Solutions to Sample Paper–2

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.

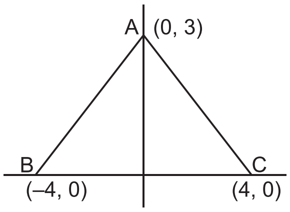
4. (*a*)

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 [$\because$ with distance formula]

$\therefore$ ΔABC is an isosceles triangle.



6. (*c*) Again at 5:00 pm.

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

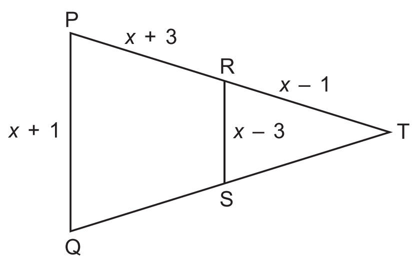
$$= \frac{1}{\cos^2\theta}.\sin^2\theta = \frac{\sin^2\theta}{\cos^2\theta} = \tan^2\theta$$

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]

$\Rightarrow \quad \dfrac{RT}{RS} = \dfrac{PT}{PQ}$

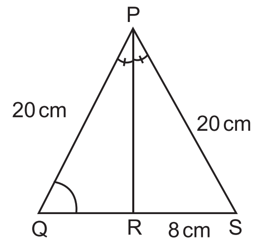
$\Rightarrow \quad \dfrac{x-1}{x-3} = \dfrac{(x+3)+(x-1)}{x+1}$

$\Rightarrow \quad \dfrac{x-1}{x-3} = \dfrac{2x+2}{x+1}$

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

$\Rightarrow \quad x = 5$

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



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

Also, $PQ = PS$

and $PR = PR$ (common)

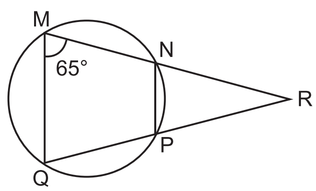
$\therefore$ $\Delta QPR \sim \Delta SPR$ (by SAS similarity conditions)

$$\therefore \quad \frac{PQ}{QR} = \frac{PS}{SR}$$

$$\frac{20}{QR} = \frac{20}{8}$$

$$\frac{20}{20} = \frac{QR}{8} \Rightarrow QR = 8 \text{ cm}$$

11. (*a*) In figure,



$NP \parallel MQ$

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

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

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

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

In ΔRNP,

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

$$\angle R + 65° + 65° = 180°$$

$$\angle R + 130° = 180°$$

$$\angle R = 50°$$

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

$$\therefore \text{ ATQ,} \quad \frac{\pi r_1^2}{\pi r_2^2} = \frac{16}{25}$$

$$\frac{r_1^2}{r_2^2} = \frac{16}{25}$$

$$\Rightarrow \quad \frac{r_1}{r_2} = \frac{4}{5}$$

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

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

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

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

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

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

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.

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

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

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

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

16. (*b*) Mean $= \dfrac{x_1 + x_2 + x_3 + \ldots + x_n}{n} = m$

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

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

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

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

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

17. (*a*) As $\tan\theta = \dfrac{a}{x}$

$\therefore$ Perpendicular $= a$ and Base $= x$

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

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

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).

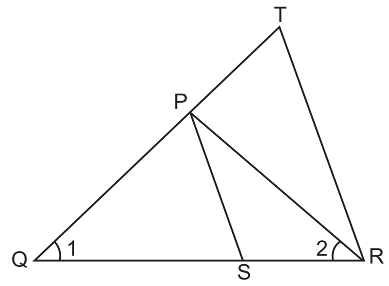
21. Equations are $4x + py + 8 = 0$ and $2x + 2y + 2 = 0$

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

For unique solution, $\dfrac{a_1}{a_2} \neq \dfrac{b_1}{b_2}$

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

22. Given: $\dfrac{QR}{QS} = \dfrac{QT}{PR}$ 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]

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

or $\dfrac{QR}{QS} = \dfrac{QT}{PQ}$ [$\therefore$ PQ = PR]

In ΔPQS and ΔTQR,

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

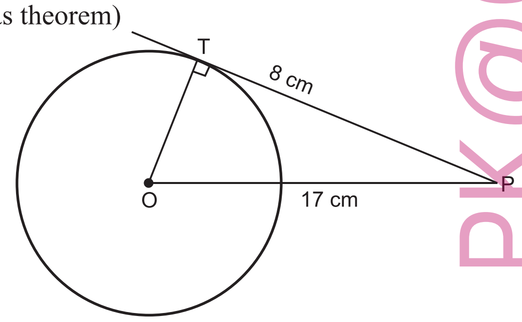
$\Rightarrow \dfrac{QR}{QT} = \dfrac{QS}{QP}$

$\angle 1 = \angle 1$ [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

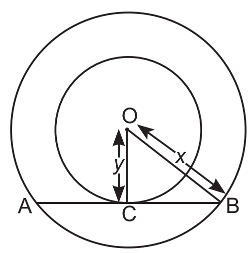
OR

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)

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

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

$\therefore AB = 2(BC) = 2\sqrt{x^2 - y^2}$ (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 $\cos^2 30° + \sin^2 45° - \frac{1}{3}\tan^2 60° + \cos 90°$

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

On substituting the values, we get

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

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

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

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

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

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

$$\Rightarrow \quad ax + bx + x^2 = -ab$$

$$\Rightarrow \quad x^2 + ax + bx + ab = 0$$

$$\Rightarrow \quad x(x + a) + b(x + a) = 0$$

$$\Rightarrow \quad (x + a)(x + b) = 0$$

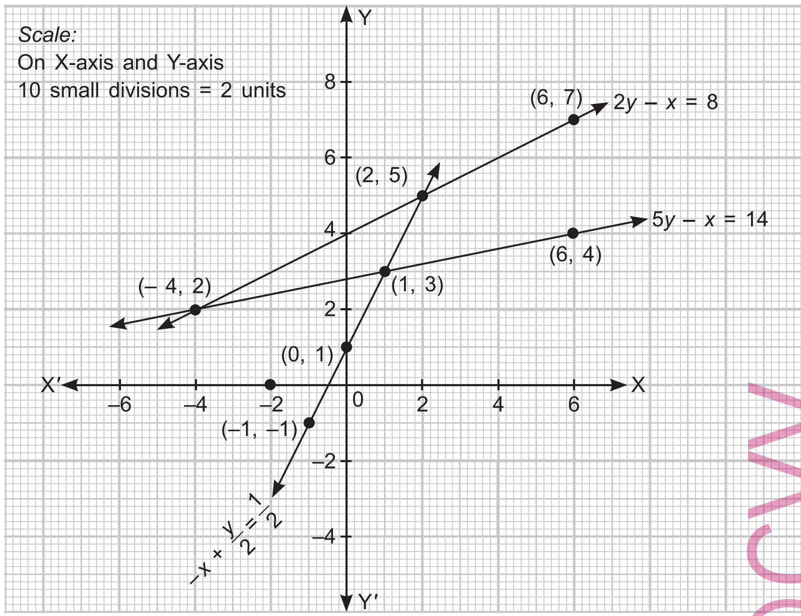
$\Rightarrow \quad x + a = 0$ or $x + b = 0$

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

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

$$\Rightarrow \quad 2y = 8 + x$$

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



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

x	–4	2	6
y	2	5	7

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

$$5y = 14 + x$$

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

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 $10x + y$

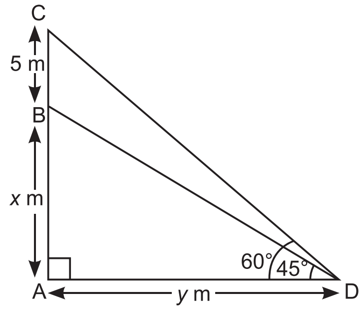
Now, $\quad 7(10y + x) = 4(10x + y) \Rightarrow 2y = x \quad$ ...(*i*)

Also, $\quad x - y = 3 \quad$ ...(*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, $\dfrac{AB}{AD} = \tan 45°$

$\Rightarrow \quad \dfrac{x}{y} = 1 \quad \Rightarrow \quad x = y \quad ...(i)$

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

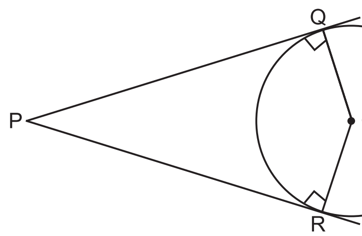
$\Rightarrow \quad \dfrac{x+5}{y} = \sqrt{3} \quad \Rightarrow \quad \dfrac{x+5}{x} = \sqrt{3}$ (Using (i))

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

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

$\therefore$ 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)

$\therefore \quad \angle OQP = 90°$

Similarly, $\angle ORP = 90°$

In quadrilateral QORP,

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

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

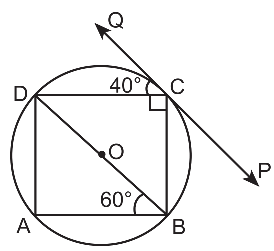
$\Rightarrow \quad \angle RPQ + \angle QOR = 180°$

$\Rightarrow$ 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.

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

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

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

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

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, $a_4 + a_8 = 24$

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

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

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

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

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

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

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

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

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

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

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

OR

Speed of boat in still water = 15 km/h

Speed of the stream be x km/h

Speed of the boat for downstream = $(15 + x)$ km/h and the speed of the boat for upstream = $(15 - x)$ km/h

Distance = 30 km

ATQ $$\frac{30}{15-x} + \frac{30}{15+x} = 4\frac{30}{60}$$

$\Rightarrow$ $$30\left[\frac{1}{15-x} + \frac{1}{15+x}\right] = \frac{270}{60} = \frac{27}{6}$$

$\Rightarrow$ $$\frac{1}{15-x} + \frac{1}{15+x} = \frac{27}{6 \times 30}$$

$$\Rightarrow \quad \frac{1}{15-x}+\frac{1}{15+x} = \frac{3}{20}$$

$$\Rightarrow \quad \frac{15+x+15-x}{(15-x)(15+x)} = \frac{3}{20}$$

$$\Rightarrow \quad \frac{30}{225-x^2} = \frac{3}{20}$$

$$\Rightarrow \quad \frac{10}{225-x^2} = \frac{1}{20}$$

$$\Rightarrow \quad 225-x^2 = 200$$

$$\Rightarrow \quad x^2 = 25$$

$$\Rightarrow \quad x = 5 \text{ or } -5$$

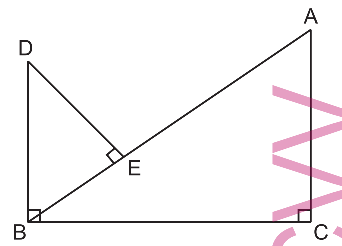
$x = -5$ is rejected because speed of stream cannot be negative.

$\therefore \quad x = 5$ km/h

Hence, speed of the stream is 5 km/h.

33. Given : $DB \perp BC$, $AC \perp BC$ and $DE \perp AB$.

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



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

$\therefore \quad \angle DBE = 90° - \angle ABC$

Also, $\angle DBE + \angle BDE = 90°$

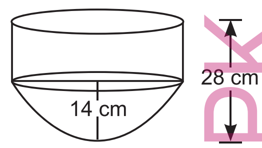
$\therefore \quad \angle ABC = \angle BDE$ ...(*ii*)

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

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

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

34. Radius of cylindrical portion $= r = 14$ cm



Height of cylindrical portion $= h = 28$ cm $- 14$ cm $= 14$ cm

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

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

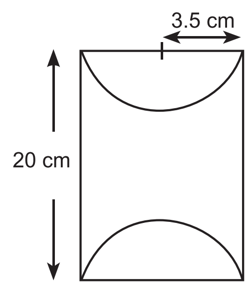
Radius of the hemispherical portion $= r = 14$ cm

$\therefore$ 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

$\therefore$ Total surface area of the article $= 2 \times$ 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	$\boxed{57 = a}$	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 $\Sigma f_i u_i = 25$

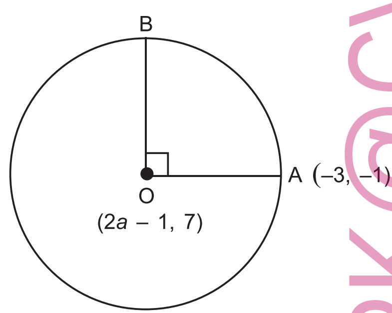
$$\therefore \quad \text{Mean} = a + h \times \frac{\Sigma f_i u_i}{\Sigma f_i} = 57 + 3 \times \frac{1}{400} \times 25 = 57.19$$

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

36. (*i*)

$$OB = OA = \text{radius}$$

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



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

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

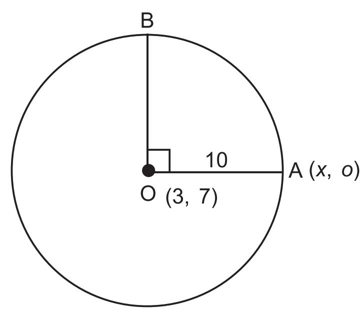
$$AB^2 = (10)^2 + (10)^2$$

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

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

(*iii*) OA = radius

If A lies on x-axis, then its coordinate are $(x, 0)$



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

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

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

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

$$\Rightarrow \quad 9 + x^2 - 6x = 51$$

$$\Rightarrow \quad x^2 - 6x = 42$$

$$\Rightarrow \quad x^2 - 6x - 42 = 0$$

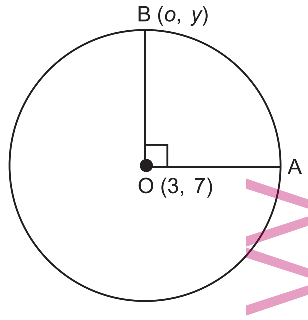
$$x = \frac{6 \pm \sqrt{36 + 168}}{2} = \frac{6 \pm \sqrt{204}}{2}$$

$$x = \frac{6 \pm 2\sqrt{51}}{2} = 3 \pm \sqrt{51}$$

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

OR

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



$$\text{OB} = \text{radius}$$

$$\sqrt{(2a - 1 - 0)^2 + (7 - y)^2} = 10$$

$$\Rightarrow \quad (2 \times 2 - 1)^2 + (7 - y)^2 = 100$$

$$\Rightarrow \quad 9 + (7 - y)^2 = 100$$

$$\Rightarrow \quad 49 + y^2 - 14y = 91$$

$$\Rightarrow \quad y^2 - 14y = 42$$

$$\Rightarrow \quad y^2 - 14y - 42 = 0$$

$$\Rightarrow \quad y = \frac{14 \pm \sqrt{196 + 168}}{2}$$

$$= \frac{14 \pm \sqrt{364}}{2} = \frac{14 \pm 2\sqrt{91}}{2} = 7 \pm \sqrt{91}$$

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

37. (*i*)

$$\text{AP} = 2.75, 3, 3.25 \ldots$$

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.

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

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

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

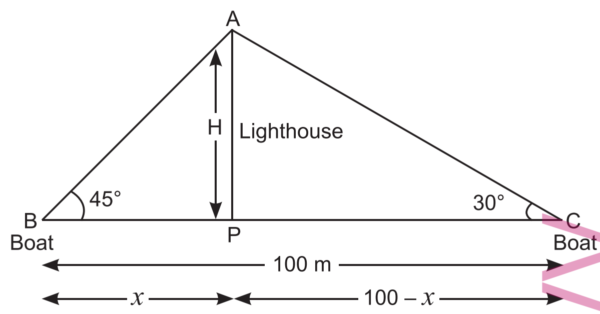
$= 10[5.50 + 4.75] = 10 \times 10.25 = 102.50$

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

38. (*i*) In ABP, let BP = x m

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

and let AP = H = Height of light house



$$\tan 45° = \frac{AP}{BP}$$

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

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

In ΔAPC, $$\tan 30° = \frac{AP}{PC}$$

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

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

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 = H = $50(\sqrt{3}-1)$ m

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

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

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

OR

$$\frac{AP}{AC} = \sin 30°$$

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

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