Solutions to RMT–DS2/Set-3

1. (*c*) $$\text{LCM} = \frac{15 \times 85}{5} = 255$$

2. (*c*) As, the graph of given polynomial, $y = f(x)$ does not intersect x-axis, so it has no zeroes.

3. (*b*) As, lines represented by $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are intersecting if

$$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$$

So, $ax + by = c$ and $qx + py = r$ are intersecting if $\frac{a}{q} \neq \frac{b}{p}$

4. (*a*) The given quadratic equation is:

$$3kx^2 - 6kx + 2 = 0$$

For real and equal roots

$$D = 0$$

$\Rightarrow$ $$b^2 - 4ac = 0$$

$\Rightarrow$ $$(-6k)^2 - 4 \times 3k \times 2 = 0$$

$\Rightarrow$ $$36k^2 - 24k = 0$$

$\Rightarrow$ $$12k[3k - 2] = 0$$

$\Rightarrow$ $$k = \frac{2}{3} \text{ or } k = 0 \text{ (rejected)}$$

So, $$k = \frac{2}{3}$$

5. (*b*) $$a_{100} - a'_{100} = -3 + 99d - 4 - 99d = -7 \qquad [\because a_n = a + (n-1)d]$$

6. (*d*)

Let P be the point of division that divides AB in the ratio of $k : 1$

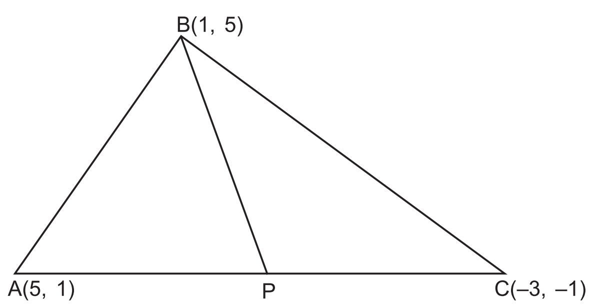
Now, P lies on y-axis, so its abscissa is 0.

$\therefore$ By section formula:

$$0 = \frac{k \times 5 + 1 \times (-2)}{k + 1} \Rightarrow k = \frac{2}{5}$$

So, required ratio = 2 : 5

7. (*a*)



Since BP is median to AC, so P is mid-point of AC.

$\therefore$ Coordinates of P $= \left(\frac{5-3}{2}, \frac{1-1}{2}\right) = (1, 0)$

$$\text{Length of median BP} = \sqrt{(1-1)^2 + (5-0)^2}$$
$$= \sqrt{0 + 25} = 5 \text{ units}$$

8. (*b*) In ΔCAB, DE || AB, then

$$\frac{AD}{DC} = \frac{BE}{EC} \qquad \text{(BPT)}$$

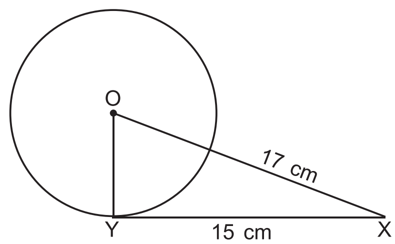
$$\Rightarrow \quad \frac{8x+9}{x+3} = \frac{3x+4}{x}$$

$$\Rightarrow \quad 5x^2 - 4x - 12 = 0$$

$$\Rightarrow \quad (x-2)(5x+6) = 0$$

$$\Rightarrow \quad x = 2 \text{ or } x = \frac{-6}{5} \text{ (rejected)}$$

9. (*b*) Let O be the centre of circle. Let XY be tangent to circle at Y.



As, tangent is $\perp$ to the radius at the point of contact, then

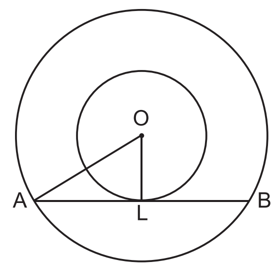
$$\angle OYX = 90°$$

Now, $$OX^2 = OY^2 + XY^2 \qquad \text{(Pythagoras Theorem)}$$

$$\Rightarrow \quad (17)^2 = OY^2 + (15)^2 \Rightarrow OY^2 = 289 - 225 = 64$$

$$\Rightarrow \quad OY = 8 \text{ cm}$$

10. (*c*) Let O be the centre of two concentric circles. Let AB is the chord of larger circle that is tangent to smaller circle at point L. As tangent is $\perp$ to radius, so $\angle OLA = 90°$



Now, $$AL^2 = OA^2 - OL^2 \qquad \text{(Pythagoras Theorem)}$$
$$= (37)^2 - (12)^2 = 1369 - 144 = 1225 = (35)^2$$

$$\Rightarrow \quad AL = 35 \text{ cm}$$

Now, $\perp$ drawn from centre of circle to the chord bisects the chord.

So, $$AB = 2AL = 70 \text{ cm}$$

11. (*c*) $$\cos\theta = \frac{b}{a}, \ \sin\theta = \sqrt{1 - \frac{b^2}{a^2}}$$

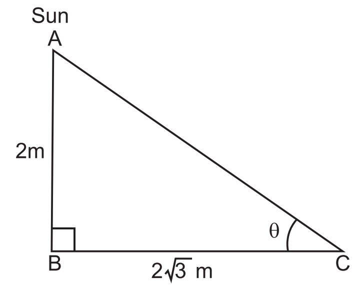
$$\Rightarrow \quad \sin\theta = \frac{\sqrt{a^2 - b^2}}{a}$$

$$\Rightarrow \quad \operatorname{cosec}\theta = \frac{1}{\sin\theta} = \frac{a}{\sqrt{a^2 - b^2}}$$

12. (*b*) $$\frac{x}{a} = \sec\theta, \ \frac{y}{b} = \tan\theta$$

$$\sec^2\theta - \tan^2\theta = 1 \Rightarrow \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

13. (*a*) Let AB = tree, BC = shadow and θ = angle of elevation



Now, $\tan\theta = \frac{AB}{BC} = \frac{2}{2\sqrt{3}}$

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

$\Rightarrow \theta = 30°$

14. (*a*) Perimeter of quadrant = 3.75 cm

$\Rightarrow \frac{\pi r}{2} + 2r = 3.75$

$\Rightarrow \frac{22}{7} \times \frac{r}{2} + 2r = 3.75$

$\Rightarrow r\left[\frac{11}{7} + 2\right] = 3.75$

$\Rightarrow r \times \frac{25}{7} = 3.75$

$\Rightarrow r = 1.05 \text{ cm} = 10.5 \text{ mm}$ [∵ 1 cm = 10 mm]

15. (*b*) Area of field left ungrazed $= 5 \times 7 - \frac{1}{4} \times \frac{22}{7} \times 25$

$= 35 - \frac{275}{14}$

$= 35 - 19.64$

$= 15.36 \text{ m}^2$

16. (*b*) Required probability $= \frac{4+1}{4+2+1} = \frac{5}{7}$

17. (*a*) Favourable outcomes : 28, 35, 42, 49, 56, 63

Total cards: 43

∴ Required probability $= \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{6}{43}$

18. (*c*) The continuous frequency distribution table is

Age (in years)	4 – 7	7 – 10	10 – 13	13 – 16
Number of students	8	2	7	7

So, frequency of class 10 – 13 is 7.

19. (*a*) Both Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A).

20. (*d*) Assertion (A) is false but reason (R) is true.

21. The prime factorisation of 135 and 714:

$135 = 3^3 \times 5$

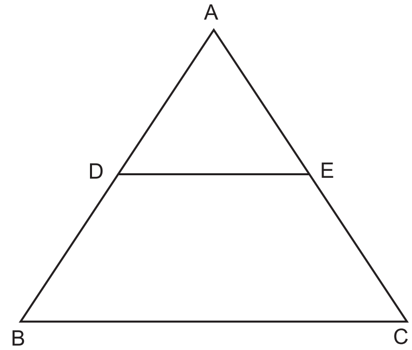
$714 = 2 \times 3 \times 7 \times 17$

HCF(135, 714) = 3

LCM (135, 714) $= 2 \times 3^3 \times 5 \times 7 \times 17$

$= 32130$

22. In ΔABC, $DE \parallel BC$, then



$$\frac{AD}{DB} = \frac{AE}{EC} \quad \text{(BPT) ... }(i)$$

As $DB = EC$ (Given)

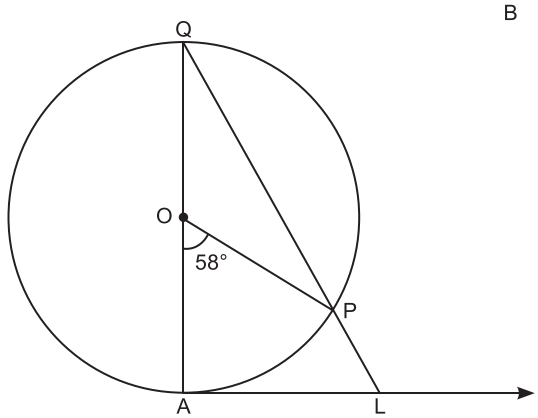
$\Rightarrow$ $AD = AE$ [From (i)]

$\therefore$ $AD + BD = AE + EC$ [$\because BD = CE$]

$\Rightarrow$ $AB = AC$

$\Rightarrow$ ΔABC is isosceles.

23.



$\angle POQ + \angle POA = 180°$ (Linear pair)

$\Rightarrow$ $\angle POQ + 58° = 180°$

$\Rightarrow$ $\angle POQ = 122°$

In ΔOQP, $OP = OQ$ (radii)

$\Rightarrow$ $\angle OQP = \angle OPQ$ (Angles opposite to equal sides are equal)

Now, $\angle OPQ + \angle OQP + \angle POQ = 180°$

$\Rightarrow$ $2\angle OQP = 180° - 122°$

$\Rightarrow$ $\angle OQP = 29°$

As, tangent to a circle is $\perp$ to its radius at the point of contact, then $\angle OAL = 90°$

In ΔQAL, $\angle AQL + \angle QAL + \angle ALQ = 180°$ (Angle sum property of a Δ)

$\Rightarrow$ $29° + 90° + \angle ALP = 180°$

$\Rightarrow$ $\angle ALP = 61°$

24. $7 \sin^2\theta + 3\cos^2\theta = 4$

$\Rightarrow$ $4\sin^2\theta + 3(\sin^2\theta + \cos^2\theta) = 4$

$\Rightarrow$ $4 \sin^2\theta + 3 = 4$

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

$\Rightarrow$ $\theta = 30°$

OR

$$3\left(x^2 - \frac{1}{x^2}\right) = 3\left[\frac{\text{cosec}^2\theta}{9} - \frac{\cot^2\theta}{9}\right]$$

$$= \frac{3}{9}(\text{cosec}^2\theta - \cot^2\theta)$$

$$= \frac{1}{3} \times 1 = \frac{1}{3}$$

25. Length of arc of each quadrant $= \dfrac{\theta}{360°} \times 2\pi r$

$= \dfrac{90°}{360°} \times 2 \times 3.14 \times 2$

$= 3.14$ cm

$\therefore$ Length of arc of 4 quadrants $= 4 \times 3.14$

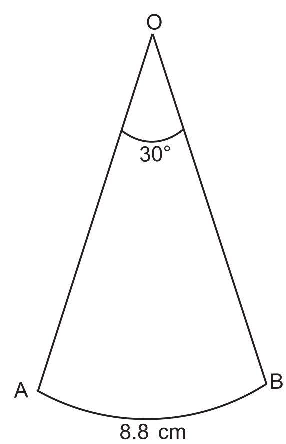
$= 12.56$ cm

Now, perimeter of shaded region $= 12.56 + 4 \times (7 - 2 \times 2) = 12.56 + 4 \times 3$

$= 12.56 + 12$

$= 24.56$ cm

OR



Length of arc $(l) = \dfrac{\theta}{180°} \times \pi r$

$\Rightarrow \quad 8.8 = \dfrac{30°}{180°} \times \dfrac{22}{7} \times r$

$\Rightarrow \quad r = \dfrac{8.8 \times 6 \times 7}{22} = 16.8$ cm

Area $= \dfrac{\theta}{360°} \times \pi r^2$

$\therefore \quad$ Area $= \dfrac{30°}{360°} \times \dfrac{22}{7} \times 16.8 \times 16.8$

$= 73.92$ cm^2

26. It is given that 3 consecutive traffic lights change after 36 sec, 42 sec and 72 sec.

If they change simultaneously, then we need to find least common multiple of three timings.

Now, $36 = 2^2 \times 3^2$

$42 = 2 \times 3 \times 7$

$72 = 2^3 \times 3^2$

LCM $= 2^3 \times 3^2 \times 7$

$= 504$ seconds

$= 480$ seconds $+ 24$ seconds

$= 8$ minutes 24 seconds

They will change simultaneously at 07 : 08 : 24 am

27. α and β are zeroes of quadratic polynomial $2x^2 + 5x + k$.

$\therefore \quad \alpha + \beta = -\dfrac{5}{2}, \ \alpha\beta = \dfrac{k}{2}$

Now, $(\alpha + \beta)^2 - \alpha\beta = 24$ (given)

$\Rightarrow \quad \left(\dfrac{-5}{2}\right)^2 - \dfrac{k}{2} = 24$

$\Rightarrow \quad \dfrac{25}{4} - \dfrac{k}{2} = 24 \Rightarrow \dfrac{k}{2} = \dfrac{25}{4} - 24$

$\Rightarrow \quad \dfrac{k}{2} = \dfrac{25 - 96}{4} \Rightarrow k = \dfrac{-71}{2}$

28. The given system of equations is,

$$2x - y = -10 \quad \text{...}(i)$$
$$-6x + y = 30 \quad \text{...}(ii)$$

Adding (*i*) and (*ii*), we get

$$2x - 6x = -10 + 30$$
$$\Rightarrow \quad -4x = 20 \Rightarrow x = -5$$

Substitute $x = -5$ in (*i*), we get

$$2(-5) - y = -10$$
$$\Rightarrow \quad -10 - y = -10$$
$$\Rightarrow \quad y = 0$$
$$\therefore \quad x = -5;\ y = 0 \text{ is the solution}$$

OR

Let total number of rows = y

Let number of students in each row = x

$\therefore$ Total students = xy

ATQ, $(x + 4)(y - 2) = xy$

$$\Rightarrow \quad xy - 2x + 4y - 8 = xy$$
$$\Rightarrow \quad -2x + 4y - 8 = 0$$
$$\Rightarrow \quad x - 2y + 4 = 0 \quad \text{...}(i)$$

and $(x - 4)(y + 4) = xy$

$$\Rightarrow \quad xy + 4x - 4y - 16 = xy$$
$$\Rightarrow \quad x - y - 4 = 0 \quad \text{...}(ii)$$

Solving (*i*) and (*ii*), we get

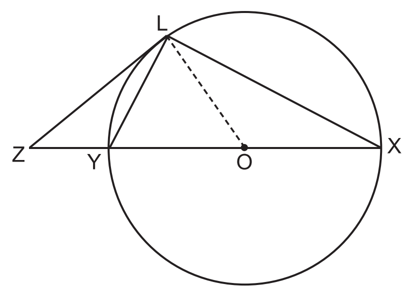
$$x - 2y + 4 = 0$$
$$x - y - 4 = 0$$
$$(-)\ (+)\ (+)$$

$$-y + 8 = 0 \Rightarrow y = 8$$

From (*i*), $x - 16 + 4 = 0 \Rightarrow x = 12$

$\therefore$ Number of students = $12 \times 8 = 96$

29.



Join O to L.

As, tangent to a circle is always perpendicular to its radius at the point of contact, then

$$\angle OLZ = 90°$$

Now, $\angle XLZ = 100°$ (given)

$$\Rightarrow \quad \angle XLO + 90° = 100°$$
$$\Rightarrow \quad \angle XLO = 10°$$

In ΔOLX, OL = OX (radii)

$$\Rightarrow \quad \angle OXL = \angle OLX = 10° \quad \text{(Angles opposite to equal sides are equal)}$$

Now, $\angle XOL + \angle OLX + \angle OXL = 180°$

$\Rightarrow \angle XOL + 2 \times 10° = 180°$

$\Rightarrow \angle XOL = 160°$

Now, $\angle YOL = 180° - \angle XOL$ (Linear pair)

$\Rightarrow \angle YOL = 180° - 160° = 20°$

In ΔOLY, $OL = OY$ (radii)

$\Rightarrow \angle OYL = \angle OLY$ (Angles opposite to equal sides are equal)

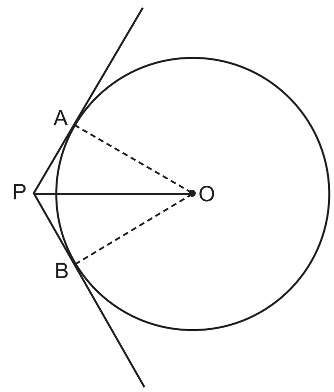
So, $\angle OYL + \angle OLY + \angle YOL = 180°$

$\Rightarrow 2\angle OYL = 180° - 20° = 160°$

$\Rightarrow \angle OYL = 80°$

So, $\angle XYL = 80°$

OR



Join OA and OB.

In triangles OAP and OBP,

$OA = OB$ (Radii)

$OP = OP$ (Common)

$PA = PB$ (Length of tangents drawn from an external point to circle are equal)

$\therefore \Delta OPA \cong \Delta OPB$ (SSS congruency)

$\therefore \angle OPA = \angle OPB = \frac{1}{2} \times 120° = 60°$ (CPCT)

As tangent to circle is $\perp$ to its radius at the point of contact, so $\angle OAP = \angle OBP = 90°$

In right angled ΔOAP,

$$\frac{AP}{OP} = \cos 60° \Rightarrow \frac{AP}{OP} = \frac{1}{2}$$

$\Rightarrow OP = 2AP$

30.

$$LHS = \left(1 + \frac{1}{\tan^2\theta}\right)\left(1 + \frac{1}{\cot^2\theta}\right)$$

$$= (1 + \cot^2\theta)(1 + \tan^2\theta)$$

$$= \operatorname{cosec}^2\theta \cdot \sec^2\theta$$

$$= \frac{1}{\sin^2\theta\cos^2\theta}$$

$$= \frac{1}{\sin^2\theta(1 - \sin^2\theta)}$$

$$= \frac{1}{\sin^2\theta - \sin^4\theta} = RHS$$

31.

Daily wages (₹) (x)	Number of workers (f)	*c.f.*
125	6	6
130	20	26
135	24	50
140	28	78
145	15	93
150	4	97
160	2	99
180	1	100

N = 100 (even)

Median is mean of the values of observation at $\left(\frac{N}{2}\right)^{th}$ and $\left(\frac{N}{2}+1\right)^{th}$ places, when N is even.

Now, $\frac{N}{2} = 50, \frac{N}{2} + 1 = 51$

Value of 50th observation = 135

Value of 51st observation = 140

$\therefore$ Median $= \frac{135 + 140}{2}$ = ₹ 137.5

32. Let sister's present age = x years

then girl's present age = $2x$ years

According to given condition,

$$(x + 4)(2x + 4) = 160$$

$$\Rightarrow 2x^2 + 4x + 8x + 16 = 160$$

$$\Rightarrow 2x^2 + 12x - 144 = 0$$

$$\Rightarrow x^2 + 6x - 72 = 0$$

$$\Rightarrow (x + 12)(x - 6) = 0$$

$$\Rightarrow x + 12 = 0 \text{ or } x - 6 = 0$$

$$\Rightarrow x = -12 \text{ (rejected) or } x = 6$$

$\therefore$ Sister's present age = 6 years

Girl's present age = 12 years

OR

Since, $x = -2$ is root of the equation $3x^2 + 7x + p = 0$, then it must satisfy it.

So, $3(-2)^2 + 7(-2) + p = 0$

$$\Rightarrow 12 - 14 + p = 0$$

$$\Rightarrow p = 2$$

Given equation is,

$$x^2 + k(4x + k - 1) + p = 0$$

$\Rightarrow \quad x^2 + 4kx + k(k - 1) + 2 = 0 \qquad [\because p = 2]$

As roots are equal, then D = 0

$\Rightarrow \quad (4k)^2 - 4 \times 1 \times [k(k - 1) + 2)] = 0$

$\Rightarrow \quad 16k^2 - 4(k^2 - k + 2) = 0$

$\Rightarrow \quad 16k^2 - 4k^2 + 4k - 8 = 0$

$\Rightarrow \quad 12k^2 + 4k - 8 = 0$

$\Rightarrow \quad 3k^2 + k - 2 = 0$

$\Rightarrow \quad 3k^2 + 3k - 2k - 2 = 0$

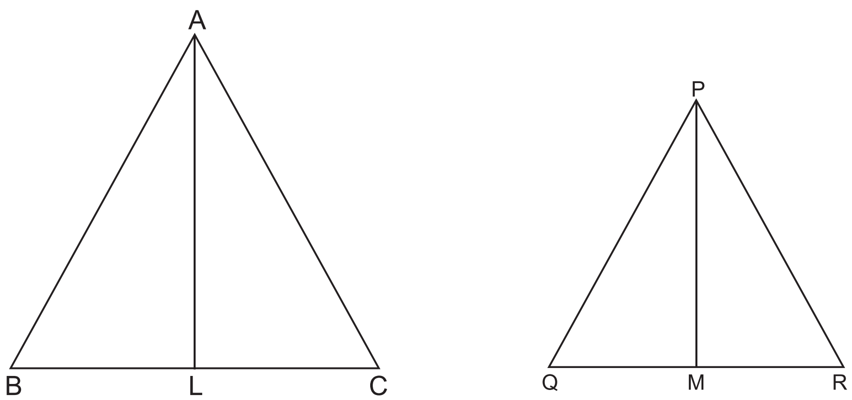
$\Rightarrow \quad 3k(k + 1) - 2(k + 1) = 0$

$\Rightarrow \quad (3k - 2)(k + 1) = 0$

$\Rightarrow \quad 3k - 2 = 0 \text{ or } k + 1 = 0$

$\Rightarrow \quad k = \frac{2}{3} \text{ or } -1$

33. Given: ΔABC and ΔPQR such that $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AL}{PM}$ where AL and PM are the medians of ΔABC and ΔPQR respectively.



To prove: $\Delta ABC \sim \Delta PQR$

Proof: We have, $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AL}{PM}$

$\frac{AB}{PQ} = \frac{2BL}{2QM} = \frac{AL}{PM} \qquad (\because$ AL and PM are medians)

$\frac{AB}{PQ} = \frac{BL}{QM} = \frac{AL}{PM} \qquad ...(i)$

In ΔABL and ΔPQM,

$\frac{AB}{PQ} = \frac{BL}{QM} = \frac{AL}{PM} \qquad$ [using (*i*)]

$\therefore \quad \Delta ABL \sim \Delta PQM \qquad$ (SSS similarity)

$\Rightarrow \quad \angle B = \angle Q \qquad$ [Corresponding angles of similar Δ's are equal]...(*ii*)

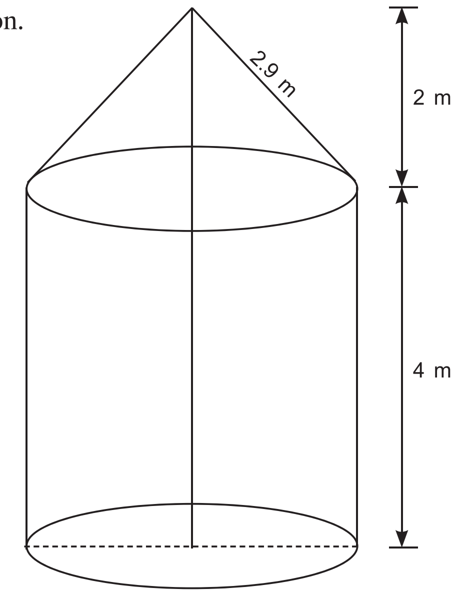
In ΔABC and ΔPQR,

$\frac{AB}{PQ} = \frac{BC}{QR} \qquad$ (given)

$\Rightarrow \quad \angle B = \angle Q \qquad$ ...[from (*ii*)]

$\Rightarrow \quad \Delta ABC \sim \Delta PQR \qquad$ ...(SAS similarity)

34. Let 'r' be the common base radius each of the conical and the cylindrical portion.



Height of conical portion, $h_1 = 2\text{m}$

Slant height of conical portion, $l = 2.9$ m

Now, $l = \sqrt{r^2 + h_1^2}$

$\Rightarrow$ $2.9 = \sqrt{r^2 + (2)^2}$

$\Rightarrow$ $8.41 = r^2 + 4$

$\Rightarrow$ $r^2 = 4.41$

$\Rightarrow$ $r = 2.1$ m

Now, height of cylindrical portion, $h = 4$ m

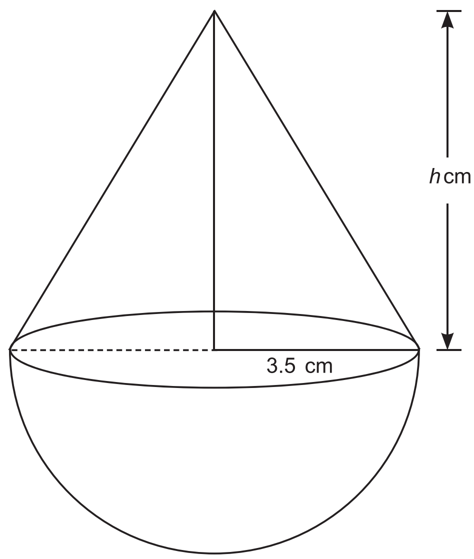
Area of canvas needed $= 2\pi rh + \pi rl$

$= 2 \times \frac{22}{7} \times 2.1 \times 4 + \frac{22}{7} \times 2.1 \times 2.9$

$= 52.8 + 19.14$

$= 71.94 \text{ m}^2$

OR



For hemisphere: Radius, $r = 3.5$ cm

For cone:

Radius of base, $r = 3.5$ cm

Let height $= h$ cm

Total volume = Volume of hemisphere + Volume of cone

$\Rightarrow$ $166\frac{5}{6} = \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h$

$166\frac{5}{6} = \frac{2}{3}\pi(3.5)^3 + \frac{1}{3}\pi(3.5)^2 h$

$\Rightarrow$ $\frac{1001}{6} = \frac{2}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times 3.5 + \frac{1}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times h$

$\Rightarrow$ $77(h + 7) = 1001$

$\Rightarrow$ $h + 7 = 13$

$\Rightarrow$ $h = 6$ cm

$$\text{Height of toy} = h + 3.5 = 6 + 3.5 = 9.5 \text{ cm}$$

$$\text{Surface area of hemisphere} = 2\pi r^2 = 2\pi(3.5)^2$$

$$= 2 \times \frac{22}{7} \times 3.5 \times 3.5 = 77 \text{ cm}^2$$

$$\therefore \quad \text{Cost} = ₹\ 10 \times 77 = ₹\ 770$$

35. First we represent the data in grouped frequency distribution table.

Marks (C.I.)	x_i	Number of students (f_i)	$u_i = \frac{x_i - A}{h} = \frac{x_i - 55}{10}$	f_iu_i
0 – 10	5	3	–5	–15
10 – 20	15	5	–4	–20
20 – 30	25	7	–3	–21
30 – 40	35	12	–2	–24
40 – 50	45	10	–1	–10
50 – 60	$\boxed{55}$ = A	20	0	0
60 – 70	65	7	1	7
70 – 80	75	6	2	12
80 – 90	85	2	3	6
90 – 100	95	8	4	32
		$\Sigma f_i = 80$		$\Sigma f_iu_i = -33$

$$\text{Mean} = A + \frac{\Sigma f_iu_i}{\Sigma f_i} \times h$$

$$= 55 - \frac{33}{80} \times 10$$

$$= 55 - 4.125 = 50.875 \text{ marks}$$

36. (*i*) We have, $a = 32$ and $d = -1$

Now, $a_5 = a + 4d$ $\quad [\because a_n = a + (n-1)d]$

$\Rightarrow$ $a_5 = 32 + 4(-1) = 28$

So, there are 28 logs in the 5th row from the bottom.

(*ii*) As $a = 32$ and $d = -1$

Now, $a_2 = a + d$

$= 32 - 1$

$= 31$

So, there are 31 logs in the 2nd row from the bottom.

(*iii*) As, $S_n = \frac{n}{2}[2a + (n-1)d]$

$\therefore$ $S_6 = \frac{6}{2}[2 \times 32 + 5(-1)]$

$= 3 \times 59$

$= 177$

Hence, 177 logs have been placed.

OR

$$S_n = 228$$

$\Rightarrow \quad \frac{n}{2}[2a + (n-1)d] = 228$

$\Rightarrow \quad n[2 \times 32 + (n-1)(-1)] = 456$

$\Rightarrow \quad n^2 - 65n + 456 = 0$

$\Rightarrow \quad (n-8)(n-57) = 0$

$\Rightarrow \quad n = 8$ or $n = 57$

When $n = 8$, then $a_8 = a + 7d$
$= 32 + 7(-1)$
$= 32 - 7$
$= 25$

When $n = 57$, then $a_{57} = a + 56d$
$= 32 + 56(-1)$
$= -24$

Since number of logs placed in a row can't be negative, so $n = 57$ is rejected.

So, 8 rows are needed to put all 228 logs of wood.

37. (*i*) The given points are: A(2, 7) and R(11, 5)

Now, $AR = \sqrt{(11-2)^2 + (5-7)^2}$
$= \sqrt{81+4} = \sqrt{85}$ units

(*ii*) The given points are: D(6, 8) and P(9, 8)

Coordinates of X are: $\left(\frac{6+9}{2}, \frac{8+8}{2}\right)$ i.e. $\left(\frac{15}{2}, 8\right)$.

(*iii*) The given points are: B(2, 3) and E(6, 3)

$BE = \sqrt{(6-2)^2 + (3-3)^2}$
$= \sqrt{16+0} = 4$ units

OR

The given points are B(2, 3), E(6, 3), T(13, 3).

Now, $BE = \sqrt{(6-2)^2 + (3-3)^2}$
$= \sqrt{16+0} = 4$ units

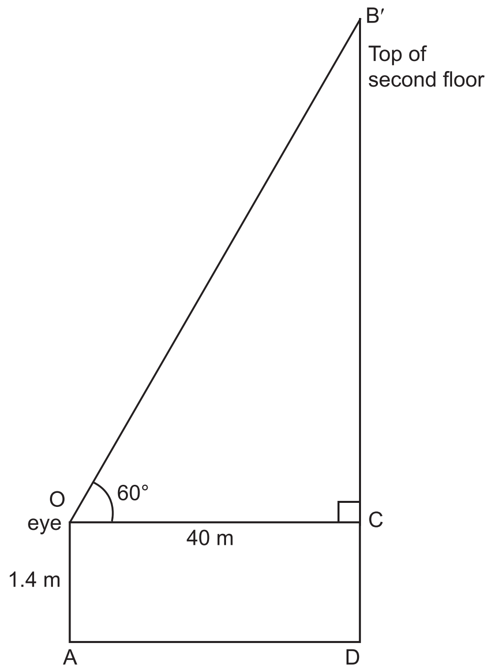
and $ET = \sqrt{(13-6)^2 + (3-3)^2}$
$= \sqrt{49+0} = 7$ units

and $BT = \sqrt{(13-2)^2 + (3-3)^2}$
$= \sqrt{121+0} = 11$ units

As $BT = BE + ET$

Hence B, E and T are in the same straight line.

38. (*i*)



In $\Delta B'CO$ $\quad \dfrac{B'C}{OC} = \tan 60°$

$\Rightarrow \quad \dfrac{B'C}{40} = \sqrt{3}$

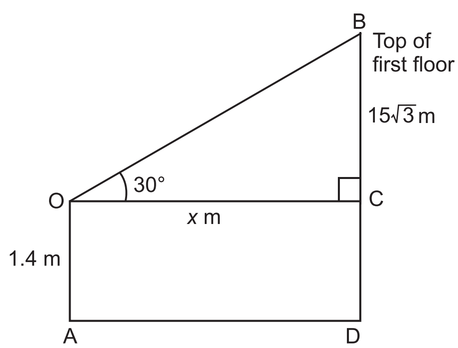
$\Rightarrow \quad B'C = 40\sqrt{3}$ m

$\therefore$ Height of top of second floor $= (40\sqrt{3} + 1.4)$ m

$= (69.2 + 1.4)$m

$= 70.6$ m

(*ii*)



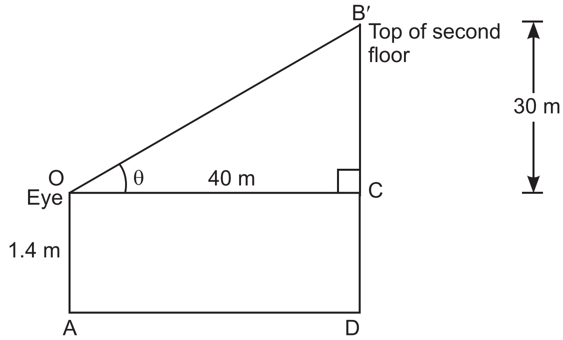
In ΔOCB, $\quad \dfrac{x}{15\sqrt{3}} = \cot 30°$ $\quad \left[\because \cot\theta = \dfrac{\text{base}}{\text{perpendicular}}\right]$

$x = 15\sqrt{3} \times \sqrt{3}$

$= 45$ m

$\therefore$ Width of river $= 45$ m

OR

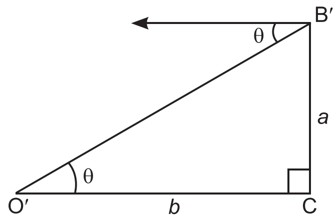


$$(OB')^2 = (40)^2 + (30)^2 \quad \text{(Pythagoras Theorem)}$$
$$= 1600 + 900$$
$$= 2500$$

$\Rightarrow$ $OB' = 50$ m

$\therefore$ $\cos\theta = \dfrac{40}{50} = \dfrac{4}{5}$

(*iii*)



We have, $\angle CO'B' = \theta$

$$(O'B')^2 = a^2 + b^2 \quad \text{[Pythagoras theorem]}$$

$\Rightarrow$ $O'B' = \sqrt{a^2 + b^2}$

Now, $\sec\theta = \dfrac{\text{hypotenuse}}{\text{base}}$

$$= \frac{O'B'}{O'C} = \frac{\sqrt{a^2 + b^2}}{b}$$