$$\text{So, } EB:ED:DE = 1:2:\sqrt{3}$$

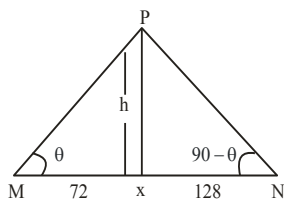
$$1 \text{ unit} \text{-----} 12.5 \text{ m}$$

$$2 \text{ unit } 12.5 \times 2 = 25\text{m}$$

So, the length of wire = 25 m

6. Sol..(b)

Let the height of building be h



In $\triangle PMX$,

$$\tan \theta = \frac{h}{72} \quad \dots (i)$$

In $\triangle PXN$,

$$\cot \theta = \frac{h}{128} \quad \dots (ii)$$

Multiplying eq. (1) and (2), we have;

$$\tan \theta \times \cot \theta = \frac{h}{72} \times \frac{h}{128}$$

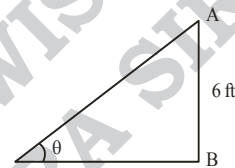
$$1 = \frac{h^2}{72 \times 128}$$

$$h = \sqrt{72 \times 128} = \sqrt{9216} = 96 \text{ m}$$

7. Sol. (b)

In triangle ABC AB is height of the man and CB is

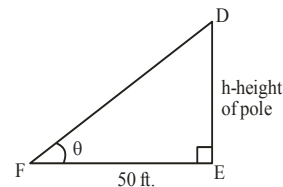
$$\text{length of the shadow } \tan \theta = \frac{AB}{BC} = \frac{6}{4} = \frac{3}{2}$$



In $\triangle DEF$

DE is height of the pole and FE is length of the shadow

$$\tan \theta = \frac{DE}{EF} = \frac{h}{50}$$



Since angular elevation will be same

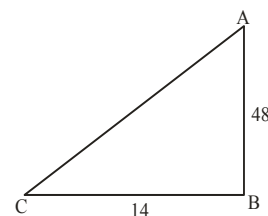
$$\tan \theta = \tan \theta$$

$$\Rightarrow \frac{3}{2} = \frac{h}{50}$$

$$h = 75\text{ft}$$

8. Sol. (c)

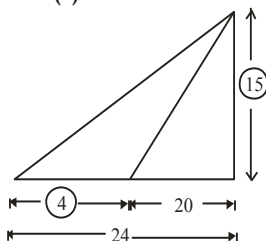
Applying the directions given in the question, we have following figure:



$$C = \sqrt{48^2 + 14^2} = \sqrt{2304 + 196} =$$

$$\frac{A}{\sqrt{2500}} = 50 \text{ km}$$

9. Sol. (c)



$$\sin \phi = 5/\sqrt{89}, \tan \phi = 5/8$$

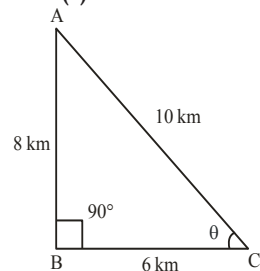
$$(3:4) \times 5 = 15:20$$

$$(5:8) \times 3 = 15:24$$

$$15 \rightarrow 135$$

$$4 \rightarrow 9 \times 4 = 36 \text{ m}$$

10. Sol. (c)



In triangle ABC,

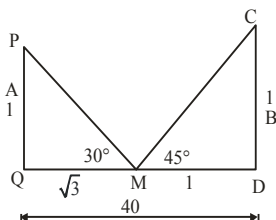
$$\tan \theta = \frac{8}{6} = \frac{4}{3} = 1.33$$

$$\text{Now, } \tan 45^\circ = 1$$

$$\tan 60^\circ = \sqrt{3} = 1.73$$

$$\text{So, } 45^\circ < \theta < 60^\circ$$

11. sol. (c)



Let the height of pillars A and B be PQ and CD respectively and M be the point on the road between the pillars.

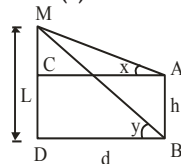
ATQ,

$$(\sqrt{3} + 1) \text{ unit} - 40 \text{ m}$$

$$\sqrt{3} \text{ unit} - \frac{40 \times \sqrt{3}}{(\sqrt{3} + 1)}$$

$$= \frac{40 \times \sqrt{3}(\sqrt{3} - 1)}{(\sqrt{3} + 1)(\sqrt{3} - 1)} = 20(3 - \sqrt{3}) \text{ m}$$

12. Sol. (c)



AB = tree 'h'

MD = Building 'L'

DB = CA = 'd'

In ΔMCA ,

$$\tan x = \frac{MC}{AC} = \frac{L-h}{d}$$

$$= d = \frac{L-h}{\tan x}$$

$$= d = \frac{L-h}{\tan x}$$

$$= d = (L-h) \cot x$$

In ΔMDB ,

$$\tan y = \frac{L}{d} = \frac{MD}{DB}$$

$$d = L \cot y$$

from equation (i) and (iii)

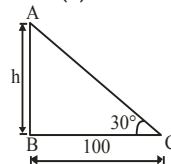
$$(L-h) \cot x = L \cot y$$

$$L \cot x - h \cot x = L \cot y$$

$$H \cot x = L(\cot x - \cot y)$$

$$L = \frac{h \cot x}{\cot x - \cot y}$$

13. Sol. (a)



In ΔABC

$$\tan 30^\circ = \frac{AB}{BC}$$

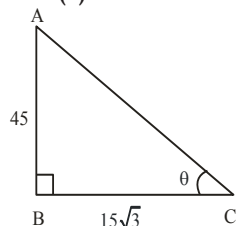
$$\frac{1}{\sqrt{3}} = \frac{AB}{BC}$$

$$AB:BC = 1 : \sqrt{3}$$



$$\text{Height of tower} = \frac{100}{\sqrt{3}} \text{ m}$$

14. Sol. (a)



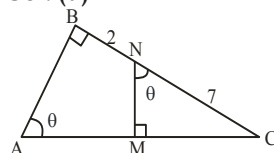
From the given figure, we have;

$$\tan \theta = \frac{AB}{BC} = \frac{45}{15\sqrt{3}} = \sqrt{3}$$

$$\Rightarrow \theta = 60^\circ$$

So, the angle of elevation of the sun = 60°

15. Sol. (d)



In $\triangle NCM$

$$\angle BCA = 90^\circ - \alpha$$

$$\Rightarrow \angle BAC = \alpha$$

In $\triangle MNC$

$$\sin \alpha = \frac{MC}{NC} = \frac{6}{7}$$

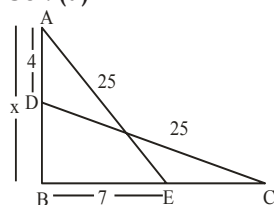
And in $\triangle ABC$

$$\sin \alpha = \frac{BC}{AC} = \frac{9}{2MC}$$

Multiply eqn. (i) and (ii)

$$\sin^2 \alpha = \frac{MC}{7} \times \frac{9}{2MC} = \frac{9}{14}$$

16. Sol. (d)



Length of the ladder $AE = DC = 25$ m Distance of foot from the base (BE) = 7 m

In triangle ABE,

$$AB^2 + BE^2 = AE^2 \Rightarrow x^2 + 7^2 = 25^2$$

$$x = \sqrt{625 - 49} = 24 \text{ m}$$

$$DB = 24 - 4 = 20 \text{ m}$$

Now in triangle DBC,

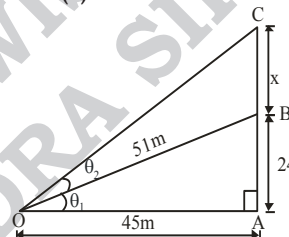
$$DB^2 + BC^2 = DC^2 \Rightarrow 20^2 + BC^2 = 25^2$$

$$BC^2 = 625 - 400 = 225 \Rightarrow BC = \sqrt{225} = 15 \text{ m}$$

$$EC = BC - BE = 15 - 7 = 8 \text{ m}$$

Hence, the foot of the ladder will slide by 8m

17. Sol. (a)



Given,

$$\sec \theta_2 = \sqrt{2}$$

$$\theta_2 = 45^\circ$$

$$\text{and } \tan \theta_1 = \frac{24}{45} = \frac{8}{15}$$

$$\text{Now, } \tan(\theta_1 + \theta_2) = \frac{24+x}{45}$$

$$\Rightarrow \frac{\tan \theta_1 + \tan \theta_2}{1 - \tan \theta_1 \tan \theta_2} = \frac{24+x}{45}$$

$$\Rightarrow \frac{\frac{8}{15} + 1}{1 - \frac{8}{15}} = \frac{24+x}{45}$$

$$\Rightarrow \frac{23}{7} = \frac{24+x}{45}$$

$$\Rightarrow 1035 = 168 + 7x$$

$$7x = 1035 - 168 = 867$$

$$x = 123.8 \text{ m}$$

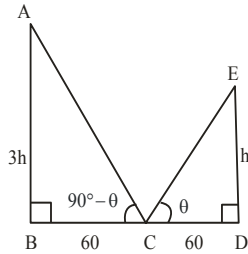
18. Sol. (d)

AB, ED = Height of the p

In $\triangle ABC$

$$\tan(90^\circ - \theta) = \frac{AB}{BC}$$

$$\Rightarrow \cot \theta = \frac{3h}{60} \Rightarrow \cot \theta = \frac{h}{20}$$



And in $\triangle CED$

$$\tan \theta = \frac{ED}{CD} = \frac{h}{60}$$

Multiply eqn. (i) and (ii)

$$\Rightarrow 1 = \frac{h^2}{60 \times 20}$$

$$\Rightarrow h^2 = 12 \times 100 \Rightarrow h = 2\sqrt{3} \times 10$$

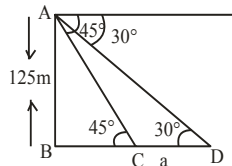
$$\Rightarrow h = 2 \times 1.732 \times 10 = 34.64$$

Height of larger pole = 3h

$$= 3(34.64) = 103.92 \text{ m}$$

19. Sol. (b)

AB = Tower



$$\text{In } \triangle ABC \tan 45^\circ = \frac{AB}{BC}$$

$$1 : \frac{AB}{BC} \Rightarrow AB : BC = 1 : 1 \quad \dots (i)$$

In $\triangle ABD$,

$$\tan 30^\circ = \frac{AB}{BD} = AB : BD = 1 : \sqrt{3} \quad \dots (ii)$$

Now,

$$BC : AB : BD$$

$$1 : 1$$

$$1 : \sqrt{3}$$

$$1 : 1 : \sqrt{3}$$

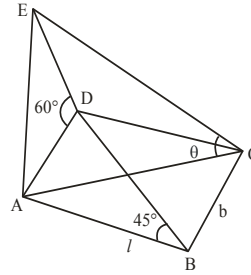
$$CD = BD = BC = (\sqrt{3} - 1) \text{ units}$$

$$AB = 1 \text{ unit} = 125 \text{ meters}$$

$$CD = (\sqrt{3} - 1) \text{ units} = 125 (\sqrt{3} - 1) \text{ meter}$$

20. Sol. (c)

Let ABCD is a rectangle of Length / and vertical tower AE is standing at the corner A.



Then, $\angle ABE = 45^\circ$ and $\angle ADE = 60^\circ$ and $\angle ACE = \theta$

From $\triangle ABE$, $AE = AB$, $\tan 45^\circ = AB = l$

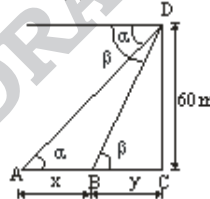
From $\triangle ADE$, $AD = AE \cdot \cot 60^\circ = \frac{l}{\sqrt{3}}$

Now, Diagonal $AC = \sqrt{(AB)^2 + (AD)^2}$

$$= \sqrt{(l)^2 + \left(\frac{l}{\sqrt{3}}\right)^2} = \frac{2l}{\sqrt{3}}$$

$$\text{Again from } \triangle ACE, \cot \theta = \frac{AC}{AE} = \frac{\frac{2l}{\sqrt{3}}}{l} = \frac{2}{\sqrt{3}}$$

21. Sol. (a)



$$\text{In } \triangle ADC, \cot \alpha = \frac{x+y}{60} \quad \dots (i)$$

$$\text{In } \triangle BCD, \cot \beta = \frac{y}{60} \quad \dots (ii)$$

From eqn. (1) and eqn. (2), we have

$$\cot \alpha = \frac{x+60\cot \beta}{60} \Rightarrow 60\cot \alpha = x + 60\cot \beta$$

$$\Rightarrow x = 60(\cot \alpha - \cot \beta)$$

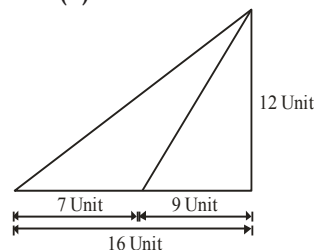
$$\Rightarrow x = 60 \left[\frac{\cos \alpha}{\sin \alpha} - \frac{\cos \beta}{\sin \beta} \right]$$

$$\Rightarrow x = 60 \left[\frac{\cos \alpha \sin \beta - \cos \beta \sin \alpha}{\sin \alpha \sin \beta} \right]$$

$$\Rightarrow x = 60 \sin(\beta - \alpha) \operatorname{cosec} \alpha \operatorname{cosec} \beta$$

$$1 \because \sin(A - B) = \sin A \cos B - \cos A \sin B$$

22. Sol. (b)



$$(3:4) \times 4 = 12:16$$

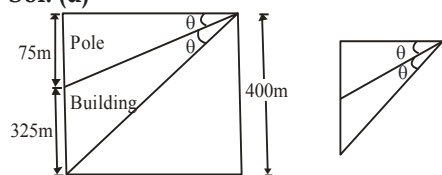
$$(4:3) \times 3 = 12:9$$

$$(7) \rightarrow 560$$

$$(1) \rightarrow 80$$

$$(12) \rightarrow 960 \text{ m}$$

23. Sol. (d)



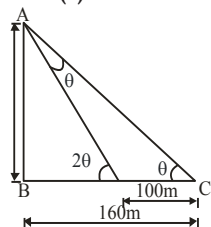
$$\tan 2\theta = \frac{400}{h} \Rightarrow \frac{2\tan \theta}{1-\tan^2 \theta} = \frac{400}{h}$$

$$\Rightarrow \frac{2 \times 75/n}{1 - \left(\frac{75}{n}\right)^2} = \frac{400}{h}$$

$$\frac{3}{8} = 1 - \left(\frac{75}{h}\right)^2 = \left(\frac{75}{h}\right)^2 = \frac{5}{8} = \frac{10}{16}$$

$$\frac{75}{n} = \frac{\sqrt{10}}{4} \Rightarrow h = \frac{300}{\sqrt{10}} = 3 \Rightarrow h = 30\sqrt{10}$$

24. Sol. (c)



In $\triangle ACD$

$$\text{Interior } \angle ACB = \angle CAD + \angle ADC$$

$$20 = \angle CAD + \theta$$

$$\angle CAD = \theta$$

$$AC = CD$$

$$AC = 100 \text{ m}$$

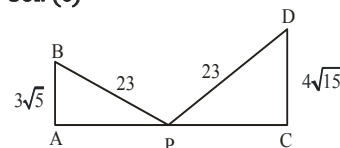
In $\triangle MBC$

$$AC = 100 \text{ m}$$

$$BC = 160 = 100 = 60 \text{ m}$$

Then $AB = 80$ on (By Pythagoras theorem)

25. Sol. (c)



Let P be the fixed point of the pole and AB and CD are two windows.,

$$\text{In } \triangle ABP, AP = \sqrt{(23)^2 - (3\sqrt{5})^2} =$$

$$\sqrt{529 - 45} = \sqrt{484} = 22 \text{ m.}$$

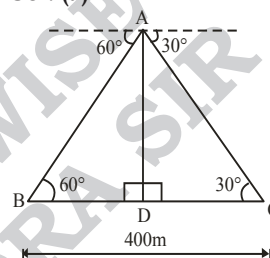
$$\text{In } \triangle DPC, PC = \sqrt{(23)^2 - (4\sqrt{15})^2}$$

$$= \sqrt{529 - 240} = \sqrt{289} = 17 \text{ m.}$$

$$\text{So, width of street} = 22 + 17 = 39$$

$$\text{So, width of street} = 22 + 17 = 39 \text{ m}$$

26. Sol. (a)



AD = Height of the aeroplane

B, C = palm trees

In $\triangle ABD$

$$\tan 60^\circ = \frac{AD}{BD} = \sqrt{3}$$

$$BD = \frac{AD}{\sqrt{3}}$$

And in $\triangle ADC$

$$\tan 30^\circ = \frac{AD}{CD} = \frac{1}{\sqrt{3}} = \frac{AD}{CD}$$

$$CD = \sqrt{3}AD$$

Now.

$$BC = BD + CD = \frac{AD}{\sqrt{3}} + \sqrt{3}AD$$

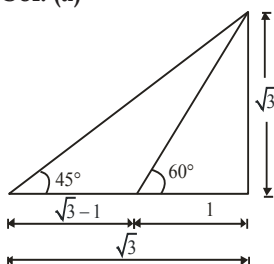
$$\Rightarrow 400 = AD \left(\frac{1}{\sqrt{3}} + \sqrt{3} \right)$$

$$\Rightarrow \frac{4AD}{\sqrt{3}} = 400$$

$$\Rightarrow AD = 100 \times \sqrt{3} = 100 \times 1.732$$

$$\Rightarrow AD = 173.2 \text{ meter}$$

27. Sol. (a)



$$\sqrt{3} - 1 \text{ unit} \rightarrow 10 \text{ min}$$

$$1 \text{ unit} \rightarrow \frac{10}{\sqrt{3}-1}$$

$$\frac{10}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1} = 5(\sqrt{3}+1)$$

$$= 5 \times 2.732$$

$$= 10 + 3.66$$

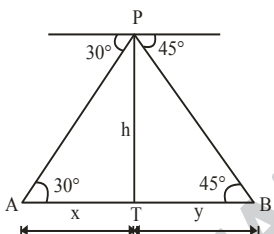
$$= 13.66 \text{ min.}$$

28. Sol. (a)

In $\triangle PBT$

$$\tan 45^\circ \frac{h}{y} = 1$$

$$y = h$$



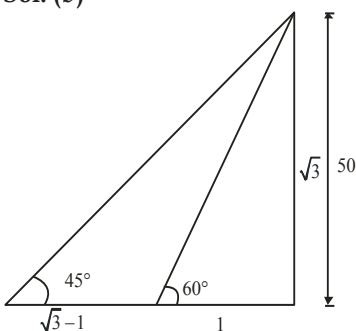
and in $\triangle PTA$

$$\tan 30^\circ = \frac{h}{x} \Rightarrow x = \sqrt{3} h \dots$$

$\therefore$ Required distance,

$$x + y = \sqrt{3}h + h = h(\sqrt{3} + 1) \text{ m}$$

29. Sol. (b)



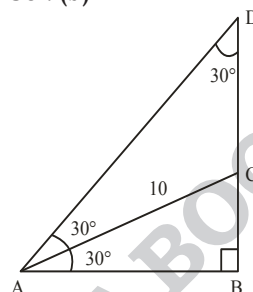
$$\sqrt{3} \rightarrow 50$$

$$1 \rightarrow \frac{50}{\sqrt{3}}$$

$$\sqrt{3} - 1 \rightarrow \frac{50}{\sqrt{3}} (\sqrt{3} - 1)$$

$$= 21.10$$

30. Sol. (b)



$$\tan 30^\circ = \frac{BC}{AB} = \frac{1}{\sqrt{3}}$$

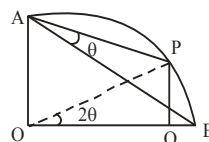
$$AC = \sqrt{1^2 + \sqrt{3}^2} = 2 \text{ units}$$

$$BC = \frac{10}{2} \times 1 = 5$$

$$\text{Height of flagstaff } BD = DC + CB = 10 + 5 = 15 \text{ m}$$

31. Sol. (c)

Join OP then,



$$\angle POB = 2\theta$$

(Angle subtended

by same arc PB)

Now in $\triangle OPQ$

$$\tan 2\theta = \frac{PQ}{OQ} = \frac{PQ}{3PQ} = \frac{1}{3}$$

$$\Rightarrow \frac{2\tan \theta}{1 - \tan^2 \theta} = \frac{1}{3}$$

$$\Rightarrow 6\tan \theta = 1 - \tan^2 \theta$$

$$\Rightarrow \tan^2 \theta + 6\tan \theta - 1 = 0$$

$$\Rightarrow \tan \theta = \frac{-6 \pm \sqrt{(6)^2 - 4(1)(-1)}}{\sqrt{10}^2}$$

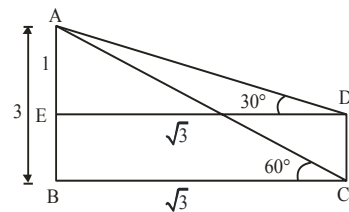
$$\Rightarrow \tan \theta = \frac{-6 \pm 2\sqrt{10}}{2}$$

$$\Rightarrow \tan \theta = -3 \pm \sqrt{10}$$

From the figure we can early observe that θ lie between 0 to 90° so $\tan \theta$ can't be negative so
 $\tan \theta = \sqrt{10} - 3$

32. Sol. (a)

Let AB and DC be the height of hill and pole respectively



ATQ, 3 unit ----- 240 m

Then 1 unit ----- $\frac{240}{3} = 80$ m

Now, the difference between the height of the pole and its distance from the hill =

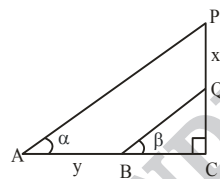
$$EB - BC = (2 - \sqrt{3}) \text{ unit} = 80(2 - \sqrt{3}) \text{ m}$$

33. Sol. (d)

PQ = height of the flag staff

CQ = Height of the tower

Let height of the tower be 'h'



In $\triangle BCQ$

$$\tan \beta = \frac{CQ}{BC}$$

$$\Rightarrow \tan \beta = \frac{h}{BC}$$

$$\Rightarrow BC = \frac{h}{\tan \beta}$$

And in $\triangle ACP$

$$\tan \alpha = \frac{PC}{AC} = \frac{PQ + QC}{AB + BC}$$

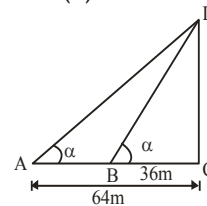
$$\Rightarrow \tan \alpha = \frac{x + h}{y + \frac{h}{\tan \beta}}$$

$$\Rightarrow y \tan \alpha + h \left(\frac{\tan \alpha}{\tan \beta} \right) = x + h$$

$$\Rightarrow h \left(\frac{\tan \alpha - \tan \beta}{\tan \beta} \right) = x - y \tan \alpha$$

$$h = \frac{x \tan \beta - y \tan \alpha \tan \beta}{\tan \alpha - \tan \beta}$$

34. Sol. (b)



Let CD = h be height of the tower.

$$\text{In } \triangle BCD, \tan \alpha = \frac{h}{36}$$

and In $\triangle ACD$,

$$\tan \beta = \frac{h}{64}$$

$$\text{But } \alpha + \beta = \frac{\pi}{2}$$

$$= \tan(\alpha + \beta) = \tan \frac{\pi}{2}$$

$$\Rightarrow \frac{\tan \alpha + \tan \beta}{1 - \tan \alpha \tan \beta} = \frac{1}{0}$$

$$\Rightarrow 1 - \tan \alpha \tan \beta = 0$$

$$= \tan \alpha \tan \beta = 1 = 1$$

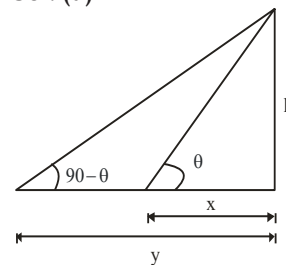
$$\tan \alpha \tan \beta = 1$$

$$\Rightarrow \frac{h}{36} \times \frac{h}{64} = 1$$

$$h^2 = 36 \times 64$$

$$h = 48 \times 64 \Rightarrow h = 6$$

35. Sol. (d)

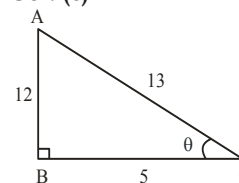


$$\tan \theta = \frac{h}{x}, \tan(90 - \theta) = \frac{h}{y}$$

$$\cot \theta = \frac{h}{y}$$

$$1 = \frac{h^2}{xy}, h^2 = xy \Rightarrow h = \sqrt{xy}$$

36. Sol. (c)



It is given that

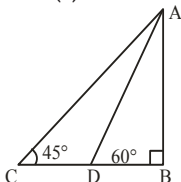
$$\cos \theta = \frac{\text{base}}{\text{hypotenuse}} = \frac{BC}{AB} = \frac{5}{13}$$

Using Pythagoras theorem, we have $AB = 12$ unit

ATQ, 12 unit $\rightarrow$ 18 m

Then, 5 unit $\rightarrow \frac{18}{12} \times 5 = 7.5$ m

37. Sol. (c)



AB = Height of the hill In $\triangle ABC$

$$\tan 45^\circ = \frac{AB}{BC}$$

$$\Rightarrow AB = BC$$

And in $\triangle ABD$

$$\tan 60^\circ = \frac{AB}{BD}$$

$$\Rightarrow \sqrt{3} = \frac{AB}{BD}$$

$$\Rightarrow BD = \frac{AB}{\sqrt{3}}$$

Now

$$CD = CB - BD = AB - \frac{AB}{\sqrt{3}}$$

$$CD = \frac{AB(\sqrt{3}-1)}{\sqrt{3}}$$

Let speed of vehicle be 's' and time taken to reach the bottom of the hill be 't'

$$BD = s \times t \text{ and } CD = s \times 10$$

$$\Rightarrow \frac{CD}{BD} = \frac{s \times 10}{s \times t} = \frac{\frac{AB(\sqrt{3}-1)}{\sqrt{3}}}{\frac{AB}{\sqrt{3}}}$$

$$\Rightarrow \frac{10}{t} = \sqrt{3} - 1$$

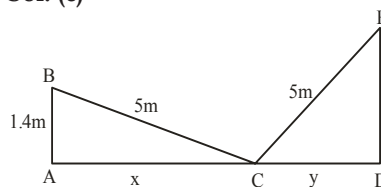
$$\Rightarrow t = \frac{10}{\sqrt{3}-1}$$

$$t = \frac{10(\sqrt{3}+1)}{2} = 5(\sqrt{3}+1)$$

$$t = 5(1.732 + 1) = 5 \times 2.732$$

$$t = 13.66 = 13 \text{ minute } 40 \text{ seconds}$$

38. Sol. (c)



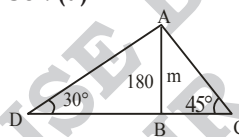
Let breadth of the room = $x + y$

$$x = \sqrt{25 - 1.96} = \sqrt{23.04} = 4.8 \text{ m}$$

$$y = \sqrt{25 - 23.04} = \sqrt{1.96} = 1.4 \text{ m}$$

$$\therefore x + y = (4.8 + 1.4) \text{ m} = 6.2 \text{ m}$$

39. Sol. (d)



In $\triangle ABC$

$$\tan 45^\circ = \frac{AB}{BC}$$

$$1 = \frac{AB}{BC} \Rightarrow AB : BC = 1 : 1$$

In $\triangle ABD$

$$\tan 30^\circ = \frac{AB}{BD}$$

$$\frac{1}{\sqrt{3}} = \frac{AB}{BD}$$

$$AB : BD = 1 : \sqrt{3}$$

Now,

$$BC : AB : BD$$

$$1 : 1$$

$$1 : \sqrt{3}$$

to make equal ratio

$$BC : AB : BD$$

$$1 : 1 : \sqrt{3}$$

$$CD = BD + BC$$

$$CD = (\sqrt{3} + 1) \text{ units}$$

$$AB = 1 \text{ unit} = 180 \text{ m}$$

$$CD = (\sqrt{3} + 1) \text{ units}$$

$$= 180(\sqrt{3} + 1) \text{ m}$$

In $\triangle ABD$

$$\tan 30^\circ = \frac{AB}{BD}$$

$$\frac{1}{\sqrt{3}} = \frac{AB}{BD}$$

$$AB: BD = 1: \sqrt{3}$$

Now,

$$BC: AB: BD$$

$$1: 1$$

$$1: \sqrt{3}$$

to make equal ratio

$$BC : AB : BD$$

$$1: 1: \sqrt{3}$$

$$CD = BD + BC$$

$$CD = (\sqrt{3} + 1) \text{ units}$$

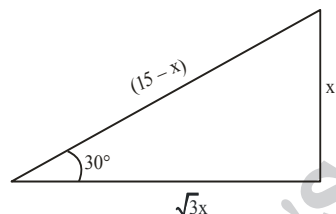
$$AB = 1 \text{ unit} = 180\text{m}$$

$$CD = (\sqrt{3} + 1) \text{ units}$$

$$= 180(\sqrt{3} + 1)\text{m}$$

40. Sol. (c)

Let the tree is broken at height x from ground



then, length of tree broken = $(15 - x)$

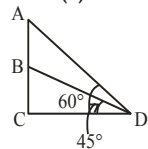
$$\text{From above triangle, } \sin 30^\circ = \frac{x}{15-x}$$

$$\Rightarrow \frac{1}{2} = \frac{x}{15-x} \Rightarrow 2x = 15 - x$$

$$3x = 15$$

$$x = 5 \text{ m}$$

41. Sol. (c)



$AC = 5000 \text{ m}$ (given) In $\triangle ACD$.

$$\tan 60^\circ = \frac{AC}{CD}$$

$$\sqrt{3} = \frac{AC}{CD} \Rightarrow AC: CD = \sqrt{3}: 1$$

In $\triangle BCD$,

$$\tan 45^\circ = \frac{BC}{CD}$$

$$1 = \frac{BC}{CD} = BC: CD = 1: 1$$

Now,

$$BC: CD \quad AC$$

$$1: \quad 1$$

$$1 \quad \sqrt{3}$$

$$1 \quad 1 \quad \sqrt{3}$$

$$-BC$$

$$AB = AC - BC$$

$$= (\sqrt{3} - 1) \text{ units}$$

$$\sqrt{3} \text{ units} = 5000 \text{ m}$$

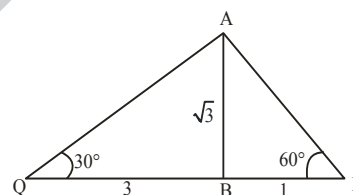
$$1 \text{ unit} = \frac{5000}{\sqrt{3}} \text{ m}$$

$$AB = (\sqrt{3} - 1) \text{ units} = \frac{5000}{\sqrt{3}} (\sqrt{3} - 1)$$

$$= 5000 \left[1 - \frac{1}{\sqrt{3}} \right] \text{ m}$$

42. Sol. (a)

As per the directions given, we have following figure:



According to the question, 4 unit - - - - -

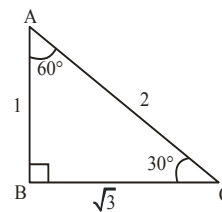
$$- - - - - 84\sqrt{3}$$

$$\text{Then, } \sqrt{3} \text{ unit} - - - - - \frac{84\sqrt{3}}{4} \times \sqrt{3} = 63$$

So, the height of pole (AB) = 63 m

43. Sol. (c)

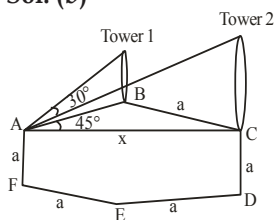
Let AB and AC be the length of wall and ladder respectively



Here, 2 unit - 22m

$$\text{Then, } 1 \text{ unit} - \frac{22}{2} = 11 \text{ m}$$

44. Sol. (b)



Let the side of regular hexagon be 'a'

Let height of the tower 1 be h_1 and tower 2 be h_2

Height of tower 1 = h_1 = (distance between A and

$$B) \cdot (\tan 30^\circ) = a \cdot \frac{1}{\sqrt{3}}$$

$$\text{Distance between A and C} = \frac{2\sqrt{3}a}{2} = \sqrt{3}a$$

Height of tower 2 = h_2 = (distance between A and

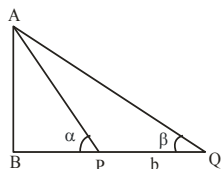
$$C) \cdot (\tan 45^\circ) = \sqrt{3}a \cdot 1 = \sqrt{3}a$$

Ratio of height of towers at B and C respectively

$$\frac{\frac{a}{\sqrt{3}}}{\sqrt{3}a} = \frac{1}{3}$$

45. Sol. (b)

Let the pole length be AB



In $\triangle ABP$, we have ;

$$\tan \alpha = \frac{AB}{BP} \Rightarrow BP = AB \cot \alpha$$

In $\triangle ABQ$, we have ;

$$\tan \beta = \frac{AB}{BQ} \Rightarrow BQ = AB \cot \beta$$

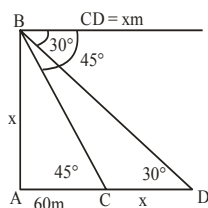
Now, $b = BQ - BP$

$$b = AB \cot \beta - AB \cot \alpha = AB(\cot \beta - \cot \alpha)$$

$$AB = \frac{b}{\cot \beta - \cot \alpha}$$

46. Sol. (a)

Let AB be a height of tower,



$$\text{In } \triangle ACB, \tan 45^\circ = \frac{AB}{AC}$$

$$\Rightarrow 1 = \frac{AB}{60} \Rightarrow AB = 60 \text{ m}$$

Now, In $\triangle ADB$,

$$\Rightarrow \tan 30^\circ = \frac{60}{60+x}$$

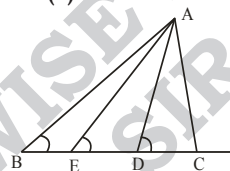
$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{60}{60+x} \Rightarrow 60+x = 60\sqrt{3}$$

$$\Rightarrow x = 60(\sqrt{3} - 1) = 60(1.73 - 1)$$

$$\therefore \text{Speed of boat} = \frac{43.8}{5} \times \frac{18}{5}$$

$$= \frac{788.4}{25} = 31.5 \text{ km/h}$$

47. Sol(a)



In $\triangle OCT$

$$\cot \theta = \frac{z}{h} \quad (1)$$

In $\triangle ACT$, $\cot \alpha$

$$= \frac{z+x}{h} = \frac{z}{h} + \frac{x}{h} \quad (2)$$

$$= \cot \theta + \frac{x}{h} \quad [\because \text{using eq(1)}]$$

$$\text{in } \triangle BCT, \cot \beta = \frac{z+y}{h} = \frac{z}{h} + \frac{y}{h}$$

$$= \cot \theta + \frac{y}{h} \quad (3)$$

From eq (2), we have

$$\cot \alpha - \cot \theta = \frac{x}{h}$$

$$h = \frac{x}{\cot \alpha - \cot \theta}$$

From eq (3), we have

$$h = \frac{y}{\cot \beta - \cot \theta} \quad (5)$$

From eq (4) and eq (5)

$$\frac{x}{\cot \alpha - \cot \theta} = \frac{y}{\cot \beta - \cot \theta}$$

$$\text{Given } \alpha = 60^\circ, \beta = 45^\circ$$

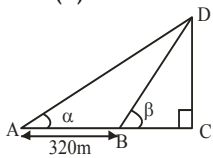
$$\frac{x}{\sqrt{3} - \cot \theta} = \frac{y}{1 - \cot \theta}$$

$$\Rightarrow x - x \cot \theta = \sqrt{3}y - y \cot \theta$$

$$\Rightarrow \cot \theta (y - x) = \sqrt{3}y - x$$

$$\Rightarrow \cot \theta = \frac{\sqrt{3}y - x}{y - x}$$

48. Sol. (b)



CD = Height of the tower

$$\text{In } \triangle ACD, \tan \alpha = \frac{CD}{AC}$$

$$\Rightarrow \frac{8}{15} = \frac{CD}{AC}$$

$$\Rightarrow AC = \frac{15}{8} CD$$

And in $\triangle BCD$

$$\tan \beta = \frac{CD}{BC} \Rightarrow \frac{24}{7} = \frac{CD}{BC}$$

$$\Rightarrow BC = \frac{7CD}{24}$$

Now, $AB = AC - BC$

$$\Rightarrow 380 = \frac{15}{8} CD - \frac{7CD}{24}$$

$$\Rightarrow 380 = \frac{38CD}{24}$$

$$CD = 240\text{m}$$

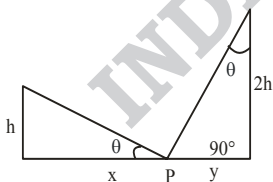
49. Sol. (C)

$$(c) \tan \theta = \frac{h}{x}$$

$$\tan(90^\circ - \theta)$$

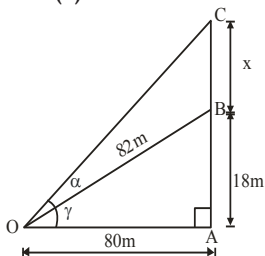
$$= \cot \theta = \frac{2h}{y}$$

$$\Rightarrow \tan \theta = \frac{y}{2h}$$



from (i) and (ii) we get $\frac{h}{x} = \frac{y}{2h} \Rightarrow 2h^2 = xy$

50. Sol. (a)



$$\text{Given } \operatorname{cosec}^{-1} \left(\frac{2}{\sqrt{3}} \right) = \alpha$$

$$\operatorname{cosec} \alpha = \frac{2}{\sqrt{3}} \Rightarrow \alpha = 60^\circ$$

$$\tan \gamma = \frac{18}{80} = \frac{9}{40}$$

$$\text{Now, } \tan(\alpha + \gamma) = \frac{18+x}{80}$$

$$\Rightarrow \frac{\tan \alpha + \tan \gamma}{1 - \tan \alpha \tan \gamma} = \frac{18+x}{80}$$

$$\Rightarrow \frac{40\sqrt{3} + 9}{40 - 9\sqrt{3}} = \frac{18+x}{80}$$

$$\Rightarrow 3200\sqrt{3} + 720$$

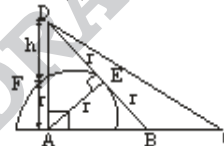
$$= 720 - 162\sqrt{3} + 40x - 9x\sqrt{3}$$

$$\Rightarrow 3362\sqrt{3} = x(40 - 9\sqrt{3})$$

$$\Rightarrow x = \frac{3362\sqrt{3}}{40 - 9\sqrt{3}} = \frac{5816.26}{24.43}$$

$$x = 238.07 \text{ m}$$

51. Sol. (a)



Given that after moving a distance d toward the door when the flag is just visible, the elevation is 45°

$\therefore DB$ is tangent

And $\angle DBA = 45^\circ$

$\therefore DB$ is tangent and AE is radius

$\therefore \angle EAB = 45^\circ \Rightarrow AE = BE = r$

$[\angle EAB = \angle EBA = 45^\circ]$

$\therefore \angle DAB = 90^\circ \& \angle EAB = 45^\circ$

$\Rightarrow \angle DAE = 45^\circ \Rightarrow \angle ADE = 45^\circ$

$\Rightarrow AE = DE = r$

$$\text{In } \triangle DAB, \tan 45^\circ = \frac{(h+r)}{AB} \Rightarrow AB = h + r$$

Again in triangle DAB , by Pythagoras theorem.

$$(z)^2 = (h + r)^2 + (h + r)^2$$

$$4r^2 = 2(h + r)^2$$

$$2r^2 = (h + r)^2 \Rightarrow h + r = \sqrt{2}r$$

$$h = (\sqrt{2} - 1)r$$

$$h = \sqrt{2} - 1$$



STATISTICS

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Statistics

1. What is the difference of mean and median of the given data?

दिए गए आंकड़ों के माध्य एवं माधिका में क्या अंतर है?

4, 13, 8, 15, 9, 21, 18, 23, 35, 1 ?

SSC MTS 2023 (Shift- 01)

- (a) 0.7 (b) 1.7
(c) 1.2 (d) 2.1

2. Find the difference between the median of data 19, 25, 59, 48, 35, 31, 30, 32, 51, and when 25 is replaced by 52 ?

डेटा 19, 25, 59, 48, 35, 31, 30, 32, 51 के माध्यक के बीच अंतर ज्ञात करें, और जब 25 को 52 से प्रतिस्थापित किया जाता है?

- (a) 32 (b) 35
(c) 3 (d) 5

3. What is the median of the data given below?

नीचे दिए गए डेटा का माधिका क्या है?

Class interval	Frequency
0-20	17
20-40	28
40-60	32
60-80	24
80-100	19

- (a) 49.375 (b) 50.084
(c) 48.166 (d) 49.75

4. For the data set 1, 2, 3, 5, 2, 3, 4, 6, 6, 8, 3, 4, 5 which of the following options is INCORRECT?

डेटा सेट 1, 2, 3, 5, 2, 3, 4, 6, 6, 8, 3, 4, 5 के लिए निम्नलिखित में से कौन-सा विकल्प गलत है?

- (a) Median > Mode (b) Mean = Median
(c) Mode < Mean (d) Mean = Mode

5. What is the mode of the given data?

दिए गए डेटा का बहुलक ज्ञात कीजिए।

5, 7, 9, 7, 3, 7, 7, 6, 7

SSC CGL TIER- II 07/03/2023

- (a) 7 (b) 6
(c) 5 (d) 3

6. If the arithmetic mean of the series x_1, x_2, x_n is 1, then what will be the arithmetic mean of $\frac{x_1}{k}, \frac{x_2}{k}, \frac{x_3}{k}, \dots, \frac{x_n}{k} (k > 0)$?

यदि श्रृंखला $x_1, x_2, \dots, x_n$ का अंकगणितीय माध्य 1 है, तो $\frac{x_1}{k}, \frac{x_2}{k}, \frac{x_3}{k}, \dots, \frac{x_n}{k} (k > 0)$ का अंकगणितीय माध्य क्या होगा?

- (a) $\frac{1}{k}$ (b) K
(c) $\frac{2}{k}$ (d) 2k

7. What is the mode of the data given below? नीचे दिए गए डेटा का बहुलक क्या है?

Class interval	Frequency
0-10	2
10-20	5
20-30	6
30-40	5
40-50	2

- (a) 25.5 (b) 24
(c) 26.66 (d) 25

8. The mean of the prime numbers between 20 and 45 is:

SSC MTS 11/10/2021 (Evening)

- (a) 36 (b) 34
(c) 24 (d) 32

9. Find mode of the following

निम्न का बहुलक ज्ञात कीजिए।

$z^3, x, y, z, x^2, x^3, y^3, z^3, x^2, ax^2, x^2, xy^2, bx^3, z^2, x^2, x^3, y, ax^2, ax^2, bx^3, ax^2, bx^3, x^3, x^2, y$

- (a) ax^2 (b) x^2
(c) zx^2 (d) bx^3

10. The arithmetic mean of the following data is 23, 17, 20, 19, 21

निम्नलिखित संख्याओं का अंकगणितीय/समांतर माध्य _____ होगा।

23, 17, 20, 19, 21

SSC CGL TIER - II 02/03/2023

- (a) 20 (b) 19
(c) 23 (d) 21
11. The mean and standard deviation of 100 observations were calculated as 40 and 5.1 respectively by a student who took 50 instead of 40 for one observation. What is the correct mean and standard deviation?

एक छात्र द्वारा 100 प्रेक्षणों के माध्य और मानक विचलन की गणना क्रमशः 40 और 5.1 के रूप में की गई, जिन्होंने एक प्रेक्षण के लिए 40 के बजाय 50 लिया। सही माध्य और मानक विचलन क्या है?

- (a) 39.9, 5 (b) 39.09, 5
(c) 39.9, 50 (d) 39.0, 5

12. The sum of deviation of n numbers from 10 and 20 are a, b respectively. If $\frac{b}{a} = -4$, then what is the mean of these numbers?

10 और 20 से n संख्याओं के विचलन का योग क्रमशः a, b है। यदि $\frac{b}{a} = -4$ तो इन संख्याओं का माध्य क्या है?

[CDs 2023]

- (a) 12 (b) 14
(c) 16 (d) 18

13. Find the least common multiple of mode, median and mean of the data given below?

निचे दिए गए आकड़ों के बहुलक, मधिका और माध्य का लघुतम समापर्वतक ज्ञात कीजिये?

7, 2, 10, 4, 3, 12, 8, 4, 6, 4

- (a) 30 (b) 20
(c) 12 (d) 60

14. The marks obtained by 15 students out of a maximum of 25 in a test are given as 13, 11, 16, 15, 18, 12, 13, 14, 10, 22, 15, 21, 20, 17 and 24. Find the product of the modes of this set of data.

एक परीक्षा में पूर्णांक 25 में से 15 विद्यार्थियों द्वारा प्राप्त अंक 13, 11, 16, 15, 18, 12, 13, 14, 10, 22, 15, 21, 20, 17 और

24 है। आकड़ों के इस समुच्चय के बहुलकों का गुणनफल ज्ञात कीजिए।

SSC CGL TIER II 26/10/2023

- (a) 182 (b) 192
(c) 195 (d) 210

15. If the ratio of the mean and median of a certain data is 4: 5, then the ratio of its mode and mean is?

यदि एक निश्चित आँकड़ों के माध्य और माधिका का अनुपात 4: 5 है, तो उसके बहुलक और माध्य का अनुपात कितना है?

- (a) 7: 5 (b) 6: 5
(c) 8: 5 (d) 7: 4

16. The mean weight of 100 students in a class is 46 kg. The mean weight of boys is 50 kg and that of girls is 40 kg. The number of boys exceeds the number of girls by

[CDS-2020-II]

- (a) 10 (b) 15
(c) 20 (d) 25

17. Find the mode for the given distribution (rounded off to two decimal places).

दिए गए बटन का बहुलक ज्ञात कीजिए (दो दशमलव स्थान पूर्णांकित)

SSC CGL TIER - II 02/03/2023

Class Interval	5-10	10-15	15-20	20-25	25-30	30-35
Frequency	8	7	6	9	11	10

- (a) 35.25 (b) 40.25
(c) 30.33 (d) 28.33

18. Find the arithmetic mean of the following frequency distribution by the assumed mean method:

कल्पित माध्य विधि द्वारा निम्नलिखित बारंबारता बंटन का समांतर माध्य ज्ञात कीजिए:

Class Interval	50-150	150-250	250-350	350-450	450-550
Frequency	16	10	22	15	12

- (a) 290 (b) 296
(c) 285 (d) 250

19. What is the mean deviation about median of the following distribution:

38, 70, 48, 34, 63, 42, 55, 44, 53, 47

निम्नलिखित वितरण के माधिका के सापेक्ष माध्य विचलन क्या है:

- (a) 8.4 (b) 5.4
(c) 5.2 (d) 5.3

20. 10 is the mean of a set of 7 observations and 5 is the mean of another set of 3 observation The mean of the combined set is:

7 प्रेक्षणों के समुच्चय का माध्य 10 है और 3 प्रेक्षणों दूसरे समुच्चय का माध्य 5 है। संयुक्त समुच्चय का मान क्या है?

- (a) 8.5 (b) 7.5 (d) 10
(c) 15

21. Find the mean of the following data: निम्नलिखित डेटा का माध्य ज्ञात कीजिए?

X	19	21	23	25	27	29	31
F	13	15	16	18	16	15	13

- (a) 20 (b) 30
(c) 28 (d) 25

22. If mode of the following data is 14, then what is the value of k?

यदि निम्न आंकड़ों का बहुलक 14 है, तो k का मान ज्ञात करें।

11, k, 8, 9, (k - 1), 11, 12, 12, 15, (k-1), 14

MTs 2020

- (a) 13 (b) 11
(c) 15 (d) 12

23. What is the algebraic sum of the deviation from the mean of a set of values 25, 65, 73, 75, 83, 76, 17, 17, 14?

मानों 25, 65, 73, 75, 83, 76, 17, 15, 7, 14 के एक समुच्चय माध्य से लिए गए विचलनों का बीजीय योगफल क्या है?

- (a) -1 (b) 0
(c) 1 (d) 2

24. The mean of 12, 13, 15, 18, X, 28, 18, 12, 6, 8 is 15. What is the median of the data?

12, 13, 15, 18, X, 28, 18, 12, 6, 8 का माध्य 15 है। आकड़ों की माधिका क्या है?

- (a) 14.5 (b) 13.5
(c) 14 (d) 13

25. Find the mode if mean and median are 4 and 5 respectively.

यदि माध्य और माधिका क्रमशः 4 और 5 हैं तो बहुलक ज्ञात कीजिए।

NTPC 05/02/2021 (Shift-01)

- (a) 9 (b) 7
(c) 11 (d) 5

26. The mode for the above grouped frequency distribution is-

उपरोक्त वर्गीकृत बारम्बारता बंटन के लिए बहुलक है-

Category	Frequency
0-10	6
10-20	$10f_1$
20-30	$20f$
30-40	$5f_2$
40-50	2

- (a) 25 (b) 26
(c) 24 (d) 29

27. The mean of 10 numbers is 0. If 38 and -2 are included in these numbers, the new mean will be:

Higher Secondary 02/08/2022 (Shift - 2)

- (a) 6 (b) 18
(c) 0 (d) 3

28. What is the range of the distribution of a variable which takes the ten values:

निम्नलिखित दस मानों वाले एक चर के वितरण का परास क्या होगा?

17, 18, 27, 11, 24, 21, 34, 21, 17, 32?

(MTS 2020)

- (a) 23 (b) 17
(c) 21 (d) 15

29. The median of the following numbers arranged in ascending order is 2.5, if so find x?

आरोही क्रम में व्यवस्थित निम्नलिखित संख्याओं की माधिका 2.5 है, तो x ज्ञात कीजिए?

0, 0, 1, 1, 2, 2, X, 3, 3, 4, 5, 7

RRB NTPC 2016

- (a) 2 (b) 3

- (c) 4 (d) 0

30. Fifteen candidates appeared in an examination. The marks of the candidates who passed in the examination are 9, 6, 7, 8, 8, 8, 9, 6, 5, 4 and 7. What is the median of marks of all the fifteen candidates?

पंद्रह अभ्यर्थी एक परीक्षा में बैठते हैं। जिन अभ्यर्थियों ने परीक्षा उत्तीर्ण की उनके अंक 9, 6, 7, 8, 8, 8, 9, 6, 5, 4 और 7 हैं। सभी पंद्रह अभ्यर्थियों के अंकों की माधिका क्या है?

- (a) 6 (b) 6.5
(c) 7 (d) 7.5

31. The following table gives a frequency distribution whose arithmetic mean is 33. Find the product of the possible values of K from the distribution.

निम्न तालिका एक बारंबारता बंटन दर्शाती है जिसका समान्तर माध्य 33 है। बंटन से K के संभावित मानों का गुणनफल ज्ञात कीजिए।

Value (x)	Frequency (f)
29	4
30	3
30+K	3 K
34	2
62	1

- (a) 4 (b) 3
(c) 5 (d) 2

32. What is the median of the data 3, 5, 9, 4, 6, 11, 18 ?

[CDS-2020-1]

- (a) 6 (b) 6.5
(c) 7 (d) 7.5

33. A set of data presented in the form of a frequency distribution table with class intervals and their respective frequencies had a mode of 48.5. The lower boundary of the modal class was 46.5 ; the frequency of the modal class was 34 ; the frequency of the class interval just preceding the modal class was 32 and the frequency of the class interval just succeeding the modal class was 25 . What was the width of the modal class?

वर्ग अंतराल और उनकी संबंधित बारंबारताओं वाले बारंबारता बंटन सारणी के रूप में प्रस्तुत आँकड़ों के एक समुच्चय का बहुलक 48.5 था। बहुलक वर्ग की निचली सीमा 46.5 थी; बहुलक वर्ग की बारंबारता 34 थी; बहुलक वर्ग से ठीक पहले

वाले वर्ग अंतराल की बारंबारता 32 थी और बहुलक वर्ग के ठीक बाद वाले वर्ग अंतराल की बारंबारता 25 थी। बहुलक वर्ग की चौड़ाई (Width) क्या थी?

SSC CGL TIER II 26/10/2023

- (a) 11 (b) 10
(c) 12 (d) 10.5

34. The median of the data $-3, 4, 0, 4, -2, -5, 1, 7, 10, 5$ is?

आँकड़ों $-3, 4, 0, 4, -2, -5, 1, 7, 10, 5$ की माधिका क्या है?

RRB NTPC 2016

- (a) 2 (b) 2.5
(c) 2.75 (d) 3

35. DIRECTIONS: Read the following frequency distribution for two series of observations and answer the two items that follow

[CDS-2019-11]

	Class interval	Frequency
	Series-I	Series-II
10-20	20	4
20-30	15	8
30-40	10	4
40-50	X	2x
50-60	Y	y
Total	100	100

- (i) What is the mean of frequency distribution of Series-I ?

- (a) 33.6 (b) 35.6
(c) 37.6 (d) 39.6

- (ii) What is the mode of frequency distribution of Series-II ?

- (a) 26 (b) 36
(c) 46 (d) 56

36. Find the mean deviation about mean 5, 8, 6, 13, 19, 23, 17

- (a) $\frac{32}{7}$ (b) $\frac{20}{7}$
(c) $\frac{40}{7}$ (d) $\frac{36}{7}$

37. What is the arithmetic mean of the first ten composite numbers?

[CDS-2021-1]

- (a) 8.5 (b) 9.5
(c) 10.2 (d) 112

38. The median of set of 11 different observations is 17.5. If each of the largest 5 observations of the set is increase by 3, then the median of new set?

11 भिन्न प्रेक्षणों के समुच्चय की माधिका 17.5 है। यदि समुच्चय के 5 सबसे बड़े प्रेक्षणों में से प्रत्येक को 3 से बढ़ा दिया जाए, तो नए समुच्चय की माधिका क्या है?

- (a) Is 3 times the original
(b) Is decreased by 3
(c) Is increased by 3
(d) Remains the same as of the original set

39. Find the variance and standard deviation 57, 64, 43, 67, 49, 59, 44, 47, 61, 59

- (a) 43.2, 7.2 (b) 29.3, 7.13
(c) 66.2, 8.13 (d) 59.3, 77.7

40. Marks scored by a student in different subjects are given in the table below

Subjects	Marks obtained out of 100
English	55
Hindi	90
Mathematics	75
Science	80
Foreign language	90

Five marks are to be deducted from each subject due to shortage of attendance. The net average of

the mean, median and mode of the marks obtained is

SSC CPO 09/11/2022 (Morning)

- (a) 79.33 (b) 77.67
(c) 82.66 (d) 73

41. The median of the following data will be _____
निम्नलिखित संख्याओं की माधिका होगी।

32, 25, 33, 27, 35, 29 and 30

SSC CGL TIER- II 03/03/2023

- (a) 32 (b) 27
(c) 30 (d) 29

42. If the mean of the observation set $x_1, x_2, \dots, x_{10}$ is 20, what will be the mean of $x_1 + 4, x_2 + 8, \dots, x_{10} + 40$? यह अवलोकन सेट $x_1, x_2, \dots, x_{10}$ का माध्य 20 है, तो $x_1 + 4, x_2 + 8, \dots, x_{10} + 40$ का माध्य क्या होगा?

- (a) 34 (b) 32 (d) 52
(c) 42

43. The median of observations $k - \frac{3}{2}, k + 2, k - 1, k + 4, k + \frac{1}{2}, k - 3, k + 4\frac{1}{2}$ is प्रेक्षणों $k - \frac{3}{2}, k + 2, k - 1, k + 4, k + \frac{1}{2}, k - 3, k + 4\frac{1}{2}$ की माधिका ज्ञात कीजिए।

NTPC 01/04/2021 (Shift-03)

- (a) $k - \frac{3}{2}$ (b) $k + \frac{1}{2}$
(c) $k - 1$ (d) $k + 2$

Statistics ANSWER KEY

1	A	2	C	3	D	4	D	5	A	6	A	7	D
8	*	9	A	10	A	11	A	12	A	13	D	14	C
15	D	16	C	17	D	18	B	19	A	20	A	21	D
22	C	23	B	24	C	25	B	26	C	27	D	28	A
29	B	30	A	31	D	32	A	33	A	34	B	35	C
36	C	37	D	38	D	39	C	40	B	41	C	42	C
43	*												

(Statistics) Solution

1. Sol. (a)

Given data is :

4, 13, 8, 15, 9, 21, 18, 23, 35, 1

Let the first arrange the data in ascending order.

1, 4, 8, 9, 13, 15, 18, 21, 23, 35

For mean, we need to find the average of give data

$$= \frac{\text{Total sum}}{\text{Total number}} = \frac{147}{10} = 14.7$$

Now, Median is half of sum of middle two values'

$$\Rightarrow \frac{13+15}{2} = 14$$

$$\therefore \text{Difference} = 14.7 - 14 = 0.7$$

2. Sol: (c)

Arrange in ascending order

Case I

19, 25, 30, 31, 32, 35, 48, 51, 59

Median = 32

Case II

19, 30, 31, 32, 35, 48, 51, 52, 59

Median = 35

Required difference = 35 - 32 = 3

3. Sol. (d)

Class interval	Frequency	C.F
0-20	17	17
20-40	23	45
40-60	32	77
60-80	24	101
80-100	19	120

$$\frac{N}{2} = 60, L = 40, F = 32, C.F = 45, H = 20$$

$$\text{Median} = L + \frac{\left(\frac{N}{2} - C.F\right)}{F} \times H$$

$$= 40 + \frac{(60 - 45)}{32} \times 20$$

$$= 40 + \frac{15}{32} \times 20 = 40 + \frac{75}{8} = 49.75$$

4. Sol. (d)

Firstly arrange in ascending order -.. 1, 2, 2, 3, 3, 3, 4, 4, 5, 5, 6, 6, 8

Where, mean = $\frac{52}{13} = 4$, mode = 3, median = 7 th digit = 4, Option (d) is incorrect.

5. Sol. (a)

7 → 5 times

6. Sol. (a)

A.T.Q,

$$\frac{x_1 + x_2 + x_3 + \dots + x_n}{n} = 1$$

Then,

$$x_1 + x_2 + x_3 + \dots + x_n = n$$

$$\text{Mean of } \frac{x_1}{k}, \frac{x_2}{k}, \frac{x_3}{k}, \frac{x_4}{k}, \dots, \frac{x_n}{k}$$

$$\Rightarrow \frac{(x_1 + x_2 + x_3 + x_4 + \dots + x_n)}{n} \times \frac{1}{k}$$

$$\Rightarrow \frac{n}{n} \times \frac{1}{k} = \frac{1}{k}$$

7. Sol. (d)

Class Interval	Frequency
0-10	2
10-20	5-f ₀
20-30	6-f ₁
30-40	5-f ₂
40-50	2

$$L = 20, H = 10$$

We know

$$\text{Mode} = L + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times H$$

$$= 20 + \left(\frac{1}{12 - 5 - 5} \right) \times 10$$

$$= 20 + \frac{10}{2} = 25$$

8. Sol. (b)

Prime numbers between 20 and 45 are :

23, 29, 31, 37, 41, 43

$$\text{Mean} = \frac{23+29+31+37+41+43}{6} = \frac{204}{6} = 34$$

9. Sol. (a)

Mode = highest occurring number

Which in given question is: ax^2 (4 times)

10. Sol (a)

23, 17, 20, 19, 21

$$\text{avg.} +3 - 3 \ 0 \ -1 + 1 = 0$$

$$= 20$$

11. Sol. (a)

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

$$\sum x = n\bar{x} = 100 \times 40 = 4000$$

$$\sigma_x^2 \frac{1}{n} \sum_{i=1}^n x_i^2 - (\bar{x})^2 = 100(26.01 + 1600) = 162601$$

$$\text{Corrected } \sum x_i = 4000 - 50 + 40 = 3990$$

$$\text{Corrected } \sum x_i^2 = 162601 - (50)^2 + (40)^2 = 161701$$

$$\text{So corrected mean} = \frac{3990}{100} = 39.9$$

$$\text{Corrected } \sigma_x^2 = \frac{161701}{100} - (39.9)^2 = 25$$

$$\text{Corrected standard deviation} = 5$$

12. Sol: (a)

Let numbers be

$$x_1, x_2, \dots, x_n$$

$$\text{then, } x_1 + x_2 + \dots + x_n = 10n + a$$

And

$$x_1 + x_2 + \dots + x_n = 20n + b$$

$$\Rightarrow 10n + a = 20n + b$$

$$\Rightarrow 10n = a - b$$

Also,

$$b = -4a$$

$$\therefore 10n = 5a$$

$$\Rightarrow n = \frac{a}{2}$$

$$\therefore \text{Mean} = \frac{x_1 + x_2 + \dots + x_n}{n}$$

$$= \frac{5a + a}{\frac{a}{2}} = \frac{6a \times 2}{a} = 12$$

13. Sol. (d)

Series in ascending order 2, 3, 4, 4, 4, 6, 7, 8, 10, 12

$$\text{Median} = \frac{4+6}{2} = 5$$

$$\text{Mode} = 4$$

$$\text{Mean} = \frac{60}{10} = 6$$

$$\text{Required LCM} = 5, 4, 6 = 60$$

14. Sol. (c)

13, 11, 16, 15, 18, 12, 13, 14, 10, 22, 15, 21, 20, 17, 24

$$\text{Mode} = 13, 15$$

$$\text{Product of the modes} = 195$$

15. Sol. (d)

$$\text{Mode} = 3 \text{ Median} - 2 \text{ Mean}$$

$$\text{Mode} = 3 \times 5 - 2 \times 4$$

$$\text{Mode} = (15 - 8) = 7$$

$$\text{Required ratio} = 7:4$$

16. Sol. (c)

Let number of boys and girls in the class are m and $(100 - m)$ respectively.

$$\text{Then, } 100 \times 46 = 50m + 40(100 - m)$$

$$\Rightarrow 600 = 10m \Rightarrow m = 60$$

$$\therefore \text{Number of boys} = m = 60$$

$$\text{Number of girls} = n = 100 - 60 = 40$$

$$\text{Difference, } m - n = 60 - 40 = 20.$$

17. Sol. (d)

$$f = 11, l = 25, f_1 = 9, h = 5, f_2 = 10$$

$$\text{Mode} = l + \left(\frac{f - f_1}{2f - f_1 - f_2} \right) \times h$$

$$= 25 + \left(\frac{2}{22 - 9 - 10} \right) \times 5$$

$$= 25 + \frac{2 \times 5}{3} = 25 + \frac{10}{3}$$

$$= 25 + 3.33 = 28.33$$

18. Sol. (b)

	-200	-100	0	+100	+200
Avg.	100	200	300	400	500
Data	16	10	22	15	12

$$\text{Days} = \frac{3200 - 1000 + 500 + 2400}{75}$$

$$= -\frac{300}{75} = 4$$

$$\text{Avg.} = 300 - 4 = 296$$

19. Sol. (a)

Mean deviation from median = Sum of absolute values of

$$= \frac{\text{Deviations from median}}{\text{Number of observation}}$$

Now,

arrange in ascending order

$$34, 38, 42, 44, 47, 48, 53, 55, 63, 70,$$

$$\Rightarrow \text{Median} = 47.5$$

Now,

absolute deviation:-

$$|34 - 47.5|, |38 - 47.5|, |42 - 47.5|, |44 - 47.5|, |47 - 47.5|, |48 - 47.5|, |53 - 47.5|, |55 - 47.5|, |63 - 47.5|, |70 - 47.5|$$

$$13.5, 9.5, 9.5, 3.5, 0.5, 0.5, 5.5, 7.5, 15.5, 22.5$$

Now,

$$\text{M. D(M)}$$

$$= \frac{13.5 + 9.5 + 5.5 + 3.5 + 0.5 + 0.5 + 5.5 + 7.5 + 15.5 + 22.5}{10} = 8.4$$

20. (a)

$$\text{Mean} = 7 \text{ observation} = 10$$

$$\text{Sum} = 7 \times 10 = 70$$

$$\text{Mean of 3 observation} = 5$$

$$\text{Sum} = 3 \times 5 = 15$$

$$\text{Mean of all observation together} = \frac{70 + 15}{10} = 8.5$$

21. Sol. (d)

X	f	fx
19	13	247
21	15	315
23	16	368
25	18	450
27	16	432
29	15	435
31	13	403

$$\Sigma f = 16 \quad \Sigma fx = 2650$$

$$\text{Mean} = \frac{2650}{106} = 25$$

22. Sol. (c)

Given that

11, k, 8, 9, (k - 1), 11, 12, 12, 15, (k - 1), 14

Mode = 14

K - = 14

K = 15

23. Sol. (b)

Given that,

25, 65, 73, 75, 83, 76, 17, 15, 7, 14

$$\begin{aligned}\text{Mean}(\bar{x}) &= \frac{25+65+73+75+83+76+17+15+7+14}{10} \\ &= \frac{450}{10} = 45\end{aligned}$$

Mean deficit = (25 - 45), (65 - 45), (73 - 45), (75 - 45), (83 - 45), (76 - 45), (17 - 45), (15 - 45), (7 - 45), (14 - 45)

$$= -20 + 20 + 28 + 30 + 38 + 31 + 28 - 30 - 38 - 31 = 0$$

24. Sol. (c)

A.T.Q

$$\Rightarrow \frac{12+13+15+18+x+28+18+12+6+8}{10} = 15$$

$$\Rightarrow \frac{x+130}{10} = 15$$

x = 20

Series in ascending order

6, 8, 12, 12, 13, 15, 18, 18, 20, 28

$$\text{Median} = \frac{13+15}{2} = 14$$

25. Sol. (b)

Mean = 4

Median = 5

Mode = 3 median - 2 mean

$$= 3 \times 5 - 2 \times 4 = 7$$

26. Sol. (c)

$$\text{Mode} = l + \left(\frac{f_1 - f_1}{2f_1 - f_1 - f_2} \right) \times h$$

$$= 20 + \left(\frac{10}{40-10-5} \right) \times 10$$

$$= 20 + \frac{210 \times 102}{288} = 24$$

27. Sol. (d)

Mean of 10 numbers = 0

Sum of 10 numbers = 0

When 38 and -2 are included in these numbers then sum of 12 numbers = 0 + 38 - 2 = 36

$$\text{Mean of 12 numbers} = \frac{36}{12} = 3$$

28. Sol. (a)

$$\text{Range} = 34 - 11 = 23$$

29. Sol. (b)

Series, 0, 0, 1, 1, 2, 2, x, 3, 3, 4, 5, 7

$$\text{Median} = \frac{2+x}{2} = \frac{5}{2} x = 3$$

30. Sol. (a)

Let,

Marks of failed student, respectively = a, b, c, d

A.T.Q,

Marks in ascending order

a, b, c, d, 4, 5, 6, 6, 7, 7, 8, 8, 8, 9, 9

Median = 6

31. Sol. (d)

Mean = 33

$$33 = \frac{(29 \times 4) + (30 \times 3) + (30 + K)3K + (34 \times 2) + (62 \times 1)}{4 + 3 + 3K + 2 + 1}$$

$$33 = \frac{116 + 90 + 90K + 3K^2 + 68 + 62}{10 + 3K}$$

$$\Rightarrow 336 + 90K + 3K^2 = 330 + 99K$$

$$\Rightarrow 3K^2 - 9K + 6 = 0$$

$$\Rightarrow K^2 - 3K + 2 = 0$$

$$\Rightarrow K^2 - 2K - K + 2 = 0$$

$$\Rightarrow K(K - 2) - 1(K - 2) = 0$$

$$\Rightarrow (K - 2)(K - 1) = 0$$

$$\therefore K = 2, 1$$

$$\therefore \text{required answer} = 2 \times 1 = 2$$

32. Sol. (a)

Arrange the number ascending order
3, 4, 5, 6, 9, 11, 18

Therefore 4th term out of 7 is Median.

$$\therefore \text{Median} = 6$$

33. Sol. (a)

$$\text{Mode} = 48.5, l = 46.5, f_1 = 34, f_0 = 32, f_2 = 25$$

We know,

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

$$48.5 = 46.5 + \left(\frac{34 - 32}{68 - 25 - 32} \right) \times h$$

$$48.5 = 46.5 + \left(\frac{2}{11} \right) \times h$$

$$2 = \frac{2}{11} \times h$$

$$h = 11$$

34. Sol. (b)

Arrange in ascending order

-5, -3, -2, 0, 1, 4, 4, 5, 7, 10

$$\text{Median} = \frac{1+4}{2} = 2.5$$

35. (i) Sol. (c)

$$x + y = 100 - (20 + 15 + 10) = 55$$

$$2x + y = 100 - (4 + 8 + 4) = 84$$

$$\Rightarrow x = 29 \text{ and } y = 26$$

Max. of freq. distribution of series I

$$= \frac{(15 \times 20) + (25 \times 15) + (35 \times 10) + (45 \times 29) + (55 \times 26)}{100}$$

$$= \frac{(300 + 375 + 350 + 1305 + 1430)}{100} = \frac{3760}{100} = 37.6$$

36. Sol. (c)

$$\text{Mean} = \frac{5+8+6+13+19+23+17}{7}$$

$$\text{Mean} = \frac{91}{7} = 13$$

We know,

$$\text{M.D} = \frac{\sum |x_i - \bar{x}|}{n}$$

$$\frac{8+5+7+0+6+10+4}{7} = \frac{40}{7}$$

37. Sol. (d)

First ten composite numbers are

4, 6, 8, 9, 10, 12, 14, 15, 16 and 18

$$\text{Mean} = \frac{1}{10} [4 + 6 + 8 + 9 + 10 + 12 + 14 + 15 + 16 + 18] = 11.2$$

38. Sol. (d)

Median of set of n observations

$$\left[\frac{(n+1)}{2} \right]^{\text{th}} \text{ observation}$$

$$\Rightarrow \left[\frac{(11+1)}{2} \right] = 6^{\text{th}} \text{ observation is not changed}$$

 $\therefore$ The median of the new set remains the same.

39. Sol. (c)

$$\text{Mean}(x) = \frac{550}{10} = 55$$

We know,

$$\text{Variance } (\sigma^2) = \frac{1}{n} (x_i - \bar{x})^2$$

Variance (σ^2)

$$= \frac{(2^2 + 9^2 + 12^2 + 12^2 + 6^2 + 4^2 + 11^2 + 8^2 + 6^2 + 4^2)}{10}$$

$$= \frac{662}{10} = 66.2$$

We know

$$\text{S.D} = \sqrt{\sigma^2}$$

$$\text{then, S.D} = \sqrt{66.2} = 8.13$$

40. Sol. (b)

Subjects	After deduction
English	50
Hindi	85
Mathematics	70
Science	75
Foreign language	85

$$\text{Mean} = \frac{50+85+70+75+85}{5} = \frac{365}{5} = 73$$

Mode = 85 (as it is repeated 2 times)

Arranging it in ascending order, we have.

50, 70, 75, 85, 85.

Since, there are 5 values. so, the middle value i.e. 75 is median

$$\text{Net average of mean, median, mode} = \frac{73+75+85}{3} = \frac{233}{3} = 77.67$$

41. Sol. (c)

25, 27, 25, 30, 32, 33, 35

Arrange in ascending order = 30

42. Sol. (c)

A.T.Q,

$$\frac{x_1 + x_2 + x_3 + x_4 + \dots + x_{10}}{10} = 20$$

$$x_1 + x_2 + x_3 + x_4 + \dots + x_{20} = 200$$

Required Mean

$$= \frac{220 + x_1 + x_2 + x_3 + x_4 + \dots + x_{10}}{10} = \frac{420}{10} = 42$$

43. Sol. (d)

$$3 < 4, -3 > -4$$

$$-1 > -2$$

