Solutions to RMT–DS1/Set-2

1. (*c*) $29 \times 17 \times 3$

2. (*b*) 2 and 5

3. (*d*) (3, 0)

4. (*d*) $x^2 + x - 12 = 0$

5. (*a*) Given,

$$a = 148$$
$$d = 141 - 148 = -7$$

Put $a_n < 0$

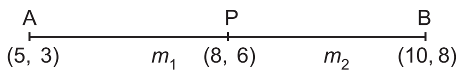
$$a + (n-1)d < 0$$
$$148 + (n-1)(-7) < 0$$
$$148 - 7n + 7 < 0$$
$$155 - 7n < 0$$
$$7n > 155$$
$$n > 22.14$$

Ist negative term when $n = 23$

$$\therefore \quad a_{23} = a + 22(-7)$$
$$= 148 + 22(-7)$$
$$= 148 - 154$$
$$= -6$$

$\therefore$ 1st negative term of the A.P. is –6.

6. (*a*) Let ratio be $k : 1$



By section formula;

$$(x, y) = \left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$$

$$(8, 6) = \left(\frac{10k + 5}{k + 1}, \frac{8k + 3}{k + 1}\right)$$

$$\therefore \quad \frac{10k + 5}{k + 1} = 8$$

$$\Rightarrow \quad 10k + 5 = 8k + 8$$

$$\Rightarrow \quad 2k = 3$$

$$\Rightarrow \quad k = \frac{3}{2} \Rightarrow k : 1 = 3 : 2$$

7. (*a*)

$$\Delta ABC \sim \Delta PQR$$

$$\frac{AB}{PQ} = \frac{BC}{QR} \qquad [\because \text{ By BPT}]$$

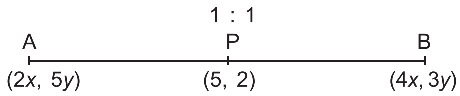
$$\Rightarrow \quad \frac{2x}{6x} = \frac{3x + 1}{7x + 9}$$

$$\Rightarrow \quad 7x + 9 = 9x + 3$$

$$\Rightarrow \quad 6 = 2x$$

$$\therefore \quad x = 3$$

8. (*b*)



By mid-point formula;

$$(5,\ 2) = \left(\frac{2x+4x}{2}, \frac{5y+3y}{2}\right)$$

$$\Rightarrow \quad (5,\ 2) = (3x,\ 4y)$$

$$\Rightarrow \quad 3x = 5 \quad \text{and} \quad 4y = 2$$

$$\therefore \quad x = \frac{5}{3} \quad \text{and} \quad y = \frac{1}{2}$$

9. (*b*)

$$3 \tan \theta = \sqrt{3}$$

$$\Rightarrow \quad \tan \theta = \frac{\sqrt{3}}{3} \times \frac{\sqrt{3}}{\sqrt{3}}$$

$$= \frac{3}{3\sqrt{3}}$$

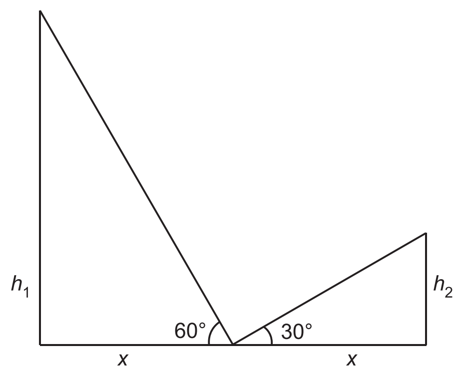
$$\Rightarrow \quad \tan \theta = \frac{1}{\sqrt{3}} \Rightarrow \theta = 30°$$

10. (*d*) Given, $\dfrac{\sin 30° \times \cot 45°}{\sec 30°}$

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

$$= \frac{1}{2} \times \frac{\sqrt{3}}{2} = \frac{\sqrt{3}}{4}$$

11. (*a*)



$$\frac{h_1}{x} = \tan 60° \text{ and } \frac{h_2}{x} = \tan 30°$$

$$\Rightarrow \quad h_1 = x\sqrt{3} \text{ and } h_2 = \frac{x}{\sqrt{3}}$$

$$\therefore \quad \frac{h_1}{h_2} = \frac{x\sqrt{3}}{\frac{x}{\sqrt{3}}} = \frac{3}{1}$$

$$\Rightarrow \quad h_1 : h_2 = 3 : 1$$

12. (*b*) $\angle PTO = 90°$ [The tangent is perpendicular to the radius drawn through point of contact]

In ΔPTO,

$\Rightarrow \quad x = \angle T + \angle P = 90° + 30°$ [Exterior angle property of a triangle]

$\therefore \quad x = 120°$

13. (*a*) In quadrilateral ABCD,

$$AB + DC = AD + BC$$

$\Rightarrow \quad AB + 9 = 10 + 5$

$\Rightarrow \quad AB = 15 - 9$

$\Rightarrow \quad AB = 6$ cm

14. (*d*) Area of sector $= \frac{1}{6} \times$ Area of circle

$\Rightarrow \quad \pi r^2 \frac{\theta}{360°} = \frac{1}{6}\pi r^2$

$\Rightarrow \quad \theta = \frac{1}{6} \times 360°$

$\therefore \quad \theta = 60°$

15. (*b*) $\frac{r^2}{2}\left[\frac{\pi\theta}{180°} - \sin\theta\right]$

16. (*b*) Multiple of 3 from 2 to 22 = {3, 6, 9, 12, 15, 18, 21}

Number of favourable outcomes = 7

Total outcomes = 21

$\therefore \quad P(E) = \frac{7}{21} = \frac{1}{3}$

17. (*b*) $\frac{12}{7}$ [$\because \; 0 \leq P(E) \leq 1$]

18. (*a*) Mean : Median = 5 : 4

Let Mean = $5x$ and Median = $4x$

We know that, Mode = 3 median – 2 mean = $3 \times 4x - 2 \times 5x$

$= 12x - 10x = 2x$

Now, $\frac{\text{Mode}}{\text{Median}} = \frac{2x}{4x} = \frac{1}{2}$

$\therefore$ Mode : Median = 1 : 2

19. (*b*) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

20. (*a*) Both assertion (A) and reason (R) are true and reason (R) is correct explanation of assertion (A).

21. Let $2 + 3\sqrt{3}$ is a rational number.

$\therefore \quad 2 + 3\sqrt{3} = \frac{a}{b}$ [where a and b are coprime integers]

$$3\sqrt{3} = \frac{a}{b} - 2$$

$$\sqrt{3} = \frac{a-2b}{3b}$$

Here, a and b are integers.

$\therefore$ $\frac{a-2b}{3b}$ is also a rational number i.e. $\sqrt{3}$ also rational.

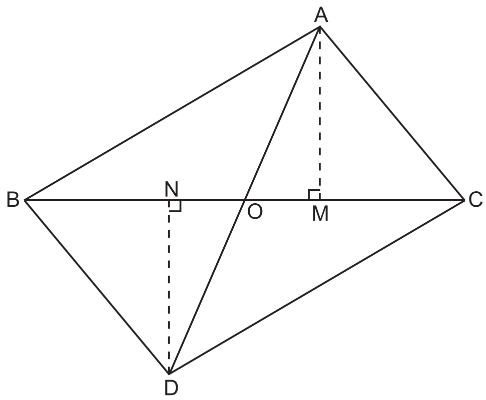
But this contradicts the fact that $\sqrt{3}$ is an irrational.

This contradiction has arisen due to our wrong assumption.

Hence, $2 + 3\sqrt{3}$ is an irrational number.

22. **Given:** ΔABC and ΔDBC on same base BC. AD Intersects BC at O.

To prove: $\frac{\text{Area of } \Delta ABC}{\text{Area of } \Delta DBC} = \frac{AO}{DO}$



Construction: Draw AM $\perp$ BC and DN $\perp$ BC

Proof: In ΔAOM and ΔDON

$$\angle AMO = \angle DNO \quad [\because \text{ Each } 90°]$$

$$\angle AOM = \angle DON$$

[$\because$ Vertically opposite angles]

$\therefore$ $\Delta AOM \sim \Delta DON$ [AA similarity rule]

$\therefore$ $\frac{AO}{DO} = \frac{AM}{DN}$ ...(i) [$\because$ CPST]

Now, $$\frac{\text{Area of } \Delta ABC}{\text{Area of } \Delta DBC} = \frac{\frac{1}{2} \times BC \times AM}{\frac{1}{2} \times BC \times DN}$$

$$\frac{\text{Area of } \Delta ABC}{\text{Area of } \Delta DBC} = \frac{AM}{DN} \quad ...(ii)$$

From equation (i) and (ii)

$$\frac{\text{Area of } \Delta ABC}{\text{Area of } \Delta DBC} = \frac{AO}{DO}$$

Hence proved.

23. $\sin^2\theta \cot^2\theta = 1 - \cos^2\theta \tan^2\theta$

LHS $\sin^2\theta \cot^2\theta$

$\Rightarrow$ $\sin^2\theta \times \frac{\cos^2\theta}{\sin^2\theta} = \cos^2\theta$

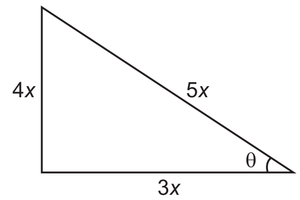
RHS $1 - \cos^2\theta \tan^2\theta$

$\Rightarrow$ $1 - \cos^2\theta \times \frac{\sin^2\theta}{\cos^2\theta}$

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

$\therefore$ LHS = RHS

OR



Given, $\sin\theta = \dfrac{4}{5} = \dfrac{\text{Perpendicular (P)}}{\text{Hypotenuse (H)}}$

Let $P = 4x$

$H = 5x$

By pythagoras;

$\Rightarrow \quad H^2 = P^2 + B^2$

$\Rightarrow \quad (5x)^2 = (4x)^2 + B^2$

$\Rightarrow \quad 25x^2 = 16x^2 + B^2$

$\Rightarrow \quad B^2 = 9x^2$

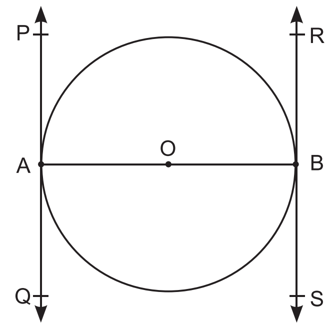
$\Rightarrow \quad B = 3x$

$\therefore \quad \sec\theta = \dfrac{H}{B} = \dfrac{5x}{3x} = \dfrac{5}{3}$,

$\tan\theta = \dfrac{P}{B} = \dfrac{4x}{3x} = \dfrac{4}{3}$,

and $\cot\theta = \dfrac{B}{P} = \dfrac{3x}{4x} = \dfrac{3}{4}$

24. Given: A circle with centre O. AB is the diameter, PQ and RS are two tangents with points of contact A and B.



To prove: PQ || RS

Proof: The tangent to a circle is perpendicular to the radius through the point of contact.

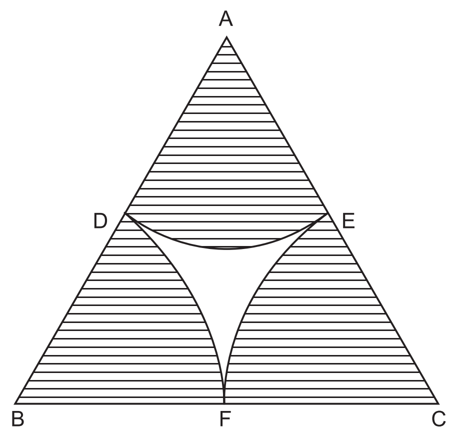
$\therefore \quad \angle PAB = \angle ABS$ [Each 90°]

If alternate interior angles are equal, then lines are parallel.

$\therefore$ PQ || RS

Hence proved

25. ΔABC is an equilateral triangle.



$\therefore \quad \angle A = \angle B = \angle C = 60°$

Each sides 6 cm i.e. radius of each sector

$r = 3$ cm

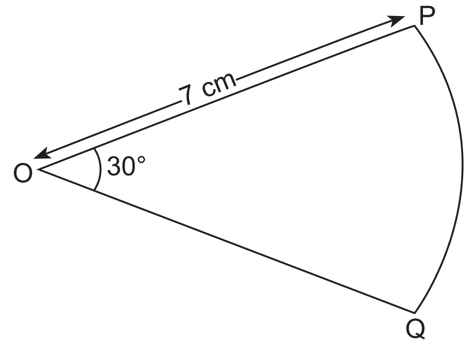
Area of shaded region $= 3 \times$ Area of sectors

$= 3 \times \dfrac{\pi r^2\theta}{360°}$

$= 3 \times \dfrac{22}{7} \times \dfrac{3\times3\times60°}{360°}$

$= \dfrac{99}{7}\ \text{cm}^2$

OR



Radius of sector = $r = 7$ cm

with central angle, $\theta = 30°$

$$\text{Perimeter of OPQ} = 2r + \text{length of arc PQ}$$

$$= 2r + \frac{\pi r\theta}{180°}$$

$$= 2 \times 7 + \frac{22}{7} \times \frac{7 \times 30°}{180°}$$

$$= 14 + \frac{11}{3}$$

$$= 14 + 3.67$$

$$= 17.67 \text{ cm}$$

26.

Mass of Mangoes (in gm)	**Number of Mangoes (f_i)**
120 – 160	16
160 – 200	$18 \rightarrow f_0$
200 – 240	$20 \rightarrow f_1$
240 – 280	$x \rightarrow f_2$
280 – 320	14
320 – 360	7
360 – 400	6
	100

$\Rightarrow$ $81 + x = 100$

$\therefore$ $x = 19$

Now, $f_1 = 20, f_0 = 18, l = 200$

$f_2 = 19, h = 40$

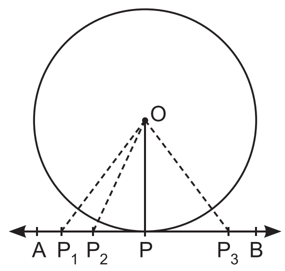
$$\text{Mode mass} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$= 200 + \left(\frac{20 - 18}{2 \times 20 - 18 - 19}\right) \times 40$$

$$= 200 + \left(\frac{2}{40 - 37}\right) \times 40$$

$$= 200 + \frac{80}{3} = \frac{680}{3} = 226.6 \text{ gm}$$

27. Given: A circle with centre O, AB is a tangent with point of contact P.



To prove: $OP \perp AB$

Construction: Mark points P_1, P_2, P_3 ..... on AB, other than P and join OP_1, OP_2, OP_3 .....

Proof:

$OP_1 >$ Radius

$OP_2 >$ Radius

$OP_3 >$ Radius

$\vdots$

$OP =$ Radius

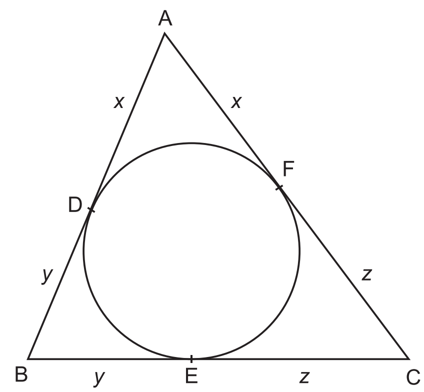
$\therefore$ $OP_1, OP_2, OP_3 .... > OP$

i.e. OP is the shortest distance of AB from O, and shortest distance is always perpendicular.

Hence, $OP \perp AB$

OR

The lengths of tangents drawn from an external point are equal.



$\therefore$ $AD = AF = x$ (let)

$BD = BE = y$ (let)

$CE = CF = z$ (let)

$x + y = 13$ cm ...(*i*)

$y + z = 14$ cm ...(*ii*)

$x + z = 15$ cm ...(*iii*)

Subtract equation (*i*) from (*ii*)

$$\begin{array}{r} y + z = 14 \\ x + y = 13 \\ - \quad - \quad\; - \\ \hline z - x = 1 \end{array}$$ ...(*iv*)

Add equation (*iii*) and (*iv*)

$$\begin{array}{r} x + z = 15 \\ z - x = 1 \\ \hline \end{array}$$

$\therefore$ $2z = 16$

$\Rightarrow$ $z = 8$ cm

Put the value of z in equation (*iii*)

$x + 8 = 15$

$\Rightarrow$ $x = 15 - 8 = 7$ cm

Put the value of x in equation (*i*)

$7 + y = 13$

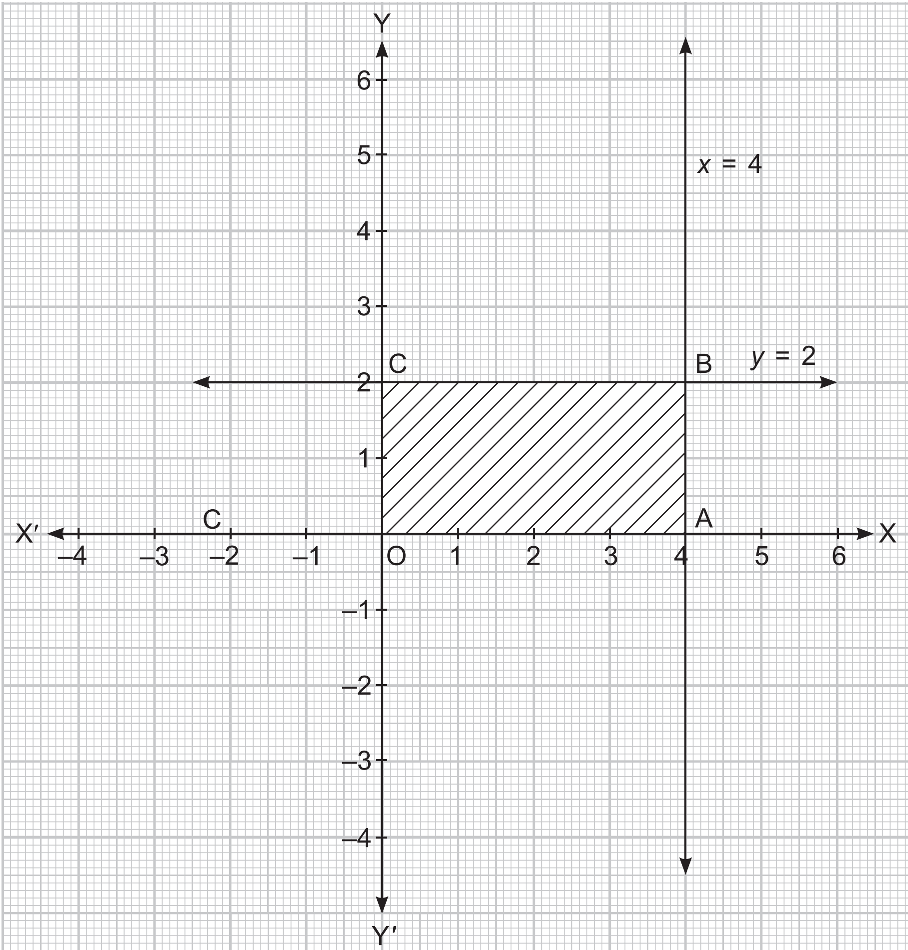
$\Rightarrow$ $y = 13 - 7 = 6$ cm

$\therefore \quad BD = y = 6$ cm

$EC = z = 8$ cm

and $\quad AF = x = 7$ cm

28.



Area enclosed by these lines with x-axis and y-axis is in the shape of rectangle OABC.

$$\text{Area of enclosed region} = l \times b$$

$$= OA \times OC$$

$$= 4 \times 2$$

$$= 8 \text{ square unit}$$

OR

Let the unit digit be x and tens digit be y.

$\therefore$ Two digit number $= 10y + x$

ATQ,

$$x + y = 11 \qquad \text{...}(i)$$

and $\quad (10x + y) - (10y + x) = 45$

$$\Rightarrow \quad 10x + y - 10y - x = 45$$

$$\Rightarrow \quad 9x - 9y = 45$$

$$\Rightarrow \quad 9(x - y) = 45$$

$$\Rightarrow \quad x - y = 5 \quad ...(ii)$$

Add equation (*i*) and (*ii*)

$$x + y = 11$$

$$x - y = 5$$

$$2x = 16$$

$$\Rightarrow \quad x = 8$$

Put the value of x in equation (*i*)

$$\Rightarrow \quad 8 + y = 11 \Rightarrow y = 3$$

$$\therefore \quad \text{Two digit number} = 10y + x$$

$$= 10 \times 3 + 8 = 30 + 8 = 38$$

29. $\dfrac{\sin\theta}{\cot\theta + \operatorname{cosec}\theta} - \dfrac{\sin\theta}{\cot\theta - \operatorname{cosec}\theta} = 2$

$$\text{LHS} = \frac{\sin\theta}{\cot\theta + \operatorname{cosec}\theta} - \frac{\sin\theta}{\cot\theta - \operatorname{cosec}\theta}$$

$$= \frac{\sin\theta(\cot\theta - \operatorname{cosec}\theta) - \sin\theta(\cot\theta + \operatorname{cosec}\theta)}{(\cot\theta + \operatorname{cosec}\theta)(\cot\theta - \operatorname{cosec}\theta)}$$

$$= \frac{\sin\theta(\cot\theta - \operatorname{cosec}\theta - \cot\theta - \operatorname{cosec}\theta)}{\cot^2\theta - \operatorname{cosec}^2\theta}$$

$$= \frac{\sin\theta \times (-2\operatorname{cosec}\theta)}{-(\operatorname{cosec}^2\theta - \cot^2\theta)} \quad [\because \operatorname{cosec}^2\theta - \cot^2\theta = 1]$$

$$= \frac{\sin\theta \times 2\operatorname{cosec}\theta}{1}$$

$$= \frac{\sin\theta \times 2}{\sin\theta} \quad \left(\because \operatorname{cosec}\theta = \frac{1}{\sin\theta}\right)$$

$$= 2 = \text{RHS}$$

$$\therefore \quad \text{LHS} = \text{RHS}$$

30. Length of step of 1st friend = 72 cm

Length of step of 2nd friend = 80 cm

Length of step of 3rd friend = 84 cm

Minimum distance each should run in complete steps = LCM of 72, 80 and 84

By prime factorisation method;

2	72, 80, 84
2	36, 40, 42
2	18, 20, 21
2	9, 10, 21
3	9, 5, 21
3	3, 5, 7
5	1, 5, 7
7	1, 1, 7
	1, 1, 1

$= 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5 \times 7$

$= 5040$ cm

31. $x^2 - 3\sqrt{3}x + 6 = 0$

$\Rightarrow \quad x^2 - 2\sqrt{3}x - \sqrt{3}x + 6 = 0$

$\Rightarrow \quad x(x - 2\sqrt{3}) - \sqrt{3}(x - 2\sqrt{3}) = 0$

$\Rightarrow \quad (x - 2\sqrt{3})(x - \sqrt{3}) = 0$

$x - 2\sqrt{3} = 0$ and $x - \sqrt{3} = 0$

$x = 2\sqrt{3}$ and $x = \sqrt{3}$

$\therefore \quad \alpha = 2\sqrt{3}$ and $\beta = \sqrt{3}$

Now, sum of zeroes; $\alpha + \beta = 2\sqrt{3} + \sqrt{3} = 3\sqrt{3}$

and $-\frac{b}{a} = \frac{-(-3\sqrt{3})}{1} = \frac{3\sqrt{3}}{1} = 3\sqrt{3}$

$\therefore \quad \alpha + \beta = \frac{-b}{a}$

Product of zeroes; $\alpha\beta = 2\sqrt{3} \times \sqrt{3} = 2 \times 3 = 6$

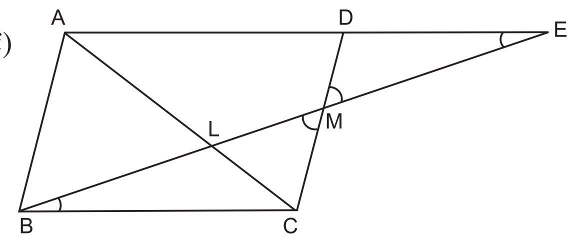
and $\frac{c}{a} = \frac{6}{1} = 6$

$\therefore \quad \alpha\beta = \frac{c}{a}$

$\therefore$ Relationship between zeroes and their coefficients is verified.

32. In ΔBMC and ΔEMD,

$$MC = MD \quad [\because \text{ M is the mid-point of CD}]$$
$$\angle CMB = \angle EMD \quad [\text{Vertically opposite angles}]$$
$$\angle MBC = \angle MED \quad [\text{as AE || BC i.e. Alternate interior angles}]$$
$\therefore$ $$\Delta BMC \cong \Delta EMD \quad [\text{AAS congruence rule}]$$
$\therefore$ $$BC = DE \quad (\text{CPCT})...(i)$$
Also, $$AD = BC \quad [\text{opposite sides of a ||gm}]$$
i.e. $$BC = AD \quad ...(ii)$$
Add equation (*i*) and (*ii*)
$$BC + BC = AD + DE$$
$$2BC = AE \quad ...(iii)$$



In ΔAEL and ΔCBL

$$\angle EAL = \angle BCL \quad [\text{Alternate interior angles}]$$
$$\angle ALE = \angle CLB \quad [\text{Vertically opposite angles}]$$
$$\Delta AEL \sim \Delta CBL \quad [\text{AA similarity rule}]$$
$\therefore$ $$\frac{EL}{BL} = \frac{AE}{BC}$$
$$\frac{EL}{BL} = \frac{2BC}{BC} \quad [\text{from (iii)}]$$
$\therefore$ $$EL = 2BL$$
Hence proved

33. $$4x^2 - 4a^3x + (a^6 - b^6) = 0$$
Discriminant; $D = B^2 - 4AC$
$$= (-4a^3)^2 - 4 \times 4(a^6 - b^6)$$
$$= 16a^6 - 16(a^6 - b^6)$$
$$= 16(a^6 - a^6 + b^6)$$
$$= 16b^6 \geq 0$$

$\therefore$ Two real roots exist.

$\therefore$ $$x = \frac{-B \pm \sqrt{D}}{2A} = \frac{-(-4a^3) \pm \sqrt{16b^6}}{2 \times 4} = \frac{4a^3 \pm 4b^3}{8}$$
$$x = \frac{a^3 \pm b^3}{2}$$
$\therefore$ $$x = \frac{a^3 + b^3}{2} \text{ and } \frac{a^3 - b^3}{2}$$

OR

$$(a - b)x^2 + (b - c)x + (c - a) = 0$$
For equal roots, $$B^2 - 4AC = 0$$
$\therefore$ $$(b - c)^2 - 4(a - b)(c - a) = 0$$
$\Rightarrow$ $$b^2 + c^2 - 2bc - 4(ac - a^2 - bc + ab) = 0$$
$\Rightarrow$ $$b^2 + c^2 - 2bc - 4ac + 4a^2 + 4bc - 4ab = 0$$
$\Rightarrow$ $$4a^2 + b^2 + c^2 - 4ab + 2bc - 4ac = 0$$
$\Rightarrow$ $$(-2a)^2 + b^2 + c^2 + 2(-2a)b + 2bc + 2(-2a)c = 0 \quad [\because a^2 + b^2 + c^2 + 2ab + 2bc + 2ca = (a + b + c)^2]$$
$\therefore$ $$(-2a + b + c)^2 = 0$$
$$-2a + b + c = 0$$
i.e., $$2a = b + c$$
Proved

If roots are equal then

$$x = \frac{-B}{2A}, \frac{-B}{2A}$$

$$= \frac{-(b-c)}{2(a-b)}, \frac{-(b-c)}{2(a-b)}$$

$$\therefore \quad x = \frac{c-b}{2(a-b)}, \frac{c-b}{2(a-b)}$$

34.

Length of leaves (in cm)	**No. of leaves f_i**	x_i	$d_i = x_i - a$	$f_i d_i$	cf
0 – 3	12	1.5	–6	–72	12
3 – 6	6	4.5	–3	–18	18
6 – 9	10	7.5 = A	0	0	28
9 – 12	13	10.5	3	39	41
12 – 15	9	13.5	6	54	50
	50			+3	

Let the assumed mean (A) = 7.5

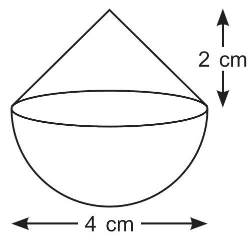
$$\text{Mean } \bar{x} = A + \frac{\sum f_i d_i}{\sum f_i} = 7.5 + \frac{3}{50} = 7.5 + 0.06 = 7.56 \text{ cm}$$

$$\text{and Median} = l + \left(\frac{\frac{N}{2} - cf}{f}\right) \times h$$

where, $\frac{N}{2} = 25, f = 10, cf = 18, l = 6$ and $h = 3$

$$\therefore \text{ Median} = 6 + \left(\frac{25-18}{10}\right) \times 3 = 6 + \frac{7 \times 3}{10} = 6 + 2.1 = 8.1 \text{ cm}$$

35. Condition I:



Radius of conical part (r) = Radius of hemispherical part (r)

$$= \frac{4}{2} = 2 \text{ cm}$$

Height of conical part (h) = 2 cm

$$\therefore \quad \text{Volume of toy} = \frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3$$

$$= \frac{1}{3}\pi \times 2^2 \times 2 + \frac{2}{3}\pi \times 2^3 = (1+2)\frac{1}{3}\pi \times 2^3$$

$$= 3 \times \frac{1}{3} \times \pi \times 2^3 = 8 \times 3.14 = 25.12 \text{ cm}^3$$

Condition II:

Radius of cylinder (r) = 2 cm

Height of cylinder (H) = height of cone + Radius of hemisphere

$= h + r$

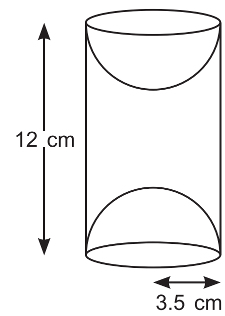
$= 2 + 2$

$= 4$ cm

Volume of cylinder $= \pi r^2 H = 3.14 \times 2 \times 2 \times 4 = 50.24 \text{ cm}^3$

$\therefore$ Difference of volume of cylinder and toy $= 50.24 - 25.12 = 25.12 \text{ cm}^3$

OR



Height of cylinder (h) = 12 cm

Radius of cylinder (r) = Radius of hemisphere (r) = 3.5 cm

Total surface area of remaining solid = C.S.A of cylinder + 2 × C.S.A. of hemisphere

$= 2\pi rh + 2 \times 2\pi r^2 = 2\pi r(h + 2r)$

$= 2 \times \frac{22}{7} \times 3.5 \times (12 + 2 \times 3.5)$

$= 22(12 + 7) = 418 \text{ cm}^2$

36. (*i*) Total distance covered by Dev watering 2nd tree and coming back

$= 2 \times 4 + 2 \times 10$

$= 28$ m

(*ii*) Distance covered by Dev watering 1st tree and coming back (a_1) = 8 m

Distance covered by Dev watering 2nd tree and coming back (a_2) = 20 m

Distance covered by Dev watering 3rd and coming back (a_3) = 32 m

∴ $d = a_2 - a_1 = a_3 - a_2 = 12$

Since, difference is common.

∴ Yes, obtained sequence is an A.P.

(*iii*) $a_7 = a + 6d$

$= 8 + 6 \times (12)$

$= 8 + 72$

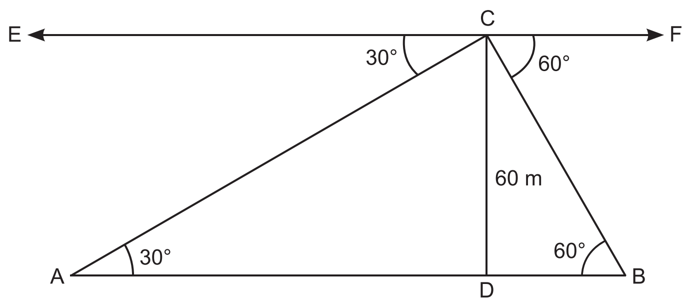
$= 80$ m

OR

∵ $S_n = \frac{n}{2}[2a + (n - 1)d]$

∴ $S_{20} = \frac{20}{2}[2 \times 8 + (20 - 1) \times 12] = 10[16 + 228] = 2440$ m

37.



As EF || AB

$\angle ECA = \angle CAD = 30°$ [Alternate interior angles]

and $\angle FCB = \angle CBD = 60°$

(*i*) In ΔADC

$\frac{DC}{AC} = \sin 30°$

$\frac{60}{AC} = \frac{1}{2}$

∴ AC = 120 m

(*ii*) In ΔBDC

$$\frac{DC}{BC} = \sin 60°$$

$$\Rightarrow \quad \frac{60}{BC} = \frac{\sqrt{3}}{2}$$

$$\Rightarrow \quad \sqrt{3}\,BC = 120$$

$$\Rightarrow \quad BC = \frac{120}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = 40\sqrt{3} \text{ m}$$

(*iii*) In ΔADC

$$\frac{DC}{AD} = \tan 30°$$

$$\Rightarrow \quad \frac{60}{AD} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow \quad AD = 60\sqrt{3} = 60 \times 1.732 = 103.92 \text{ m}$$

In ΔBDC

$$\frac{DC}{BD} = \tan 60°$$

$$\Rightarrow \quad \frac{60}{BD} = \sqrt{3}$$

$$\Rightarrow \quad \sqrt{3}\,BD = 60$$

$$\Rightarrow \quad BD = \frac{60}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = 20\sqrt{3} = 20 \times 1.732 = 34.64 \text{ m}$$

$$\therefore \quad \text{Width of River} = AD + BD$$

$$= 103.92 + 34.64$$

$$= 138.56 \text{ m}$$

OR

$$\text{Speed of boat} = \frac{\text{Distance}}{\text{Time}}$$

$$= \frac{138.56}{15} = 9.24 \text{ m/min}$$

38. (*i*) (5, 2)

(*ii*) (–5, 7)

(*iii*) Distance between Prime Minister's seat and opposition Minister's seat

$$= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{(-5-5)^2 + (7-2)^2} = \sqrt{125} = 5\sqrt{5} \text{ units}$$

OR

Distance between origin and PM's seat $= \sqrt{(5-0)^2 + (2-0)^2}$

$= \sqrt{25+4} = \sqrt{29}$ units

Distance between origin and opposition Minister's seat $= \sqrt{(-5-0)^2 + (7-0)^2}$

$= \sqrt{25+49} = \sqrt{74}$ units