Solutions to RMT–DS2/Set-2

1. (*c*) As, $\text{HCF} \times \text{LCM} = 24 \times 32$

$\Rightarrow \quad \text{HCF} \times \text{LCM} = 768$

2. (*b*) 1, as it cuts x-axis at one point.

3. (*d*) The given equations are:

$$5x - 6y - 7 = 0 \text{ and } -15x + \alpha y + 21 = 0$$

For infinitely many solutions:

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

$$\Rightarrow \quad \frac{5}{-15} = \frac{-6}{\alpha} = \frac{-7}{21}$$

$$\Rightarrow \quad \alpha = 18$$

4. (*a*) We have, $D = (1)^2 - 4 \times 1 \times 1 = -3 < 0$

So, given quadratic equation has no real roots.

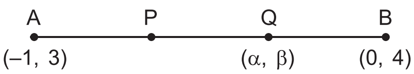
5. (*d*) AP is $\sqrt{2}, 2\sqrt{2}, 3\sqrt{2}$ .....

As, $a_n = a + (n - 1)d$

So, $a_7 = a + 6d$

$$= \sqrt{2} + 6\sqrt{2} = 7\sqrt{2} = \sqrt{98}$$

6. (*a*)



Let P and Q be the points of trisection.

Now, Q divides AB in the ratio of 2 : 1.

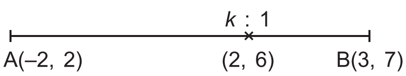
By section formula,

$$\alpha = \frac{2 \times 0 + 1 \times (-1)}{2+1}, \ \beta = \frac{2 \times 4 + 1 \times 3}{2+1}$$

So, $\alpha = \frac{-1}{3}, \ \beta = \frac{11}{3}$

Required point is $Q\left(\frac{-1}{3}, \frac{11}{3}\right)$.

7. (*b*)



Let ratio is k : 1.

$$\left(\frac{3k-2}{k+1}, \frac{7k+2}{k+1}\right) = (2, 6)$$

So, $\frac{3k-2}{k+1} = 2 \Rightarrow 3k - 2 = 2k + 2 \Rightarrow k = 4$

and $\frac{7k+2}{k+1} = 6 \Rightarrow 7k + 2 = 6k + 6 \Rightarrow k = 4$

So, ratio is 4 : 1.

8. (*c*) As $\Delta AOB \sim \Delta COD$ (AA similarity)

$$\Rightarrow \quad \frac{AO}{CO} = \frac{OB}{OD}$$

$$\Rightarrow \qquad \frac{x+5}{x+3} = \frac{x-1}{x-2}$$

$$\Rightarrow \qquad (x+5)(x-2) = (x+3)(x-1)$$

$$\Rightarrow \qquad x^2 + 3x - 10 = x^2 + 2x - 3$$

$$\Rightarrow \qquad x = 7$$

9. (*d*) AR = 4 cm, RB = 3 cm, AC = 11 cm

As, tangents drawn from an external point to a circle are equal. Then

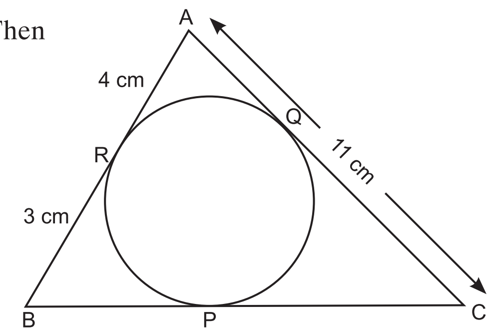
AQ = AR ⇒ AQ = 4 cm

Now, QC = 11 – 4 = 7 cm

Now, PC = QC = 7 cm

and BP = RB = 3 cm

∴ BC = 3 cm + 7 cm = 10 cm



10. (*a*) Tangents drawn from an external point to a circle are equal in length. Then,

AQ = AR, BQ = BX and CR = CX

Now, perimeter of ΔABC = AB + BC + CA

⇒ 12 = AQ – BQ + BX + XC + AR – CR

⇒ 12 = AR – BQ + BQ + CR + AR – CR

⇒ 12 = 2AR

⇒ AR = 6 cm

11. (*b*) $$\sin\theta = \frac{a}{b}$$

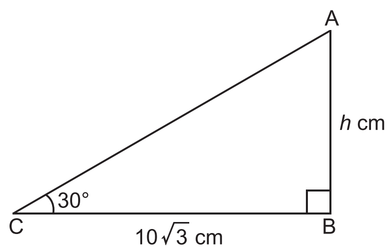
Now, $$\cos\theta = \sqrt{1-\sin^2\theta} = \sqrt{1-\frac{a^2}{b^2}} = \frac{\sqrt{b^2-a^2}}{b}$$

So, $$\cot\theta = \frac{\cos\theta}{\sin\theta} = \frac{\sqrt{b^2-a^2}}{a}$$

12. (*a*) $(\sec^2\theta - 1)(\operatorname{cosec}^2\theta - 1) = k \Rightarrow \tan^2\theta \cdot \cot^2\theta = k \Rightarrow 1 = k$ or $k = 1$

13. (*b*) In ΔABC, $$\frac{h}{10\sqrt{3}} = \tan 30°$$

$$\Rightarrow \qquad h = \frac{10\sqrt{3}}{\sqrt{3}} = 10 \text{ cm}$$



14. (*c*) $$\text{Perimeter} = \frac{270°}{360°} \times 2\pi(42) + 2 \times 42$$

$$= \frac{3}{4} \times 2 \times \frac{22}{7} \times 42 + 84$$

$$= 198 \text{ cm} + 84 \text{ cm} = 282 \text{ cm}$$

15. (*c*) Let r be the radius.

ATQ, $$\frac{\theta}{360^\circ} \times 2\pi r = 2\pi r \times \frac{7}{9}$$ [θ = angle subtended by major arc at the centre]

$$\Rightarrow \quad \theta = 280^\circ$$

So, angle subtended by minor arc at centre = 360° – 280° = 80°

16. (*b*) P(picking a red flower) = P(number ≤ 4) = $\frac{4}{6} = \frac{2}{3}$

17. (*a*) When a coin is tossed thrice, then possible outcomes are: HHH, HHT, HTH, THH, TTT, TTH, THT, HTT. Let E be the event of getting at least 2 heads. Outcomes favourable to E are : HHT, HTH, THH, HHH

$$\therefore \quad P(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcome}} = \frac{4}{8} = \frac{1}{2}$$

18. (*c*) Let mode = $3x$ and mean = x

Now, mode = 3 median – 2 mean

$\Rightarrow$ $3x$ = 3 median – $2x$

$\Rightarrow$ 3 median = $5x$

$\Rightarrow$ 3 × median = 5 × mean

$\Rightarrow$ mean : median = 3 : 5

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

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

21. Let if possible, $\sqrt{11}$ is a rational number.

Then $\sqrt{11} = \frac{a}{b}$, where a, b are coprime integers and $b \neq 0$

$$\Rightarrow \quad 11 = \frac{a^2}{b^2} \Rightarrow a^2 = 11b^2 \qquad ...(i)$$

$\Rightarrow a^2$ is a multiple of 11

$\Rightarrow a$ is a multiple of 11

$\Rightarrow a = 11m$, where m is any integer. ...(*ii*)

Substituting $a = 11m$ in (*i*), we get

$$(11m)^2 = 11b^2 \Rightarrow b^2 = 11m^2$$

$\Rightarrow b^2$ is a multiple of 11

$\Rightarrow b$ is a multiple of 11

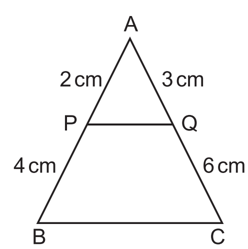
$\Rightarrow b = 11n$, where n is any integer. ...(*iii*)

From (*ii*) and (*iii*), we get that a and b are not coprime. as 11 is the common factor of a and b.

So, this is a contradiction. So, our assumption is wrong.

Hence, $\sqrt{11}$ is an irrational number.

22. We have, $\frac{AP}{PB} = \frac{1}{2}, \frac{AQ}{QC} = \frac{1}{2}$



So, $\frac{AP}{PB} = \frac{AQ}{QC}$

$\Rightarrow$ PQ || BC (Converse of BPT)

In ΔAPQ and ΔABC,

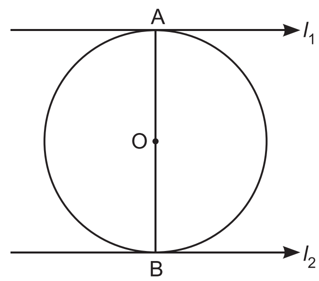
∠APQ = ∠ABC (Corresponding angles)

∠AQP = ∠ACB (Corresponding angles)

∴ ΔAPQ ~ ΔABC (AA similarity)

$$\therefore \quad \frac{AP}{AB} = \frac{PQ}{BC} \Rightarrow \frac{2}{6} = \frac{PQ}{BC} \Rightarrow BC = 3PQ$$

23. Let AB is diameter of a circle with centre O. Suppose l_1 and l_2 are tangents to circle at A and B respectively.



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

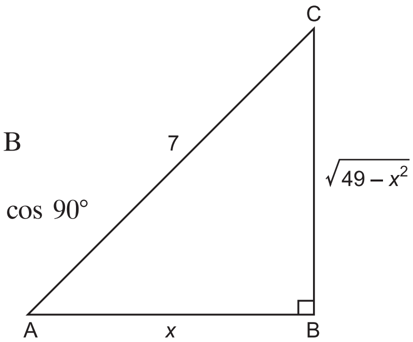
So, $OA \perp l_1$ or $BA \perp l_1$ ...(*i*)

and $OB \perp l_2$ or $AB \perp l_2$ ...(*ii*)

Two lines perpendicular to same line are parallel to each other.

$\therefore$ From (*i*) and (*ii*), we get $l_1 \parallel l_2$.

24. We have, $AB = x$ units, $AC = 7$ units and $\angle B = 90°$



$\therefore$ $BC = \sqrt{49 - x^2}$

Now, $\sqrt{7-x}\ \tan C + \sqrt{7+x}\ \cot A - 14 \cos A + 21 \sin C + \sqrt{49+x^2}\ \cos B$

$$= \sqrt{7-x} \times \frac{x}{\sqrt{49-x^2}} + \sqrt{7+x} \times \frac{x}{\sqrt{49-x^2}} - 14 \times \frac{x}{7} + 21 \times \frac{x}{7} + \sqrt{49+x^2} \times \cos 90°$$

$$= \frac{x}{\sqrt{49-x^2}}\left(\sqrt{7-x} + \sqrt{7+x}\right) + 7 \cdot \frac{x}{7} + 0$$

$$= x\left[\frac{\sqrt{7-x} + \sqrt{7+x} + \sqrt{49-x^2}}{\sqrt{49-x^2}}\right]$$

OR

$$\cot \theta = \frac{\cos \theta}{\sin \theta} = \frac{1}{\sec \theta \sin \theta} = \frac{1}{xy}$$

Now, $\tan \theta = \frac{1}{\cot \theta} = xy$

$$\frac{\cot \theta + \tan \theta}{\cot \theta - \tan \theta} = \frac{\frac{1}{xy} + xy}{\frac{1}{xy} - xy} = \frac{1 + x^2y^2}{1 - x^2y^2}$$

25. Area of shaded region = Area of larger sector – Area of smaller sector

$$= \frac{30°}{360°}\pi[(7)^2 - (3.5)^2]$$

$$= \frac{1}{12}\pi[49 - 12.25] = \frac{1}{12} \times \frac{22}{7} \times 36.75$$

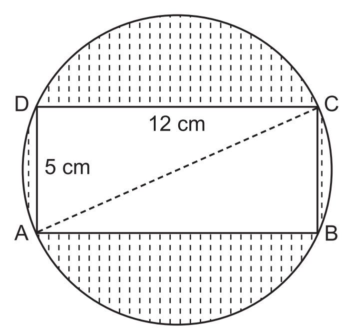
$$= 9.625 \text{ cm}^2$$

OR

Join AC.

Diagonal of rectangle ABCD = Diameter of circle

$$= \sqrt{12^2 + 5^2} = 13 \text{ cm}$$



$\therefore$ Area of shaded region = area of circle – area of rectangle ABCD

$$= \pi\left(\frac{13}{2}\right)^2 - 12 \times 5$$

$$= 3.14 \times (6.5)^2 - 60$$

$$= 132.67 - 60 = 72.67 \text{ cm}^2$$

26.

Subject	Mathematics	Science	Social Science
Number of books	28	16	12

(*a*) We have to find HCF of 28, 16, 12

Now, $28 = 2^2 \times 7$

$16 = 2^4$

$12 = 2^2 \times 3$

$\therefore$ $\text{HCF} = 2^2 = 4$

So, each student got 4 books.

(*b*) Total number of students who got the books $= \left(\frac{28}{4} + \frac{16}{4} + \frac{12}{4}\right)$

$= 7 + 4 + 3 = 14$

27. As, α and β are zeroes of the polynomial $3x^2 + 2x - 1$,

$\therefore$ $\alpha + \beta = -\frac{2}{3},\ \alpha\beta = -\frac{1}{3}$

Now, zeroes of required polynomial: $2\alpha + 1$, $2\beta + 1$

Sum, $S = 2\alpha + 1 + 2\beta + 1 = 2(\alpha + \beta + 1)$

$= 2\left(-\frac{2}{3} + 1\right) = 2 \times \frac{1}{3} = \frac{2}{3}$

Product, $P = (2\alpha + 1)(2\beta + 1)$

$= 4\alpha\beta + 2\alpha + 2\beta + 1$

$= -\frac{4}{3} - \frac{4}{3} + 1 = -\frac{8}{3} + 1 = -\frac{5}{3}$

$\therefore$ Polynomial $= k[x^2 - Sx + P]$, k is non-zero real number.

$= k\left[x^2 - \frac{2x}{3} - \frac{5}{3}\right]$

$= \frac{k}{3}[3x^2 - 2x - 5]$

$= 3x^2 - 2x - 5$ (Taking $k = 3$)

28. Let the digit at ones place and tens place be y and x respectively.

So, original number $= 10x + y$

ATQ, $\frac{10x + y}{x + y} = 7 \Rightarrow 10x + y = 7x + 7y$

$\Rightarrow$ $3x = 6y \Rightarrow x = 2y$ ...(*i*)

Also, $10x + y - 27 = 10y + x \Rightarrow 9x - 9y = 27$

$\Rightarrow$ $x - y = 3$

$\Rightarrow$ $2y - y = 3$ [from (*i*)]

$\Rightarrow$ $y = 3$

From (*i*), $x = 2 \times 3 = 6$

$\therefore$ Number is $60 + 3 = 63$

OR

We have,

$$5x + \frac{4}{y} = 9 \quad \text{...}(i)$$

$$7x - \frac{2}{y} = 5 \quad \text{...}(ii)$$

Multiplying (*ii*) by '2', we get

$$14x - \frac{4}{y} = 10 \quad \text{...}(iii)$$

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

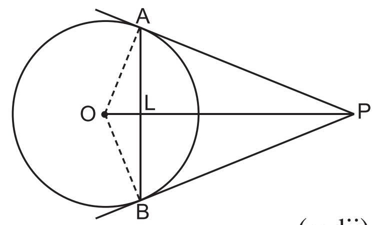
$$19x = 19 \Rightarrow x = 1$$

$\therefore$ From (*i*),

$$5 + \frac{4}{y} = 9 \quad \Rightarrow \quad \frac{4}{y} = 4 \quad \Rightarrow \quad y = 1$$

$\therefore$ Solution is $x = 1, y = 1$

29. Given: PA and PB are tangents to the circle with centre O, with points of contact A and B respectively.



To prove: OP is right bisector of AB.

Construction: Join OA and OB.

Proof: Consider ΔOAP and ΔOBP,

$$OA = OB \quad \text{(radii)}$$

$$AP = BP \quad \text{(tangents drawn from an external point to a circle are equal)}$$

$$OP = OP \quad \text{(common)}$$

$\therefore$ $\Delta OAP \cong \Delta OBP$ [SSS congruency]

$\Rightarrow$ $\angle AOP = \angle BOP$ or $\angle AOL = \angle BOL$ [CPCT] ...(*i*)

Consider Δs OAL and OBL,

$$OA = OB \quad \text{(radii)}$$

$$OL = OL \quad \text{(common)}$$

$$\angle AOL = \angle BOL \quad \text{[from } (i)\text{]}$$

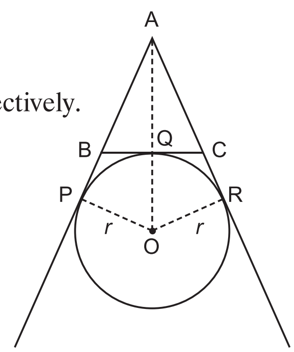
$\therefore$ $\Delta AOL \cong \Delta BOL$ (SAS congruency)

$\Rightarrow$ $AL = BL$ [CPCT] and $\angle OLA = \angle OLB$ (CPCT)

Also, $\angle OLA = \angle OLB = 90°$ [as $\angle ALO + \angle BLO = 180°$]

$\therefore$ OL or OP is right bisector of AB.

OR



Given: Sides AB, BC, CA touch the circle with centre O and radius '*r*' at P, Q, R respectively. Sides AB and CA touch circle when produced.

To prove: (*a*) AB + BQ = AC + CQ

(*b*) ar(APOR) = $\frac{1}{2}$(perimeter of ΔABC) $\times$ *r*

Proof: As, lengths of tangents drawn from an external point to a circle are equal.

So, AP = AR, BQ = BP, CQ = CR

(*a*) As, $AP = AR$

$\Rightarrow$ $AB + BP = AC + CR$

$\Rightarrow$ $AB + BQ = AC + CQ$ [$\because$ BP = BQ and CR = CQ] (*b*) As, tangent to a circle is ⊥ to radius at the point of contact.

So, $\angle OPA = \angle ORA = 90°$

Now,
$$\begin{aligned} ar(\square APOR) &= ar(\Delta OPA) + ar(\Delta ORA) \\ &= \frac{1}{2} \times AP \times OP + \frac{1}{2} \times AR \times OR \\ &= \frac{1}{2} \times r \times (AP + AR) \\ &= \frac{1}{2} \times r \times 2AP \qquad [\because AP = AR] \qquad ...(i) \end{aligned}$$

Now,
$$\begin{aligned} \text{perimeter of } \Delta ABC &= AB + BC + CA \\ &= AP - BP + BQ + QC + AR - CR \\ &= AP - BP + BP + CR + AP - CR \\ &= 2AP \qquad ...(ii) \end{aligned}$$

∴ from (*i*) and (*ii*), we get

$$ar(\square APOR) = \frac{1}{2} \times r \times \text{perimeter of } \Delta ABC$$

30. Consider $$\frac{1}{\operatorname{cosec}\theta - \cot\theta} - \frac{1}{\sin\theta} = \frac{1}{\sin\theta} - \frac{1}{\operatorname{cosec}\theta + \cot\theta}$$

$$\Rightarrow \quad \frac{1}{\operatorname{cosec}\theta - \cot\theta} + \frac{1}{\operatorname{cosec}\theta + \cot\theta} = \frac{1}{\sin\theta} + \frac{1}{\sin\theta} = \frac{2}{\sin\theta}$$

For proving the given identity, it is just sufficient to prove

$$\frac{1}{\operatorname{cosec}\theta - \cot\theta} + \frac{1}{\operatorname{cosec}\theta + \cot\theta} = \frac{2}{\sin\theta}$$

$$\begin{aligned} \text{LHS} &= \frac{1}{\operatorname{cosec}\theta - \cot\theta} + \frac{1}{\operatorname{cosec}\theta + \cot\theta} \\ &= \frac{\operatorname{cosec}\theta + \cot\theta + \operatorname{cosec}\theta - \cot\theta}{(\operatorname{cosec}\theta - \cot\theta)(\operatorname{cosec}\theta + \cot\theta)} \\ &= \frac{2\operatorname{cosec}\theta}{\operatorname{cosec}^2\theta - \cot^2\theta} \\ &= \frac{2\operatorname{cosec}\theta}{1} = \frac{2}{\sin\theta} = \text{RHS} \end{aligned}$$

$$\therefore \quad \frac{1}{\operatorname{cosec}\theta - \cot\theta} - \frac{1}{\sin\theta} = \frac{1}{\sin\theta} - \frac{1}{\operatorname{cosec}\theta + \cot\theta}$$

31. First we represent data in continuous grouped frequency distribution table as:

Wages in (₹) C.I.	***f***	***c*.f.**	
80 – 90	9	9	
90 – 100	17	26	
100 – 110	19	45	
110 – 120	45	90	←Median class
120 – 130	33	123	
130 – 140	15	138	
140 – 150	12	150	
	N = 150		

$$\frac{N}{2} = \frac{150}{2} = 75$$

Median class : 110 – 120

So, $l = 110, f = 45, cf = 45, h = 10$

$$\text{Now, Median} = l + \frac{\frac{N}{2} - cf}{f} \times h$$

$$= 110 + \frac{75 - 45}{45} \times 10$$

$$= 110 + \frac{30}{45} \times 10 = 110 + 6.67 = ₹\ 116.67$$

32. Let the total number of students who planned for picnic $= x$

Cost to each student originally $= \dfrac{\text{total budget}}{x}$

$$= ₹ \left(\frac{1800}{x}\right)$$

Number of students who attended picnic $= x - 4$

Now, cost to each student $= ₹ \left(\dfrac{1800}{x-4}\right)$

ATQ, $$\frac{1800}{x-4} - \frac{1800}{x} = 5$$

$$\Rightarrow \quad \frac{1}{x-4} - \frac{1}{x} = \frac{1}{360}$$

$$\Rightarrow \quad \frac{x - x + 4}{x(x-4)} = \frac{1}{360}$$

$$\Rightarrow \quad x^2 - 4x - 1440 = 0$$

$$\Rightarrow \quad x^2 - 40x + 36x - 1440 = 0$$

$$\Rightarrow \quad x(x - 40) + 36(x - 40) = 0$$

$$\Rightarrow \quad (x - 40)(x + 36) = 0$$

$$\Rightarrow \quad x = 40 \text{ or } x = -36 \text{ (rejected)}$$

So, number of students who attended picnic $= 40 - 4 = 36$

Cost to each student $= \dfrac{1800}{36} = ₹\ 50$

OR

The given quadratic equation is,

$$3x^2 + px - 8 = 0$$

Since –4 is a root of the above equation, then it must satisfy it. Then,

$$3(-4)^2 + p \times (-4) - 8 = 0$$

$$\Rightarrow \quad 48 - 4p - 8 = 0$$

$$\Rightarrow \quad 4p = 40 \Rightarrow p = 10$$

Now, the other equation is,

$$px^2 + 3px - k = 0$$

$$\Rightarrow \quad 10x^2 + 30x - k = 0$$

Now, $$a = 10;\ b = 30;\ c = -k$$

$$D = b^2 - 4ac$$
$$= (30)^2 - 4 \times 10(-k)$$
$$= 900 + 40k$$

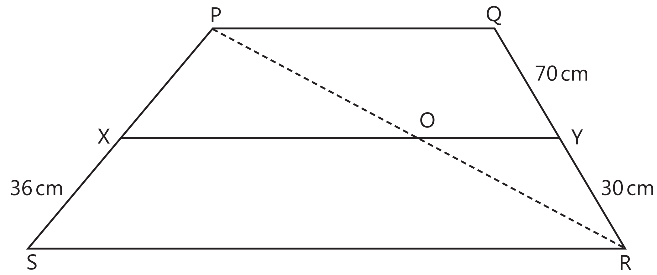
For equal roots, $D = 0$

$\Rightarrow \quad 900 + 40k = 0$

$\Rightarrow \quad k = \dfrac{-900}{40}$

$\Rightarrow \quad k = \dfrac{-45}{2}$

33. Join PR and suppose it intersects XY at O.



In ΔPSR, XO $\parallel$ SR, then

$$\frac{PX}{XS} = \frac{PO}{OR} \qquad \text{[BPT]...}(i)$$

Now, PQ $\parallel$ SR (given) ...(*ii*)

Also XY $\parallel$ SR or OY || SR ...(*iii*)

So, from (*ii*) and (*iii*), we get

$$OY \parallel PQ$$

In ΔPRQ, $OY \parallel PQ$

$$\frac{RO}{OP} = \frac{RY}{YQ} \qquad \text{[BPT]}$$

$$\Rightarrow \quad \frac{PO}{OR} = \frac{QY}{YR} \qquad ...(iv)$$

From (*i*) and (*iv*), we get

$$\frac{PX}{XS} = \frac{QY}{YR}$$

$$\Rightarrow \quad \frac{PX}{36} = \frac{70}{30} \Rightarrow PY = 84 \text{ cm}$$

34. For cylinder:

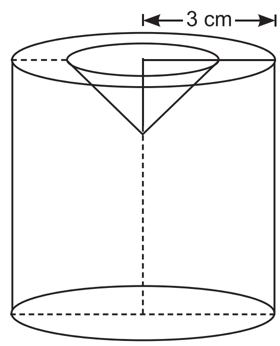
Radius of base, $R = 3$ cm

height, $H = 5$ cm

For cone:

Radius of base, $r = \dfrac{3}{2}$ cm

Height, $h = \dfrac{8}{9}$ cm



Volume of metal taken out, V_1 = Volume of cone

$$= \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi\left(\frac{3}{2}\right)^2 \cdot \frac{8}{9} = \frac{2}{3}\pi \text{ cm}^3$$

Volume of metal left in cylinder, $V_2 = \pi R^2 H - \dfrac{1}{3}\pi r^2 h = \pi(3)^2 \times 5 - \dfrac{2}{3}\pi$

$$\Rightarrow \quad V_2 = 45\pi - \frac{2}{3}\pi = \frac{133\pi}{3} \text{ cm}^3$$

$$\Rightarrow \quad V_2 : V_1 = 133 : 2$$

OR

Let height of rain water on roof $= h$ m

Volume of water on roof $= lbh = 22 \times 20 \times h \text{ m}^3$ ...(*i*)

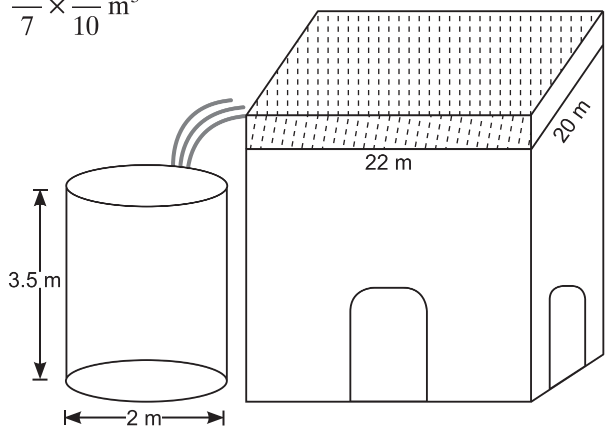
Volume of cylindrical vessel $= \pi r^2 H = \pi(1)^2 \times 3.5 \text{ m}^3 = \frac{22}{7} \times \frac{35}{10} \text{ m}^3$

As cylinder is filled with rainwater upto brim,

$\therefore \quad 22 \times 20 \times h = \frac{22}{7} \times \frac{35}{10}$

$\Rightarrow \quad h = \frac{22}{7} \times \frac{7}{2} \times \frac{1}{22 \times 20}$

$= \frac{1}{40} \text{ m} = 2.5 \text{ cm}$



35. Median $= 14.4$ and $\Sigma f = N = 20$

C.I.	*f*	*c.f.*
0 – 6	4	4
6 – 12	x	$4 + x$
12 – 18	5	$9 + x$
18 – 24	y	$9 + x + y$
24 – 30	1	$10 + x + y$
	N = 20	

← Median class

Now, $N = 20 \Rightarrow 10 + x + y = 20 \Rightarrow x + y = 10$ ...(*i*)

Median class : 12 – 18

Now, $l = 12, f = 5, cf = (4 + x), h = 6, N = 20$

$$\text{Median} = l + \frac{\frac{N}{2} - cf}{f} \times h$$

$\Rightarrow \quad 14.4 = 12 + \frac{10 - (4 + x)}{5} \times 6$

$\Rightarrow \quad 2.4 = \frac{(6 - x)6}{5} \Rightarrow 6 - x = \frac{2.4 \times 5}{6}$

$\Rightarrow \quad x = 6 - 2 = 4$

from (*i*), we get $\quad y = 6$

$\therefore x = 4, y = 6$

Calculation of mode:

$$\text{Modal class} = 18 - 24$$

Now, $l = 18, f_1 = 6, f_0 = 5, f_2 = 1$ and $h = 6$

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

$$= 18 + \frac{6-5}{12-5-1} \times 6$$

$$= 18 + \frac{1}{6} \times 6 = 19$$

36. (*i*) Thief is 100 m ahead of policeman.

(*ii*) Thief is running at uniform speed of 100 m/min.

$\therefore$ In 5 minutes distance covered $= 5 \times 100 + 100 = 600$ m

So, distance covered by thief is 600 m.

(*iii*) For policeman, distance covered in 5 minutes

$$= \frac{5}{2}[2 \times 100 + (5-1) \times 1] \qquad \left[\because S_n = \frac{n}{2}\{2a + (n-1)d\}\right]$$

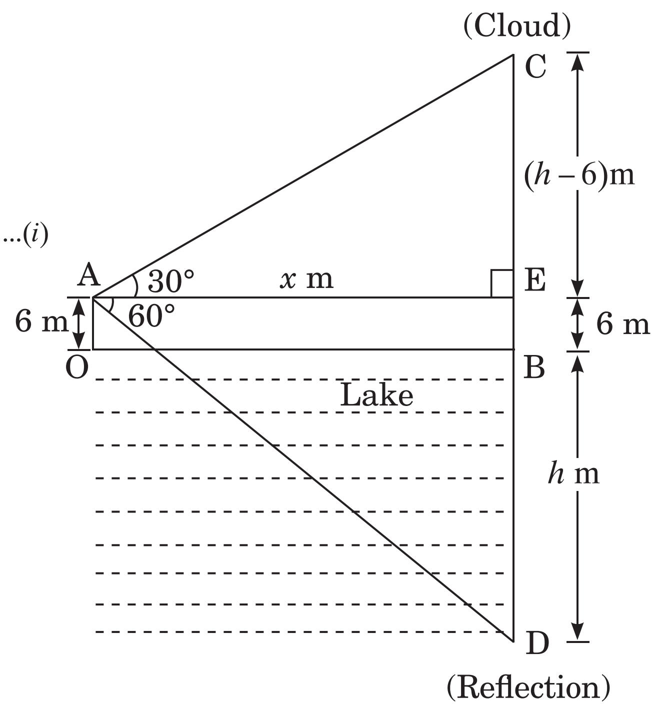
$$= \frac{5}{2}[200 + 4] = 510 \text{ m}$$

OR

$$\text{Required distance} = 100 \times 4 - \frac{3}{2}[2 \times 100 + (3-1) \times 1]$$

$$= 400 - 3 \times 101 = 400 - 303 = 97 \text{ m}$$

37. In right ΔAEC,



(*i*) $\frac{h-6}{x} = \tan 30°$

$\Rightarrow \frac{h-6}{x} = \frac{1}{\sqrt{3}}$

$\Rightarrow x = \sqrt{3}(h-6)$ ...(*i*)

(*ii*) DE = DB + BE

$= (h + 6)$m

(*iii*) AE $= x = \sqrt{3}(h-6)$ [from (*i*)]

In ΔAED, $\frac{AE}{DE} = \cot 60°$

$\Rightarrow \frac{x}{h+6} = \frac{1}{\sqrt{3}} \Rightarrow x = \frac{h+6}{\sqrt{3}}$ ...(*ii*)

OR

As, $\sqrt{3}(h-6) = \frac{h+6}{\sqrt{3}}$ [using (*i*) and (*ii*)]

$\Rightarrow 3(h-6) = h + 6$

$\Rightarrow 3h - 18 = h + 6$

$\Rightarrow 2h = 24 \Rightarrow h = 12$ m

Height of the cloud from surface of lake = 12 m

38. (*i*) Coordinates of mid point of line segment joining points B(5, 5) and C(3, 5) are $\left(\frac{5+3}{2}, \frac{5+5}{2}\right)$ i.e. (4, 5)

(*ii*) The coordinates of H and I are $H\left(\frac{13}{3}, 5\right)$ and $I\left(\frac{11}{3}, 3\right)$

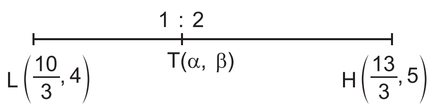
Now,
$$HI = \sqrt{\left(\frac{11}{3} - \frac{13}{3}\right)^2 + (3-5)^2}$$
$$= \sqrt{\frac{4}{9} + 4} = \sqrt{\frac{40}{9}} = \frac{2\sqrt{10}}{3} \text{ units}$$

(*iii*) The coordinates of F and D are:

F(4, 6) and D(3, 3)

$$\text{Now, } FD = \sqrt{(3-4)^2 + (3-6)^2} = \sqrt{1+9} = \sqrt{10} \text{ units}$$

OR



Let T(α, β) be the point.

By section formula:

$$\alpha = \frac{1 \times \frac{13}{3} + 2 \times \frac{10}{3}}{1+2} = \frac{11}{3}$$

and
$$\beta = \frac{1 \times 5 + 2 \times 4}{1+2} = \frac{13}{3}$$

So, coordinates of required point = $\left(\frac{11}{3}, \frac{13}{3}\right)$