SSC CGL (Tier-II) Mathematics Practice Set

Answers with Explanation

1. (a) $\frac{2}{3}=0.67;\ \frac{5}{6}=0.83$

$\frac{11}{15}=0.73;\ \frac{7}{8}=0.875$ অ্যাচিভার্স

2. (b) Here, 52 is a multiple of 13. Hence, the required remainder is obtained on dividing 45 by 13. Required remainder = 6.

3. (b) Number just greater than 3 which is divisible by 7 = 7

Number just smaller than 200

which is divisible by 7 = 196

Here, a = 7, a_n = 196, d = 7, n = 8

$\therefore\ a_n = a + (n-1)d$

$\Rightarrow 196 = 7 + (n-1) \times 7$

$\Rightarrow n - 1 = \frac{196-7}{7} = 27$

$\Rightarrow n = 27 + 1 = 28$

4. (c) A number is divisible by 9, if sum of its digits is divisible by 9. Let the number be x.

$\Rightarrow 5 + 4 + 3 + 2 + x + 7$

$= 21 + x$ অ্যাচিভার্স

$\therefore\ x = 6$

5. (d) First number × Second number

= HCF × LCM

$\Rightarrow$ 864 × Second number

= 96 × 1296 $\Rightarrow$ Second number

$= \frac{96\times1296}{864} = 144$

6. (b) $15 = 3 \times 5$

$18 = 3^2 \times 2$

$21 = 3 \times 7$

$24 = 2^3 \times 3$ অ্যাচিভার্স

LCM = 8 × 9 × 5 × 7 = 2520

The largest number of four digits = 9999

2520)9999(3
7560
2439

Required number

= 9999 – 2439 – 4 = 7556

(Because 15 – 11 = 4

18 – 14 = 4

21 – 17 = 4

24 – 20 = 4) অ্যাচিভার্স

7. (a) The LCM of 5, 6, 8 and 9

= 360 seconds = 6 minutes

8. (a) The number will be HCF of 307 – 3 = 304 and 330 – 7 = 323

304) 323 (1
304
19) 304 (16
19
114
114
×

$\therefore$ Required number = 19

9. (d) $\frac{2}{1+\frac{1}{\frac{1}{2}}}\times\frac{3}{\left(\frac{5}{6}\times\frac{3}{2}\right)\div\frac{5}{4}}$ অ্যাচিভার্স

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

$=\frac{2}{3}\times\frac{3}{\frac{5}{4}\times\frac{4}{5}}=\frac{2}{3}\times3=2$

10. (a) Expression

$=\frac{\frac{7}{3}-\frac{13}{11}}{3+\frac{1}{3+\frac{1}{\frac{9+1}{3}}}}=\frac{\frac{77-39}{33}}{3+\frac{1}{3+\frac{3}{10}}}$ অ্যাচিভার্স

$=\frac{\frac{38}{33}}{3+\frac{1}{\frac{30+3}{10}}}=\frac{\frac{38}{33}}{3+\frac{10}{33}}$

$=\frac{\frac{38}{33}}{\frac{99+10}{33}}=\frac{38}{33}\times\frac{33}{109}=\frac{38}{109}$ অ্যাচিভার্স

11. (d) We have

$\frac{5}{3}\div\frac{2}{7}\times\frac{*}{7}=\frac{5}{4}\times\frac{2}{3}\times6$

$\Rightarrow\frac{5}{3}\times\frac{7}{2}\times\frac{*}{7}=\frac{5\times2\times6}{4\times3}$

$$\therefore * = \frac{5\times2\times6\times3\times2\times7}{5\times7\times4\times3} = 6$$

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12. (c) $\frac{\frac{3}{2}}{\frac{1}{2}} \div \frac{4}{7}\left(\frac{4+3}{10}\right) \text{of} \frac{\frac{3+2}{6}}{\frac{3-2}{6}}$

$$= 3 \div \frac{4}{7}\left(\frac{7}{10}\right) \text{of} \left(\frac{5}{6}\times6\right)$$

$$= 3 \div \left(\frac{4}{7}\times\frac{7}{10}\times5\right) = 3 \div 2 = \frac{3}{2}$$

13. (b) Required average

$$= \frac{32\times60+33\times40}{72}$$

$$= \frac{1920+1320}{72} = \frac{3240}{72} = 45$$

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14. (c) Total expenditure of the year
= ₹ (3 × 2200 + 4 × 2550 + 5 × 3120)
= ₹ (6600 + 10200 + 15600) = ₹ 32400
∴ Total income of the year
= ₹ (32400 + 1260) = ₹ 33660
∴ Average monthly income
$= ₹ \frac{33660}{12}$ = ₹ 2805

15. (b) Person's income in the eighth month
= ₹ (3160 × 8 + 5 × 4120 – 12 × 3400)
= ₹ (25280 + 20600 – 40800)
= ₹ 5,080

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16. (d) Middle i.e. eighth number
= 8 × 6.5 + 8 × 8.5 – 15 × 7
= 52 + 68 – 105 = 120 – 105 = 15

17. (c) x : y = 3 : 2
$\Rightarrow x^2 : y^2 = 9 : 4$

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

$$= \frac{2\times\frac{9}{4}+3}{3\times\frac{9}{4}-2} = \frac{\frac{18+12}{4}}{\frac{27-8}{4}} = 30:19$$

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18. (b) $a+b\sqrt{3}$

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

(After rationalising)

$\Rightarrow$ a = 2 and b = 1
∴ a : b = 2 : 1

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19. (a) $\frac{a+b}{6} = \frac{b+c}{7} = \frac{c+a}{8} = k$
$\Rightarrow$ a + b = 6k; b + c = 7k; c + a = 8k
∴ a + b + b + c + c + a = 6k + 7k + 8k
$\Rightarrow$ 2 (a + b + c) = 21k

$$\Rightarrow 2 \times 14 = 21k \Rightarrow k = \frac{4}{3}$$

∴ c = (a + b + c) – (a + b)

$$= 14 - 6\times\frac{4}{3} = 14 - 8 = 6$$

20. (d) Ratio of division

$$= \frac{1}{2}:\frac{2}{3}:\frac{4}{5}$$

$$= \frac{1}{2}\times30 : \frac{2}{3}\times30 : \frac{4}{5}\times30$$

[LCM of 2, 3 and 5 = 30]
= 15 : 20 : 24
∴ Sum of the terms of ratio = 15 + 20 + 24 = 59
∴ Second part

$$= \text{Rs.}\left(\frac{20}{59}\times177\right) = \text{Rs. } 60$$

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21. (d) $\frac{A\times90}{100} = \frac{B\times30}{100}$
$\Rightarrow 3A = B$

$$\Rightarrow 3A = A\times\frac{2x}{100}$$

$$\Rightarrow 300 = 2x \Rightarrow x = 150$$

22. (a) $(A+B)\times\frac{40}{100}$

$$= (A-B)\times\frac{60}{100}$$

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$\Rightarrow$ 2(A + B) = 3(A – B)
$\Rightarrow$ 2A + 2B = 3A – 3B
$\Rightarrow$ A = 5B

$$\therefore \frac{2A-3B}{A+B} = \frac{10B-3B}{5B+B}$$

$$= \frac{7B}{6B} = \frac{7}{6}$$

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23. (c) According to the question, Required difference

$$= \text{Rs.}\left(312\times\frac{200}{3}\% - 200\right)$$

$$= \text{Rs.}\left(312\times\frac{200}{300} - 200\right)$$

= Rs. (208 – 200) = Rs. 8

24. (c) Required per cent
$$= \frac{40}{100-40} \times 100$$
$$= \frac{40 \times 100}{60} = \frac{200}{3} = 66\frac{2}{3}\%$$

25. (d) CP of 75 litres of mixture of milk and water = ₹ 630
SP of 75 litres of mixture of milk and water = 9 × 75 = ₹ 675
Gain = 675 – 630 = ₹ 45
$$\text{Gain per cent} = \frac{45}{630} \times 100 = \frac{50}{7} = 7\frac{1}{7}\%$$

26. (d) Let the C.P. of article be Rs. x.
According to the question,
425 – x = x – 355
$\Rightarrow$ 2x = 425 + 355 = 780
$\Rightarrow$ x = $\frac{780}{2}$ = Rs. 390

27. (d) Let the cost price of each book be Re. 1.
$\therefore$ C.P. of 20 books = Rs. 20
S.P. of 20 books = Rs. 25
$\therefore$ Profit per cent
$$= \left(\frac{25-20}{20}\right) \times 100$$
$$= \frac{5 \times 100}{20} = 25\%$$

28. (c) Gain per cent
$$= \frac{400-320}{320} \times 100$$
$$= \frac{80}{320} \times 100 = 25\%$$

29. (c) Let the CP of each ball = x
Then, clearly the cost price of (17 – 5) balls = ₹ 720
i.e., 12x = 720 $\Rightarrow$ x = 60 i.e. ₹ 60

30. (d) Let the second discount be x per cent.
According to the question
$$450 \times \frac{100-10}{100} \times \frac{100-x}{100} = 344.25$$
$\therefore$ 100 – x
$$= \frac{344.25 \times 100 \times 100}{450 \times 90}$$
$\therefore$ 100 – x = 85
$\therefore$ x = 100 – 85 = 15 per cent

31. (c) Single equivalent discount
$$= \left(10 + 5 - \frac{10 \times 5}{100}\right)\%$$
= (15 – 0.5)% = 14.50%

32. (d) Single equivalent discount for discounts of 10% and 20%
$$= \left(20 + 10 - \frac{20 \times 10}{100}\right)\%$$
= (30 – 2)% = 28%
Single equivalent discounts for discounts of 28% and 25%
$$= \left(28 + 25 - \frac{28 \times 25}{100}\right)\%$$
= (53 – 7)% = 46%

33. (b) Let the cost price be ₹ 100.
$\therefore$ Marked price = ₹ 120
SP = $87\frac{1}{2}\%$ of 120
$$= \frac{175}{200} \times 120 = ₹\ 105$$
$\therefore$ Gain per cent = 5%

34. (c) C.P. of article = ₹ 100 and marked price of article = ₹ x (let)
$$\therefore x \times \frac{90}{100} = 117$$
$$\Rightarrow x = \frac{117 \times 100}{90} = ₹\ 130$$
i.e. 30% above the cost price.

35. (d) Let the rate of interest per annum be r%
According to the question
$$\frac{5000 \times 2 \times r}{100} + \frac{3000 \times 4 \times r}{100} = 2200$$
$\Rightarrow$ 100r + 120r = 2200
$\Rightarrow$ 220r = 2200
$$\Rightarrow r = \frac{2200}{220} = 10\%$$

36. (a) Equal instalment
$$= \frac{6450 \times 200}{4\left[200 + (4-1) \times 5\right]}$$
$$= \frac{6450 \times 200}{4(215)}$$
$$= \frac{6450 \times 50}{215} = ₹\ 1500$$

37. (c) S.I. for 1 year
= 14250 – 12900 = Rs. 1350
S.I. for 4 years = 1350 × 4 = ₹ 5400
$\therefore$ Principal = 12900 – 5400 = ₹ 7500
$$\therefore \text{Rate} = \frac{\text{S.I} \times 100}{\text{Principal} \times \text{Time}}$$

$= \frac{5400 \times 100}{7500 \times 4}$

= 18% per annum

38. (c) $R = \frac{(2-1)}{10} \times 100\%$

R = 10%

$T = \frac{(n-1)}{R} \times 100$ years

$= \frac{3-1}{10} \times 100$

= 20 years

39. (b) Let principal be Rs. x.

∴ Amount = Rs. 2x

∴ Interest = Rs. (2x – x) = Rs. x

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

$= \frac{x \times 100}{x \times 15} = \frac{20}{3}$

$= 6\frac{2}{3}\%$ per annum

40. (b) Amount after 10 years

$= P\left(1 + \frac{RT}{100}\right) = P\left(1 + \frac{R \times 10}{100}\right)$

$= \text{Rs. } P\left(1 + \frac{R}{10}\right)$

$\therefore \text{Interest} = \text{Rs. } P\left(1 + \frac{R}{10}\right) \times \frac{2}{5}$

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

$\Rightarrow R = \frac{P\left(1 + \frac{R}{10}\right) \times \frac{2}{5} \times 100}{P \times 10}$

$\Rightarrow R = 4\left(1 + \frac{R}{10}\right)$

$\Rightarrow \frac{R}{4} = 1 + \frac{R}{10}$

$\Rightarrow \frac{R}{4} - \frac{R}{10} = 1$

$\Rightarrow \frac{5R - 2R}{20} = 1$

$\Rightarrow 3R = 20$

$\Rightarrow R = \frac{20}{3} = 6\frac{2}{3}\%$

41. (a) Let the required time be n years.

Then,

$1331 = 1000\left(1 + \frac{10}{100}\right)^n$

$\left[\because P_1 = P\left(1 + \frac{r}{100}\right)^n\right]$

$= \frac{1331}{1000} = \left(\frac{10+1}{10}\right)^n$

$\Rightarrow \left(\frac{11}{10}\right)^n = \left(\frac{11}{10}\right)^3$

$\Rightarrow n = 3$ years

42. (c) Amount

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

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

∴ CI = ₹ (6930 – 6000) = ₹ 930

43. (b) $\text{C.I.} = P\left[\left(1 + \frac{R}{100}\right)^T - 1\right]$

$= 5000\left[\left(1 + \frac{10}{100}\right)^3 - 1\right]$

$= 5000\left[\left(\frac{11}{10}\right)^3 - 1\right]$

$= 5000\left[\frac{1331}{1000} - 1\right] = 5000\left[\frac{331}{1000}\right]$

$\therefore \text{C.I.} = \frac{5000 \times 331}{1000} = ₹\ 1,655$

44. (c) Let principal be Rs. P.

Interest in 1 year $= \frac{PRT}{100}$

$= \frac{P \times 10}{100} = \text{Rs. } \frac{P}{10}$

According to question,

$\therefore P\left[\left(1 + \frac{R}{100}\right)^2 - 1\right] - \frac{P}{10} = 132$

$\Rightarrow P\left[\left(1 + \frac{10}{100}\right)^2 - 1\right] - \frac{P}{10} = 132$

$$\Rightarrow P\left[\left(\frac{11}{10}\right)^2 - 1\right] - \frac{P}{10} = 132$$

$$\Rightarrow \frac{21P}{100} - \frac{P}{10} = 132$$ অ্যাচিভার্স

$$\Rightarrow \frac{21P - 10P}{100} = 132$$

$$\Rightarrow \frac{11P}{100} = 132$$

$$\Rightarrow P = \frac{132 \times 100}{11} = ₹\ 1200$$

45. (a) Here, C.I. = ₹ 328, R = 5%, S.I. = ?

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

$$328 = S.I.\left(1 + \frac{5}{200}\right)$$ অ্যাচিভার্স

$$328 = S.I.\left(1 + \frac{1}{40}\right)$$

$$S.I. = \frac{328 \times 40}{41}$$

S.I. = 8 × 40 = ₹ 320

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

$$\Rightarrow 2916 = x\left(1 + \frac{8}{100}\right)^2$$ অ্যাচিভার্স

$$\Rightarrow 2916 = x\left(\frac{27}{25}\right)^2$$

$$\Rightarrow x = \frac{2916 \times 25 \times 25}{27 \times 27} = ₹\ 2500$$

$$\therefore S.I. = \frac{P \times R \times T}{100}$$

$$= \frac{2500 \times 9 \times 3}{100} = ₹\ 675$$

47. (a) A alone can complete the work in 42 days working 1 hour daily.
Similarly, B will take 56 days working 1 hour daily.

A's 1 day's work $= \frac{1}{42}$

B's 1 day's work $= \frac{1}{56}$ অ্যাচিভার্স

(A + B)'s 1 day's work

$$= \frac{1}{42} + \frac{1}{56} = \frac{4+3}{168} = \frac{7}{168}$$

∴ Time taken by (A + B) working 8 hours daily $= \frac{168}{7 \times 8} = 3$ days অ্যাচিভার্স

48. (d) B alone can do in

$$= \frac{2 \times 12 \times 15 \times 20}{-12 \times 15 + 15 \times 20 + 20 \times 12}$$

$$= \frac{24 \times 300}{-180 + 300 + 240}$$

$$= \frac{24 \times 300}{360} = 20 \text{ days}$$

49. (a) A's 1 day's work

$$= \frac{1}{12} - \frac{1}{30} = \frac{5-2}{60} = \frac{3}{60} = \frac{1}{20}$$

Hence, A alone will complete the work in 20 days.

50. (d) Here, m = 12, n = 18, p = 2 অ্যাচিভার্স
Time taken by B

$$= \frac{mn - p(m+n)}{m}$$

$$= \frac{12 \times 18 - 2(12+18)}{12}$$

$$= \frac{216 - 60}{12} = 13 \text{ days}$$

51. (a) A's 1 day's work $= \frac{1}{20}$

A's 4 days' work $= \frac{4}{20} = \frac{1}{5}$

Remaining work $= 1 - \frac{1}{5} = \frac{4}{5}$

This part is completed by A and B together.
Now, (A + B)'s 1 day's work

$$= \frac{1}{20} + \frac{1}{12} = \frac{3+5}{60} = \frac{8}{60} = \frac{2}{15}$$ অ্যাচিভার্স

Now, $\frac{2}{15}$ work is done by (A + B) in 1 day.

$\therefore \frac{4}{5}$ work is done in

$$= \frac{15}{2} \times \frac{4}{5} = 6 \text{ days.}$$

Hence, the work lasted for 4 + 6 = 10 days.

52. (c)

Hours/day	Days	Pumps
6 ↑	15 ↑	12 ↓
9	12	x

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Let x be number of pumps
∴ 9 : 6 :: 12 : x = 12 : 15 :: 12 : x

$\Rightarrow 9 \times 12 \times x = 6 \times 12 \times 15$

$\Rightarrow x = \frac{6\times12\times15}{9\times12} = 10$

53. (a) Part of the tank filled by all three taps in an hour

$= \frac{1}{4}+\frac{1}{6}+\frac{1}{12} = \frac{6+4+2}{24} = \frac{1}{2}$

$\therefore$ Hence, the tank will be filled in 2 hours.

54. (c) Part of the tank filled by B and C in half an hour

$= \frac{1}{2}\left(\frac{1}{9}+\frac{1}{12}\right) = \frac{1}{2}\left(\frac{4+3}{36}\right) = \frac{7}{72}$

Remaining part

$= 1-\frac{7}{72} = \frac{72-7}{72} = \frac{65}{72}$

Part of tank filled by three pipes in an hour

$= \frac{1}{6}+\frac{1}{9}+\frac{1}{12} = \frac{6+4+3}{36} = \frac{13}{36}$

$\therefore$ Time to fill remaining part

$= \frac{65}{72}\times\frac{36}{13} = \frac{5}{2} = 2\frac{1}{2}$ hours

55. (a) Total distance covered

= Speed × Time

= 40 × 9 = 360 km.

The required time at 60 kmph

$= \frac{360}{60} = 6$ hours

56. (b) Distance covered on foot

$= 4\times3\frac{3}{4}$ km. $= 15$ km.

$\therefore$ Time taken on cycle

$= \frac{\text{Distance}}{\text{Speed}} = \frac{15}{16.5}$ hours

$= \frac{15\times60}{16.5}$ minutes

= 54.55 minutes

57. (b) Time = 12 minutes

$= \frac{12}{60}$ hour $= \frac{1}{5}$ hour

Speed of train $= \frac{10}{\frac{1}{5}}$ = 50 kmph

New speed = 50 – 5 = 45 kmph

$\therefore$ Required time $= \frac{\text{Distance}}{\text{Speed}}$

$= \frac{10}{45} = \frac{2}{9}$ hour

$= \left(\frac{2}{9}\times60\right) = \frac{40}{3}$ minutes

58. (c) When a train crosses a bridge it covers the distance equal to length of Bridge & its own length

Let the length of the train be = x

$\therefore$ Speed of the train

$= \frac{x+800}{100}$ m/s

Since train passes the 800 m bridge in 100 seconds.

Again, train passes the 400 m bridge in 60 seconds.

$\therefore \frac{400+x}{\frac{x+800}{100}} = 60$

$\Rightarrow \frac{(400+x)\times100}{x+800} = 60$

$\Rightarrow$ 40000 + 100x

= 60x + 48000

$\Rightarrow$ 100x – 60x = 48000 – 40000

$\Rightarrow$ 40x = 8000

$\therefore x = \frac{8000}{40} = 200$ m

59. (d) Speed of current

$= \frac{1}{2}$ (Rate downstream & rate upstream)

$= \frac{1}{2}(12-8) = 2$ km/ph

60. (a) Speed in still water = x km/h

Speed of current = y km/h

$\therefore x+y = \frac{1}{\frac{4}{60}} = 15$

$x-y = \frac{1}{\frac{10}{6}} = 6$

$\therefore$ Speed of current

$= \frac{1}{2}[(x+y)-(x-y)]$

$= \frac{1}{2}(15-6) = \frac{9}{2} = 4.5$ km / h

61. (b) Let the speed of stream be x kmph, then speed of boat in still water = 4x kmph

$\therefore$ Rate downstream

= 4x + x = 5x kmph

Rate upstream = 4x – x = 3x kmph

$\therefore \frac{30}{3x}+\frac{30}{5x}=8 \Rightarrow \frac{10}{x}+\frac{6}{x}=8$

$\Rightarrow \frac{16}{x}=8 \Rightarrow x=\frac{16}{8}=2$ km/hour

62. (c) Here, x = 5, y = 3, t = 3

$d=\frac{t\left(x^2-y^2\right)}{2x}$

$=\frac{3\left(5^2-3^2\right)}{2\times 5}=\frac{3\times 16}{10}=4.8$ km

63. (c) $\frac{2p}{p^2-2p+1}=\frac{1}{4}$

$\Rightarrow \frac{p^2-2p+1}{2p}=4$

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

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

$\Rightarrow p+\frac{1}{p}=8+2=10$

64. (c) $3^{x+3}+7=250$

$\Rightarrow 3^{x+3}=243$

$\Rightarrow 3^{x+3}=3^5$

$\Rightarrow x+3=5 \Rightarrow x=2$

65. (d) Tricky Approach

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

$\Rightarrow \left(\frac{a}{1-a}+1\right)+\left(\frac{b}{1-b}+1\right)+\left(\frac{c}{1-c}+1\right)$

$=3+1=4$

$\Rightarrow \frac{a+1-a}{1-a}+\frac{b+1-b}{1-b}+\frac{c+1-c}{1-c}=4$

$\Rightarrow \frac{1}{1-a}+\frac{1}{1-b}+\frac{1}{1-c}=4$

66. (b) Given $x=\frac{\sqrt{3}}{2}$

Given expression

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

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

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

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

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

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

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

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

$=\frac{2+\sqrt{\frac{4-2\sqrt{3}}{2}}-\sqrt{\frac{4+2\sqrt{3}}{2}}}{\frac{\sqrt{3}}{2}}$

$\left[\because \sqrt{4-2\sqrt{3}}=\sqrt{3+1-2\sqrt{3}}=\sqrt{\left(\sqrt{3}-1\right)^2}=\sqrt{3}-1\right]$

and $\left[\sqrt{4+2\sqrt{3}}=\sqrt{3+1+2\sqrt{3}}=\sqrt{\left(\sqrt{3}+1\right)^2}=\sqrt{3}+1\right]$

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

67. (b) $x=\frac{4\sqrt{15}}{\sqrt{5}+\sqrt{3}}$

$=\frac{4\sqrt{15}\left(\sqrt{5}-\sqrt{3}\right)}{\left(\sqrt{5}+\sqrt{3}\right)\left(\sqrt{5}-\sqrt{3}\right)}$

$=\frac{4\sqrt{15}\left(\sqrt{5}-\sqrt{3}\right)}{5-3}$

$=2\sqrt{15}\left(\sqrt{5}-\sqrt{3}\right)=10\sqrt{3}-6\sqrt{5}$

$\therefore \frac{x+\sqrt{20}}{x-\sqrt{20}}+\frac{x+\sqrt{12}}{x-\sqrt{12}}$

$=\frac{10\sqrt{3}-6\sqrt{5}+2\sqrt{5}}{10\sqrt{3}-6\sqrt{5}-2\sqrt{5}}+\frac{10\sqrt{3}-6\sqrt{5}+2\sqrt{3}}{10\sqrt{3}-6\sqrt{5}-2\sqrt{3}}$

$$= \frac{10\sqrt{3}-4\sqrt{5}}{10\sqrt{3}-8\sqrt{5}} + \frac{12\sqrt{3}-6\sqrt{5}}{8\sqrt{3}-6\sqrt{5}}$$

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

$$= 60 - 15\sqrt{15} - 8\sqrt{15} + 30 + 90$$

$$= \frac{-15\sqrt{15}-24\sqrt{15}+60}{\left(5\sqrt{3}-4\sqrt{5}\right)\left(4\sqrt{3}-3\sqrt{5}\right)}$$

$$= \frac{240-62\sqrt{15}}{60-15\sqrt{15}-16\sqrt{15}+60}$$

$$= \frac{240-62\sqrt{15}}{120-31\sqrt{15}}$$

$$= \frac{2\left(120-31\sqrt{15}\right)}{120-31\sqrt{15}} = 2$$

68. (a) $\frac{x}{b+c} = \frac{y}{c+a}$

$$= \frac{x-y}{b+c-c-a} = \frac{x-y}{b-a}$$

$$\frac{y}{c+a} = \frac{z}{a+b}$$

$$= \frac{y-z}{c+a-a-b} = \frac{y-z}{c-b}$$

$$\frac{z}{a+b} = \frac{x}{b+c}$$

$$= \frac{z-x}{a+b-b-c} = \frac{z-x}{a-c}$$

$$\therefore \frac{x-y}{b-a} = \frac{y-z}{c-b} = \frac{z-x}{a-c}$$

69. (d) 100% = 360°

$$\therefore 1\% = \frac{360°}{100}$$

$$\therefore 10\% = \frac{360° \times 10}{100} = 36°$$

70. (b) 35% total cost = ₹ 17500

∴ 15% of total cost

$$= ₹\ \frac{17500 \times 15}{35} = ₹\ 7500$$

71. (c) Difference in per cent cost of 'binding and cutting charges' and 'royalty'

= (18 – 15)% = 3%

∵ 4% of total cost = ₹ 6000

∴ 3% of total cost

$$= ₹\ \frac{6000 \times 3}{4} = ₹\ 4500$$

72. (b) Difference in per cent expenses on printing cost and advertisement charges = (35 – 18)% = 17%

Now, 1 % = 3.6°

∴ 17% = 3.6° × 17 = 61.2°

73. (b) The required per cent

$$= \frac{10 \times 100}{35} = 28.6\% \text{ (approx.)}$$

74. (d) $\frac{5x}{2x^2+5x+1} = \frac{1}{3}$

Dividing Numerator and Denominator by x,

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

On dividing N^r and D^r by 2,

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

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

$$\Rightarrow x+\frac{1}{2x} = \frac{15}{2}-\frac{5}{2} = \frac{10}{2} = 5$$

75. (c) $\frac{x}{y} = \frac{4}{5}$ (Given)

$$\text{Expression} = \frac{4}{7} + \frac{2y-x}{2y+x}$$

$$= \frac{4}{7} + \frac{\frac{2y}{y}-\frac{x}{y}}{\frac{2y}{y}+\frac{x}{y}}$$

$$= \frac{4}{7} + \frac{2-\frac{x}{y}}{2+\frac{x}{y}} = \frac{4}{7} + \frac{2-\frac{4}{5}}{2+\frac{4}{5}}$$

$$= \frac{4}{7} + \frac{\frac{10-4}{5}}{\frac{10+4}{5}} = \frac{4}{7} + \frac{6}{14}$$

$$= \frac{4}{7} + \frac{3}{7} = \frac{7}{7} = 1$$

76. (a) $\left(2b+\frac{1}{b}\right)^2$ অ্যাচিভার্স

$=4b^2+\frac{1}{b^2}+2\times 2b\times\frac{1}{b}=2+4=6$

$\Rightarrow 2b+\frac{1}{b}=\sqrt{6}$

$\therefore 8b^3+\frac{1}{b^3}$

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

$=\left(\sqrt{6}\right)^3-6\left(\sqrt{6}\right)$

$=6\sqrt{6}-6\sqrt{6}=0$ অ্যাচিভার্স

77. (b) $3x+\frac{1}{2x}=5$

On multiplying both sides by $\frac{2}{3}$,

$2x+\frac{1}{3x}=\frac{10}{3}$

Cubing both sides,

$8x^3+\frac{1}{27x^3}+3\times 2x\times\frac{1}{3x}$

$\left(2x+\frac{1}{3x}\right)=\frac{1000}{27}$

$\Rightarrow 8x^3+\frac{1}{27x^3}+2\times\frac{10}{3}=\frac{1000}{27}$

$\Rightarrow 8x^3+\frac{1}{27x^3}=\frac{1000}{27}-\frac{20}{3}$ অ্যাচিভার্স

$=\frac{1000-180}{27}=\frac{820}{27}=30\frac{10}{27}$

78. (d) $\left(a+\frac{1}{a}\right)^2=3=\left(\sqrt{3}\right)^2$

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

Cubing both sides,

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

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

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

$\Rightarrow a^3+\frac{1}{a^3}=0$

79. (c) Here, $x+\frac{1}{x}=2$ অ্যাচিভার্স

$\Rightarrow x^{17}+\frac{1}{x^{19}}=2$

80. (b) Let the number of terms be n, then

a_n = a + (n – 1)d

85 = 5 + (n –1)

$\Rightarrow$ n – 1 = 85 – 5 = 80

$\Rightarrow$ n = 81

$\therefore \sin^2 5° + \sin^2 6° + ... + \sin^2 45° + ... + \sin^2 84° + \sin^2 85°$

$= (\sin^2 5° + \sin^2 85°) + (\sin^2 6° + ... + \sin^2 84°) + ... +$ to (40 terms) $+ \sin^2 45°$

$= (\sin^2 5° + \cos^2 5°) + (\sin^2 6° + ... + \cos^2 6°) + ...$ + to 40 terms +

$\sin^2 45°$ $\left[\begin{matrix}\sin(90°-\theta)=\cos\theta\\ \sin^2-\theta+\cos^2\theta=1\end{matrix}\right]$ অ্যাচিভার্স

$=40+\left(\frac{1}{\sqrt{2}}\right)^2=40+\frac{1}{2}=40\frac{1}{2}$

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

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

[$\because$ tan(90° – θ) = cotθ, cot (90° – θ)= tanθ]

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

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

= tan53°.cot33°

= cot37°.tan57°

82. (b) asinθ + bcosθ = c ...(i)

acosθ – bsinθ = x ...(ii)

Squaring both the equations and adding,

$a^2\sin^2\theta + b^2\cos^2\theta + 2ab \sin\theta.\cos\theta = c^2 + x^2$

$\Rightarrow a^2\sin^2\theta + a^2\cos^2\theta + b^2\cos^2\theta + b^2\sin^2\theta = c^2 + x^2$

$\Rightarrow a^2(\sin^2\theta + \cos^2\theta) + b^2(\cos^2\theta + \sin^2\theta = c^2 + x^2$

$\Rightarrow a^2 + b^2 = c^2 + x^2$

$\Rightarrow x^2 = a^2 + b^2 - c^2$ অ্যাচিভার্স

$\Rightarrow x=\pm\sqrt{a^2+b^2-c^2}$

83. (a) $x \sin 45° = y \operatorname{cosec} 30°$

$\Rightarrow x \times \frac{1}{\sqrt{2}} = y \times 2$

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

$\Rightarrow \frac{x^4}{y^4} = \left(2\sqrt{2}\right)^4 = 2^4 \times 2^2$

$= 2^6 = 4^3$

84. (b) $\text{Cos}\theta = \frac{15}{17}$

$\Rightarrow \sec\theta = \frac{1}{\cos\theta} = \frac{17}{15}$

$\therefore \cot(90° - \theta) = \tan\theta$

$= \sqrt{\text{Sec}^2\theta - 1}$

$= \sqrt{\left(\frac{17}{15}\right)^2 - 1} = \sqrt{\frac{289}{225} - 1}$

$= \sqrt{\frac{289 - 225}{225}} = \sqrt{\frac{64}{225}} = \frac{8}{15}$

85. (c) $\frac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta} = 3$

$\Rightarrow \sin\theta + \cos\theta = 3\sin\theta - 3\cos\theta$

$\Rightarrow 4\cos\theta = 2\sin\theta \Rightarrow \tan\theta = 2$

$\therefore \sin^4\theta - \cos^4\theta$

$= (\sin^2\theta + \cos^2\theta)(\sin^2\theta - \cos^2\theta)$

$= \sin^2\theta - \cos^2\theta$

$= \cos^2\theta(\tan^2\theta - 1)$

$= \frac{\tan^2\theta - 1}{\sec^2\theta}$

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

86. (c) $\frac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta} = \frac{5}{4}$

$\Rightarrow \frac{\cos\theta\left(\frac{\sin\theta}{\cos\theta} + 1\right)}{\cos\theta\left(\frac{\sin\theta}{\cos\theta} - 1\right)} = \frac{5}{4}$

$\Rightarrow \frac{\tan\theta + 1}{\tan\theta - 1} = \frac{5}{4}$

$\Rightarrow 4\tan\theta + 4 = 5\tan\theta - 5$

$\Rightarrow \tan\theta = 9$

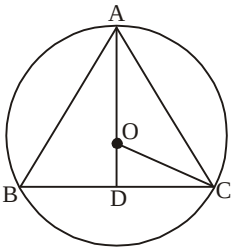
$\Rightarrow \frac{2\tan\theta}{2} = \frac{5 + 4}{5 - 4}$

(By componendo and dividendo)

$\therefore \frac{\tan^2\theta + 1}{\tan^2\theta - 1} = \frac{(9)^2 + 1}{(9)^2 - 1} = \frac{81 + 1}{81 - 1} = \frac{82}{80} = \frac{41}{40}$

87. (a) The medians of an equilateral triangle are equal.

88. (b)



$AD \perp BC$

BD = DC = 12 cm.

OC = OA = Circum-radius

= r cm.

$AD = \sqrt{AB^2 - BD^2}$

$= \sqrt{\left(12\sqrt{5}\right)^2 - (12)^2}$

$= \sqrt{144 \times 5 - 144}$

$= \sqrt{144(5 - 1)} = \sqrt{144 \times 4} = 24$ cm

In ΔOCD,

OD = (24 – r) cm.

$\therefore OC^2 = OD^2 + CD^2$

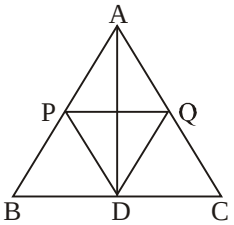
$\Rightarrow r^2 = (24 - r)^2 + 12^2$

$\Rightarrow r^2 = 576 - 48r + r^2 + 144$

$\Rightarrow 48r = 720$

$\Rightarrow r = \frac{720}{48} = 15$ cm.

89. (b)



AB = AC

Point D is the mid-point of side BC.

$\therefore \angle ADB = 90° = \angle ADC$

PD is internal bisector of $\angle ADB$.

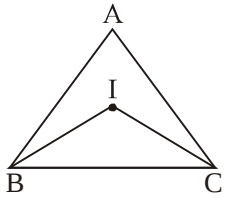
$\therefore \angle PDA = 45°$

$PQ \parallel BC$

$\therefore \angle ADQ = 45°$

$\therefore PDQ = 45° + 45° = 90°$

90. (b)



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$\angle ABC = 60°$, $ACB = 50°$

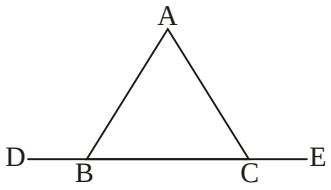
$\angle IBC = \frac{1}{2}\angle ABC = 30°$

$\angle ICB = \frac{1}{2}\angle ACB = 25°$

$\therefore \angle BIC = 180° - (30° + 25°)$

$= 180^{o} - 55^{o} = 125°$

91. (c)



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$\angle ABD = 120°$

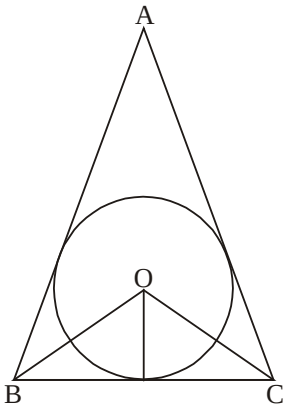
$\therefore \angle ABC = 180° - 120° = 60°$

$\angle ACE = 105°$

$\therefore \angle ACB = 180° - 105° = 75°$

$\therefore \angle BAC = 180° - 60° - 75° = 45°$

92. (b)



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$\angle BOC = 90° + \frac{\angle A}{2}$

$\Rightarrow 110 = 90° + \frac{\angle A}{2}$

$\Rightarrow \angle A = 2 \times 20 = 40°$

93. (c) Let diagonals be 2x and 5x.

$\therefore \frac{A_1}{A_2} = \frac{\frac{1}{2}\times(2x)^2}{\frac{1}{2}\times(5x)^2} = \frac{4}{25}$

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$\Rightarrow 4:25$

94. (b) Sides of triangle

Let 3x, 4x and 5x units

$(3x)^2 + (4x)^2 = (5x)^2$

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$\therefore$ It is a right angled triangle.

Now, Area of triangle

$= \frac{1}{2} \times 3x \times 4x = 6x^2$

$\therefore 6x^2 = 72$

$\Rightarrow x^2 = \frac{72}{6}$

$\Rightarrow x = \sqrt{12} = 2\sqrt{3}$

Perimeter of right angled triangle

$= 3x + 4x + 5x$

$= 12x = 12 \times 2\sqrt{3}$

$= 24\sqrt{3}$ units

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$\therefore$ Perimeter of equilateral triangle

$= 24\sqrt{3}$ units

Its side $= \frac{24\sqrt{3}}{3} = 8\sqrt{3}$ units

Area $= \frac{\sqrt{3}}{4} \times (\text{side})^2$

$= \frac{\sqrt{3}}{4} \times 8\sqrt{3} \times 8\sqrt{3}$

$= 48\sqrt{3}$ square units.

95. (b)

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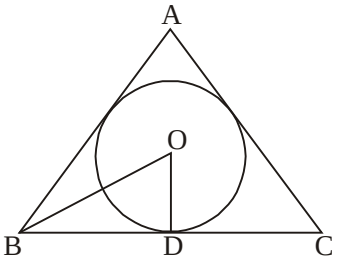

Radius of in-circle = BD cot $60° = \frac{4}{\sqrt{3}}$ cm

Area of the circle $= \pi \times \frac{4}{\sqrt{3}} \times \frac{4}{\sqrt{3}}$

$= \frac{16}{3}\pi$ cm^2 $= 16.76$ cm^2

Area of the triangle

$= \frac{\sqrt{3}}{4} \times 8 \times 8 = 16\sqrt{3}$ cm^2

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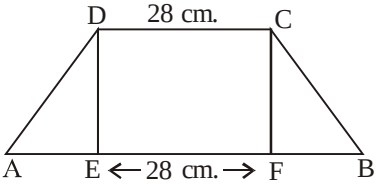
$\therefore$ Required area $= 16\sqrt{3} - 16.76$

= (27.71 – 16.76) = 10.95 cm^2

96. (c)



AE = FB = 6 cm.

In ΔADE,

$DE = \sqrt{AD^2 - AE^2}$

$= \sqrt{12^2 - 6^2}$

$= \sqrt{(12+6)(12-6)}$

$= \sqrt{18 \times 6} = 6\sqrt{3}$ cm

$\therefore$ Area of CDEF

$= 28 \times 6\sqrt{3} = 168\sqrt{3}$ sq.cm.

Area of ΔADE

$= \frac{1}{2} \times AE \times DE$

$= \frac{1}{2} \times 6 \times 6\sqrt{3}$

$= 18\sqrt{3}$ sq.cm.

$\therefore$ Area of trapezium

$= \left(168\sqrt{3} + 2 \times 18\sqrt{3}\right)$ sq.cm.

$= 204\sqrt{3}$ sq.cm.

97. (b) Required percentage

$= \frac{3150}{4500} \times 100 = 70\%$

98. (c) Average demand

$\left(\frac{2100 + 3150 + 2600 + 5000 + 2800 + 3300}{6}\right)$

lakh tonnes

$= \frac{18950}{6}$ lakh tonnes

Average production

$= \left(\frac{1450 + 3660 + 3100 + 4200 + 3700 + 4500}{6}\right)$

lakh tonnes

$= \frac{20610}{6}$ lakh tonnes

Required difference

$= \frac{20610}{6} - \frac{18950}{6}$

$= \frac{1660}{6} = 276.7$ lakh tonnes

$\therefore$ Required answer = 275 lakh tonnes

99. (d) Required percent

$= \frac{1450}{2600} \times 100 = \frac{1450}{26} = 55.8$ or 55%

100. (b) Companies having more demand than production

$\Rightarrow$ A and D

Companies having more production than demand

$\Rightarrow$ B, C, E and F

$\therefore$ Required ratio = 2 : 4 = 1 : 2

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