1. (*d*) Least possible number of planks = $\dfrac{\text{Sum of 42, 49 and 63}}{\text{HCF of 42, 49 and 63}} = \dfrac{154}{7} = 22.$

2. (*b*) Zero of $p(x)$

Let $\quad p(x) = ax + b$

Put $\quad x = k$

$$p(k) = ak + b = 0$$

$\therefore$ k is zero of $p(x)$.

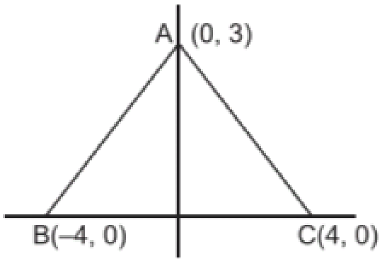
3. (*c*) HCF of 52 and 91 = Height possible speed = 13 m/min.

4. (*a*)

5. (*b*) Let ABC is a triangle with coordinates of vertices A(0, 3), B(–4, 0) and C(4, 0).

$\therefore$ Distance between AB = 5 units, AC = 5 units and BC = 8 units [using distance formula]

$\therefore$ ΔABC is an isosceles triangle.



6. (*c*) LCM (20, 25, 30) = 300 minutes

300 minutes after 12 noon = 5:00 p.m.

7. (*c*) We have $(1 + \tan^2\theta)\sin^2\theta = \sec^2\theta.\sin^2\theta$

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

8. (*b*)

$$\frac{a\sin\theta + b\cos\theta}{a\sin\theta - b\cos\theta} = \frac{\dfrac{a\sin\theta}{\cos\theta} + \dfrac{b\cos\theta}{\cos\theta}}{\dfrac{a\sin\theta}{\cos\theta} - \dfrac{b\cos\theta}{\cos\theta}} = \frac{a\tan\theta + b}{a\tan\theta - b}$$

$$= \frac{a \times \dfrac{a}{b} + b}{a \times \dfrac{a}{b} - b} = \frac{a^2 + b^2}{a^2 - b^2}$$

9. (*c*) We have PQ || RS

$\therefore \quad \Delta TRS \sim \Delta TPQ$ (By AA similarity)

$\therefore \quad \dfrac{RT}{PT} = \dfrac{RS}{PQ}$ [$\because$ CPST]

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

$\Rightarrow \quad x^2 - 1 = 2x^2 - 6x + 2x + 6$

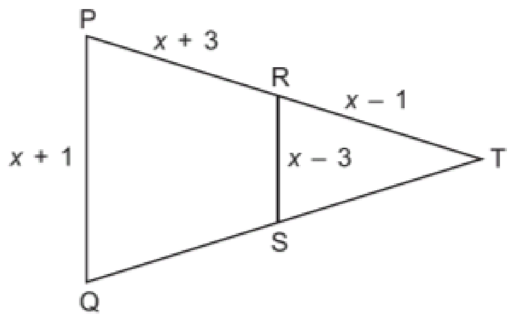
$\Rightarrow \quad x^2 - 4x - 5 = 0$

$\Rightarrow \quad (x - 5)(x + 1) = 0$

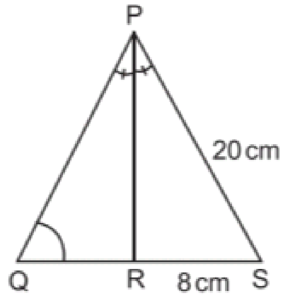
$\Rightarrow \quad x - 5 = 0$ or $x + 1 = 0$

$\Rightarrow \quad x = 5$ or $x = -1$ (not possible)

$\Rightarrow \quad x = 5$



10. (*b*) Given PQ = 20 cm



In ΔQPR and ΔSPR, $\angle QPR = \angle SPR$

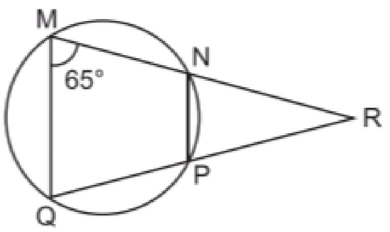
$PR = PR$ (Common)

$\therefore$ $\Delta QPR \sim \Delta SPR$ (By SAS similarity criteria)

$\therefore$ $\dfrac{PR}{PR} = \dfrac{QR}{SR}$

$\Rightarrow$ $QR = SR = 8$ cm

11. (*a*) In figure,



$NP \parallel MQ$

$\therefore$ $\angle RNP = \angle NMQ = 65°$ (Corresponding angles)

Also $\dfrac{RN}{NM} = \dfrac{RP}{PQ}$ (By BPT)

$\Rightarrow$ $RN = RP$ [$\because$ MN = QP]

$\therefore$ $\angle RNP = \angle RPN = 65°$

In ΔRNP,

$\angle R + \angle RNP + \angle RPN = 180°$

$\Rightarrow$ $\angle R + 65° + 65° = 180°$

$\Rightarrow$ $\angle R = 50°$

12. (*a*) Let radii of two circles be r_1 and r_2.

ATQ, $\dfrac{\pi r_1^2}{\pi r_2^2} = \dfrac{16}{25}$

$\Rightarrow$ $\dfrac{r_1^2}{r_2^2} = \dfrac{16}{25}$

$\Rightarrow$ $\dfrac{r_1}{r_2} = \dfrac{4}{5}$

Ratio of their circumference $= \dfrac{2\pi r_1}{2\pi r_2} = \dfrac{r_1}{r_2} = \dfrac{4}{5}$

13. (*d*) Diameter of largest possible circle = 20 cm.

$\therefore$ Area of circle $= \pi r^2 = \pi \times (10)^2 = 100\pi$ cm^2

$\therefore$ Area of 6 circles $= 6 \times 100\pi = 600\pi$ cm^2 ($\because$ there are six faces in a cube)

Also, surface area of cube $= 6 \times (20)^2 = 2400$ cm^2

Area of unpainted surface $= 2400$ cm$^2 - 600\pi$ cm$^2 = 2400$ cm$^2 - 600 \times \dfrac{22}{7}$ cm$^2 = 514.28$ cm^2.

14. (*c*) Required mean $= \dfrac{(50 \times 38) - (55 + 45)}{(50 - 2)} = \dfrac{1800}{48} = 37.5$

15. (*d*) Let radii of two spheres be r_1 and r_2.

$$\text{Ratio of their volumes} = \frac{\frac{4}{3}\pi r_1^3}{\frac{4}{3}\pi r_2^3} = \frac{8}{27}$$

$$\Rightarrow \quad \frac{r_1^3}{r_2^3} = \frac{8}{27}$$

$$\Rightarrow \quad \frac{r_1}{r_2} = \frac{2}{3}$$

$$\text{Ratio of their surface areas} = \frac{4\pi r_1^2}{4\pi r_2^2} = \frac{r_1^2}{r_2^2} = \left(\frac{2}{3}\right)^2 = \frac{4}{9}$$

16. (*b*)

$$\text{Mean} = \frac{x_1 + x_2 + x_3 + \ldots + x_n}{n} = m$$

$$\Rightarrow \quad x_1 + x_2 + \ldots + x_n = nm$$

$$\Rightarrow \quad x_1 + x_2 + \ldots x_{n-1} + x_n = nm$$

$$\Rightarrow \quad x_1 + x_2 + \ldots + x_{n-1} = nm - x_n \qquad \ldots(i)$$

$$\text{New sum} = x_1 + x_2 + \ldots + x_{n-1} + x = nm - x_n + x \qquad \text{[From } (i)\text{]}$$

$$\text{New mean} = \frac{nm - x_n + x}{n}$$

17. (*a*) As

$$\tan\theta = \frac{a}{x}$$

$$\therefore \quad \text{Perpendicular} = a \text{ and Base} = x$$

$$\Rightarrow \quad \text{Hypotenuse} = \sqrt{a^2 + x^2}$$

So,

$$\frac{x}{\sqrt{a^2 + x^2}} = \frac{\text{Base}}{\text{Hypotenuse}} = \cos\theta$$

18. (*d*) 1, $\because$ It is a sure event.

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

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

21. Equations are $4x + py + 8 = 0$ and $2x + 2y + 2 = 0$

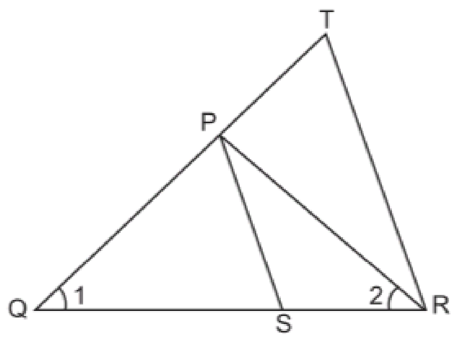
Here, $a_1 = 4, b_1 = p, c_1 = 8$ and $a_2 = 2, b_2 = 2, c_2 = 2$

For unique solution,

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

$$\Rightarrow \quad \frac{4}{2} \neq \frac{p}{2} \quad \Rightarrow \quad p \neq 4$$

22. Given: $\frac{QR}{QS} = \frac{QT}{PR}$ and $\angle 1 = \angle 2$



To Prove: $\Delta PQS \sim \Delta TQR$

Proof: In ΔPQR,

$\angle 1 = \angle 2$ [Given]

$PQ = PR$ [Sides opposite to equal angles]

$\frac{QR}{QS} = \frac{QT}{PR}$ [Given]

or $\frac{QR}{QS} = \frac{QT}{PQ}$ [$\because$ PQ = PR]

In ΔPQS and ΔTQR,

$\frac{QR}{QS} = \frac{QT}{PQ}$ (Proved above)

$\Rightarrow$ $\frac{QR}{QT} = \frac{QS}{QP}$

$\angle 1 = \angle 1$ [Common]

$\therefore$ $\Delta PQS \sim \Delta TQR$ [SAS]

23. PT is tangent to circle at T.

In ΔOPT, $OT \perp PT$

$\therefore$ $OP^2 = OT^2 + PT^2$ (Using Pythagoras theorem)

$\Rightarrow$ $(17)^2 = OT^2 + (8)^2$

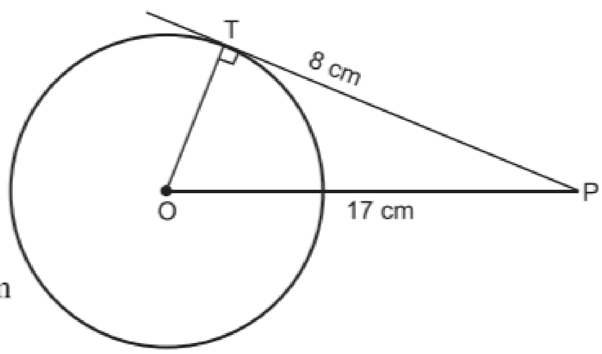
$\Rightarrow$ $289 = OT^2 + 64$

$\Rightarrow$ $OT^2 = 289 - 64$

$\Rightarrow$ $OT^2 = 225$

$\Rightarrow$ $OT = \sqrt{225} = 15$ cm

Radius of circle = 15 cm

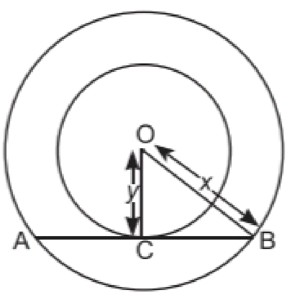


OR

Here, radius of the larger circle is x units.

Radius of the smaller circle is y units.

C is the mid-point of AB, also $OC \perp AB$.



$\therefore$ In ΔOCB,

$OB^2 = OC^2 + BC^2$ (By Pythagoras theorem)

$\Rightarrow$ $x^2 = y^2 + BC^2$

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

$\therefore$ $AB = 2(BC) = 2\sqrt{x^2 - y^2}$ (Perpendicular drawn from the centre on chord bisects the chord)

24. Here, radius(r) of sector = 21 cm and sector angle (θ) = 60°

$\therefore$ Area of sector = $\frac{\theta}{360°} \times \pi r^2 = \frac{60°}{360°} \times \frac{22}{7} \times 21 \times 21 \text{ cm}^2 = \frac{1}{6} \times 22 \times 3 \times 21 = 231 \text{ cm}^2$

25. We have $\cos^2 30° + \sin^2 45° - \frac{1}{3}\tan^2 60° + \cos 90°$

$$= (\cos 30°)^2 + (\sin 45°)^2 - \frac{1}{3}(\tan 60°)^2 + \cos 90°$$

$$= \left(\frac{\sqrt{3}}{2}\right)^2 + \left(\frac{1}{\sqrt{2}}\right)^2 - \frac{1}{3}(\sqrt{3})^2 + 0$$

$$= \frac{3}{4} + \frac{1}{2} - \frac{3}{3} = \frac{3}{4} + \frac{1}{2} - 1 = \frac{3+2-4}{4} = \frac{5-4}{4} = \frac{1}{4}$$

OR

Given, $\tan\theta = \frac{a}{b}$

We have $\frac{a\sin\theta - b\cos\theta}{a\sin\theta + b\cos\theta}$

Dividing numerator and denominator by $\cos\theta$, we get

$$\frac{a\frac{\sin\theta}{\cos\theta} - b\frac{\cos\theta}{\cos\theta}}{a\frac{\sin\theta}{\cos\theta} + b\frac{\cos\theta}{\cos\theta}} = \frac{a\tan\theta - b}{a\tan\theta + b} = \frac{a\left(\frac{a}{b}\right) - b}{a\left(\frac{a}{b}\right) + b} \quad (\because \text{Given})$$

$$= \frac{a^2 - b^2}{a^2 + b^2}$$

26. Let $3\sqrt{3}$ be a rational number

Then it will be of the form $\frac{p}{q}$, where p and q are integers having no common factor other than 1, and $q \neq 0$.

Now, $\frac{p}{q} = 3\sqrt{3}$

$\Rightarrow$ $\frac{p}{3q} = \sqrt{3}$ ...(i)

Since, p is an integer and $3q$ is also an integer ($3q \neq 0$)

So, $\frac{p}{3q}$ is a rational number.

From (i), we get $\sqrt{3}$ is a rational number.

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

Hence, our supposition is wrong. Hence, $3\sqrt{3}$ is an irrational number.

27. Given, $\frac{1}{a} + \frac{1}{b} + \frac{1}{x} = \frac{1}{a+b+x}$; ($a \neq 0$, $b \neq 0$, $x \neq 0$)

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

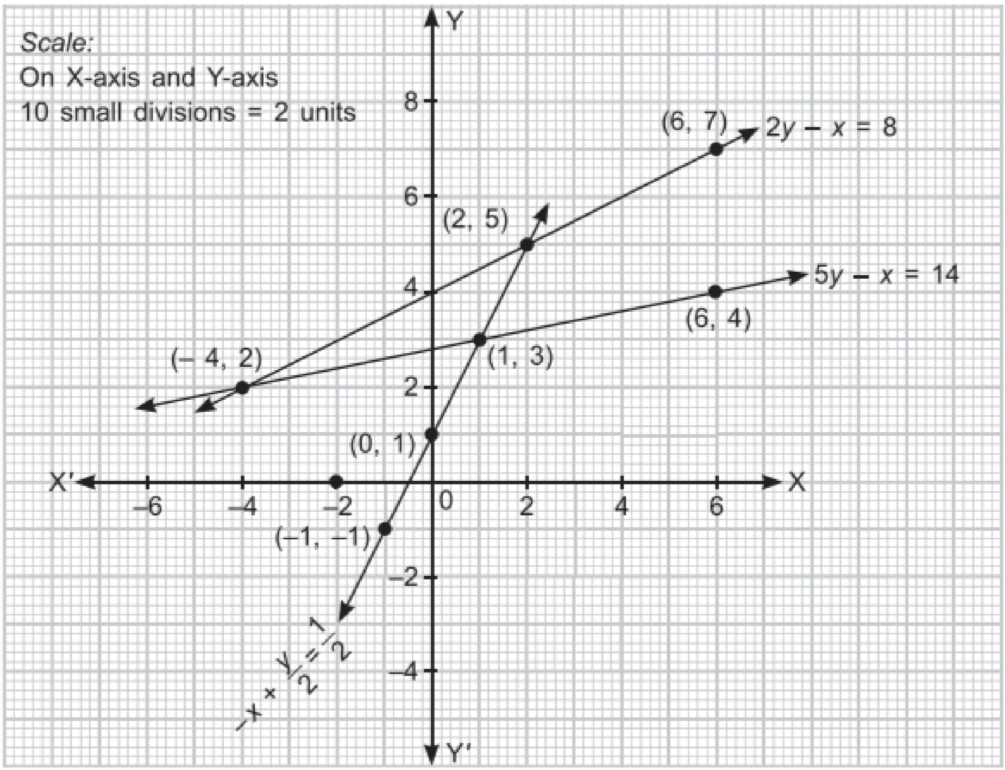
$\Rightarrow$ $\frac{b+a}{ab} = \frac{x-a-b-x}{(a+b+x)x}$

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

$$\Rightarrow \quad ax + bx + x^2 = -ab$$
$$\Rightarrow \quad x^2 + ax + bx + ab = 0$$
$$\Rightarrow \quad x(x + a) + b(x + a) = 0$$
$$\Rightarrow \quad (x + a)(x + b) = 0$$
$\Rightarrow$ $x + a = 0$ or $x + b = 0$

$\Rightarrow$ $x = -a, -b$

28. 1st equation: $2y - x = 8$



$$\Rightarrow \quad 2y = 8 + x$$
$$\Rightarrow \quad y = \frac{8+x}{2}$$

The solution table for $2y - x = 8$ is:

x	–4	2	6
y	2	5	7

2nd equation: $5y - x = 14$

$$5y = 14 + x$$
$$y = \frac{14+x}{5}$$

The solution table for $5y - x = 14$ is:

x	1	6	– 4
y	3	4	2

3rd equation: $-x + \frac{y}{2} = \frac{1}{2} \Rightarrow -2x + y = 1$

$$y = 1 + 2x$$

The solution table for $-2x + y = 1$ is:

x	0	1	– 1
y	1	3	– 1

$\therefore$ From graph, vertices of the triangle are (2, 5), (1, 3) and (– 4, 2).

OR

Let the ten's and the unit's digit be y and x respectively.

So, the number be $10y + x$

The number when digits are reversed is $10x + y$

Now, $7(10y + x) = 4(10x + y) \Rightarrow 2y = x$ ...(*i*)

Also, $x - y = 3$ ...(*ii*) (As $x > y$)

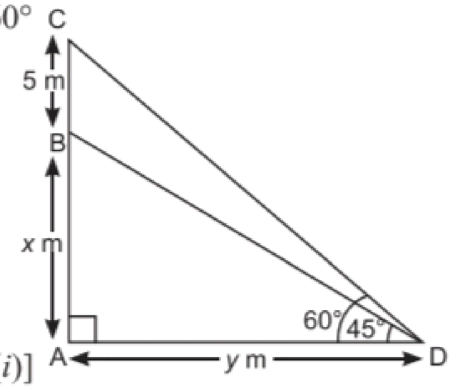
Solving (*i*) and (*ii*), we get $y = 3$ and $x = 6$

Hence, the number is 36.

29. Let AB be a pillar and BC be the flagstaff.

According to question, BC = 5 m, $\angle ADB = 45°$, $\angle ADC = 60°$

Let AB = x m and AD = y m



In right-angled ΔBAD, $\frac{AB}{AD} = \tan 45°$

$\Rightarrow \frac{x}{y} = 1 \Rightarrow x = y$ ...(*i*)

In right-angled ΔCAD, $\frac{AC}{AD} = \tan 60°$

$\Rightarrow \frac{x+5}{y} = \sqrt{3} \Rightarrow \frac{x+5}{x} = \sqrt{3}$ [Using (*i*)]

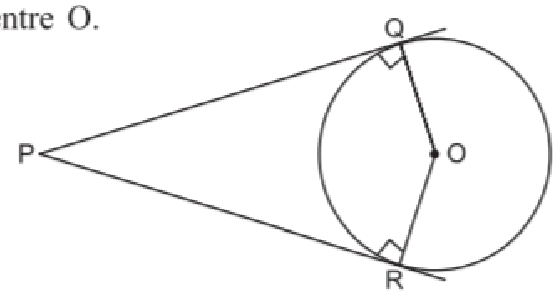
$\Rightarrow x + 5 = \sqrt{3}x \Rightarrow 5 = x(\sqrt{3} - 1)$

$$\Rightarrow x = \frac{5}{\sqrt{3}-1} = \frac{5(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}+1)} = \frac{5 \times 2.732}{(\sqrt{3})^2 - 1^2} = 6.83$$

$\therefore$ Height of the pillar = 6.83 m.

30. Given: PQ and PR are tangents drawn to a circle with centre O.

To prove: QORP is a cyclic quadrilateral.



Proof: PQ is a tangent to the circle and OQ is radius.

$\therefore$ OQ $\perp$ PQ. (Radius is perpendicular to the tangent at the point of contact)

$\therefore \angle OQP = 90°$

Similarly, $\angle ORP = 90°$

In quadrilateral QORP,

$\angle RPQ + \angle OQP + \angle ORP + \angle QOR = 360°$ (Angle sum property of quadrilateral)

$\Rightarrow \angle RPQ + 90° + 90° + \angle QOR = 360°$

$\Rightarrow \angle RPQ + \angle QOR = 180°$

$\Rightarrow$ In quadrilateral QORP, opposite angles are supplementary.

$\therefore$ QORP is a cyclic quadrilateral.

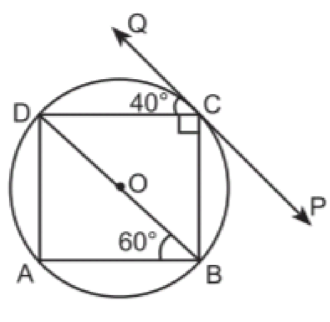
OR

Given: BD is a diameter of the circle with centre O, ABCD is a cyclic quadrilateral.

To find: $\angle BCP$

Sol. Since BD is the diameter of the circle,

$\Rightarrow \overset{\frown}{BCD}$ is a semicircle.



$\Rightarrow \angle BCD = 90°$ (Angle in a semicircle)

But, $\angle BCP + \angle BCD + \angle DCQ = 180°$ (Sum of all the angles at a point on the line)

$\Rightarrow \angle BCP + 90° + 40° = 180°$

$\Rightarrow \angle BCP = 180° - 130° = 50°$

31. Number of ways to draw a card = 52 (Total possible outcomes)

(*i*) A = card is a king of red colour

Number of favourable cases = 2

$P(A) = \frac{2}{52} = \frac{1}{26}$

(*ii*) B = card is a face card.

Number of favourable cases = 12

$P(B) = \frac{12}{52} = \frac{3}{13}$

(*iii*) C = card is a queen of diamonds

Number of favourable cases = 1

$P(C) = \frac{1}{52}$

32. Let Ist term of the AP be a and common difference be d.

According to question, $a_4 + a_8 = 24$

$\Rightarrow \quad a + 3d + a + 7d = 24$

$\Rightarrow \quad 2a + 10d = 24$

$\Rightarrow \quad a + 5d = 12 \quad ...(i)$

Also, $a_6 + a_{10} = 44$

$\Rightarrow \quad a + 5d + a + 9d = 44$

$\Rightarrow \quad 2a + 14d = 44$

$\Rightarrow \quad a + 7d = 22 \quad ...(ii)$

Subtracting (*i*) from (*ii*), we get

$a + 7d - a - 5d = 22 - 12$

$\Rightarrow \quad 2d = 10$

$\Rightarrow \quad d = 5$

Putting $d = 5$ in (*i*), we get

$a + 5 \times 5 = 12 \quad \Rightarrow \quad a = -13$

$\therefore \; a = a_1 = -13, \; a_2 = a + d = -13 + 5 = -8,$

$a_3 = a + 2d = -13 + 2 \times 5 = -3$

OR

Let height of each candle = x unit.

Height of 1^{st} candle burnt in 1 hr = $\frac{x}{6}$ unit

and height of 2^{nd} candle burnt in 1 hr = $\frac{x}{8}$ unit

Let the required time = y hrs.

Length of 1^{st} candle burnt after y hrs = $\frac{y \times x}{6}$ unit

Height of 1^{st} candle left = $\left(x - \frac{xy}{6}\right)$

Length of 2^{nd} candle burnt after y hrs = $\left(\frac{y \times x}{8}\right)$unit

Height of 2^{nd} candle left = $\left(x - \frac{xy}{8}\right)$

A.T.Q.,

Height of 1^{st} candle = $\frac{1}{2}$ Height of 2^{nd} candle

$$\Rightarrow \quad x - \frac{xy}{6} = \frac{1}{2}\left(x - \frac{xy}{8}\right) \Rightarrow x\left(1 - \frac{y}{6}\right) = \frac{1}{2}x\left(1 - \frac{y}{8}\right)$$

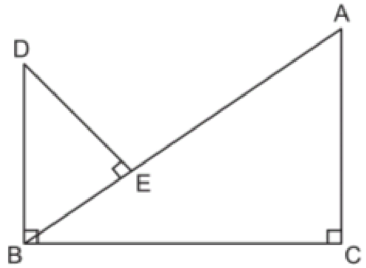
$$1 - \frac{y}{6} = \frac{1}{2}\left(1 - \frac{y}{8}\right) \Rightarrow 2 - \frac{y}{3} = 1 - \frac{y}{8}$$

$$2 - 1 = \frac{y}{3} - \frac{y}{8}$$

$$1 = \frac{8y - 3y}{24} \Rightarrow 24 = 5y \quad \Rightarrow \quad y = \frac{24}{5}$$

$$y = 4.8 \text{ hrs.} = 4 \text{ hrs. } 48 \text{ minutes}$$

33. Given : DB ⊥ BC, AC ⊥ BC and DE ⊥ AB.



To Prove : $\frac{BE}{DE} = \frac{AC}{BC}$

Proof : $\angle DEB = \angle ACB$ [Each 90°] ...(*i*)

∴ $\angle DBE = 90° - \angle ABC$

Also, $\angle DBE + \angle BDE = 90°$

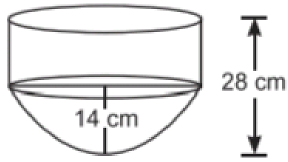
∴ $\angle ABC = \angle BDE$ ...(*ii*)

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

$\Delta BDE \sim \Delta ABC$ [By AA Similarity]

∴ $\frac{BE}{DE} = \frac{AC}{BC}$ Hence proved.

34. Radius of cylindrical portion = r = 14 cm



Height of cylindrical portion = h = 28 cm – 14 cm = 14 cm

∴ Volume of cylindrical portion = $\pi r^2 h$

$= \pi \times (14)^2 \times 14 = \pi \times (14)^3 \text{ cm}^3 = 8624 \text{ cm}^3$

Radius of the hemispherical portion = r = 14 cm

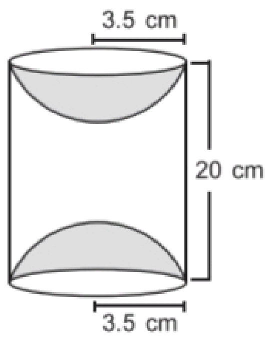
∴ Volume of hemispherical portion = $\frac{2}{3}\pi r^3 = \frac{2}{3}\pi \times (14)^3 \text{ cm}^3 = \frac{17248}{3} \text{ cm}^3$

Volume of the solid = $\left(\frac{17248}{3} + 8624\right) \text{cm}^3 = \left(\frac{17248 + 25872}{3}\right) \text{cm}^3 = \frac{43120}{3} \text{ cm}^3$

OR

Height of cylinder = h = 20 cm

Radius of cylinder = r = 3.5 cm = Radius of each hemisphere



∴ Total surface area of the article = 2 × C.S.A. of a hemisphere + C.S.A. of the cylinder

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

$= 2 \times \frac{22}{7} \times 3.5(2 \times 3.5 + 20)$

$= 44 \times 0.5(7 + 20) = 44 \times 0.5 \times 27 \text{ cm}^2 = 594 \text{ cm}^2$

35. We choose step-deviation method for finding the mean.

By step deviation method, which is given as follows:

Number of pencils	Number of boxes (f_i)	Class marks (x_i)	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
49.5 – 52.5	15	51	– 2	– 30
52.5 – 55.5	110	54	– 1	– 110
55.5 – 58.5	135	57 = a	0	0
58.5 – 61.5	115	60	1	115
61.5 – 64.5	25	63	2	50
Total	$\Sigma f_i = 400$			$\Sigma f_i u_i = 25$

We have $a = 57$, $h = 3$, $\Sigma f_i = 400$ and $\Sigma f_i u_i = 25$

$$\therefore \quad \text{Mean} = a + h \times \frac{\Sigma f_i u_i}{\Sigma f_i} = 57 + 3 \times \frac{1}{400} \times 25 = 57.19$$

Hence, the mean number of pencils kept in a packed box is 57.

36. (*i*) $\text{OB} = \text{OA} = \text{radii}$

$$\sqrt{[(2a-1)+3]^2 + (7+1)^2} = 10$$

On squaring both sides, we get

$$[(2a-1)+3]^2 + (8)^2 = 100$$

$$\Rightarrow \quad 4a^2 + 4 + 8a + 64 = 100$$

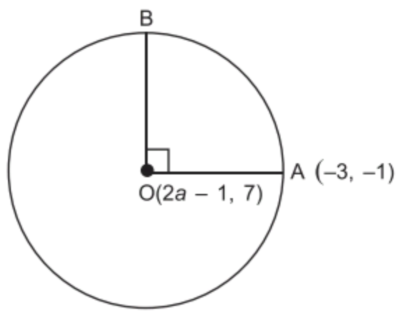
$$\Rightarrow \quad 4a^2 + 8a - 32 = 0$$

$$\Rightarrow \quad a^2 + 2a - 8 = 0$$

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

$$\Rightarrow \quad a(a+4) - 2(a+4) = 0$$

$$\Rightarrow \quad a = -4, a = 2$$



(*ii*) $\angle AOB = 90°$

$\therefore$ By pythagoras theorem

$$AB^2 = OA^2 + OB^2 \qquad \text{(OA = OB = radii of a circle)}$$

$$AB^2 = (10)^2 + (10)^2$$

$$AB^2 = 100 + 100 = 200$$

$$AB = 10\sqrt{2} \text{ units}$$

(*iii*) OA = radius

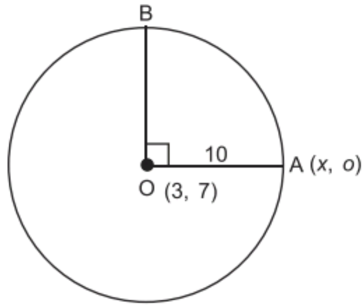
If A lies on the x-axis, then its coordinates be $(x, 0)$

$$\Rightarrow \quad \sqrt{(2a-1-x)^2 + (7)^2} = 10$$

$$\Rightarrow \quad (2a-1-x)^2 + 49 = 100$$

$$\Rightarrow \quad (2a-1-x)^2 = 51$$

Here $a = 2 \Rightarrow (3-x)^2 = 51$

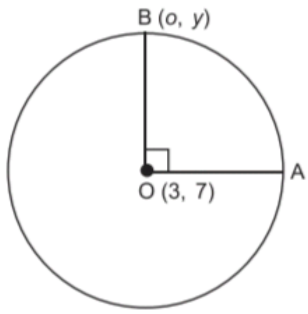


$$\Rightarrow \quad 9 + x^2 - 6x = 51$$
$$\Rightarrow \quad x^2 - 6x = 42$$
$$\Rightarrow \quad x^2 - 6x - 42 = 0$$
$$x = \frac{6 \pm \sqrt{36+168}}{2} = \frac{6 \pm \sqrt{204}}{2}$$
$$x = \frac{6 \pm 2\sqrt{51}}{2} = 3 \pm \sqrt{51}$$

$\Rightarrow$ Possible values of x are $3 + \sqrt{51}$ and $3 - \sqrt{51}$.

OR

Point B lies on y-axis, then its coordinates are $(0, y)$.



$$OB = \text{radius}$$
$$\sqrt{(2a-1-0)^2 + (7-y)^2} = 10$$
$$\Rightarrow \quad (2 \times 2 - 1)^2 + (7-y)^2 = 100$$
$$\Rightarrow \quad 9 + (7-y)^2 = 100$$
$$\Rightarrow \quad 49 + y^2 - 14y = 91$$
$$\Rightarrow \quad y^2 - 14y = 42$$
$$\Rightarrow \quad y^2 - 14y - 42 = 0$$
$$\Rightarrow \quad y = \frac{14 \pm \sqrt{196+168}}{2}$$
$$= \frac{14 \pm \sqrt{364}}{2} = \frac{14 \pm 2\sqrt{91}}{2} = 7 \pm \sqrt{91}$$

$\therefore$ Possible values of y are $7 + \sqrt{91}$ and $7 - \sqrt{91}$.

37. (*i*) $AP = 2.75, 3, 3.25 \ldots$

Here, $a = 2.75$, $d = 0.25$

$$a_n = 7.75$$
$$a_n = a + (n-1)d$$
$$\Rightarrow \quad 7.75 = 2.75 + (n-1)0.25$$
$$\Rightarrow \quad \frac{5}{0.25} = n - 1$$
$$\Rightarrow \quad 20 = n - 1 \quad \Rightarrow \quad n = 21$$

(*ii*) $n = 25$

$$a_{25} = a + 24d$$
$$= 2.75 + 24(0.25) = 8.75$$

On 25th day he will save ₹ 8.75.

$$a_{14} = a + 13d = 2.75 + 13 \times 0.25 = 6$$

On 14th day he will save ₹ 6.00

Difference $= a_{25} - a_{14} =$ ₹ 8.75 – ₹ 6 = ₹ 2.75

(*iii*) $S_{20} = \frac{10}{2}[2 \times 2.75 + (10-1) \times 0.25]$

$$= 5(5.50 + 2.25) = 5 \times 7.75 = 38.75$$

Hence, sum of amount saved in first 10 days = ₹ 38.75

OR

$$S_{20} = \frac{20}{2}[2 \times 2.75 + (20 - 1) \times 0.25]$$

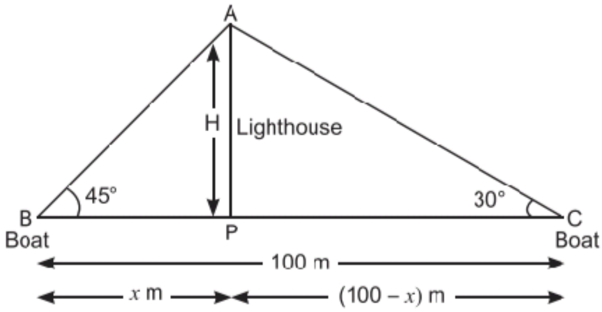
$$= 10(5.50 + 4.75) = 10 \times 10.25 = 102.50$$

Hence, sum of amount saved in first 20 days = ₹ 102.50.

38. (*i*) In ΔABP, let BP = x m

$\therefore$ PC = $(100 - x)$ m

and let AP = H = Height of lighthouse



$$\tan 45^\circ = \frac{AP}{BP}$$

$$\Rightarrow \quad 1 = \frac{AP}{x}$$

$$\Rightarrow \quad AP = H = x \qquad ...(i)$$

In ΔAPC, $$\tan 30^\circ = \frac{AP}{PC}$$

$$\Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{H}{100 - x}$$

$$\Rightarrow \quad (100 - x) = \sqrt{3}\ H$$

From equation (*i*) we have

$$(100 - H) = \sqrt{3}\ H$$

$$\Rightarrow \quad H = \frac{100}{(\sqrt{3}+1)} = \frac{100}{(\sqrt{3}+1)} \frac{(\sqrt{3}-1)}{(\sqrt{3}-1)}$$

$$= \frac{100(\sqrt{3}-1)}{2} = 50(\sqrt{3}-1) \text{ m}$$

(*ii*) BP = x = $50(\sqrt{3}-1)$ m

(*iii*) In ΔAPB, $$\sin 45^\circ = \frac{AP}{AB}$$

$$AB = \sqrt{2}(AP) = \sqrt{2} \times 50 \times (\sqrt{3} - 1)$$

$$= 50(\sqrt{6} - \sqrt{2}) \text{ m}$$

OR

In ΔAPC, $$\frac{AP}{AC} = \sin 30^\circ$$

$$\Rightarrow \quad \frac{AP}{\sin 30^\circ} = AC$$

$$\Rightarrow \quad AC = \frac{50(\sqrt{3}-1)}{\frac{1}{2}} = 100(\sqrt{3}-1) \text{ m}$$