ANSWER KEY

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

HINTS & SOLUTION

1. *(b)* Median =

$$\frac{\text{3rd term} + \text{4th term}}{2} \Rightarrow 2 = \frac{b+b}{2} = b$$

Arithmetic mean =

$$\frac{7}{3} = \frac{2a+2b+2c}{6}$$

$$\Rightarrow a+b+c=7$$

$$\Rightarrow a+c=5$$

Geometric mean =

$$2 = \sqrt[3]{abc} \Rightarrow abc = 8$$

$$\Rightarrow ac = 4 \quad \Rightarrow c = \frac{4}{a}$$

We know $a + c = 5$

Upon solving $a = 1, c = 4$

Required sum =

$$2\left(1^2 + 2^2 + 4^2\right) = 42$$

2. *(d)* Value of $c = 4$

3. *(d)* Mode = 3 Median – 2 Mean

$$\Rightarrow 3(2) - 2\left(\frac{7}{3}\right) = \frac{18-14}{3} = \frac{4}{3}$$

4. *(b)*

x	f	xf
1	3	3
2	5	10
3	9	27
4	f_1	$4f_1$
5	2	10
Total	$19 + f_1$	$50 + 4f_1$

$$\text{Mean} = \frac{\sum xf}{\sum f}$$

$$2.96 = \frac{50 + 4f_1}{19 + f_1}$$

$$\Rightarrow 56.24 + 2.96f_1 = 50 + 4f_1$$

$$\Rightarrow 6.24 = 1.04f_1 \quad \Rightarrow f_1 = 6$$

5. *(b)* The values correspond to "less than 10," "less than 20," "less than 30,". Total frequency for a class interval includes all the data points that are **less than the upper limit** of that interval. For example, the cumulative frequency for the class 0–20 includes frequencies from the intervals 0–10 and 0–20.

6. *(b)* Mode $= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$

Income less than	Class interval	Number of persons	Frequency
1500	1250 – 1500	100	20
1250	1000 – 1250	80	10
1000	750 – 1000	70	15
750	500 – 750	55	23
500	250 – 500	32	20
250	0 – 250	12	12

$$\Rightarrow 250 + \left(\frac{20-12}{40-12-23}\right) \times 250$$

$$\Rightarrow 250 + \frac{8}{5} \times 250 = 650$$

7. *(c)* We know, $AM = \frac{a+b}{2}$

$$\Rightarrow a+b=20$$

$$GM = \sqrt{ab} \quad \Rightarrow 8 = \sqrt{ab}$$

$$ab = 64$$

Upon solving we get a, b as 16, 4

8. *(b)* Nominal scale is where number has no value e.g colour of hair (black, white, grey)

ordinal scale implies that the classes must be put into an order such that each case in one class is different from other

Interval scale has equal interval with no true zero, zero doesn't refer to no value or nothing e.g zero temperature

Ratio scale has equal interval along with true zero, zero here refers to nothing

9. *(b)* Given, Median or middle term is 30
One value added is 8 which is less than 30
Another value 32 is more than 30
Hence, 30 is still the middle term

10. *(b)* As the number of observations and classes increases, the shape of frequency polygon tends to become increasingly smooth.

11. *(b)* We will first find total number of each type of pencil

$$\text{Number of type A pencil} = \frac{50}{1}$$

$$\text{Number of type B pencil} = \frac{x}{1.5}$$

$$\text{Number of type C pencil} = \frac{20}{2} = 10$$

$$\text{Average} = \frac{\text{Total money spent}}{\text{Total number of pencil}} = 1.25$$

$$\Rightarrow \frac{x + 50 + 20}{50 + 10 + \frac{x}{1.5}} = 1.25$$

$$\Rightarrow 70 + x = 1.25\left(60 + \frac{x}{1.5}\right)$$

$$\Rightarrow 70 + x = 75 + \frac{1.25}{1.5}x$$

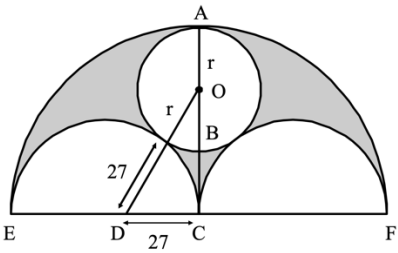
$$\Rightarrow x = 30$$

12. *(c)*

$$f_1 = 29 - 18 = 11$$

$$f_2 = 45 - 29 = 16$$

13. *(c)* Draw perpendicular OC on line CD



$$OA = r,\ OC = 54 - r,\ OD = 27 + r$$

$$In\ \Delta\ OCD,\ (27 + r)^2 = (54 - r)^2 + (27)^2 \quad \Rightarrow r = 18$$

Area of semi circle with diameter EF = $\frac{\pi}{2}(54)^2$

Area of semi circle with diameter EC = Area of semi circle with diameter CF = $\frac{\pi}{2}(27)^2$

Area of circle with diameter AB = $\pi(18)^2$

Area of shaded portion

$$\frac{\pi}{2}(54)^2 - \left[\frac{\pi}{2}(27)^2 + \frac{\pi}{2}(27)^2 + \pi(18)^2\right]$$

$$= 405\pi$$

14. *(c)* Area of square = 16

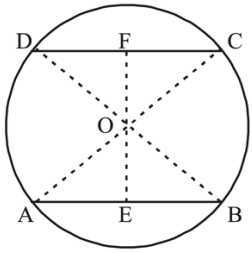
$$\text{Area of circle of centre} = 4 \times \frac{\pi}{4}\left(\frac{2}{2}\right)^2 = \pi$$

Total area removed = $\pi + \pi = 2\pi$

Area of shaded region $= 16 - \frac{44}{7} = \frac{68}{7}$

$= 9\frac{5}{7}$

15. *(b)*



$In\ \Delta BOE,\ OE = \sqrt{(OB)^2 - (BE)^2}$

$= \sqrt{(10)^2 - (8)^2} = 6$

$OF = \sqrt{(OC)^2 - (CF)^2}$

$= \sqrt{(10)^2 - (6)^2} = 8$

Distance between two parallel chord

$EF = OE + OF = 6 + 8 = 14$

Hence, one of the chords is 14 cm

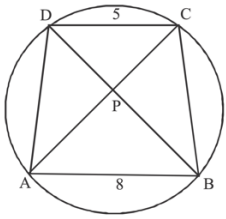
16. *(b)* Arc of sector $= \frac{1}{2}\theta \times r^2$

$25.6 = \frac{1}{2} \times \theta \times 16 \Rightarrow \theta = 3.2$

17. *(d)* Area of largest square in circle $= \frac{d^2}{2}$

We know radius is 1 cm, Area $= \frac{2^2}{2} = 2$

18. *(d)*



$\angle CDP = \angle ABP, \quad \angle DCP = \angle PAB$

Hence, Δ APB $\sim \Delta$ CPD

$\Rightarrow \frac{\text{Area of } \Delta \text{ APB}}{\text{Area of } \Delta \text{ CPD}} = \frac{AB^2}{CD^2}$

$\Rightarrow \frac{24}{\text{Area of } \Delta \text{ CPD}} = \frac{64}{25}$

$\Rightarrow$ Area of Δ CPD $= 9.375$

19. *(b)* Since interior angle of a regular polygon is 140°

Hence, exterior angle = $180° - 140° = 40°$

Number of sides $= \frac{360°}{40°} = 9$ sides or vertices

20. *(c)* Length of side of equilateral $\Delta = x$

Length of side of square = y

Given, $3x = 4y$

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

Area of square $= \left(\frac{3}{4}x\right)^2 = \frac{9}{16}x^2$

21. *(c)* If All sides are same for parallelogram then it is a rhombus

$d_1 + d_2 = 12\ cm,\ d_2 = 2d_1$

$\Rightarrow d_1 = 4cm,\ d_2 = 8cm$

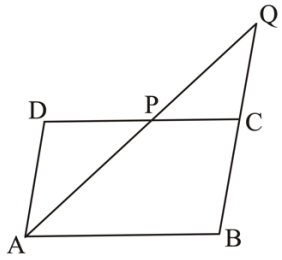
Area $= \frac{1}{2} \times d_1 d_2 = \frac{1}{2} \times 4 \times 8 = 16$

22. *(d)*

$\Delta APD \equiv \Delta QPC$

$\Rightarrow \frac{PC}{AB} = \frac{1}{2}$

$\Rightarrow \frac{Area\ (\Delta QPC)}{Area\ (\Delta QAB)} = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$



23. *(b)* Perimeter of $\Delta ABC = 75\ cm$

Perimeter of $\Delta PQR = 50\ cm$

$$\frac{\Delta ABC}{\Delta PQR} = \frac{AB}{PQ} \Rightarrow \frac{75}{50} = \frac{x}{20}$$

So, $\Rightarrow x = \frac{75 \times 20}{50} = 30\ cm$

24. *(a)* Area of $\Delta ABC = \frac{\sqrt{3}}{4} l^2$

Area of $\Delta ADE = \frac{\sqrt{3}}{4} \times \left(\frac{l}{2}\right)^2 = \frac{\sqrt{3}}{16} l^2$

Area of shaded region $= \frac{\sqrt{3}}{4} l^2 - \frac{\sqrt{3}}{16} l^2$

$\Rightarrow \frac{3\sqrt{3}}{16} l^2$

25. *(d)* Let BD = h

$In\ \Delta ABC,\ BC = \sqrt{h^2 + 16}$

$In\ \Delta BDA,\ AB = \sqrt{h^2 + 81}$

$In\ \Delta ABC,\ AB = \sqrt{169 - (h^2 + 16)}$

$\Rightarrow \sqrt{h^2 + 81} = \sqrt{153 - h^2}$

$\Rightarrow h^2 + h^2 = 153 - 81$

$\Rightarrow 2h^2 = 72 \Rightarrow h = 6$

26. *(a)* Area = $\frac{\sqrt{3}}{4} \times l^2$

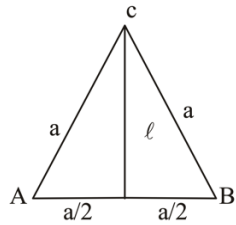
Area with half side = $\frac{\sqrt{3}}{4}\left(\frac{l}{2}\right)^2$

Percentage decrease in area =

$$\frac{\frac{\sqrt{3}}{4} l^2 - \frac{\sqrt{3}}{4}\left(\frac{l}{2}\right)^2}{\frac{\sqrt{3}}{4} l^2} \times 100$$

$$\Rightarrow \left(1 - \frac{1}{4}\right) \times 100 = 75\%$$

27. *(a)* Area of equilateral triangle = $\frac{\sqrt{3}}{4} a^2$



$$l = \sqrt{a^2 - \left(\frac{a}{2}\right)^2} = \frac{\sqrt{3}}{2} a$$

$$a = \frac{2}{\sqrt{3}} l$$

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

28. *(c)* Given, $\angle A = 80°,\ \angle ABC = 60°$

$\angle ACB = 180° - (80° + 60°) = 40°$

$$\Rightarrow x = \frac{40}{2} = 20$$

$$\angle DBC = \frac{60}{2} = 30,$$

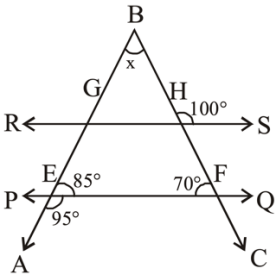
$\angle y = 180 - (30 + 20) = 130$

$x = 20,\ y = 130$

29. *(c)* Both the statements are correct.

30. *(b)*

$x = 180° - 85° - 70° = 25°$



31. *(b)* Let the radius of sphere be r

$4\pi r^2 = \frac{4}{3}\pi r^3 \Rightarrow r^2 = \frac{r^3}{3}$

$\Rightarrow r = 3$

32. *(d)* Volume of rectangle $= 20 \times 15 \times 10$
$= 3000$

Let number of equal small cube $= n$

Let the dimension of cube $= l$

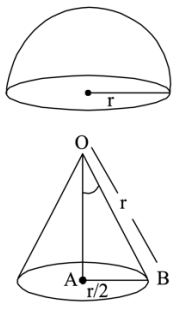
$n \times l^3 = 3000$

Taking $n = 24$ Option (d) , we get

$l^3 = \frac{3000}{24} = 125 \Rightarrow l = 5$

33. *(c)* Since, the radius of semicircle = slant height of the cone = r

Circumference of semi circle = Circumference of base of cone



$\pi r = 2\pi R \qquad \frac{r}{2} = R$

In $\Delta\, OAB,\ \sin\theta = \frac{R}{r} = \frac{\frac{r}{2}}{r} = \frac{1}{2}$

$\Rightarrow \sin\theta = \frac{1}{2}\ ,\ \sin 30° = \frac{1}{2}$

34. *(b)* Lateral surface area $= \frac{1}{2} \times$ Total surface area

$\Rightarrow 2\pi rh = \frac{1}{2}\left(2\pi rh + 2\pi r^2\right)$

$\Rightarrow 2\pi rh = \pi rh + \pi r^2$

$\Rightarrow 2\pi rh = \pi r(h + r)$

$\Rightarrow 2h = h + r \quad \Rightarrow h = r = \pi$

35. *(b)* We know that radius of sphere and cylinder will be the same

Volume of cylinder $= \pi r^2 h$

$\pi r^2 H = \pi r^2 D = 2\pi R^3$

$V = 2\pi R^3$

Volume of sphere $= \frac{4}{3}\pi R^3$ or $\frac{2}{3}V$

Required Volume $= 2\pi R^3 - \frac{4}{3}\pi R^3$

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

36. *(a)* Area $= xy$

Increased area $= 1.2x \times 1.1y = 1.32xy$

Percentage change $= \frac{0.32}{1} \times 100 = 32\%$

37. *(c)* Given, $l = 3b$

Perimeter $= 2(l + b) = 2(3b + b) = 8b$

Changed length = $l + \frac{30l}{100} = 1.3l = 3.9b$

changed breath $= b + \frac{10b}{100} = 1.1b$

New perimeter = $2(3.9b + 1.1b) = 10b$

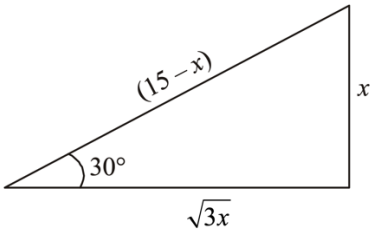
Percentage change in perimeter = $\left(\frac{10b - 8b}{8b}\right) \times 100 = 25\%$

38. *(c)* Area of square = a^2

Area of rectangle = xy

$x = a^2,\ a^2 = xy \Rightarrow y = 1$

39. *(c)* A tree is broken at height x from the ground



Length of broken tree = $(15 - x)$

$\sin 30° = \frac{x}{15 - x} \Rightarrow \frac{1}{2} = \frac{x}{15 - x}$

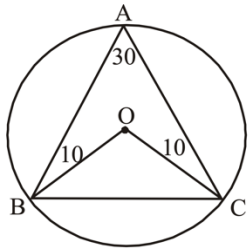
$\Rightarrow 2x = 15 - x \quad \Rightarrow 3x = 15,\ x = 5$

40. *(b)* We know, $\angle O = 60°$

Given triangle BOC is isosceles,

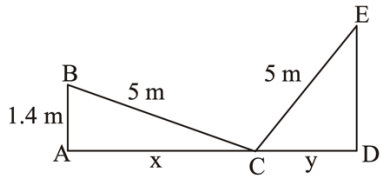
$\angle B = \angle C = x$

$60° + x + x = 180° \Rightarrow x = 60°$



Hence, It is equilateral triangle. BC = 10cm

41. *(c)* Let breadth of room = $x + y$



$x = \sqrt{25 - 1.96} = \sqrt{23.04} = 4.8$

$y = \sqrt{25 - 23.04} = \sqrt{1.96} = 1.4$

$x + y = (4.8 + 1.4) = 6.2$

42. *(c)* $\cot\theta = \frac{63}{16}$

Base = 16, Perpendicular = 63, Hypotenuse = 65

$\sin\theta + \cos\theta = \frac{P + B}{H} = \frac{63 + 16}{65} = \frac{79}{65}$

43. *(c)* Revolution in a minute = 360

Revolution in a second = 6

Number of radian it turns in one second

$= 6 \times 2\pi = 12\pi$

44. *(a)*

$\tan 6\theta = \cot 2\theta$

$\Rightarrow \cot(90° - 6\theta) = \cot 2\theta$

$\Rightarrow 90° - 6\theta = 2\theta$

$\Rightarrow 4\theta = 45°$

$\sec 4\theta = \sec 45° = \sqrt{2}$

45. *(c)*

$$\frac{\sin 19°}{\cos 71°} + \frac{\cos 73°}{\sin 17°}$$

$$\frac{\sin 19°}{\cos(90° - 19°)} + \frac{\cos 73°}{\sin(90° - 73°)}$$

$$\Rightarrow \frac{\sin 19°}{\sin 19°} + \frac{\cos 73°}{\cos 73°} = 1 + 1 = 2$$

46. *(b)* $\sin^2 25 + \cos^2 25° = 1$

47. *(b)* Taking option (a)

$4\sin^2\theta + 1 \geq 2$

$\Rightarrow 4\sin^2\theta - 1 \geq 0$

But we know this doesn't hold true when $\theta = 15°$ and $\sin 15° = 0.2588$

Taking option (b)

$4\sin^2\theta + 1 \geq 4\sin\theta$

$\Rightarrow 4\sin^2\theta - 4\sin\theta + 1 \geq 0$

$\Rightarrow (2\sin\theta - 1)^2 \geq 0$

48. *(c)*

$\sin(A+B) = \frac{\sqrt{3}}{2}$

$\Rightarrow \sin(A+B) = \sin\left(\frac{\pi}{3}\right) \Rightarrow A+B = \frac{\pi}{3}$

$\cos B = \frac{\sqrt{3}}{2}$

$\Rightarrow \cos B = \cos\left(\frac{\pi}{6}\right) \Rightarrow B = \frac{\pi}{6}$

$A = \frac{\pi}{3} - \frac{\pi}{6} = \frac{\pi}{6}$

$\tan(2A - B) = \tan\left(2\times\frac{\pi}{6} - \frac{\pi}{6}\right)$

$\Rightarrow \tan\left(\frac{\pi}{3} - \frac{\pi}{6}\right) = \tan\left(\frac{\pi}{6}\right) = \frac{1}{\sqrt{3}}$

49. *(b)* $\cos\theta = \frac{1}{\sqrt{5}}$

$H = \sqrt{5}$, $B = 1$, $P = 2$

$\tan\theta = \frac{2}{1} = 2$

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

50. *(b)* Given, $\tan x = 1$, $x = 45°$

$2\sin x\cos x = 2\times\frac{1}{\sqrt{2}}\times\frac{1}{\sqrt{2}} = 1$

51. *(c)* $\frac{\cos^4 A - \sin^4 A}{\cos^2 A - \sin^2 A}$

$\Rightarrow \frac{(\cos^2 A)^2 - (\sin^2 A)^2}{\cos^2 A - \sin^2 A}$

$\Rightarrow \frac{(\cos^2 A + \sin^2 A)(\cos^2 A - \sin^2 A)}{\cos^2 A - \sin^2 A} = 1$

52. *(c)*

$0 < x < \frac{\pi}{2}$

$\sin 0 < \sin x < \frac{\sin\pi}{2} \Rightarrow 0 < \sin x < 1$

Similarly, $\infty > \operatorname{cosec} x > 1$

Hence, $\sin x + \operatorname{cosec} x > 2$

53. *(b)*

$\frac{\sin 1°}{\sin 1^c} = \frac{0.0174}{\sin\left(\frac{180}{\pi}\right)} = \frac{0.0174}{0.8415} = 0.02$

54. *(d)*

$7\sin^2 x + 3\cos^2 x = 4$

$\Rightarrow 7\sin^2 x + 3 - 3\sin^2 x = 4$

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

$P = 1,\ H = 2,\ B = \sqrt{3}$

$\Rightarrow \tan x = \frac{1}{\sqrt{3}}$

55. *(a)*

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

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

Hence, $A = B$

56. *(a)* When $\cos\theta_1+\cos\theta_2+\cos\theta_3=3$

$\sin\theta_1+\sin\theta_2+\sin\theta_3$ will be zero

57. *(d)*

$$\left(\sin^2\theta\right)^2-\left(\cos^2\theta\right)^2$$

$$\Rightarrow\left(\sin^2\theta+\cos^2\theta\right)\left(\sin^2\theta-\cos^2\theta\right)$$

$$\Rightarrow 1\left(\sin^2\theta-\cos^2\theta\right)=1-2\cos^2\theta$$

58. *(c)* Compliment angle of 80° = 90° − 80° = 10°

10° in radian can be written as $10\times\frac{\pi}{180}=\frac{\pi}{18}$

59. *(a)* We know that $\tan\theta + sec\theta = 2$

Also,

$$\left(sec^2\theta-\tan^2\theta\right)=1$$

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

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

$$2\tan\theta=2-\frac{1}{2}\Rightarrow\tan\theta=\frac{3}{4}$$

60. *(d)*

$$\sin\theta\cos\theta=2\cos^3\theta-1.5\cos\theta$$

$$\sin\theta\cos\theta=\left[2\cos^2\theta-1.5\right]\cos\theta$$

$$\sin\theta=2\,(1-\sin2\theta)-1.5$$

$$2\sin^2\theta+\sin\theta-0.5=0$$

$$\sin\theta=\frac{-1\pm\sqrt{(1)^2+4\times2\times0.5}}{4}$$

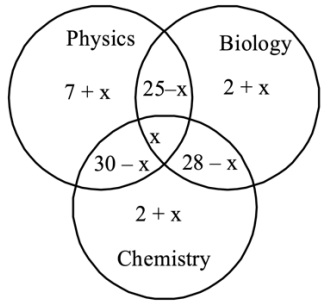
$$\Rightarrow\frac{-1\pm\sqrt{5}}{4}$$

61. *(d)*

$$(X\cap Y)=\{a,\{b\},c\}\cap\{\{a\},b,c\}=c$$

$$\Rightarrow(X\cap Y)\cap Z=c\cap\{a,b,\{c\}\}=\phi$$

62. *(a)*



Total passed student = 98%

$$7+x+2+x+2+x+30-x+25-x+28-x+x=98$$

$$94+x=98,x=4\%$$

63. *(b)* Percentage of students passed in exactly one subject

$$7+x+2+x+2+X=11+3x$$

$$11+12=23\%$$

64. *(a)* Passed in at least two subject

$$\frac{25-x+30-x+28-x+x}{100}\times360$$

$$\Rightarrow\frac{83-2x}{100}\times360=270$$

65. *(b)* Ratio $=\frac{30}{25-x}=\frac{30}{21}=\frac{10}{7}$

66. *(a)*

α, β are roots of $x^2+kx-15=0$

Sum of roots $(\alpha+\beta)=-k$

Product of roots $(\alpha\beta)=-15$

Given, $\alpha-\beta=8$

$(\alpha-\beta)^2+4\alpha\beta=(\alpha+\beta)^2$

$\Rightarrow 64+(4\times -15)=k^2 \quad \Rightarrow k=2$

67. *(a)*

$\alpha+\beta=-\frac{m}{l},\ \alpha\beta=\frac{m}{l}$

Given, $\frac{\alpha}{\beta}=\frac{p}{q}$

$\sqrt{\frac{p}{q}}+\sqrt{\frac{q}{p}}+\sqrt{\frac{m}{l}}$

$\Rightarrow\sqrt{\frac{\alpha}{\beta}}+\sqrt{\frac{\beta}{\alpha}}+\sqrt{\frac{m}{l}}=\frac{\alpha+\beta}{\alpha\beta}+\sqrt{\frac{m}{l}}$

$\Rightarrow\frac{-\frac{m}{l}}{\sqrt{\frac{m}{l}}}+\sqrt{\frac{m}{l}}=-\sqrt{\frac{m}{l}}+\sqrt{\frac{m}{l}}=0$

68. *(a)* Given, p, q are roots of the equation $p+q=-p\ ,\ pq=q$

Hence, $p=1,\ q=-2p$

69. *(c)* Let the wife get share of x

Each of the 4 daughters get $2x$

Each of the 5 sons get share of $6x$

So, $x+4\times 2x+5\times 6x=390000$

$\Rightarrow 39x=390000 \ \Rightarrow x=10000$

Hence, Wife share is 10000

70. *(b)*

$3^{x+2}+3^{-x}=10$

Using option (a), when $x=0$

$\Rightarrow 3^2+3^0=10$

When $x=-2$

$\Rightarrow 3^{-2+2}+3^2=10$

Hence, Option (a) is the answer

71. *(a)* Taking $k=0$, we get $x^3-7x+6=0$

$x^2(x-1)+x(x-1)-6(x-1)=0$

$(x-1)\left(x^2+x-6\right)=0$

$(x-1)(x+3)(x-2)=0$

$x=1,\ 2\ \&\ -3$

72. *(d)* $\frac{1}{x^2+5x+10}$ will be maximum when $x^2+5x+10$ will be minimum

Option (d) will be $\frac{1}{\frac{4}{15}}=\frac{15}{4}=3.75$

73. *(a)* $\left(x-x^2\right)$ is maximum when $0<x<1$

Hence, option (c) is the answer

74. *(c)*

$\frac{a^2-1}{a}=5 \ \Rightarrow\frac{a^2}{a}-\frac{1}{a}=5$

$\Rightarrow a-\frac{1}{a}=5$

$\Rightarrow\frac{a^6-1}{a^3}=\frac{a^6}{a^3}-\frac{1}{a^3}=a^3-\frac{1}{a^3}$

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

$(5)^3+3\times 5=140$

75. *(a)* The roots of any square number is always positive and hence it can be zero only at $a=b$

So the above equation is positive only when $a\neq b$

76. *(a)*

$(a+b)^3=125$

$\Rightarrow a^3+b^3+3ab(a+b)=125$

$\Rightarrow a^3+b^3=125-90=35$

77. *(c)*
$\log(108)^{10} = 10\log 108 = 10\log(2^2 \times 3^3)$
$\Rightarrow 10(2\log 2 + 3\log 3)$
$\Rightarrow 10(2 \times 0.301 + 3 \times 0.477)$
$= 10(0.602 + 1.431)$
$\Rightarrow 10 \times 2.033 = 20.33$

78. *(a)* Option (a) is correct

79. *(a)*
$\log_{10}(\cos\theta \sin\theta \tan\theta \cot\theta \sec\theta \operatorname{cosec}\theta)$
$= 1$

80. *(c)* $y = x^{\log x}$
Taking log on both sides we get
$\log y = \log(x^{\log x})$
$\Rightarrow \log x \times \log x = (1.25)^2 = 1.5625$

81. *(d)*
$\frac{12 \times 16}{10} = \frac{8 \times t_2}{20} \Rightarrow t_2 = 48$

82. *(d)* Time taken to empty tank by second outlet $= \frac{1}{\left(\frac{1}{20} - \frac{1}{30}\right)} = \frac{1}{\frac{1}{60}} = 60$

83. *(c)* $\frac{5 \times 5}{5} = \frac{x \times 50}{100} \Rightarrow x = 10$

84. *(c)* Time taken by X and Y to cover distance is $5x$, $4x$ respectively
$5x - 4x = 45\ min \Rightarrow x = 45$
Hence, $4x = 180$

85. *(c)* Cost of 1 orange 1st variety = 1/3
Cost of 1 orange 2nd variety = 1/2
Cost of 1 orange after mixing = 5/12
Profit of 20% on mixed orange =
$\frac{5}{12} \times \frac{120}{100} = \frac{1}{2}$
Selling price of 1 orange = 1/2
Selling price of 12 orange = 6

86. *(c)* Given, $P = x,\ A = y$

87. *(c)* Let the actual cost price of cloth = x
Cost price of False 1.1m cloth = x
Now, cost price of false 1 m cloth = $\frac{x}{1.1}$
Given, he sells at cost price
So actual selling price of 1m cloth = x
Selling price of 0.9 m cloth = $\frac{x}{0.9}$
Profit = $\frac{\left(\frac{x}{0.9} - \frac{x}{1.1}\right)}{\frac{x}{1.1}} \times 100 = 22\frac{2}{9}\%$

88. *(b)* Average speed = $\frac{\text{Total distance}}{\text{Total time}}$
$\frac{9\frac{50}{60} + 8\frac{80}{60} + 7.5\frac{100}{60}}{\frac{50}{60} + \frac{80}{60} + \frac{100}{60}} = \frac{(45 + 64 + 75)}{23}$
$\Rightarrow 8$

89. *(c)*
$\frac{(11 + 22 + 33 + 44 \ldots\ldots + 99)}{9} = 55$

90. *(c)* Given,
$y = \frac{k}{\sqrt{x}}$
$\Rightarrow 36 = \frac{k}{\sqrt{36}} = \frac{k}{6} \Rightarrow k = 216$
$\Rightarrow \sqrt{x} = \frac{k}{y} = \frac{216}{54} = 4 \Rightarrow x = 16$

91. *(a)* Train fare is $3x$, when increased by 12% it becomes $3.6x$
Bus fare is $4x$, when increased by 13% it becomes $5.2x$
Ratio = $\frac{3.6}{5.2}$ = 9:13

92. *(c)*
$(a+b)^2 = 16+6\sqrt{7}$
$\Rightarrow 2ab = 6\sqrt{7}\ ,\ \Rightarrow ab = 3\sqrt{7}$
$\Rightarrow a = 3,\ b = \sqrt{7}$
$\Rightarrow (16+6\sqrt{7}) = (9+7+6\sqrt{7})$
$\Rightarrow (3^3 + (\sqrt{7})^2 + 2\times 3\sqrt{7})$
$\Rightarrow (\sqrt{7}+3)^2$

93. *(c)* Value of $0.\dot{9} = \frac{9}{9} = 1$
Value of $0.9 = \frac{9}{10}$
Difference = $1 - \frac{9}{10} = \frac{1}{10} = 0.1$

94. *(b)* HCF of two numbers are 12
Let the two numbers are $12a, 12b$
Then, $12a \times 12b = 2160$
$\Rightarrow ab = 15$
Set of numbers possible are (1,15) & (3,5)
Mean of these numbers are 8, 4
Mean of means = 6
$\Longrightarrow 6 \times 12 = 72$

95. *(d)* For prime no units place cannot be occupied by even number except for 2
Thus no of digits occupying unit digit of prime numbers = 6 (1,2,3,5,7,9).

96. *(c)* If p×q is even, then at least one of p or q is even. So the statement (c) is false

97. *(d)* 0.12112211122211112222.....cannot be represented in the form of p/q. So that is an irrational number.

98. *(b)* $3^{98} - 3^{89}$
$3^{4\times 24+2} - 3^{4\times 22+1}$
Last digit of $3^{4\times 24+2}$ is 9
Last digit of $3^{4\times 22+1}$ is 3
$9 - 3 = 6$

99. *(d)* The product of two square numbers is always a square number

100. *(d)* $a^n + b^n$ is only divisible by $a+b$
When n is odd. $a^n + b^n$ is not divisible by $a-b$