SSC CGL (Tier-II) Mathematics Practice Set

Answers with Explanation

1. (b) Decimal equivalents :

$\frac{4}{9} = 0.\dot{4}; \sqrt{\frac{9}{49}} = \frac{3}{7} = 0.43$

$0.\dot{4}\dot{5}; (0.8)^2 = 0.64$

∴ Least number = 0.43

$= \sqrt{\frac{9}{49}}$

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2. (d) $\frac{13}{4} \times \frac{2}{3} - \left(\frac{9}{4} - \frac{5}{3}\right) \times \frac{3}{4}$

$= \frac{13}{6} - \left(\frac{27-20}{12}\right) \times \frac{3}{4}$

$= \frac{13}{6} - \frac{7}{12} \times \frac{3}{4} = \frac{13}{6} - \frac{7}{16}$

$= \frac{104-21}{48} = \frac{83}{48}$

3. (c) Let the numbers be x and y and x is greater than y.

As given,

xy = 9375 ....(i)

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Again,

$\frac{x}{y} = 15$

⇒ x = 15y

∴ From equation (i),

15y × y = 9375

$\Rightarrow y^2 = \frac{9375}{15} = 625$

$\Rightarrow y = \sqrt{625} = 25$

∴ x = 15y = 15 × 25 = 375

∴ x + y = 375 + 25 = 400

4. (a) $999\frac{998}{999} \times 999$

$= \left(999 + \frac{998}{999}\right) \times 999$

$= 999^2 + 998$

$= (1000 - 1)^2 + 998$

$= 1000000 - 2000 + 1 + 998$

$= 998999$

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5. (b) Let LCM be L and HCF be H, then L = 4H

∴ H + 4H = 125

⇒ 5H = 125

$\Rightarrow H = \frac{125}{5} = 25$

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∴ L = 4 × 25 = 100

∴ Second number

$= \frac{L \times H}{\text{First number}}$

$= \frac{100 \times 25}{100} = 25$

6. (c) LCM of 21, 36 and 66

∴ LCM = 3 × 2 × 7 × 6 × 11

= 3 × 3 × 2 × 2 × 7 × 11

∴ Required number

$= 3^2 \times 2^2 \times 7^2 \times 11^2 = 213444$

7. (b) LCM of 20, 30 and 40 minutes = 120 minutes

Hence, the bells will toll together again after 2 hours i.e. at 1 p.m.

8. (c) 3026 – 11 = 3015 and 5053 – 13 = 5040

Required number = HCF of 3015 and 5040 = 45

9. (b) $1 + \frac{4}{2 + \frac{3}{\frac{10-1}{2}}} - \frac{1}{2} \times 5$

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$= 1 + \frac{4}{2 + \frac{6}{9}} - \frac{5}{2} = 1 + \frac{4}{2 + \frac{2}{3}} - \frac{5}{2}$

$= 1 + \frac{4}{\frac{8}{3}} - \frac{5}{2} = 1 + \frac{4 \times 3}{8} - \frac{5}{2}$

$= 1 + \frac{3}{2} - \frac{5}{2} = \frac{2+3-5}{2} = 0$

10. (b) Expression $= 3 + \frac{3}{3 + \frac{1}{\frac{9+1}{3}}}$

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$= 3 + \frac{3}{3 + \frac{3}{10}} = 3 + \frac{3}{\frac{30+3}{10}}$

$$= 3 + \frac{30}{33} = 3 + \frac{10}{11} = \frac{33+10}{11} = \frac{43}{11}$$

11. (a) $\frac{1}{9} + \frac{1}{6} + \frac{1}{12} + \frac{1}{20} + \frac{1}{30} + \frac{1}{42} + \frac{1}{56} + \frac{1}{72}$

$$= \frac{1}{9} + \frac{1}{2\times3} + \frac{1}{3\times4} + \frac{1}{4\times5} + \frac{1}{5\times6} + ... + \frac{1}{8\times9}$$

$$= \frac{1}{9} + \frac{1}{2} - \frac{1}{3} + \frac{1}{3} - \frac{1}{4} + ... + \frac{1}{8} - \frac{1}{9} = \frac{1}{2}$$

12. (a) Using (x) of Basic Formulae

Let 0.9 = x, 0.2 = y and 0.3 = z

Then, the given expression

$$= \frac{x^3 + y^3 + z^3 - 3xyz}{x^2 + y^2 + z^2 - xy - yz - zx}$$

$$= \frac{(x+y+z)\left(x^2 + y^2 + z^2 - xy - yz - zx\right)}{x^2 + y^2 + z^2 - xy - yz - zx}$$

= x + y + z

= 0.9 + 0.2 + 0.3 = 1.4

13. (c) Number of workers in the factory

$$= \frac{1534}{118} = 13$$

14. (a) Required average

$$= \frac{1.11 + 0.01 + 0.101 + 0.001 + 0.11}{5}$$

$$= \frac{1.332}{5} = 0.2664$$

15. (d) Last number

= 30 × 12 – 20 × 11 – 9 × 10

= 360 – 220 – 90

= 360 – 310 = 50

16. (c) Required average

$$= \frac{3(1+2+3+...+9)}{9} = \frac{9\times10}{2\times3} = 15$$

17. (c) A : B $= \frac{1}{2} : \frac{3}{8}$ = 4 : 3 = 8 : 6

B : C $= \frac{1}{3} : \frac{5}{9}$ = 3 : 5 = 6 : 10

C : D $= \frac{5}{6} : \frac{3}{4}$ = 10 : 9

∴ A : B : C : D = 8 : 6 : 10 : 9

18. (c) A : B = 3 : 4

B : C = 8 : 9

∴ A : B : C = (3 × 8) : (4 × 8) : (4 × 9)

= 24 : 32 : 36

= 6 : 8 : 9

19. (c) a × 5.5 = b × 0.65

$$\Rightarrow \frac{a}{b} = \frac{0.65}{5.5} = \frac{65}{550} = \frac{13}{110}$$

20. (b) Let the required fraction be x.

According to the question,

$$x : \frac{1}{27} = \frac{3}{7} : \frac{5}{9}$$

$$\Rightarrow x \times \frac{5}{9} = \frac{1}{27} \times \frac{3}{7} = \frac{1}{63}$$

$$\Rightarrow x = \frac{1}{63} \times \frac{9}{5} = \frac{1}{35}$$

21. (d) $A \times \frac{30}{100} + \frac{B\times40}{100} = \frac{B\times80}{100}$

⇒ A × 30 = B × 40

$$\Rightarrow \frac{A}{B} = \frac{40}{30} = \frac{4}{3}$$

$$\Rightarrow \frac{B}{A} = \frac{3}{4}$$

$$\Rightarrow \frac{B}{A} \times 100 = \frac{3}{4} \times 100 = 75\%$$

22. (d) $0.1\% = \frac{0.1}{100} = 0.001$

23. (a) Let B's income be Rs. 100.

∴ A's income = Rs. 125

∴ Required per cent

$$= \left(\frac{100}{125} \times 100\right) = 80\%$$

24. (b) Suppose income of A = ₹ 100

∴ Income of B = ₹ 125

Income of C = ₹ 150

∴ Required percentage

$$= \frac{50\times100}{100} = 50\%$$

25. (a) Total cost of typewriter

= ₹ (1200 + 200) = ₹ 1400

S.P. = ₹ 1680

Profit = ₹ (1680 – 1400) = ₹ 280

∴ Profit % $= \frac{280}{1400} \times 100 = 20\%$

26. (d) Let C.P. of each article be Rs. 1.

C.P. of 15 articles = Rs. 15

Their S.P. = Rs. 10

∴ Loss percent $= \frac{15-10}{15} \times 100 = \frac{100}{3} = 33.3\%$

27. (a) Let C.P. of each article be Rs. 1.

∴ C.P. of 40 articles = Rs. 40

S.P. of 40 articles = Rs. 50

∴ Profit per cent

$$=\left(\frac{50-40}{40}\times 100\right)\% = 25\%$$

28. (d) Let the CP of each pen be ₹ 1.
∴ CP of 8 pens = ₹ 8
SP of 8 pens = ₹ 12
∴ Gain % = $\frac{4}{8}\times 100 = 50\%$

29. (c) Let the number of pencils bought = LCM of 4, 6 = 12
CP of 6 pencils = ₹ 4
∴ CP of 12 pencils = ₹ 8
S.P. of 4 pencils = ₹ 6
∴ S.P. of 12 pencils = ₹ 18
Profit = Rs. (18 – 8) = ₹ 10
∴ Profit % = $\frac{10}{8}\times 100 = 125\%$

30. (c) (i) : Equivalent discount

$$=\left(25+15-\frac{25\times 15}{100}\right)\%$$

= (40 – 3.75) % = 36.25%
(ii) : Equivalent discount

$$=\left(30+10-\frac{30\times 10}{100}\right)\%$$

= (40 – 3) % = 37%
(iii) : Equivalent discount

$$=\left(35+5-\frac{35\times 5}{100}\right)\%$$

= (40 – 1.75) % = 38.25%
Clearly, third offer is best for a customer.

31. (b) Single equivalent discount

$$=\left(x+y-\frac{xy}{100}\right)\%$$

$$=\left(20+15-\frac{20\times 15}{100}\right)\% = 32\%$$

32. (d) Marked price of article = Rs. x (let)
According to the question,

$$x\times\frac{80}{100}\times\frac{85}{100}=3060$$

$$\Rightarrow x=\frac{3060\times 100\times 100}{80\times 85}=\text{Rs. } 4500$$

33. (a) Let the C.P. be ₹ 100
∴ Marked price = ₹ 130
S.P. = 85% of ₹ 130

$$=₹\left(\frac{85\times 130}{100}\right)=₹\ 110.5$$

∴ Gain percent = 10.5%

34. (d) Marked price of article = ₹ x

$$\therefore \frac{x\times(100-12.5)}{100}=\frac{210\times 120}{100}$$

$\Rightarrow$ x × 87.5 = 210 × 120

$$\Rightarrow x=\frac{210\times 120}{87.5}=₹\ 288$$

35. (a) Simple interest for 2 years = ₹ (568 – 520) = ₹ 48
∴ Interest for 5 years

$$=₹\ \frac{48}{2}\times 5 = ₹\ 120$$

Principal = ₹ (520 – 120) = ₹ 400

36. (a) Time from 11 May to 10 September, 1987 = 21 + 30 + 31 + 31 + 10 = 123 days

∴ Time = 123 days $=\frac{123}{365}$ year

$$\therefore \text{S.I.}=\frac{7300\times 123\times 5}{365\times 100}=₹\ 123$$

37. (a) Required time = t years

$$\text{S.I.}=\frac{\text{Principal}\times\text{Rate}\times\text{Time}}{100}$$

$$\therefore \frac{6000\times 4\times 5}{100}=\frac{8000\times 3\times t}{100}$$

$\Rightarrow$ 6000 × 4 × 5 = 8000 × 3 × t

$$\therefore t=\frac{6000\times 4\times 5}{8000\times 3}=5 \text{ years}$$

38. (d) If the principal be x, the amount = 2x
∴ SI = x

$$\therefore \text{Time}=\frac{\text{SI}\times 100}{\text{Principal}\times\text{Rate}}$$

$$=\frac{x\times 100}{x\times 15}=\frac{20}{3}=6\frac{2}{3} \text{ years}$$

39. (c) Principal = Rs. x (let)
∴ Amount = Rs. 5x
Interest = Rs. (5x – x) = Rs. 4x

$$\therefore \text{Rate}=\frac{\text{S.I.}\times 100}{\text{Principal}\times\text{Time}}$$

$$=\frac{4x\times 100}{x\times 8}=50\% \text{ per annum}$$

40. (d) According to question,
Interest of one year = ₹ 42
Rate = 5% and Time = 1 year

$$\therefore \text{Principal}=\frac{\text{Interest}\times 100}{\text{Rate}\times\text{Time}}$$

$= \frac{42 \times 100}{5 \times 1} = ₹\ 840$

41. (c) Let the principal be P.

$\therefore 270.40 = P\left(1 + \frac{4}{100}\right)^2$

$\Rightarrow$ 270.40 = P $(1 + 0.04)^2$

$\Rightarrow P = \frac{270.40}{1.04 \times 1.04} = ₹\ 250$

42. (c) Amount

$= 6000\left(1 + \frac{10}{100}\right) \times \left(1 + \frac{\frac{1}{2} \times 10}{100}\right)$

$= 6000 \times \frac{11}{10} \times \frac{21}{20} = ₹\ 6930$

$\therefore$ CI = ₹ (6930 – 6000) = ₹ 930

43. (a) $A = P\left(1 + \frac{R}{100}\right)^T$

$\Rightarrow \frac{3362}{3200} = \left(1 + \frac{10}{400}\right)^{4t}$

$\Rightarrow \frac{1681}{1600} = \left(\frac{41}{40}\right)^{4t}$

$\Rightarrow \left(\frac{41}{40}\right)^2 = \left(\frac{41}{40}\right)^{4t}$

$\Rightarrow 4t = 2 \Rightarrow t = \frac{1}{2}$ year

44. (c) Let the principal be Rs. P.
According to the question,

$P\left(1 + \frac{R}{100}\right)^2 - P\left(1 + \frac{R}{100}\right)^2 = 420$

$\Rightarrow P\left(1 + \frac{R}{100}\right)\left(1 + \frac{R}{100} - 1\right) = 420$

$\Rightarrow P\left(1 + \frac{R}{100}\right) \times \frac{R}{100} = 420$

$\Rightarrow P\left(1 + \frac{5}{100}\right) \times \frac{5}{100} = 420$

$\Rightarrow P\left(1 + \frac{1}{20}\right) = 420 \times 20$

$\Rightarrow P \times \frac{21}{20} = 420 \times 20$

$\Rightarrow P = \frac{420 \times 20 \times 20}{21} =$ Rs. 8000

45. (b) Here, C.I. = ₹ 2448, R = 4%, S.I. = ?

$C.I. = S.I.\left(1 + \frac{R}{200}\right)$

$2448 = S.I.\left(1 + \frac{4}{200}\right)$

$2448 = S.I.\left(1 + \frac{1}{50}\right)$

$2448 = S.I.\left(\frac{51}{50}\right)$

$S.I. = \frac{2448 \times 50}{51}$

S.I. = ₹ 2400

46. (c) C.I. – S.I. = ₹ 15, R = 5%, T = 2 years, P = ?

$C.I. - S.I. = P\left(\frac{R}{100}\right)^2$

$15 = P\left(\frac{5}{100}\right)^2$

P = 15 × 400

P = ₹ 6000

47. (c) C alone can do in

$= \frac{2 \times 10 \times 12 \times 15}{10 \times 12 - 12 \times 15 + 10 \times 15}$

$= \frac{240 \times 15}{120 - 180 + 150}$

$= \frac{240 \times 15}{90} = 40$ days

48. (c) Time taken

$= \frac{2 \times 10 \times 6 \times 12}{10 \times 6 + 6 \times 12 + 12 \times 10}$

$= \frac{1440}{60 + 72 + 120}$

$= \frac{1440}{252} = \frac{40}{7} = 5\frac{5}{7}$ days

49. (b) C alone can do in

$= \frac{2xyz}{xy - yz + zx}$ days

$= \frac{2 \times 36 \times 60 \times 45}{36 \times 60 - 60 \times 45 + 45 \times 36}$

$= \frac{2 \times 36 \times 60 \times 3}{144 - 180 + 108}$

$= \frac{72 \times 180}{252 - 180} = 180$ days

50. (c) Here, m = 6, n= 12, and p = 3
Time taken by B
$= \frac{mn - (m+n)p}{m}$
$= \frac{6 \times 12 - (6+12) \times 3}{6}$
$= \frac{72 - 54}{6} = 3$ days
∴ Total number of days taken to finish the works = 6 days

51. (b) Here, x = 45, y = 40, a = 23
$\Rightarrow$ Required time $t = \frac{(y-a)}{(x+y)} \times x$
$t = \frac{(40-23) \times 45}{45+40} = \frac{17 \times 45}{85} = 9$ days

52. (a) Part of the cistern filled by both pipes in 1 hour.
$= \frac{1}{10} + \frac{1}{15} = \frac{3+2}{30} = \frac{1}{6}$
∴ The cistern will be filled in 6 hours.

53. (a) If the slower pipe fills the tank in x hours, then
$\frac{1}{x} + \frac{1}{x-10} = \frac{1}{12}$
$\Rightarrow \frac{x-10+x}{x(x-10)} = \frac{1}{12}$
$\Rightarrow x^2 - 10x = 24x - 120$
$\Rightarrow x^2 - 34x + 120 = 0$
$\Rightarrow x^2 - 30x - 4x + 120 = 0$
$\Rightarrow x(x - 30) - 4(x - 30) = 0$
$\Rightarrow (x - 4)(x - 30) = 0$
∴ x = 30 because $x \neq 4$
∴ Required time = 30 – 10 = 20 hours

54. (d) Work done in 1 hour by the filling pump $= \frac{1}{2}$
Work done in 1 hour by the leak and the filling pump $= \frac{3}{7}$
∴ Work done by the leak in 1 hour
$= \frac{1}{2} - \frac{3}{7} = \frac{7-6}{14} = \frac{1}{14}$
Hence, the leak can empty the tank in 14 hours.

55. (c) Let the distance be x km.
Total time = 5 hours 48 minutes
$= 5 + \frac{48}{60} = \left(5 + \frac{4}{5}\right)$ hours
$= \frac{29}{5}$ hours
$\therefore \frac{x}{25} + \frac{x}{4} = \frac{29}{5}$
$\Rightarrow \frac{4x + 25x}{100} = \frac{29}{5}$
$\Rightarrow 5 \times 29x = 29 \times 100$
$\Rightarrow x = \frac{29 \times 100}{5 \times 29} = 20$ km.

56. (b) Speed of train $= \frac{\text{Distance}}{\text{Time}}$
$= \frac{10}{\frac{12}{60}}$ kmph
$= \frac{10 \times 60}{12} = 50$ kmph
New speed = 45 kmph
∴ Required time $= \frac{10}{45}$ hour
$= \frac{2}{9} \times 60 = \frac{40}{3}$ minutes
= 13 minutes 20 seconds

57. (d) Distance covered by truck in $\frac{3}{2}$ hours
= Speed × Time
$= 90 \times \frac{3}{2} = 135$ km
Remaining distance = 310 – 135 = 175 km
∴ Time taken at 70 kmph
$= \frac{175}{70} = 2.5$ hours
∴ Total time = 1.5 + 2.5 = 4 hours

58. (c) In crossing the bridge, the train travels its own length plus the length of the bridge.
Total distance (length)
= 300 + 200 = 500 m.
Speed = 25m/sec.
∴ The required time = 500 ÷ 25 = 20 seconds

59. (c) Rate downstream = 5 kmph
Rate upstream = 1 kmph
∴ Required time $= \frac{10}{5} + \frac{10}{1} = 12$ hours

60. (a) Let the speed of boat in still water be x kmph and the rate of stream be y kmph.

$\therefore$ Downstream rate
= (x + y) kmph and upstream rate = (x – y) kmph.

Now, $\frac{20}{x+y}=1$

$\Rightarrow$ x + y = 20 ...(i)

and $\frac{20}{x-y}=2$

$\Rightarrow$ x – y = 10 ...(ii)

From (i) and (ii) we have x = 15 kmph.

61. (b) Here, Speed of Boat $=\frac{9}{2}$ km/hr

$t_1 = 2x$, $t_2 = x$

$$\frac{\text{Speed of Boat}}{\text{Speed of Stream}}=\frac{t_1+t_2}{t_1-t_2}$$

$$\frac{9}{2\times\text{Speed of stream}}=\frac{2x+x}{2x-x}$$

Speed of Stream = 1.5 km/hr

62. (c) Let the speed of motor-boat be 36x kmph and and Speed of current = 5x kmph
The boat goes along with the current in 5 hours 10 minutes i.e. $\frac{31}{6}$ hours.

$\therefore$ Distance $=\frac{31}{6}\times(36x+5x)$

$=\frac{41x\times31}{6}$km.

Rate upstream = 36x – 5x = 31x kmph

$\therefore$ Time taken $=\frac{41x\times\frac{31}{6}}{31x}=\frac{41}{6}$ hours

or 6 hours 50 minutes

63. (b) $\frac{\sqrt{7}-2}{\sqrt{7}+2}=\frac{\sqrt{7}-2}{\sqrt{7}+2}\times\frac{\sqrt{7}-2}{\sqrt{7}-2}$

(Rationalising the denominator)

$=\frac{\left(\sqrt{7}-2\right)^2}{7-4}=\frac{7+4-4\sqrt{7}}{3}$

$=\frac{11}{3}-\frac{4\sqrt{7}}{3}$

$\therefore\frac{\sqrt{7}-2}{\sqrt{7}+2}=a\sqrt{7}+b$

$\Rightarrow\frac{11}{3}-\frac{4}{3}\sqrt{7}=a\sqrt{7}+b$

Clearly,

$a=-\frac{4}{3}$ and $b=\frac{11}{3}$

64. (c) $\left(\frac{3}{5}\right)^3\left(\frac{3}{5}\right)^{-6}=\left(\frac{3}{5}\right)^{2x-1}$

$\Rightarrow\left(\frac{3}{5}\right)^{-6+3}=\left(\frac{3}{5}\right)^{2x-1}$

$\Rightarrow$ –3 = 2x –1

$\Rightarrow$ –2 = 2x

$\Rightarrow$ x = –1

65. (b) $\frac{2x-y}{x+2y}=\frac{1}{2}$

$\Rightarrow$ 4x – 2y = x + 2y

$\Rightarrow$ 3x = 4y

$\Rightarrow\frac{x}{y}=\frac{4}{3}$

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

$$=\frac{3\times\frac{4}{3}-1}{3\times\frac{4}{3}+1}$$

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

66. (d) $x^2 - y^2 = 80$

x – y = 8

$\therefore x+y=\frac{x^2-y^2}{x-y}=\frac{80}{8}=10$

$\therefore$ Required average

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

67. (d) $\frac{x}{a}=\frac{1}{a}-\frac{1}{x}$

$\Rightarrow\frac{x}{a}=\frac{x-a}{ax}$

$\Rightarrow x^2 = x - a$

$\Rightarrow x - x^2 = a$

68. (d) $x=3+2\sqrt{2}$

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

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

$$= \frac{3-2\sqrt{2}}{9-8} = 3-2\sqrt{2}$$

$$x + \frac{1}{x} = 3+2\sqrt{2}+3-2\sqrt{2} = 6$$

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

$= (6)^2 - 2 = 36 - 2 = 34$

69. (a) Maximum expenditure of the family is on food, i.e., 23%.

70. (c) ∵ Expenditure on housing = Savings = 15%

71. (a) % Expenditure on transport and other items = (20 + 5)% = 25%

72. (b) Expenditure on the education of children = 12% of ₹ 100000

$$= ₹\frac{12\times100000}{100} = ₹\,12000$$

73. (d) The percentage difference in expenditure on housing and transport = (15 – 5)% = 10%
The required difference = 10% of ₹ 100000 = ₹ 10000

74. (a) $\sqrt{1+\frac{27}{169}} = 1+\frac{x}{13}$

$$\Rightarrow \sqrt{\frac{169+27}{169}} = 1+\frac{x}{13}$$

$$\Rightarrow \sqrt{\frac{196}{169}} = 1+\frac{x}{13}$$

$$\Rightarrow \frac{14}{13} = 1+\frac{x}{13}$$

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

$$\Rightarrow x = 1$$

75. (c) $a = \frac{\sqrt{x+2}+\sqrt{x-2}}{\sqrt{x+2}-\sqrt{x-2}}$

By componendo and dividendo,

$$\frac{a+1}{a-1}$$

$$= \frac{\sqrt{x+2}+\sqrt{x-2}+\sqrt{x+2}-\sqrt{x-2}}{\sqrt{x+2}+\sqrt{x-2}-\sqrt{x+2}+\sqrt{x-2}}$$

$$\Rightarrow \frac{a+1}{a-1}$$

$$= \frac{2\sqrt{x+2}}{2\sqrt{x-2}} = \frac{\sqrt{x+2}}{\sqrt{x-2}}$$

On squaring both sides,

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

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

By componendo and dividendo,

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

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

$\Rightarrow a^2 + 1 = ax$

$\Rightarrow a^2 - ax = -1$

76. (b) $2p + \frac{1}{p} = 4$

$$\Rightarrow p + \frac{1}{2p} = 2$$

$$\therefore \left(p+\frac{1}{2p}\right)^3$$

$$= p^3 + \frac{1}{8p^3} + 3.p.\frac{1}{2p}\left(p+\frac{1}{2p}\right)$$

$$\Rightarrow 8 = p^3 + \frac{1}{8p^3} + \frac{3}{2}\times 2$$

$$\Rightarrow p^3 + \frac{1}{8p^3} = 8-3 = 5$$

77. (c) $\frac{x^3+\frac{1}{x}}{x^2-x+1} = \frac{x^2+\frac{1}{x^2}}{x-1+\frac{1}{x}}$

$$= \frac{\left(x+\frac{1}{x}\right)^2-2}{\left(x+\frac{1}{x}\right)-1} = \frac{9-2}{3-1} = \frac{7}{2}$$

78. (b) $a + \frac{1}{a} = \sqrt{3}$

On cubing both sides,

$$a^3 + \frac{1}{a^3} + 3a.\frac{1}{a}\left(a+\frac{1}{a}\right) = 3\sqrt{3}$$

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

$\Rightarrow a^3+\frac{1}{a^3}=0$ ...(i)

$\Rightarrow a^6-\frac{1}{a^6}+2$

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

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

79. (c) $\frac{1}{x^{99}}=\frac{1}{(-1)^{99}}=-1$

$\frac{1}{x^{98}}=\frac{1}{(-1)^{98}}=1$ and so on.

$\therefore$ Expression = – 1 + 1 – 1 + 1 – 1 + 1 – 1 – 1 = –2

80. (b) $Z = \sin\theta + \cos\theta$

$\Rightarrow Z^2 = \sin^2\theta + \cos^2\theta + 2\sin\theta.\cos\theta$

$= 1 + 2\sin\theta.\cos\theta$

$\because 0 < \theta < 90°$

$\therefore \sin\theta < 1; \cos\theta < 1$

$\therefore 2\sin\theta . \cos\theta < 1$ and $2\sin\theta\cos\theta > 1$

$\Rightarrow Z^2 < 2$

$\Rightarrow Z < \sqrt{2}$

81. (b) $\frac{\tan 57° + \cot 37°}{\tan 33° + \cot 53°}$

$=\frac{\cot 33° + \tan 53°}{\tan 33° + \cot 53°}$

[$\because \tan(90° - \theta) = \cot\theta$, $\cot(90° - \theta) = \tan\theta$]

$=\frac{\frac{1}{\tan 33°}+\tan 53°}{\tan 33°+\frac{1}{\tan 53°}}$

$=\frac{1+\tan 53°.\tan 33°}{\tan 33°.\tan 53°+1}\times\frac{\tan 53°}{\tan 33°}$

$= \tan 53°.\cot 33°$

$= \cot 37°.\tan 57°$

82. (d) $\cos\theta.\operatorname{cosec}23° = 1$

$\Rightarrow \operatorname{cosec}23° = \frac{1}{\cos\theta} = \sec\theta$

$\Rightarrow \operatorname{cosec}23° = \operatorname{cosec}(90° - \theta)$

$\Rightarrow 23° = 90° - \theta$

$\Rightarrow \theta = 90° - 23° = 67°$

83. (c) $5\tan\theta = 4 \Rightarrow \tan\theta = \frac{4}{5}$

$\therefore \frac{5\sin\theta - 3\cos\theta}{5\sin\theta + 2\cos\theta}$

Dividing numerator and denominator by $\cos\theta$,

$=\frac{5\frac{\sin\theta}{\cos\theta}-\frac{3\cos\theta}{\cos\theta}}{5\frac{\sin\theta}{\cos\theta}+\frac{2\cos\theta}{\cos\theta}}$

$=\frac{5\tan-3}{5\tan\theta+2}=\frac{5\times\frac{4}{5}-3}{5\times\frac{4}{5}+2}$

$=\frac{4-3}{4+2}=\frac{1}{6}$

84. (b) $\sin\alpha + \cos\beta = 2$

$\sin\alpha \le 1$; $\cos\beta \le 1$

$\Rightarrow \alpha = 90°$; $\beta = 0°$

$\therefore \sin\left(\frac{2\alpha+\beta}{3}\right)=\sin\left(\frac{180°}{3}\right)$

$=\sin 60°=\frac{\sqrt{3}}{2}$

Also,

$\cos\frac{\alpha}{3}=\cos 30°=\frac{\sqrt{3}}{2}$

85. (a) $\sec^2\theta + \tan^2\theta = 7$

$\Rightarrow 1 + \tan^2\theta + \tan^2\theta = 7$

$\Rightarrow 2\tan^2\theta = 7 - 1 = 6$

$\Rightarrow \tan^2\theta = 3 \Rightarrow \tan\theta = \sqrt{3}$

$\Rightarrow \theta = 60°$

86. (c) $\sec\theta + \tan\theta = 2$ ....(i)

$\therefore \sec^2\theta - \tan^2\theta = 1$

$\Rightarrow (\sec\theta + \tan\theta)(\sec\theta - \tan\theta) = 1$

$\Rightarrow \sec\theta - \tan\theta = \frac{1}{2}$ ....(ii)

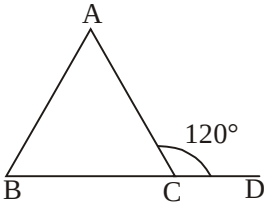
By adding equations (i) and (ii),

$\therefore \sec\theta + \tan\theta + \sec\theta - \tan\theta$

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

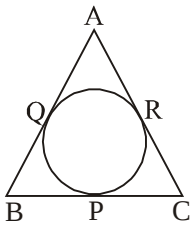
$\Rightarrow 2\sec\theta=\frac{5}{2}\Rightarrow\sec\theta=\frac{5}{4}$

87. (b)



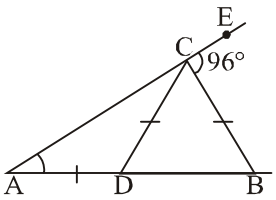
$\angle ACB = 180° - 120° = 60°$
$AB = AC$
$\therefore \angle ABC = \angle ACB = 60°$
$\therefore \angle BAC = 60°$

88. (a)



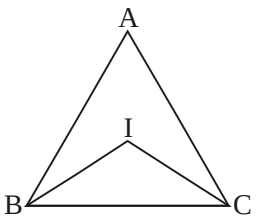
Tangents drawn on a circle from an exterior point are equal.
$AQ = AR$
$\because AB = AC$
$\therefore BQ = RC$
Again, $BQ = BP$; $CP = CR$
$\therefore BP = PC$

89. (c)



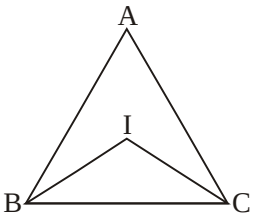
Let $\angle ACD = a = \angle DAC$
$\therefore \angle CDB = 2a = \angle CBD$
The angles of the base of an isosceles triangle are equal.
$\therefore \angle ACB = 180° - 96° = 84°$
$\therefore \angle ACD + \angle DCB = 84°$
$\Rightarrow a + 180° - 4a = 84°$
$\Rightarrow 180° - 3a = 84°$
$\Rightarrow 3a = 180° - 84° = 96°$
$\Rightarrow a = \frac{96}{3} = 32°$
$\Rightarrow \angle DBC = 2a = 64°$

90. (b)



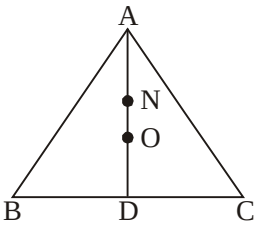
$\angle IBC = \frac{1}{2}\angle ABC = \frac{65}{2} = 32.5°$
$\angle ICB = \frac{1}{2}\angle ACB = \frac{55}{2} = 27.5°$
$\therefore \angle BIC = 180° - 32.5° - 27.5° = 120°$

91. (b)



$\angle B + \angle C = 180 - 50 = 130°$
In ΔBIC,
$\angle IBC + \angle ICB + \angle BIC = 180°$
$\Rightarrow \frac{\angle B}{2} + \frac{\angle C}{2} + \angle BIC = 180°$
$\Rightarrow \angle BIC = 180° - \frac{1}{2}(\angle B + \angle C)$
$= 180° - \frac{130}{2}$
$= 180° - 65° = 115°$

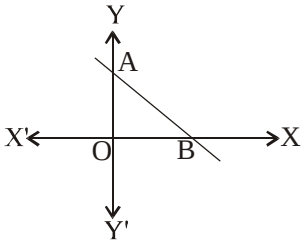
92. (a)



$AD = 27$ cm
Centroid = O
$\therefore OD = \frac{1}{3} AD$
$= \frac{1}{3} \times 27 = 9$ cm
$ND = 12$ cm
$\therefore ON = DN - OD$
$= 12 - 9 = 3$ cm

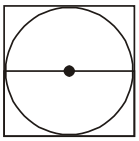
93. (c) Side of the squares are 6 cm, 8 cm, 10 cm, 19 cm and 20 cm respectively.
Sum of their areas = $(6^2 + 8^2 + 10^2 + 19^2 + 20^2)$ cm^2
$= (36 + 64 + 100 + 361 + 400)$ cm$^2 = 961$ cm^2
$\therefore$ Area of largest other square = 961 cm^2
$\Rightarrow$ Its side $= \sqrt{961} = 31$ cm
$\therefore$ Required perimeter $= 4 \times 31 = 124$ cm.

94. (c)



Putting y = 0 in the equation 3x + 4y = 12,
3x + 0 = 12 $\Rightarrow$ x = 4
Co-ordinates of point B = (4, 0)
Putting x = 0 in the equation 3x + 4y = 12
0 + 4y = 12 $\Rightarrow$ y = 3
$\therefore$ Co-ordinates of point A = (0, 3)
$\Rightarrow$ OB = 4 and OA = 3
$\therefore$ Area of ΔOAB
$= \frac{1}{2} \times OB \times OA$
$= \frac{1}{2} \times 4 \times 3 = 6$ sq. units

95. (c)



$\therefore$ Area of the circle = $\pi r^2 = 9\pi$
$\Rightarrow r^2 = 9$
$\Rightarrow r = \sqrt{9} = 3$ cm
$\therefore$ Side of the square = 2r = 6 cm
$\therefore$ Area of the Square = side^2
= 6 × 6 = 36 cm^2

96. (b) Area of the field with side 50 m = 50 × 50 = 2500 sq. metre
Area of the field of side 100 m
= 100 × 100 = 10000 sq. metre
$\because$ 2500 sq. metre $\equiv$ 750 kg.
$\therefore$ 10000 sq. metre
$\equiv \frac{750}{2500} \times 10000$ kg. = 3000 kg.

97. (d) Time spent in studying history and chemistry
$= 4\frac{1}{2}$ hours
Their corresponding percentage = (15 + 15)% = 30%
$\because$ 30% $\equiv \frac{9}{2}$ hours
$\therefore 20\% \equiv \frac{9 \times 20}{2 \times 30} = 3$ hours

98. (b) $\because$ 15% $\equiv$ 3 hours
$\therefore 10\% \equiv \frac{3}{15} \times 10 = 2$ hours

99. (a) $\because$ 100% $\equiv$ 10 hours
$\therefore 30\% \equiv \frac{10}{100} \times 30 = 3$ hours

100. (c) Usual time spent in studying Maths
$= \frac{20}{100} \times 30 = 6$ hours
Usual time spent in studying other subjects
$= \frac{10}{100} \times 20 = 2$ hours
New time spent in studying other subjects
$= \frac{15 \times 20}{100} = 3$ hours
Difference = (3 – 2) = 1 hour.

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