ANSWER KEY

1) c	2) a	3) b	4) c	5) b
6) c	7) c	8) a	9) b	10) c
11) c	12) a	13) a	14) c	15) b
16) c	17) a	18) d	19) d	20) b
21) c	22) d	23) d	24) a	25) d
26) d	27) d	28) c	29) b	30) a
31) a	32) a	33) a	34) a	35) c
36) c	37) b	38) a	39) c	40) d
41) a	42) d	43) b	44) a	45) a
46) c	47) b	48) c	49) c	50) a
51) b	52) a	53) b	54) c	55) d
56) d	57) b	58) a	59) d	60) a
61) b	62) c	63) c	64) b	65) b
66) a	67) d	68) c	69) a	70) b
71) d	72) b	73) b	74) c	75) b
76) a	77) a	78) c	79) d	80) c
81) b	82) c	83) c	84) a	85) c
86) a	87) a	88) b	89) a	90) b
91) a	92) c	93) b	94) c	95) a
96) b	97) b	98) b	99) c	100) a

HINTS & SOLUTION

1. *(c)* $\because$ Dividend $= D \times Q + R$
Given, $D = 5Q$ and $D = 2R$
When $R = 15$, D $= 2 \times 15 = 30$
$\therefore\ Q = \frac{D}{5} = \frac{30}{5} = 6$
$\therefore$ Dividend $= 30 \times 6 + 15 = 195$

2. *(a)* $\frac{a}{4} = \frac{b}{5} = \frac{c}{6} = k$ (say)
$\Rightarrow\ a = 4k,\ b = 5k \text{ and } c = 6k$
So, $\frac{a+b+c}{b} = \frac{4k+5k+6k}{5k}$
$\frac{15k}{5k} = 3$

3. *(b)* As, n is divided by 4 the remainder is 3, so
$n = 4q + 3$, where q is quotient.
$\Rightarrow 2n = 8q + 6$
$\Rightarrow 2n = (8k + 4) + 2 = 4\ (2k + 1) + 2$
So, if $2n$ is divided by 4 the quotient is $2k + 1$ and remainder is 2.

4. *(c)* I. If $x = 15$ and y = 14, then $x + y = 15 + 14 = 29$, which is a prime number. So, if x and y are composite, then $x + y$ is not always composite.
II. If $x = 15$ and $y = 14$, then $x - y = 15 - 14 = 1$ which is neither prime nor composite, hence again $x - y$ is not always composite.
III. Third condition is satisfied for all measure. Hence, only III is correct.

5. *(b)* Clearly, absolute value is defined by
$|x| = -x$

6. *(c)* Middle term = $T_{\frac{n+1}{2}}$
$\therefore\ a + \left(\frac{n+1}{2} - 1\right)d = m$ (given)
$2a + (n-1)d = 2m$ …(i)
Now, $S_n = \frac{n}{2}\left[2a + (n-1)d\right] = nm$

7. *(c)* Given, $\frac{1}{b-a} + \frac{1}{b-c} = \frac{1}{a} + \frac{1}{c}$
$\Rightarrow \frac{1}{b-a} - \frac{1}{c} = \frac{1}{a} - \frac{1}{b-c}$
$\Rightarrow \frac{(c-b+a)}{c(b-a)} = \frac{(b-c-a)}{a(b-c)}$
$\Rightarrow \frac{1}{c(b-a)} = -\frac{1}{a(b-c)}$
$\Rightarrow ba - ca = -cb + ac$
$\Rightarrow ab + bc = 2ac$
$\therefore\ b = \frac{2ac}{a+c}$
Hence, a, b, c are in HP.

8. *(a)* $\because \frac{\frac{n}{2}\left[2 \times 3 + (n-1)2\right]}{\frac{10}{2}\left[2 \times 5 + (10-1) \times 3\right]} = 7$
$\Rightarrow \frac{n(n+2)}{5 \times 37} = 7$
$\Rightarrow n^2 + 2n - 1295 = 0$
$\Rightarrow n^2 + 37n - 35n - 1295 = 0$
$\Rightarrow (n+37)(n-35) = 0$
$\therefore\ n = 35$

9. *(b)* The numbers are $13x$ and $15x$.
So, x is the HCF. Now,
HCF $\times$ LCM = Product of numbers

$x \times 39780 = 13x \times 15x$

$\Rightarrow x \times 39780 = 13 \times 15 \times x^2$

$\Rightarrow \quad x = \dfrac{39780}{13 \times 15} = 204$

$\therefore$ Numbers are $13 \times 204 = 2652$ and $15 \times 204 = 3060$

10. *(c)* I. Let $a = 4$, and $b = 10$

$\therefore \quad a + b = 14$

HCF (4, 10) = 2

and HCF (14, 10) = 2

$\therefore$ HCF (a,b) = HCF $(a + b,b)$

II. Let $a = 6$ and $b = 15$

$\therefore b - a = 15 - 6 = 9$

HCF (6, 15) = 3

HCF (6, 9) = 3

$\therefore$ HCF (a,b) = HCF $(a,b - a)$

11. *(c)* Required time = LCM of 42,56 and 63 s LCM of 42, 56 and 63 is

2	42, 56, 63
3	21, 28, 63
7	7, 28, 21
	1, 4, 3

$\therefore$ Required time

$= 2 \times 3 \times 7 \times 4 \times 3 = 504$ s.

12. *(a)* LCM of 6, 9 and 12 = 36

13. *(a)* $x = 15.9273 - 11.0049 = 4.9224$

14. *(c)* $\dfrac{3}{4} = 0.75, \dfrac{5}{6} = 0.833$

$\dfrac{1}{2} = 0.5, \dfrac{2}{3} = 0.66, \dfrac{4}{5} = 0.8$ and $\dfrac{9}{10} = 0.9$

Clearly, 0.8 lies between 0.75 and 0.8333.

$\therefore \dfrac{4}{5}$ lies between $\dfrac{3}{4}$ and $\dfrac{5}{6}$.

15. *(b)* $\dfrac{0.004 \times 0.0008}{0.002} = \dfrac{0.0000032}{0.02}$

$= 0.00016$

16. *(c)* Given expression

$= (11.98)^2 + (0.02)^2 + 11.98 \times x$

For the given expression to be a perfect square, we must have

$11.98 \times x = 2 \times 11.98 \times 0.02$

$\Rightarrow \quad x = 0.04$

[by using $(a + b)^2 = a^2 + b^2 + 2ab$]

17. *(a)* $N = 2^{0.15}$

$\Rightarrow N = (2)^{3/20}$

$\Rightarrow (N)^b = (2)^{3b/20}$

But, $N^b = 16$

$\therefore \quad 16 = (2)^{3/20}$

$\Rightarrow 2^4 = (2)^{3b/20}$

$\Rightarrow \quad 4 = \dfrac{3b}{20} \Rightarrow b = \dfrac{80}{3}$

18. *(d)* We know that, $(42)^2 = 1764$ and $(43)^2 = 1849$

Since, 1764 < 1780 < 1849

Hence, the smallest number that must be added to 1780 is (1849 − 1780), i.e. 69.

19. *(d)* $3\sqrt{5} + \sqrt{125} = 17.88$

$\Rightarrow \quad 3\sqrt{5} + 5\sqrt{5} = 17.88$

$\Rightarrow 8\sqrt{5} = 17.88$

$\Rightarrow \quad \sqrt{5} = \dfrac{17.88}{8} = 2.235$

$\therefore \sqrt{80} + 6\sqrt{5} = 4\sqrt{5} + 6\sqrt{5}$

$= 10\sqrt{5} = 10 \times 2.235$

$= 22.35$

20. *(b)* Total distance covered = 50 + 40 + 90 = 180 km

Total time taken

$= \left(\frac{50}{25} + \frac{40}{20} + \frac{90}{15}\right) = 10\text{ h}$

∴ Average speed for the whole journey

$= \frac{\text{Total distance travelled}}{\text{Total time taken}}$

$= \frac{180}{10} = 18\text{ km/h}$

$\therefore\ 18\text{ km/h} = \frac{18 \times 5}{18}\text{ m/s} = 5\text{ m/s}$

21. *(c)* I. Here, x = 20 km/h, y = 4 km/h,

$t_1 = 30\text{ min}, t_2 = 10\text{ min}$

According to formula,

∴ Required distance

$= (t_1 - t_2)(x + y)\frac{x}{y}$

$= \frac{(30 - 10)}{60}(20 + 4)\left(\frac{20}{4}\right)$

$= \frac{20}{60} \times 24 \times \frac{20}{4} = 5 \times 8 = 40\text{ km}$

So, I is incorrect.

II. Here, x = 20 km/h, y = 10 km/h,

$t_1 = 30\text{ min}, t_2 = 10\text{ min}$

According to formula,

∴ Required distance

$= \left(\frac{30 - 10}{60}\right)(20 + 10)\left(\frac{20}{10}\right)$

$= \frac{20}{60} \times 30 \times \frac{20}{10} = 20\text{ km}$

So, II is correct.

22. *(d)* Actual speed of boy = $(p - q)$ km/h

Time taken to cover 1 km = $\frac{1}{p - q}$

$\therefore \frac{1}{p - q} = r$

$\Rightarrow \frac{1}{r} = p - q$

23. *(d)* Let the distance between P and $Q = d$ km. Total time taken by Pranit

$= \frac{d}{10} + \frac{d}{15} = \frac{25d}{150}$

Total time taken by Harish.

$= \frac{2d}{12.5} = \frac{4d}{25}$

According to question,

$\frac{25d}{150} - \frac{4d}{25} = \frac{12}{60}$

$\Rightarrow d\left[\frac{25 - 24}{150}\right] = \frac{1}{5}$

$\Rightarrow \frac{d}{150} = \frac{1}{5} \Rightarrow d = 30\text{ km}$

24. *(a)* Let x km distance be covered in y h.

Then, speed of object in first case

$= \frac{x}{y}\text{ km/h}$

As, half of this distance is covered in double time.

Then, speed of object in second case

$= \frac{x}{y} \div 2y = \frac{x}{2} \times \frac{1}{2y} = \frac{x}{4y}\text{ km/h}$

∴ Ratio of first and second speeds

$= \frac{x}{y} : \frac{x}{4y} = 1 : \frac{1}{4} = 4 : 1$

25. *(d)* Distance travelled in 44 s = 2πr

$= 2 \times \frac{22}{7} \times 21 = 132\text{ m}$

$\therefore$ Speed $= \frac{132}{4} = 3$ m/s

$\left[\because \text{speed} = \frac{\text{distance}}{\text{time}}\right]$

Time taken to travel 3 km $= \frac{3000}{3}$

$= 1000 \text{ s} = \frac{1000}{60}$ min

$= 16$ min 40 s

26. *(d)* I. 18 men can earn in 5 days = ₹ 1440

1 man can earn in 1 day = ₹ $\frac{1440}{18 \times 5}$

$\therefore$ 10 men can earn in 6 days

$= \frac{1440}{18 \times 5} \times 6 \times 10$

$=$ ₹960 $\neq$ ₹1280

II. 16 men can earn in 7 days = ₹ 1120

1 man can earn in 1 day $= \frac{1120}{16 \times 7}$

$\therefore$ 21 men can earn in 4 days

$= \frac{1120}{16 \times 7} \times 21 \times 4 =$ ₹840 $\neq$ ₹800

So, neither statement I nor II is correct.

27. *(d)* 1 day work of $A = \frac{1}{x}$

1 day work of $B = \frac{1}{3x}$

$\therefore$ 1 day work of both A and B

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

given, one day work of both A and B

$= \frac{1}{12}$

$\Rightarrow \frac{4}{3x} = \frac{1}{12} \Rightarrow 3x = 48$

$\Rightarrow x = 16$

Hence, the value of x is 16.

28. *(c)* $\therefore$ One day work of Rajesh $= \frac{1}{6}$

$\therefore$ One day work of Shailesh $= \frac{1}{12}$

Hence, one day work of, Rajesh and Shailesh

$= \frac{1}{6} + \frac{1}{12} = \frac{2+1}{12} = \frac{3}{12} = \frac{1}{4}$

$\therefore$ Two day's work $= \frac{1}{2}$

Thus, if they work together for 2 day's, then half of the work will be complete.

29. *(b)* Given, x% of $y = 13x$

$\Rightarrow \frac{x}{100} y = 13x$

$\therefore y = 13 \times 100 = 1300$

30. *(a)* Let fraction be $\frac{x}{y}$

New fraction $= \frac{120\% \text{ of } x}{90\% \text{ of } y} = \frac{4x}{3y}$

According to question,

$\frac{4x}{3y} = \frac{16}{27} \Rightarrow \frac{x}{y} = \frac{16}{27} \times \frac{3}{4} = \frac{4}{9}$

31. *(a)* Let the total number of questions in examination be x.

By given condition, 40% of $x = 10$

$\Rightarrow \frac{x \times 40}{100} = 10 \Rightarrow x = \frac{1000}{40} = 25$

32. *(a)* Water in the mixture = 10% of 140 L

$= \frac{10}{100} \times 140 = 14$ L

Let x L of water added in the mixture, then

$\left(\frac{14 + x}{140 + x}\right) \times 100 = 12.5$

$\Rightarrow 1400 + 100x = 1750 + 12.5x$

$\Rightarrow 87.5x = 350$

$\Rightarrow\ x = \dfrac{350}{87.5} = 4\text{L}$

33. *(a)* Let monthly income be ₹ x

$\Rightarrow\ 87\frac{1}{2}\%$ of x = ₹ 3500

$\Rightarrow\ \dfrac{175}{2\times 100}x$ = ₹ 3500

$\therefore\ x = \dfrac{3500\times 2\times 100}{175}$ = ₹ 4000

34. *(a)* The price of item first increased by 20% and then decreased by 20%.

$\therefore$ Net effect

$= \left(20 - 20 + \dfrac{20\times(-20)}{100}\right)$

$= \dfrac{-400}{100} = -4\%$

35. *(c)* Glycerine in the given sample = 80% of

$5\text{ L} = \dfrac{80}{100}\times 5 = 4\text{L}$

Let x L of glycerine be added, then

$\dfrac{4+x}{(5+x)}\times 100 = 95$

$\Rightarrow\ 80 + 20x = 95 + 19x$

$\therefore\ x = 15\text{ L}$

36. *(c)* Let the sum be ₹ x.

Then, $\dfrac{x\times 13\times 1}{100} - \dfrac{x\times 12\times 1}{100} = 110$

$\Rightarrow\ \dfrac{x}{100} = 110$

$\Rightarrow\ x = 110\times 100$ = ₹ 11000

37. *(b)* Let the amount of A = ₹ a, time = 2 yr and rate = 5%

$\therefore$ Simple Interest of

$A = \dfrac{a\times 2\times 5}{100} = \dfrac{10a}{100}$

Let the amount of B = ₹ b, rate = 5% and time = 3 yr.

$\therefore$ Simple interest of

$B = \dfrac{b\times 3\times 5}{100} = \dfrac{15b}{100}$

Let the amount of C = ₹ c, time = 4 yr and rate = 5%

$\therefore$ Simple interest of

$C = \dfrac{c\times 4\times 5}{100} = \dfrac{20c}{100}$

But $\dfrac{a\times 10}{100} = \dfrac{b\times 15}{100} = \dfrac{c\times 20}{100}$

$\Rightarrow\ 10a = 15b = 20c = k$

So, $a = \dfrac{k}{10},\ b = \dfrac{k}{15},\ c = \dfrac{k}{20}$

$\therefore\ a:b:c = \dfrac{1}{10}:\dfrac{1}{15}:\dfrac{1}{20}$

38. *(a)* Given, P = ₹ 400, R = 5% and T = 3 yr

Simple interest $= \dfrac{P\times R\times T}{100}$

$SI = \dfrac{400\times 3\times 5}{100}$ = ₹ 60

$\therefore$ Amount = $P + SI$ = 400 + 60 = ₹ 460

39. *(c)* Here, rate of interest

$= 3\frac{1}{8}\% = \frac{25}{8}\%$

Let principal be ₹ x.

and simple interest = ₹ $\dfrac{3}{8}x$

$\therefore\ \dfrac{3}{8}x = \dfrac{x\times\frac{25}{8}\times T}{100}$

$\Rightarrow \dfrac{300}{25} = T \Rightarrow\ T = 12$ yr

40. *(d)* Let the person invest amount x and y into two different rates of interest.

$$\therefore \frac{x \times 12 \times 1}{100} + \frac{y \times 10 \times 1}{100} = 130$$

$\Rightarrow 12x + 10y = 13000$ ...(i)

and $\frac{y \times 12 \times 1}{100} + \frac{x \times 10 \times 1}{100} = 134$

$\Rightarrow 12y + 10x = 13400$ ...(ii)

On solving Eqs. (i) and (ii), we get

x = ₹ 500 and y = ₹ 700

41. *(a)* Given, P = ₹ 24000, R = 5% per annum and n = 3 yr

$$\therefore A = P\left(1 - \frac{R}{100}\right)^n$$

$$= 24000\left(1 - \frac{5}{100}\right)^3$$

$$= 24000\left(\frac{95}{100}\right)^3$$

$$= ₹\ 20577$$

42. *(d)* I. Given, R = 4%, n = 2 yr and A = ₹ 169, P = ?

$$A = P\left(1 + \frac{R}{100}\right)^n$$

$$169 = P\left(1 + \frac{4}{100}\right)^2$$

$$\Rightarrow 169 = P\left(\frac{26}{25}\right)^2$$

$$P = \frac{169 \times 25 \times 25}{26 \times 26} = ₹\ 156.25$$

II. Given, SI = ₹ 120, n = 2 yr and CI = ₹ 129

$$SI = \frac{P \times R \times T}{100}$$

$$120 = \frac{P \times R \times 2}{100} \Rightarrow PR = ₹\ 6000$$

$$\therefore P = \frac{6000}{R} \quad \ldots(i)$$

$$CI = P\left[\left(1 + \frac{R}{100}\right)^n - 1\right]$$

$$129 = P\left[\left(1 + \frac{R}{100}\right)^2 - 1\right]$$

$$1290000 = P\left[(100 + R)^2 - 100^2\right]$$

$$= P\left[R^2 + R \times 200\right]$$

$$= \frac{6000}{R}\left[R^2 + R \times 200\right]$$

[from eqn (i)]

1290000 = 6000R + 1200000

$$R = \frac{90000}{6000} = 15\%$$

Hence, both statement are correct.

43. *(b)* Give, CI = ₹ 832, SI = ₹ 800, n = 2 yr

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

$$\therefore 832 = P\left\{\left(1 + \frac{R}{100}\right)^2 - 1\right\} \ldots(i)$$

Also, $SI = \frac{P \times R \times T}{100}$

$$\Rightarrow 800 = \frac{P \times R \times T}{100}$$

$$\Rightarrow P = \frac{40000}{R}$$

From Eq. (i),

$$832 = \frac{40000}{R}\left(\frac{R^2}{10000} + \frac{2R}{100}\right)$$

$$\Rightarrow 832 = \frac{40000}{100}\left(\frac{R}{100} + 2\right)$$

$$\Rightarrow 832 = 4R + 800$$

$$\therefore R = \frac{32}{4} = 8\%$$

44. *(a)* Given, selling price of article

= ₹ 247.50 and gain = $\frac{25}{2}$%

$\therefore$ Cost price

$$= ₹\left\{\frac{100}{\left(100+\frac{25}{2}\right)}\times 247.50\right\}$$

$$= ₹\,\frac{100\times 2\times 247.50}{225} = ₹\ 220$$

45. *(a)* To calculate overall percentage is:

$$\text{Overall \%} = \frac{Gain\,\%\times Loss\,\%}{100}$$

Gain% = 20%

Loss% = 20%

Substituting,

$$\text{Overall Loss\%} = \frac{20\times 20}{100} = 4\%$$

Thus the man incurs a loss of 4%.

46. *(c)* Let marked price be ₹ x.

Selling price after 5% discount

$$= x - \frac{5}{100}x = \frac{19}{20}x$$

$$\text{Profit} = \text{SP} - \text{CP} = \frac{19}{20}x - 380$$

$$\text{Profit \%} = \frac{\frac{19}{20}x - 380}{380}\times 100$$

$$25 = \frac{\frac{19}{20}x - 380}{380}\times 100$$

$$x = 475\times\frac{20}{19} = ₹\,500$$

47. *(b)* Given, cost of article = ₹ 200

Selling price of article = 95% of (90% of 200)

$$= \frac{95}{100}\times\frac{90}{100}\times 200 = ₹\,171$$

48. *(c)* Given, cost price of 1L = ₹ 8.50

$\therefore$ Total CP of milk = 28 $\times$ 8.50 = ₹ 238

$\therefore$ Profit = 12.5% of 238

$$= \frac{12.5}{100}\times 238 = ₹\ 29.75$$

Let he added x L of water.

$\therefore$ Profit = $x \times 8.5 \Rightarrow 29.75 = x \times 8.5$

$\therefore \quad x = 3.5$L

49. *(c)* Let the cost price be ₹ x.

$$\text{Marked price} = \frac{x\times 100}{100} = ₹\,\frac{11x}{10}$$

$$\therefore\quad SP = \frac{11x}{10}\times\frac{90}{100} = \frac{99x}{100}$$

$\therefore$ Required gain/loss per cent

$$= \frac{\frac{99x}{100} - x}{x}\times 100 = -1\%$$

50. *(a)* Given, $x : y = 1 : 3$, $y : z = 5 : k$, $z : t = 2 : 5$ and $t : x = 3 : 4$

$$\frac{x}{y}\times\frac{y}{z}\times\frac{z}{t}\times\frac{t}{x} = 1$$

$$\Rightarrow \frac{1}{3}\times\frac{5}{k}\times\frac{2}{5}\times\frac{3}{4} = 1$$

$$\Rightarrow k = \frac{1}{2}$$

51. *(b)* $Speed \propto \dfrac{1}{Time}$

$\therefore$ Required ratio

$$= \frac{1}{4} : \frac{1}{3} : \frac{1}{2} = 3 : 4 : 6$$

52. *(a)* Let the number of coins of ₹ 1, 50 paise and 10 paise be 3x, 8x and 10x, respectively According to the question,

$$\frac{3x}{1} + \frac{8x}{2} + \frac{10x}{10} = 112$$

$$\Rightarrow 3x + 4x + x = 112$$

$$\Rightarrow \quad x = \frac{112}{8} = 14$$

∴ Number of 50 paise coins

= 14 × 8 = 112

53. *(b)* As $x \propto \frac{1}{y^2} \Rightarrow x = \frac{k}{y^2}$ …(i)

If $x = 1$
and $y = 6$

$1 = \frac{k}{6^2} \Rightarrow k = 36$

On putting the value of k in Eq. (i), we get

$x = \frac{36}{y^2}$ …(ii)

I. On putting $y = 3$ in Eq. (ii), $x = \frac{36}{9}$

$x = 4$

II. On putting $y = 6$ in Eq. (ii), we get

$x = \frac{36}{36} = 1$

$x = 1$

Both statements I and II are correct.

54. *(c)* Fresh grapes contain 10% pulp.

∴ 20 kg fresh grapes contain 2 kg pulp.

Dry grapes contain 80% pulp.

2 kg pulp would contain

$\frac{2}{0.8} = \frac{20}{8} = 2.5$ kg dry grapes

55. *(d)* $\left[\log_{10}\left(5 \log_{10} 100\right)\right]^2$

$= \left[\log_{10}\left(5 \log_{10} 10^2\right)\right]^2$

$= \left[\log_{10}\left(10 \log_{10} 10\right)\right]^2$

$= \left[\log_{10} 10\right]^2 \quad \left[\because \log_{10} 10 = 1\right]$

$= 1^2 = 1$

56. *(d)* The characteristic in log 6.7482×10^{-5} is – 5.

57. *(b)* $10^{\log_{10} m + 2\log_{10} n + 3\log_{10} p}$

$= 10^{\log_{10} m + \log_{10} n^2 + \log_{10} p^3}$

$\Rightarrow 10^{\log_{10} mn^2 p^3} = mn^2 p^3$

$\left[\because a^{\log_a p} = p\right]$

58. *(a)* $8 - 4x - 2x^3 + x^4 = 4(2 - x) - x^3(2 - x)$

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

59. *(d)* $\because (a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$

$\therefore (6)^2 = 26 + 2(ab + bc + ca)$

$\Rightarrow 2(ab + bc + ca) = 10$

$\Rightarrow ab + bc + ca = 5$

60. *(a)* $x^4 + 4y^4$

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

$= \left(x^2 + 2y^2\right)^2 - (2xy)^2$

$= \left(x^2 + 2y^2 - 2xy\right)\left(x^2 + 2y^2 + 2xy\right)$

From above it is clear that $x^4 + 4y^4$ is divisible by $x^2 + 2y^2 + 2xy$

61. *(b)* $x^{3/2} - xy^{1/2} + x^{1/2}y - y^{3/2}$

$= x\left(x^{1/2} - y^{1/2}\right) + y\left(x^{1/2} - y^{1/2}\right)$

$= \left(x^{1/2} - y^{1/2}\right)(x + y)$

⇒ Quotient

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

62. *(c)* Given, $f(x)$ and $g(x)$ vanish at $x = 1/2$

So, $(2x - 1)$ is a factor of $f(x)$ and $g(x)$ both.

Hence, HCF of $f(x)$ and $g(x) = 2x - 1$

63. *(c)* We know that, $(x + y)$ and $(x - y)$ are the factors of $(x^{10} - y^{10})$.

64. *(b)* $4y^4x - 9y^2x^3 = y^2x\left(4y^2 - 9x^2\right)$

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

$4y^2x^2+6yx^3 = 2yx^2(2y+3x)$

$\therefore$ Required HCF = $xy(2y+3x)$

65. *(b)* Since, HCF of x^2+x-12 and $2x^2-kx-9$ is $(x-k)$, then $(x-k)$ will be the factor of $2x^2-kx-9$.

$\therefore 2x^2-kx-9=0$

$\Rightarrow k^2-9=0$

$\Rightarrow k=\pm 3$

and factor of $2x^2-kx-9$ are $(x+4)(x-3)$.

Hence, value of k is 3.

66. *(a)* Here, $\dfrac{x^3+3x^2-1}{x^2+\sqrt{x-1}}$ is not rational expression, since the denominator is not a polynomial.

67. *(d)* Given, $x+y+z=0 \Rightarrow x+y=-z$.

On squaring both sides, we get

$x^2+y^2+2xy=z^2$

Similarly, $y^2+z^2-x^2=-2yz$ and $z^2+x^2-y^2=-2zx$

$$\therefore \frac{1}{x^2+y^2-z^2}+\frac{1}{y^2+z^2-x^2}+\frac{1}{z^2+x^2-y^2}$$

$$=\frac{1}{-2xy}+\frac{1}{-2yz}+\frac{1}{-2zx}$$

$$=\frac{1}{2}\left(\frac{z+x+y}{xyz}\right)=0$$

68. *(c)* Given equations are,

$\alpha x+3y=\alpha-3$ and $12x+\alpha y=\alpha$

Here, $a_1=\alpha,\ b_1=3,\ c_1=\alpha-3$

$a_2=12,\ b_2=\alpha,\ c_2=\alpha$

Since, system has unique solution,

So, $\dfrac{a_1}{a_2}\neq\dfrac{b_1}{b_2} \Rightarrow \dfrac{\alpha}{12}\neq\dfrac{3}{\alpha}$

$\Rightarrow \alpha^2\neq 36 \Rightarrow \alpha\neq\pm 6$

69. *(a)* Given, $ax^2-2\sqrt{5}x+4=0$ has equal roots.

$\therefore$ Discriminant

$$=\left(-2\sqrt{5}\right)^2-4(a)4=0 \quad [\because D=B^2-4AC]$$

$\Rightarrow 20-16a=0 \Rightarrow a=5/4$

70. *(b)* Let roots of equation be α and $\dfrac{1}{\alpha}$.

$\therefore$ Product of roots

$$=\alpha\times\frac{1}{\alpha}=\frac{\text{Constant term}}{\text{Coefficient of } x^2}=\frac{r}{p}$$

$\Rightarrow 1=\dfrac{r}{p} \Rightarrow r=p$

71. *(d)* Given, $\alpha+\beta=24$ and $\alpha-\beta=8$

On solving, we get $\alpha=16$ and $\beta=8$

Sum of roots = $\alpha+\beta=24$

and product of roots = 16×8 = 128

So, required equation is

$$x^2-24x+128=0$$

72. *(b)* Given, $2x^2-3x-4=0$

For getting a reciprocal roots, we replace x by $\dfrac{1}{x}$, we get

$$2\left(\frac{1}{x}\right)^2-3\left(\frac{1}{x}\right)-4=0$$

$$\Rightarrow \frac{2}{x^2}-\frac{3}{x}-4=0$$

$\Rightarrow \; -4x^2-3x+2=0$

$\Rightarrow \; 4x^2+3x-2=0$

73. *(b)* Here, $\alpha+\beta=b/a$ and $\alpha\beta=b/a$

So, $\sqrt{\dfrac{\alpha}{\beta}}+\sqrt{\dfrac{\beta}{\alpha}}=\dfrac{\alpha+\beta}{\sqrt{\alpha\beta}}=\dfrac{b/a}{\sqrt{b/a}}$

$=\sqrt{\dfrac{b}{a}}$

74. *(c)* Given, $\log_{10}\left(x^2-6x+45\right)=2$

$\Rightarrow \left(x^2-6x+45\right)=10^2=100$

$\Rightarrow x^2-6x-55=0$

$\Rightarrow x^2-11x+5x-55=0$

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

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

$\therefore x=11,\,-5$

75. *(b)* $\dfrac{1}{2}\left(\dfrac{3}{5}x+4\right)\geq\dfrac{1}{3}(x-6)$

$\Rightarrow \dfrac{3}{10}x+2\geq\dfrac{1}{3}x-2$

$\Rightarrow 9x+60\geq 10x-60$

$\Rightarrow -x\geq -120$

[multiplying both sides by -1]

$\Rightarrow x\leq 120$

Thus, all real numbers x which are less than or equal to 120 satisfies the inequality.

76. *(a)* $A\cup B=\{5,6,7\}\cup\{7,8,9\}$

$=\{5,6,7,8,9\}$

77. *(a)* Clearly, $A\cap(A\cup B)=A$

78. *(c)* Equivalent sets have same cardinal numbers. Here, cardinal numbers of I, III, IV sets are same.

79. *(d)* $\{x : x$ is an integer and less than $1000\}$ = [... ,998,999]

i.e. $x\in(-\infty, 1000)$ is an infinite set.

80. *(c)* $n(A\cup B)=n(A)+n(B)-n(A\cap B)$

$\therefore n(A\cap B)=n(A)+n(B)-n(A\cup B)$

$= 17 + 23 - 38 = 2$

81. *(b)* $\cos 15^\circ-\sin 15^\circ=\cos 15^\circ-\sin(90^\circ-75^\circ)$

$=\cos 15^\circ-\cos 75^\circ$

$=2\sin\dfrac{15^\circ+75^\circ}{2}\cdot\sin\dfrac{75^\circ-15^\circ}{2}$

$\left(\because \cos C-\cos D=2\sin\dfrac{C+D}{2}\sin\dfrac{D-C}{2}\right)$

$=2\sin 45^\circ\cdot\sin 30^\circ$

$=2\dfrac{1}{\sqrt{2}}\cdot\dfrac{1}{2}=\dfrac{1}{\sqrt{2}}$

82. *(c)* $\because$ Given, $\tan\theta+\dfrac{1}{\tan\theta}=2$

On squaring both side, we get

$\left(\tan\theta+\dfrac{1}{\tan\theta}\right)^2=(2)^2$

$\Rightarrow \tan^2\theta+\dfrac{1}{\tan^2\theta}+2=4$

$\Rightarrow \tan^2\theta+\dfrac{1}{\tan^2\theta}=2$

83. *(c)* Given, $x=y\cos\dfrac{2\pi}{3}=z\cos\dfrac{4\pi}{3}$

$\Rightarrow x=\dfrac{-y}{2}=\dfrac{-z}{2}=k$ (let)

$x=k,\; y=-2k,\; z=-2k$

$\Rightarrow xy+yz+zx=k(-2k)+(-2k)(-2k)+(-2k)k$

$=-2k^2+4k^2-2k^2=0$

84. *(a)* $\because A+B+C+D=360^\circ$

$\therefore A+B=360^\circ-(C+D)$

$\therefore \sin(A+B)=\sin[360^\circ-(C+D)]$

$= -\sin(C+D)$

$\therefore \sin(A+B)+\sin(C+D)=0$

Also,

$\cos(A+B)=\cos[360^\circ-(C+D)]$

$\cos(A+B)=\cos(C+D)$

Hence, only statement I is correct.

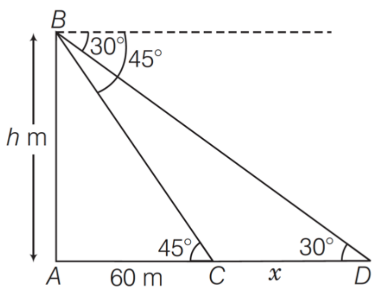
85. *(c)* $\cos 4x=1-2\sin^2 2x$

$=1-2(2\sin x\cos x)^2$

$=1-2(4\sin^2 x\cos^2 x)$

$=1-8\sin^2 x\cos^2 x$

86. *(a)* Let height of tower AB be h m and distance between C and D be x m.



In right angled ΔACB, $\tan 45^\circ=\frac{AB}{AC}$

$\Rightarrow 1=\frac{h}{60} \Rightarrow h=60$ m ...(i)

Now, in right angled ΔADB,

$\tan 30^\circ=\frac{AB}{AD}=\frac{AB}{AC+CD}$

$=\frac{60}{60+x}$

[from Eq. (i)]

$\Rightarrow \frac{1}{\sqrt{3}}=\frac{60}{60+x}$

$\Rightarrow 60+x=60\sqrt{3}$

$\Rightarrow x=60(\sqrt{3}-1)=60(1.73-1)$

$=60\times 0.73=43.8$ m

Now, given time = 5 s

We know that, Speed $=\frac{\text{Distance}}{\text{Time}}$

$\therefore$ Speed of boat

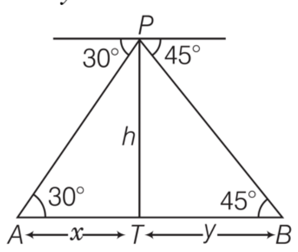
$=\frac{43.8}{5}\times\frac{18}{5}=\frac{788.4}{25}$

$=31.5$ km/h

87. *(a)* In right angled

ΔPBT, $\tan 45^\circ=\frac{h}{y}$

$\Rightarrow 1=\frac{h}{y}$



$\therefore y=h$ ...(i)

and in right angled ΔPTA,

$\tan 30^\circ=\frac{h}{x} \Rightarrow x=\sqrt{3}h$ ...(ii)

$\therefore$ Required distance, $AB=x+y$

$x+y=\sqrt{3}h+h=h(\sqrt{3}+1)$ m

88. *(b)* Given, angle = $\frac{3}{5}$ of right angle

$=\frac{3}{5}\times 90^\circ=3\times 18^\circ=54^\circ$

Supplement of $54^\circ=(180^\circ-54^\circ)$

= An angle of measure 126°

89. *(a)* Only statements I and II are true.

90. *(b)* Let the angles of a triangle be $2x$, $3x$, $4x$, then $2x + 3x + 4x = 180°$
[by angle sum property of a triangle]

$9x = 180° \Rightarrow x = 20°$

So, angles are $2x = 40°$,

$3x = 60°$, $4x = 80°$.

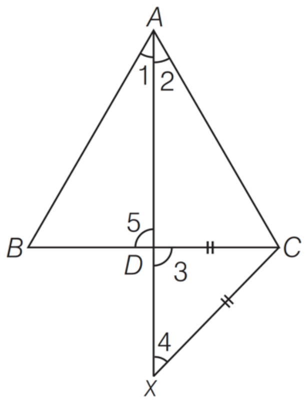
91. *(a)* In ΔDCX, $CD = CX$ [given]

$\angle 3 = \angle 4$
[opposite angle of same sides]

But $\angle 3 = \angle 5$, So, $\angle 4 = \angle 5$

In ΔABD and ΔACX,

$\angle 1 = \angle 2$ [given]

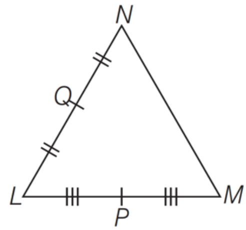


$\angle 4 = \angle 5$

$\therefore \quad \Delta ABD \sim \Delta ACX$
[by *AA* similarity]

92. *(c)* I. It is true that the three medians of a triangle divide it into six triangles of equal area.
II. It is also true that, the perimeter of a triangle is greater than the sum of the lengths of its three medians.
Hence, I and II are correct.

93. *(b)* Given,



I. $PQ^2 = MP^2 + NQ^2$

$\Rightarrow PQ^2 = LP^2 + LQ^2$

[$\because LP = MP$ and $NQ = LQ$]

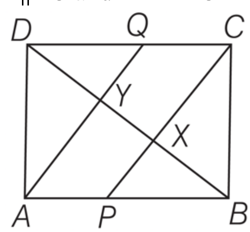
$\Rightarrow \angle QLP = 90°$

It means, ΔNLM is a right-angled triangle.

II. It also true that if in a ΔABC. $AB^2 > BC^2 + CA^2$, then $\angle ACB$ is obtuse.
Hence, both statements are individually true but statement II is not the correct explanation of statement I.

94. *(c)* As *ABCD* is a ||gm

$\therefore$ $AB || DC$ and $AB = DC$



and $\frac{1}{2}AB = \frac{1}{2}DC$

$\Rightarrow AP = QC$

$\therefore$ *APCQ* is a ||gm

$\Rightarrow \quad AQ || PC$

In ΔBAY, $XP || AY$
and P is the mid-point of AB

$\therefore BX = YX$

Similarly, in ΔDXC, $DY = YX$

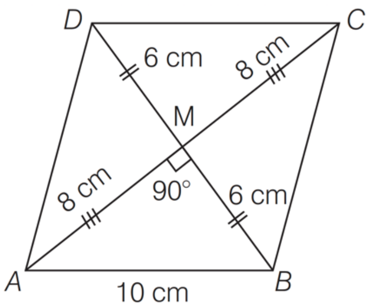
$\therefore\ BX = XY = DY$

95. *(a)* In a rhombus *ABCD*, if *AC* and *BD* are two diagonals then

$$AB^2 + BC^2 + CD^2 + AD^2 = AC^2 + BD^2$$

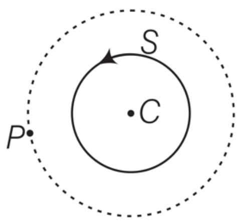
$$\Rightarrow (10)^2 + (10)^2 + (10)^2 + (10)^2 = (16)^2 + (12)^2$$

$$\Rightarrow 400 = 400$$



Hence, both I and II are true but III is false.

96. *(b)* If *S* is a circle with centre *C* and *P* be a movable point outside *S*, then the locus of *P* such that the tangent from *P* to *S* are of constant length is the circle through *P* with centre at *C*.



97. *(b)* Circumference of circle

$$= 2\pi r = 2 \times \frac{22}{7} \times 42 = 264 \text{ cm}$$

$\therefore$ Length of wire = 264 cm

Wire is bent into a square.

$\therefore$ Perimeter of square = 264 cm

$\Rightarrow 4 \times$ Sides of square = 264

$\therefore$ Side of square = $\frac{264}{4}$ = 66 cm

98. *(b)* Let the radius of big drop and small drop be *R* and *r* respectively.

By given condition,

27 × Volume of smaller drops = Volume of bigger drop

$$\therefore\ 27 \times \frac{4}{3}\pi r^3 = \frac{4}{3}\pi R^3$$

$$\Rightarrow 27 \times (0.2)^3 = R^3 \left[\because r = 0.2 \text{ cm}\right]$$

$$\Rightarrow (3 \times 0.2)^3 = R^3 \Rightarrow 0.6 \text{ cm}$$

99. *(c)* Lower class limits are obtained by subtracting 0.5 from the lower limit, so clearly 9.5, 19.5, 29.5 and 39.5 are the actual lower class limits.

100. *(a)* Required class boundary = Lower class boundary of lowest class + Width of class × Number of class

$$= 5.1 + 2.5 \times 10 = 30.1$$