ANSWER KEY

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

HINTS & SOLUTION

1. *(b)* Difference = Sum of digit at odd place – Sum of digit at even place =(1+5+9+4) – (2+4+3)
=19–9=10
In 10, we must add at least 1 so that it is divisible by 11. So $x = 1$
Also, the sum of digits of 1254934 =1+2+5+4+9+3+4=28
1254934 will be divisible by 3, after adding y, if the value of y is – 1. So, $x = 1$ and $y = -1$ is the set of values for x and y.

2. *(c)* Sum of all the digits in the number 26492518 = 2+6+4+9+2+5+1+8 = 37
When we subtract 4 from 37 then number will be divisible by 3 & 33 will not be divisible by 9

3. *(c)* HM = $\frac{2AB}{A+B} = \frac{2P}{S}$

4. *(d)* $\sqrt{\frac{x}{y}} = \frac{10}{3} - \sqrt{\frac{y}{x}}$ can be written as $\sqrt{\frac{x}{y}} = \frac{10}{3} - \frac{1}{\sqrt{\frac{x}{y}}}$

Let $\sqrt{\frac{x}{y}} = z$, Hence, $z = \frac{10}{3} - \frac{1}{z}$

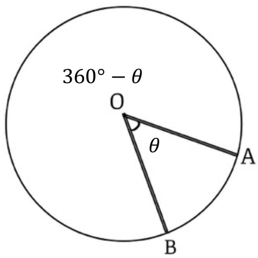
$\Rightarrow 3z^2 - 10z + 3 = 0$ Therefore, $z = 3$

We can say $\sqrt{\frac{x}{y}} = 3$,

Upon squaring both sides we get,
$\frac{x}{y} = 9 \;\; or \;\; x = 9y$

We also know that $x - y = 8$
Equating both we get $x = 9 \;,\; y = 1$

5. *(a)*



Let us say minute hand travelled x minutes
Hour hand is OA, Minute hand is OB
Angle between hour and minute hand, shown by BOA is θ
Now, If the minute hand and hour hand have interchanged the places then
OA hour hand will take place of OB traveling at angle θ
OB minute hand will take place of OA clockwise traveling $360° - \theta$
We know that Minute hand moves 6 degrees every minute
So, If minute hand travelled x *minutes*
$6x = 360 - \theta$
Hour hand moves 0.5 degrees every minute. Therefore, $0.5x = \theta$
Solving both equations we get
$x = 55.38$

6. *(a)*
$n = 5q + 2$

$3n = 3(5q + 2)$

$3n = 15q + 6$

$3n = 5(3q + 1) + 1$

7. *(b)*
$(n-1)^2 + n^2 + (n+1)^2 + (n+2)^2$
$= 294$

$4n^2 + 4n + 6 = 294$

Therefore, $n = 7$
Numbers are 7, 8, 9 and 10

8. *(b)* Given that,
$a^2 - b^2 = 35$

$(a+b)(a-b) = 35$

There can only two pairs as we know that only 7×5 *and* 35×1 will be 35.

(6,1) as $6^2 - 1^2 = 35$

(18,17) as $18^2 - 17^2 = 35$

9. *(b)*24=12×2, 36=12×3, 48=12×4, 72=12×6
HCF (24, 36, 48, 72) = 12
Total pieces = 2+3+4+6 = 15

10. *(a)* LCM of 2, 4, 6, 8 and 10 is 120
Therefore, we can say that all bells ring together at the same time after 120 seconds or 2 mins
Hence, in 20 minutes, all the bell will ring together 10 times

11. *(a)* Let 1st number = x , Let 2nd number = y

Also, LCM = 16HCF, LCM + HCF = 850

LCM × HCF = Product of numbers = $x \times y$

We know $x = 50$. Therefore upon solving we get, $y = 800$

12. *(d)* $\dfrac{LCM\ of\ 1,5,2,4}{HCF\ of\ 3,6,9,27} = \dfrac{20}{3}$

13. *(c)* LCM of these numbers will be
$3 \times 2 \times 2 \times 5 \times 3 \times 7 = 1260$

We can see that only 5 & 7 don't have pair. Hence, to make least perfect square we will multiply 1260 with 5 and 7

$1260 \times 5 \times 7 = 44100$

14. *(b)* We can write it as $\sqrt{\dfrac{64 \times 625}{81 \times 484}}$

$$\sqrt{\frac{(8 \times 25)^2}{(9 \times 22)^2}} = \frac{8 \times 25}{9 \times 22} = \frac{100}{99}$$

15. *(a)* Decimal expansion of a rational number is terminating.

16. *(c)* Upon solving option (c) , it gives -5 which is integer.

$[(\sqrt{2}+\sqrt{3})/(\sqrt{2}-\sqrt{3})] + 2\sqrt{6}$

By conjugate property, we can write

$$\left[\frac{\sqrt{2}+\sqrt{3}}{\sqrt{2}-\sqrt{3}} \times \frac{\sqrt{2}+\sqrt{3}}{\sqrt{2}+\sqrt{3}}\right] + 2\sqrt{6}$$

$$\left[\frac{5 + 2\sqrt{6}}{2-3}\right] + 2\sqrt{6}$$

$$-5 - 2\sqrt{6} + 2\sqrt{6} = -5$$

17. *(c)* Squaring option (c), we get

$(\sqrt{2})^2 + (\sqrt{7})^2 + 2 \times \sqrt{2} \times \sqrt{7}$

$2 + 7 + 2 \times \sqrt{2} \times \sqrt{7}$

$9 + 2\sqrt{14}$

18. *(a)* $11^3 = m^n \quad \therefore m = 11 \ , n = 3$

$(m - 1)^{(n-1)} = 10^2 = 100$

19. *(a)* Let the number be x.

Given that $x^2 + \dfrac{1}{x^2} = 3\left(x^2 - \dfrac{1}{x^2}\right)$

$2x^2 = \dfrac{4}{x^2} \quad \Rightarrow x^4 = 2 \quad \Rightarrow x = 2^{\frac{1}{4}}$

20. *(a)* Area of rectangle = Length × breadth.
If length is increased by 10% and area remains constant then breadth will decrease

$$\frac{110}{100}l \times b\frac{100}{110} = K$$

Percentage decrease in breadth

$$\frac{b - \frac{100b}{110}}{b} \times 100 = \frac{100}{11}\%$$

21. *(c)* Volume of a cylinder = $\frac{1}{3}\pi r^2 h$

Volume after increase =

$$\frac{1}{3}\pi\left(\frac{120}{100}r\right)^2 \times \left(\frac{120}{100}h\right)$$

$$\Rightarrow \frac{1}{3}\pi \times \frac{6}{5}r \times \frac{6}{5}r \times \frac{6}{5}h$$

$$\Rightarrow \frac{72}{125}\pi r^2 h$$

Percentage increase $= \dfrac{\frac{72}{125}\pi r^2 h - \frac{1}{3}\pi r^2 h}{\frac{1}{3}\pi r^2 h}$

$$\Rightarrow \frac{\frac{216\pi r^2 h - 125\pi r^2 h}{375}}{\frac{1}{3}\pi r^2 h} = \frac{3 \times 91\ \pi r^2 h}{375\ \pi r^2 h}$$

$$\Rightarrow \frac{273}{375} = 73\%$$

22. *(d)* Given that $x = \frac{k}{y^2}$, $x = 1,\ y = 6$

$\therefore k = 36$

Given if $y = 3,\ x = \frac{k}{y^2}$

$$\Rightarrow x = \frac{36}{3^2} = \frac{36}{9} = 4$$

23. *(b)* Let present age of mother and daughter be x and y.

2 years ago $(x-2) = 8(y-2)$

$\Rightarrow (x - 8y) = -14$

1 year after, $(x+1) = 5(y+1)$

$\Rightarrow x - 5y = 4$

On solving $y = 6$, $x = 34$

Given that after z years. Mother will be three times the daughter

$34 + z = 3(6+z) \quad \Rightarrow z = 8$ years

24. *(c)* Let the number of coins of 50 paise ,1 rupee and 2 rupee coins are $2x, 3x$ & $4x$ respectively.

Value of 50 paise coins = x Value of 1 coin = $3x$

Value of 2 coins = $8x$

According to the question,

$x + 3x + 8x = 240 \quad \Rightarrow x = 20$

Hence, total coins are $2x + 3x + 4x$

$\Rightarrow 9x = 9 \times 20 = 180$

25. *(c)* Let x number be added to 49 : 68, then it becomes 3:4

$$\frac{49+x}{68+x} = \frac{3}{4}$$

$196 + 4x = 204 + 3x$

$\Rightarrow x = 8$

26. *(b)* Let the average of 5 innings = x

Scores in 6th inning = 80. Hence, Total of 5 innings = $5x$

According to the question,

$$\frac{5x+80}{6} = x + 5$$

$\Rightarrow 5x + 80 = 6x + 30$

$\Rightarrow x = 80 - 30 = 50$

Average after six innings $= 50 + 5 = 55$

27. *(c)* Let x kg of tea be 9 Rupee per kg

$$\frac{9\times x+13.5\times 100}{x+100}=11$$

$\Rightarrow 9x + 1350 = 11x + 1100$

$\Rightarrow 2x = 250$

$\Rightarrow x = 125\ kg$

28. *(c)* Since, 5th term = average of 9 numbers $= x$

Sum of first five larger numbers = 68 × 5 = 340

Sum of first five smaller numbers = 44 × 5 = 220

Average of 9 numbers = $\frac{340+220-x}{9}$

(Since, x is subtracted because 5^{th} term is repeated twice)

$x=\frac{560-x}{9}$

$\Rightarrow 9x + x = 560 \Rightarrow x=56$

Sum of 9 numbers $= 56\times 9 = 504$

29. *(b)* Total borrowed money = ₹40000

Rate of interest = 8%

2 years interest $= \frac{40000\times 8\times 2}{100}=6400$

Let he be paid ₹x at the end of second year

Interest will be calculated on ₹$(40000 - x + 6400)$

Interest for 3 years = $\frac{(46400-x)\times 3\times 8}{100}$

$\frac{6}{25}(46400-x)$

$$\Rightarrow \frac{6}{25}(46400-x)+46400-x=35960$$

$$\Rightarrow 11136-\frac{6x}{25}+46400-x=35960$$

$$\Rightarrow \frac{31x}{25}=21576 \Rightarrow x=17400$$

30. *(b)*

$\frac{\log(x)}{\log(y)}\times T$

$$\Rightarrow \frac{\log(8)}{\log(2)}\times 4=\frac{\log_2(3)}{\log_2(1)}\times 4$$

$$\Rightarrow \frac{3}{1}\times 4=12$$

31. *(c)* Let the cost price of the watch = ₹x

After 40% marked price and 10% discount

$1.4x - 0.14x = 1.26x$

Hence, profit = $0.26x$

Tax of 10% was paid on the profit

$0.26x - 0.026x = 0.234x$

Given that, $0.234x = 468$

$\frac{234}{468}x = 468. \quad x = 2000$

32. *(b)* Two successive discounts will be

$36+4-\frac{36\times 4}{100}=38.56\%$

Difference between discounts = 40% − 38.56% = 1.44%

Amount will be = $10000\times\frac{1.44}{100}=144$

33. *(c)* Let the total distance of the journey be x km

According to the question

$$\frac{\frac{x}{2}}{30}+\frac{\frac{x}{2}}{70}=10 \Rightarrow \frac{7x+3x}{210}=20$$

$x = 2\times 210 = 420$ km

34. *(c)* Let speed of bike be v km.

Time taken = $\frac{200}{v}$

Time taken to cover 400 km at speed of (v+5) km = $\frac{200}{(v+5)}$

$$\frac{200}{v} - \frac{200}{v+5} = 2$$

$$\Rightarrow v^2 + 5v - 500 = 0$$

$$\Rightarrow v = 20$$

35. *(c)* Let us assume speed of X as 5 m/s
Therefore, speed of Y will be 6 m/s
Time taken by Y to cover 1.2 km race

$$\frac{1200}{6} = 200\ sec$$

Time taken by X to cover 1.2 km race

$$\frac{1200-70}{5} = \frac{1130}{5} = 226\ sec$$

So, Y wins the race by 26 seconds
Distance travelled by X in 26 seconds

$$26 \times 5 = 130m$$

36. *(b)* Let the number of men be n.

$$\frac{n}{42} = \frac{25}{14} \quad \Rightarrow n = 75$$

37. *(b)* One day work of A = $\frac{1}{8}$

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

3 day work of A = $\frac{3}{8}$

Remaining work of A = $1 - \frac{3}{8} = \frac{5}{8}$

One day work of A & B together = $\frac{1}{8} + \frac{1}{12} = \frac{5}{24}$

Days required to finish the remaining work

$$= \frac{5/8}{5/24} = 3$$

38. *(b)* $\frac{x}{p} = \frac{m}{m+r} \Rightarrow x = \frac{mp}{m+r}$

39. *(b)*

$$\left(\frac{\log(2)}{\log\left(\frac{1}{2}\right)}\right)\left(\frac{\log(3)}{\log\left(\frac{1}{3}\right)}\right)\left(\frac{\log(4)}{\log\left(\frac{1}{4}\right)}\right)\cdots\cdots$$

$$\left(\frac{\log(1000)}{\log\left(\frac{1}{1000}\right)}\right)$$

$$\Rightarrow \left(\frac{\log(2)}{-\log(2)}\right)\left(\frac{\log(3)}{-\log(3)}\right)\left(\frac{\log(4)}{-\log(4)}\right)\cdots$$

$$\left(\frac{\log(1000)}{-\log(1000)}\right)$$

$$\Rightarrow (-1)(-1)(-1)\ldots\ldots(-1) = -1$$

40. *(a)*

$$\log\left(\frac{5}{8}\right)^2 + \log\left(\frac{128}{125}\right) + \log\left(\frac{5}{2}\right)$$

$$\Rightarrow \log\left(\frac{5^2 \times 128 \times 5}{8^2 \times 125 \times 2}\right) = \log\frac{5^2 \times 2^7 \times 5}{(2^3)^2 \times 5^3 \times 2}$$

$$\Rightarrow \log\left(\frac{2^7 \times 5^3}{2^6 \times 5^3 \times 2}\right) = \log\frac{2^7 \times 5^3}{2^7 \times 5^3} = \log 1 = 0$$

41. *(b)* Given $x = \frac{k}{2}$ satisfies the equation

$$3\left(\frac{k}{2}\right)^3 - k\left(\frac{k}{2}\right)^2 + 4\left(\frac{k}{2}\right) + 16 = 0$$

$$\Rightarrow \frac{3k^3 - 2k^3 + 16k + 128}{8} = 0$$

$$\Rightarrow k^3 + 16k + 128 = 0$$

$$\Rightarrow (k+4)\left(k^2 - 4k + 32\right) = 0$$

$$\Rightarrow k + 4 = 0 \quad \Rightarrow k = -4$$

42. *(c)*
$x^4+xy^3+xz^3+x^3y+y^4+yz^3$
$\Rightarrow x\left(x^3+y^3+z^3\right)+y\left(x^3+y^3+z^3\right)$
$\Rightarrow (x+y)\left(x^3+y^3+z^3\right)$
Hence, $\left(x^3+y^3+z^3\right)$ is factor of
$x^4+xy^3+xz^3+x^3y+y^4+yz^3$

43. *(a)*
Given, $x+y+z=2s$
$\Rightarrow (s-x)+(s-y)-z=2s-(x+y+z)$
$=2s-2s=0$
$(s-x)^3+(s-y)^3-z^3+3(s-x)$
$(s-y)(z)=0$
$\Rightarrow (s-x)^3+(s-y)^3+3(s-x)$
$(s-y)(z)=z^3$

44. *(c)*
$(p+q)\left(p^2+q^2-pq\right)-r^3$
$(p+q)\left[(p+q)^2-3pq\right]-r^3$
$Given,\ p+q=r,\ pqr=30$
$r\left[r^2-3\times\frac{30}{r}\right]-r^3$
r^3-90-r^3

45. *(a)* Only Using $x=1$ satisfies the equation

46. *(c)* Given, $ab-b+1=0$.
$\Rightarrow b(a-1)=-1$
$\Rightarrow b=\frac{1}{1-a}$ ....(i)
Also, $bc-c+1=0$
$\Rightarrow b=\frac{-1+c}{c}$ ....(ii)

From equations (i) and (ii)
$\frac{1}{1-a}=\frac{-1+c}{c} \Rightarrow c=(1-a)(-1+c)$
$\Rightarrow c=-1+c+a-ac \Rightarrow a-ac=1$

47. *(a)* Given, $x+y+z=6$,
$xy+yz+zx=11$
Therefore, $x^3+y^3+z^3-3xyz$
$(x+y+z)(x+y+z)^2-3(xy+yz+zx)$
$\Rightarrow 6\left(6^2-3(11)\right)=6\times 3=18$

48. *(b)* Let S = {….-4, -2, 0, 2, 4, …}
I. Now, (-2) + 2 = 0 which is even integer
II. (-2) – 2 = - 4 which is even integer
III. (-2) × 2 = - 4 which is even integer
IV. (-2) / 2 = -1 which is odd integer

49. *(d)* Let a two digit number be $(10x+y)$ and reversing number be $(10y+x)$
Therefore, Required sum $=10x+y+10y+x$
$=11x+11y=11(x+y)$
Hence, it is divisible by 11

50. *(d)* Suppose there are x passengers at start
Number of passengers after 1st halt
$\left(x-\frac{x}{3}\right)+120=\frac{2x}{3}+120$
Number of passengers after 2nd halt
$\frac{1}{2}\left(\frac{2x}{3}+120\right)+100=240$
$\Rightarrow \frac{2x}{3}+120=(240-100)\times 2$
$\Rightarrow \frac{2x}{3}=280-120 \Rightarrow x=240$

51. *(c)* Let the price of each book be ₹x and the number of book is y. $\therefore xy=80$
$(y+4)(x-1)=80$

$\Rightarrow xy - y + 4x - 4 = 80$

$\Rightarrow 80 - y + 4x = 84$

$\Rightarrow 4x - y = 4 \quad \Rightarrow y = 4(x - 1)$

We know $xy = 80$

$4(x-1)(x) = 80$

$x^2 - x - 20 = 0 \quad \Rightarrow x = 5$

52. *(c)* Let the number be y

$\frac{y}{3} = \frac{y}{4} + 8$

$\Rightarrow \frac{4y - 3y}{12} = 8$

$\Rightarrow y = 12 \times 8 = 96$

Sum of digits $= 9 + 6 = 15$

53. *(c)* Given, $a1 = 4, b1 = 2, c1 = 0$

$a2 = 6, b2 = 3, c2 = 0$

$\frac{a1}{a2} = \frac{b1}{b2}$

Therefore, $\frac{4}{6} = \frac{2}{3} \Rightarrow \frac{2}{3} = \frac{2}{3}$

54. *(d)*

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

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

$\Rightarrow \frac{-(a+b)}{(a+b+x)x} = \frac{(a+b)}{ab}$

$\Rightarrow x^2 + (a+b)x + ab = 0$

$(x+a)(x+b) = 0$

$x = -a, -b$

55. *(c)* Let $\sqrt{\frac{x}{1-x}} = y$

$y + \frac{1}{y} = \frac{13}{6} \quad \Rightarrow (y^2 + 1)6 = 13y$

$\Rightarrow 6y^2 - 13y + 6 = 0$

$\Rightarrow y = \frac{2}{3}, \frac{3}{2}$

Putting value of y in x

$y = \frac{2}{3} \quad \Rightarrow \frac{x}{1-x} = \frac{4}{9}$

$\Rightarrow 9x = 4 - 4x$

$\Rightarrow x = \frac{4}{13}$

Putting value of y as $\frac{3}{2}$ in x

we get $x = \frac{9}{13}$

56. *(a)* Given, $px^2 + qx + r = 0$

α, β are the roots of the equation

According to question $\beta = 2\alpha$

$\alpha\beta = \frac{r}{p} = 2\alpha^2$

$\alpha^2 = \frac{r}{2p}$

$\alpha + \beta = -\frac{q}{p} = 3\alpha \qquad \Rightarrow \alpha = -\frac{q}{3p}$

$\left(\frac{q}{3p}\right)^2 = \frac{r}{2p} \quad \Rightarrow 2q^2 = 9pr$

57. *(b)*

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

Let $\sqrt{\frac{2x}{3-x}} = a$

$a - \frac{1}{a} = \frac{3}{2}$

$\Rightarrow 2(a^2-1)=3a$

$\Rightarrow 2a^2-3a-2=0 \quad \Rightarrow a=2$

$\Rightarrow \sqrt{\dfrac{2x}{3-x}}=2$

$\Rightarrow$ Squaring both the sides we get

$2x=12-4x \quad \Rightarrow x=2$

58. *(a)*
$\{(A\cup B)'\cap A\}-(A-B)$
$=\{(U-(A\cup B))\cap A\}-(A-B)$
$=\{(U\cap A)-\{(A\cup B)\cap A\}\}-(A-B)$
$=\{A-A\}-(A-B)$
$=\phi-(A-B)=\phi$

59. *(a)* A = {0,9,54,243…..}
B = {0,9,18,27,36,45,54……}
Hence, $A\subset B$

60. *(b)* {∅} is an element of {{∅}, {{∅}}}

61. *(d)* n(P∪M) = n(P) + n(M) – n(P∩M)
⇒ 50 + 75 – 35 =90
n(P∪M)′ = U – n(P∪M)
⇒ 250 – 90 = 160

62. *(c)*

$sec\theta=\dfrac{13}{5} \quad \Rightarrow sec^2\theta=\dfrac{169}{25}$

$\Rightarrow 1+\tan^2\theta=\dfrac{169}{25}$

$\Rightarrow \tan^2\theta=\dfrac{144}{25}=\dfrac{12}{5}$

$\Rightarrow \dfrac{2\sin\theta-3\cos\theta}{4\sin\theta-9\cos\theta}=\dfrac{2\dfrac{\sin\theta}{\cos\theta}-3}{4\dfrac{\sin\theta}{\cos\theta}-9}$

$\Rightarrow \dfrac{2\tan\theta-3}{4\tan\theta-9}=\dfrac{2\left(\dfrac{12}{5}\right)-3}{4\left(\dfrac{12}{5}\right)-9}=\dfrac{24-15}{48-45}=3$

63. *(d)* Squaring both the sides we get
$\sin^2+\cos^2\theta-2\sin\theta\cos\theta=1$

$\Rightarrow 1-2\sin\theta\cos\theta=1$

$\Rightarrow 1-\sin2\theta=1$

$\Rightarrow \sin2\theta=0$

Hence, θ is 0 & we can say $0°\leq\theta\leq 90°$

64. *(c)*

$\left(\cos^2\dfrac{\pi}{8}+\sin^2\dfrac{\pi}{8}\right)+4\cos^2\dfrac{\pi}{8}-\sec\dfrac{\pi}{3}+5\tan^2\dfrac{\pi}{3}$

$\Rightarrow 1+4\times\left(\dfrac{1}{\sqrt{2}}\right)^2-2+5\left(\sqrt{3}\right)^2$

$\Rightarrow 1+2-2+15=16$

65. *(d)* when $\theta=90°$, sin θ + cosec θ = 2
⇒ 1 +1 = 2
Similarly, keeping $\theta=90°$ in $sin^4\theta+cos^4\theta$, we get 1 + 0 = 1

66. *(a)* 3 sin θ + 4 cos θ = 5
Squaring both the sides we get

$9\,sin^2\theta+16\,cos^2\theta+24\,sin\theta cos\theta$
$=25$

$9(1-cos^2\theta)+16\,(1-sin^2\theta)$
$+24\,sin\theta cos\theta=25$

$9\,cos^2\theta+16\,sin^2\theta+24\,sin\theta cos\theta=0$

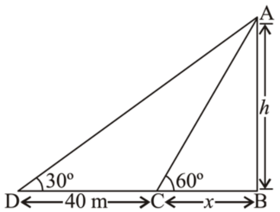
⇒ $(3\cos\theta-4\sin\theta)^2=0$
⇒ $(3\cos\theta-4\sin\theta)=0$

67. *(b)* $0\leq sin^2x\leq 1$
$0\leq sin^{10}x\leq 1$
$0\leq p\leq 1$

68. *(c)* sin46°cos44° + cos46°sin44°

$\Rightarrow \sin 46° \sin(90° - 44°) + \cos 46° \cos(90° - 44°)$
$\Rightarrow sin^2 46° + cos^2 46° = 1$

69. *(b)* Let the height of the tower be h and $BC = x$

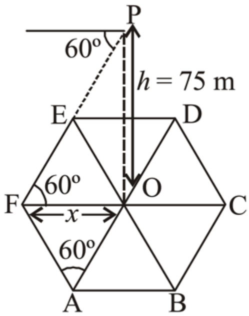


In ΔABC, $\tan 60° = h/x \quad \Rightarrow h = \sqrt{3}x$
In ΔADB, $\tan 30° = h/40+x$

$$h = \frac{40+x}{\sqrt{3}}$$

$$\sqrt{3}x = \frac{40+x}{\sqrt{3}} \Rightarrow 2x = 40 \Rightarrow x = 20$$

70. *(c)* Let OP be the height of the tower
x = distance between O and F

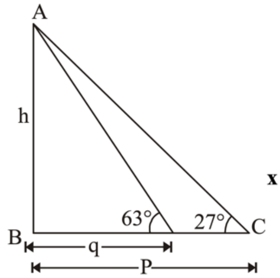


In ΔFOP,

$$\tan 60° = \frac{75}{x} \Rightarrow x = \frac{75}{\sqrt{3}} = 25\sqrt{3}$$

In a regular hexagon ΔOEF, ΔOED are equilateral triangles.
∴ OF = AF = AB = BC = CD = DE = EF = $25\sqrt{3}$ m
Length of hexagon = $25\sqrt{3}$ m

71. *(b)*



$$\tan 63° = \frac{h}{q} \qquad \tan 27° = \frac{h}{p}$$

$$\Rightarrow \tan(90° - 63°) = \frac{h}{p}$$

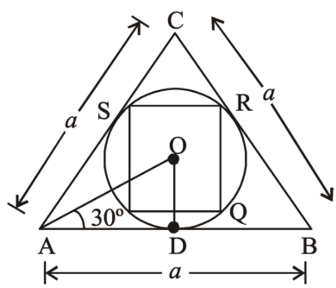
$$\Rightarrow \cot 63° = \frac{h}{p}$$

$$\Rightarrow \tan 63° = \frac{p}{h}$$

$$\Rightarrow \frac{h}{q} = \frac{p}{h} \qquad \Rightarrow h^2 = pq$$

$$\Rightarrow h = \sqrt{pq}$$

72. *(c)*



In ΔAOD,

$$\tan 30° = \frac{OD}{AD} = \frac{1}{\sqrt{3}} \Rightarrow OD = \frac{1}{\sqrt{3}}AD$$

$$\Rightarrow OD = \frac{1}{\sqrt{3}}AD = \frac{a}{2\sqrt{3}}$$

Now, OD "r" is radius of circle. Therefore diagonal of square = $2r = 2 \times \frac{a}{2\sqrt{3}} = \frac{a}{\sqrt{3}}$

Let side of the square be s

We know diagonal = $\sqrt{2}\,s$

$$\Rightarrow \frac{a}{\sqrt{3}} = \sqrt{2}\,s$$

$$\Rightarrow s = \frac{a}{\sqrt{6}} \quad \Rightarrow s^2 = \frac{a^2}{6}$$

73. *(b)* Let side of S1 & S2 be a & b

Perimeter of S1 = $4a$

Perimeter of S2 = $4b$

Area of S1 = a^2

Area of S2 = b^2

$\Rightarrow 4a = 4b + 12$

$\Rightarrow a = b + 3$

$\Rightarrow a^2 = 3(b^2) - 11$

$\Rightarrow (b+3)^2 = 3b^2 - 11$

$\Rightarrow b^2 + 9 + 6b = 3b^2 - 11$

$\Rightarrow 2b^2 - 6b - 20 = 0$

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

$\Rightarrow b = 5$, Perimeter of S1 = 32

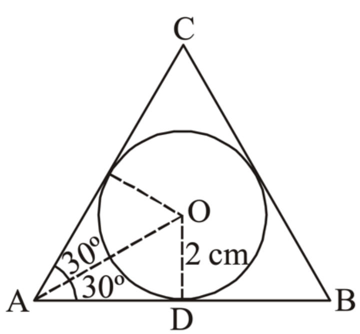
74. *(b)* We know that angle made by minute hand of a clock in a minute is 6°

Hence, angle made in 15 mins = 90°

$$\text{distance} = 2\pi r \times \frac{\theta}{360°}$$

$$\Rightarrow 2 \times \frac{22}{7} \times 14 \times \frac{90}{360} = 22$$

75. *(a)*



Given, Area of circle = 4p

$\Rightarrow \pi r^2 = 4\pi = r = 2\text{cm}$

$$\Rightarrow \text{In } \Delta \text{ OAD, } \tan 30° = \frac{\text{OD}}{\text{AD}}$$

$\Rightarrow \text{AD} = 2\sqrt{3}$

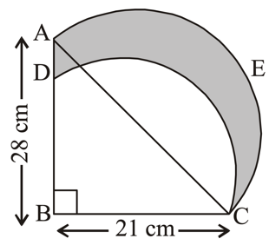
$\text{AB} = 2\text{ AD}$, Hence, $\text{AB} = 4\sqrt{3}$

Area of equilateral Δ ABC,

$$\Rightarrow \frac{\sqrt{3}}{4}(\text{AB})^2 = \frac{\sqrt{3}}{4}\left(4\sqrt{3}\right)^2$$

$\Rightarrow 12\sqrt{3}$

76. *(d)*



In Δ ABC, $\text{AC}^2 = \sqrt{28^2 + 21^2} = 35$

Area of shaded portion = Area of semi-circle ACE + Area of ΔABC – Area of quadrant circle BCD

$$\Rightarrow \frac{\pi r^2}{2} + \frac{1}{2} \times BC \times BA - \frac{\pi}{4} \times r^2$$

$$\Rightarrow \frac{22}{7} \times \frac{35}{2} \times \frac{35}{2} \times \frac{1}{2} + \frac{1}{2} \times 21 \times 28 - \frac{22}{7} \times \frac{1}{4} \times 21 \times 21$$

$\Rightarrow 428.75$

77. *(b)* Since, the distance covered by a man diagonally is

$$d = \frac{3 \times 100}{60} \times 1 = 50m$$

Area of field $= \frac{1}{2}d^2 = \frac{1}{2} \times 50^2 = 1250$

78. *(b)* 27 × Volume of smaller drops = Volume of bigger drop

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

$\Rightarrow 27 \times (0.2)^3 = R^3$

$\Rightarrow (3 \times 0.2)^3 = R^3$

$\Rightarrow R = 0.6$

79. *(b)* Let r be the radius of hemispherical bowl.

$2\pi r = \frac{132}{7}$

$\Rightarrow r = \frac{132}{7} \times \frac{7}{2 \times 22} = 3$

Volume of hemispherical bowl $= \frac{2}{3}\pi r^3$

$\frac{2}{3}\pi \times 3^3 = 18\pi$

80. *(b)* Let the radii and slant height of two right circular cone are r_1, l_1 *and* r_2, l_2 respectively.

Ratio of curved surface area = $\frac{\pi r_1 l_1}{\pi r_2 l_2} = \frac{l_1}{l_2} = 3:2$

81. *(b)* Perimeter = $4a = 20$

$a = 5$

Volume of cube = $a^3 = 125$

82. *(d)* Volume of wire = $\pi r^2 h$

New radius of wire = $\frac{r \times 90}{90} = \frac{9r}{10}$

Let new length of wire be L

Volume of new wire = $\pi\left(\frac{9r}{10}\right)^2 \times L = \frac{81}{100}\pi r^2 L$

According to the question,

$\pi r^2 h = \frac{81}{100}\pi r^2 L \Rightarrow L = \frac{100}{81}h$

Increase in length = $\frac{100}{81}h - h = \frac{19}{81}h$

Percentage increase = $\frac{\frac{19h}{81h}}{h} \times 110 = 23\%$

83. *(d)* Let x be the diameter of moon.

Required ratio = $\frac{\textit{volume of moon}}{\textit{volume of earth}}$

$\Rightarrow \frac{\frac{4}{3}\pi\left(\frac{x}{8}\right)^3}{\frac{4}{3}\pi\left(\frac{x}{2}\right)^3} = \frac{1}{64}$

84. *(b)* Let the angle be x, then supplement angle is $(180° - x)$

$\Rightarrow x = \frac{1}{5}(180 - x) \Rightarrow 5x = 180 - x$

$\Rightarrow x = \frac{180}{6} = 30$

85. *(b)* $AC \parallel BD$

$\angle DBA = 180 - 130 = 50$

Since, DBG is a straight line

$\angle DBA + \angle ABF + \angle FBG = 180$

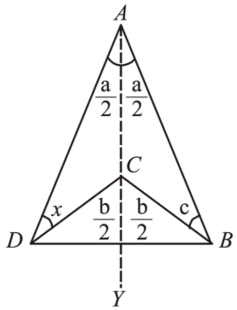
$\Rightarrow 50 + \angle ABF + 60 = 180$

$\Rightarrow \angle ABF = 70$

Since, $AE \parallel BF$

$x = 180 - \angle ABF = 110$

86. *(a)* A bisector AY is drawn of $\angle A$ & $\angle C$



In ΔADC,

$$x+\frac{a}{2}=\frac{b}{2}$$

In ΔACB,

$$c+\frac{a}{2}=\frac{b}{2}$$

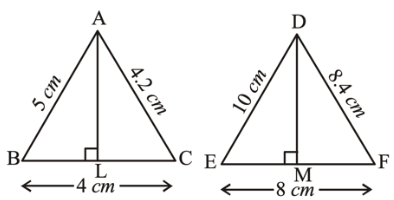
Upon adding both the equations

$$x+\frac{a}{2}+\frac{a}{2}+c=\frac{b}{2}+\frac{b}{2}$$

$$x+a+c=b$$

$$x=b-a-c$$

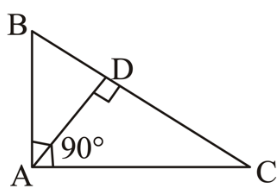
87. *(a)*



Every side of ΔDEF is double of ΔABC

Hence, we can say $\frac{AL}{DM}=\frac{1}{2}$

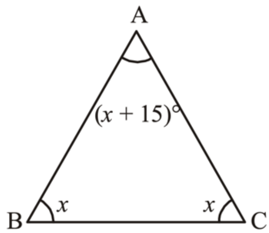
88. *(c)*



ΔABC is a right angled triangle at A

$AD \perp BC$, then according to triangle property $\Delta ABC \sim \Delta ADC \sim \Delta ADB$

89. *(b)* Let each base angle of isosceles triangle be x



Vertical angle of isosceles triangle = $x + 15°$

We know that, $\angle A + \angle B + \angle C = 180°$

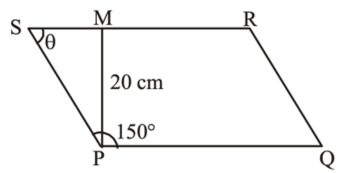
$\Rightarrow x + 15° + x + x = 180°$

$\Rightarrow 3x = 165° \qquad \Rightarrow x = 55°$

90. *(a)* Given that, $\angle SPQ = 150°$, $PM = 20$

In parallelogram PQRS,

$$\angle RSP + \angle SPQ = 180°$$
$$\angle RSP = 180° - 150° = 30°$$
$$\angle RSP = 30°$$



In ΔPSM, $\angle S$

$$\sin 30 = \frac{PM}{SP}$$

$$\Rightarrow \frac{1}{2}=\frac{20}{SP} \Rightarrow SP = 40cm$$

$$RQ=SP=40cm$$

91. *(b)* ABCD is a trapezium.

AD//BC & EF//BC (given)

Hence, EF//AD

$$\angle x + \angle y = 180°$$
$$\angle y = 180° - 120° = 60°$$

92. *(c)* The quadrilateral formed by joining the mid-points of the sides is a parallelogram.

93. *(c)* Given $\angle PAQ = 59°$, $\angle APD = 40°$

$\angle ADP = 180° - 59° - 40° = 81°$

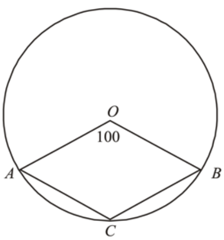
$\angle ADC + \angle ABC = 180° - 81° = 99°$

Now, In ΔABQ,

$\angle ABQ + \angle BAQ + \angle ABQ = 180°$

$\angle ABQ = 180° - 158° = 22°$

94. *(d)* It is given that, $\angle AOB = 100°$



Reflex$\angle AOB = 360° - \angle AOB$ =260°

$$\Rightarrow \angle ACB = \frac{\text{Reflex}\angle AOB}{2} = \frac{260}{2} = 130$$

95. *(d)* The variables are 210, 201, 102, 20, 12, 10, 2, 1 and 0

$GM = \sqrt[9]{210 \times 201 \times 102 \times 20 \times 12 \times 10 \times 2 \times 1 \times 0}$

$\Rightarrow \sqrt[9]{0} = 0$

96. *(c)* Here, maximum frequency is 80, hence mode will be between 15-20.

97. *(c)* Let the observation mean = x

Sum of 50 Observations = $50x$

According to the question,

$$\frac{50x - 45}{49} = x$$

$\Rightarrow 50x - 45 = 49x$

$\Rightarrow x = 45$

98. *(c)* Mode can be obtained from a histogram.

99. *(c)* Given,

$$\frac{x}{40 + 15 + x + 12 + 23} \times 360 = 36°$$

$$\Rightarrow \frac{x}{90x} = \frac{36°}{360°}$$

$\Rightarrow x = 10$

100. *(b)* For District A:

Maximum frequency = 59

Modal class = 44-47

$l = 44,\ f_1 = 59,\ f_0 = 36,\ f_2 = 30,$
$h = 3$

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$$

$$\Rightarrow 44 + \frac{59 - 36}{2 \times 59 - 36 - 30} \times 3$$

$$\Rightarrow 44 + \frac{23}{52} \times 3 = 44 + 1.33 = 45.33$$

For District B:

Maximum frequency = 54

Modal class = 47-50

$l = 47,\ f_1 = 54,\ f_0 = 35,\ f_2 = 41,$
$h = 3$

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$$

$$\Rightarrow 47 + \frac{54 - 35}{2 \times 54 - 35 - 41} \times 3$$

$$\Rightarrow 44 + \frac{19}{32} \times 3 = 47 + 1.78 = 45.33$$

Mode of District B > Mode of District A