X ICSE 2026 [SOLUTIONS- MATHEMATICS]

SEC-A

Ans 01: (i) (a) -1
(ii) (c) 18%
(iii) (d) 9
(iv) (d) Both A and B are same (₹10,000)
(v) (a) $y = 6$
(vi) (b) ₹15
(vii) (c) $\sqrt{3}:2$
(viii) (d) 130°
(ix) (c) real, distinct and irrational
(x) (b) (A) is false and (R) is true
(xi) (a) 3:8
(xii) (b) -16
(xiii) (a) (x, y)
(xiv) (d) product AB is not possible
(xv) (c) Both (A) and (R) are true and (R) is the correct explanation of (A).

Ans 02: (i) Given, $a_4 = 60$ and $a_7 = 114$

$a + (4-1)d = 60$ and $a + (7-1)d = 114$

$a + 3d = 60$ — (i) and $a + 6d = 114$ — (ii)

Subtract eqⁿ (i) from eqⁿ (ii)

$$\cancel{a} + 6d = 114$$
$$\underline{\cancel{a} + 3d = 60}$$
$$3d = 54$$
$$d = 54/3$$
$$\boxed{d = 18}$$

Put $d = 18$ in eqⁿ (i)

$$a + 3(18) = 60$$
$$a + 54 = 60$$
$$a = 60 - 54$$
$$\boxed{a = 6}$$

(a) First term $= 6$, Common difference $= 18$ Ans.

Ans 03 : (i) Let $f(x) = kx^3 + 3x^2 - 11x - 6$

(a) Remainder when $f(x)$ is divided by $(x+1) = 6$

$$\Rightarrow f(-1) = 6$$
$$\Rightarrow k(-1)^3 + 3(-1)^2 - 11(-1) - 6 = 6$$
$$\Rightarrow -k + 3 + 11 - 6 = 6$$
$$\Rightarrow -k + 8 = 6$$
$$\Rightarrow -k = -2$$
$$\Rightarrow \boxed{k = 2} \text{ Ans}$$

(b) Thus, $f(x) = 2x^3 + 3x^2 - 11x - 6$

Putting $x = 2$ in $f(x)$;

$$f(2) = 2(2)^3 + 3(2)^2 - 11(2) - 6$$
$$= 16 + 12 - 22 - 6$$
$$= 0$$

Since, $f(2) = 0$, hence $(x-2)$ is a factor of $f(x)$ by factor theorem.

Now dividing $f(x)$ by $(x-2)$

$$
\begin{array}{r|l}
 & 2x^2 + 7x + 3 \\
\hline
x-2 & 2x^3 + 3x^2 - 11x - 6 \\
 & \underline{\cancel{2x^3} - 4x^2} \\
 & \quad - \quad + \\
 & 7x^2 - 11x \\
 & \underline{\cancel{7x^2} - 14x} \\
 & \quad - \quad + \\
 & 3x - 6 \\
 & \underline{\cancel{3x} - \cancel{6}} \\
 & \quad - \quad + \\
 & 0
\end{array}
$$

Thus, $f(x) = (x-2)(2x^2 + 7x + 3)$

$$= (x-2)(2x^2 + 6x + x + 3)$$
$$= (x-2)(x+3)(2x+1) \text{ Ans}$$

(ii) height of cylinder = height of cone = 7 cm.

radius = $7/2$ cm.

(a) Minimum height of the cylindrical box $= 7 + 7$
$= 14$ cm. Ans

(b) Volume of liquid (shaded) $= V_{cylinder} - V_{hemisphere}$

$$= \pi r^2 h - \frac{2}{3}\pi r^3$$
$$= \pi r^2 \left[h - \frac{2}{3} r \right]$$
$$= \frac{\cancel{22}^{11}}{\cancel{7}} \times \frac{\cancel{7}}{\cancel{2}} \times \frac{7}{2} \left[7 - \frac{\cancel{2}}{3} \times \frac{7}{\cancel{2}} \right]$$
$$= \frac{77}{2} \left[7 - \frac{7}{3} \right]$$
$$= \frac{77}{\cancel{2}} \times \frac{\cancel{14}^{7}}{3} = \frac{539}{3} \text{ cm}^3 \text{ Ans}$$

(b) Sum of 10 terms $= \frac{10}{2}\left[2\times 6+(10-1)\,18\right]$
$= 5\,[12+162]$
$= 5\,[174] \quad = 870$ Ans

(ii) Given, $A=\begin{bmatrix}3 & 1\\ 5 & 3\end{bmatrix}$, $B=\begin{bmatrix}-1 & a\\ 3 & -5\end{bmatrix}$ and $AB=\begin{bmatrix}b & 7\\ 4 & 5\end{bmatrix}$

$\therefore \begin{bmatrix}3 & 1\\ 5 & 3\end{bmatrix}\begin{bmatrix}-1 & a\\ 3 & -5\end{bmatrix}=\begin{bmatrix}b & 7\\ 4 & 5\end{bmatrix}$

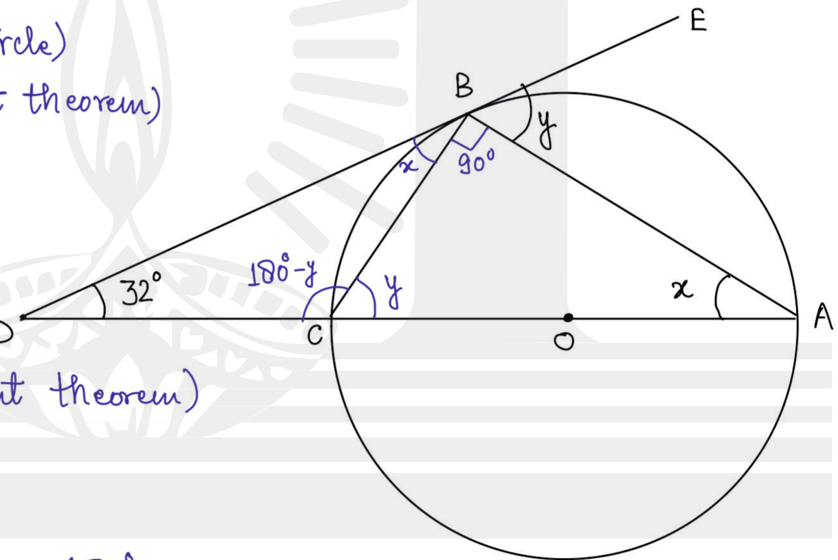
$\Rightarrow \begin{bmatrix}-3+3 & 3a-5\\ -5+9 & 5a-15\end{bmatrix}=\begin{bmatrix}b & 7\\ 4 & 5\end{bmatrix}$

$\Rightarrow \begin{bmatrix}0 & 3a-5\\ 4 & 5a-15\end{bmatrix}=\begin{bmatrix}b & 7\\ 4 & 5\end{bmatrix}$

By equality of matrices, $\boxed{b=0}$ and $3a-5=7$
$3a=12 \Rightarrow \boxed{a=4}$

Hence, $a=4$ and $b=0$ Ans.

(iii) $\angle CBA = 90^\circ$ (angle in a semi-circle)
$\angle ACB = \angle ABE$ (alternate segment theorem)
$\angle ACB = y$



$\therefore$ In $\triangle ABC$, $x+y+90^\circ=180^\circ$
$\Rightarrow x+y=90^\circ$ — (i)

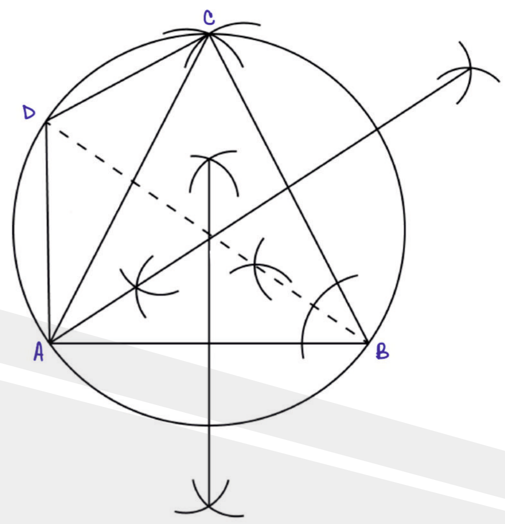
$\angle DBC = \angle CAB$ (alternate segment theorem)
$\Rightarrow \angle DBC = x$.
$\angle DCB = 180-y$

$\therefore$ In $\triangle DBC \Rightarrow \quad 32^\circ+180^\circ-y+x=180^\circ$
$\Rightarrow x-y=-32^\circ$ — (ii)

From eq^n (i) and (ii);
$x+\cancel{y}=90^\circ$
$x-\cancel{y}=-32^\circ$
$2x=58^\circ$
$\boxed{x=29^\circ}$

Put $x=29^\circ$ in eq^n (i)
$29^\circ+y=90^\circ$
$\boxed{y=61^\circ}$

Hence, $x=29^\circ$ and $y=61^\circ$ Ans (iii)(d) Geometric name of quadrilateral ABCD is a kite.



SEC-B

Ans 4: (i) To Prove: $(\sec\theta - \cos\theta)(\operatorname{cosec}\theta - \sin\theta) = \sin\theta\cos\theta$

$$LHS = (\sec\theta - \cos\theta)(\operatorname{cosec}\theta - \sin\theta)$$
$$= \left(\frac{1}{\cos\theta} - \cos\theta\right)\left(\frac{1}{\sin\theta} - \sin\theta\right)$$
$$= \left(\frac{1-\cos^2\theta}{\cos\theta}\right)\left(\frac{1-\sin^2\theta}{\sin\theta}\right)$$
$$= \frac{\sin^{\cancel{2}}\theta}{\cancel{\cos\theta}} \cdot \frac{\cos^{\cancel{2}}\theta}{\cancel{\sin\theta}}$$
$$= \sin\theta \cdot \cos\theta = RHS$$

; Hence, proved.

(ii) Given, Cost Price = ₹20,000

Marked Price = ₹24,000

(a) Discount provided by shopkeeper = 10% of 24000

$= \frac{10}{100} \times 24000$

$= 2400$

∴ Discounted price = ₹24000 − ₹2400

= ₹21,600 Ans

(b) GST = 12% of 21,600

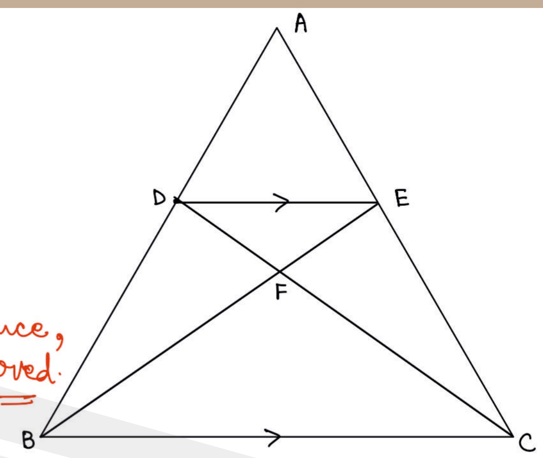
$= \frac{12}{100} \times 21600$

= ₹2,592

∴ Total amount paid by customer

= ₹21,600 + ₹2592

= ₹24,192 Ans



(iii) Given, DE ∥ BC.

(a) In $\triangle ADE$ and $\triangle ABC$,

$\angle ADE = \angle ABC$ (corresponding angles)

$\angle AED = \angle ACB$ (corresponding angles)

$\therefore \triangle ADE \sim \triangle ABC$ (by AA similarity) Hence, proved.

Given, $AD : DB = 2 : 3$

Let $AD = 2x$ and $DB = 3x$.

$\therefore AB = AD + DB = 2x + 3x = 5x$.

We know, corresponding sides of similar triangles are in proportion.

$$\therefore \frac{DE}{BC} = \frac{AD}{AB} = \frac{2x}{5x} = \frac{2}{5}$$

Hence, $\boxed{DE : BC = 2 : 5}$ Ans

(b) In $\triangle DFE$ and $\triangle CFB$,

$\angle DFE = \angle CFB$ (vertically opposite angles)

$\angle DEF = \angle CBF$ (alternate interior angles)

$\therefore \triangle DFE \sim \triangle CFB$ (by AA similarity) Hence, proved

(c) We know, areas of two similar triangles are proportional to the squares of their corresponding sides.

$$\Rightarrow \frac{ar(\triangle DFE)}{ar(\triangle CFB)} = \left(\frac{DE}{BC}\right)^2$$

$$\Rightarrow \frac{16}{ar(\triangle CFB)} = \left(\frac{2}{5}\right)^2$$

$$\Rightarrow \frac{16}{ar(\triangle CFB)} = \frac{4}{25}$$

$$\Rightarrow ar(\triangle CFB) = \frac{\overset{4}{\cancel{16}} \times 25}{\cancel{4}}$$

$$\Rightarrow \boxed{ar(\triangle CFB) = 100 \text{ sq. units}}$$ Ans

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Ans 05: (i) (a) Number of students whose height is 150 cm and above = 13.

(b) Modal height = 137 cm.

Ans 06: (i) (a) Given, number of shares = 120

Nominal value = ₹100

Market value = ₹100 + ₹25 = ₹125.

Total money invested by Kabir = number of shares × Market value

= 120 × 125

= ₹15000 **Ans**

(b) Total dividend = ₹1080

∵ Dividend = number of shares × $\frac{\text{Rate of dividend}}{100}$ × N.V. of share

$\Rightarrow 1080 = 120 \times \frac{\text{Rate of dividend}}{\cancel{100}} \times \cancel{100}$

$\Rightarrow$ Rate of dividend $= \frac{1080}{120} = 9\%$ **Ans**

(c) Rate of Return $= \left(\frac{\text{Total dividend}}{\text{Total investment}} \times 100\right)\%$

$= \left(\frac{108\cancel{0}}{15\cancel{000}} \times 1\cancel{00}\right)\%$

$= 7.2\%$ **Ans**

(ii) Here, class size (h) = 8 and assumed mean (A) = 28

Class Interval	Frequency (f)	Class mark (x)	d (x − A)	u $\left(= \frac{d}{h}\right)$	fu
0-8	10	4	−24	−3	−30
8-16	20	12	−16	−2	−40
16-24	14	20	−8	−1	−14
24-32	16	28	0	0	0
32-40	18	36	8	1	18
40-48	22	44	16	2	44
Total	$\Sigma f = 100$				$\Sigma fu = -22$

$\text{Mean} = A + \frac{\Sigma fu}{\Sigma f} \times h$

$= 28 + \frac{-22}{100} \times 8$

$= 28 - \frac{176}{100}$

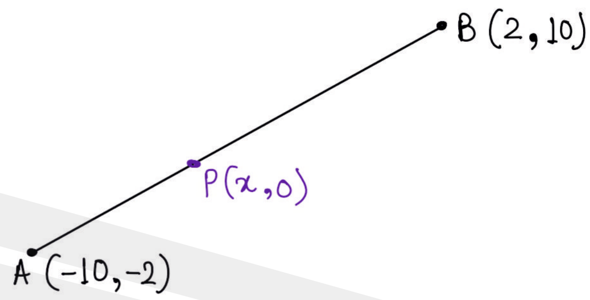
$= 28 - 1.76$

$= 26.24$

Hence, $\boxed{\text{mean} = 26.24}$ **Ans**

(c) Total number of students = 56.

(ii) (a) Let point at which AB intersects x-axis be $P(x, 0)$ and P divides AB in the ratio $m:n$.



Using section formula,

$$P = \left(\frac{2m - 10n}{m+n}, \frac{10m - 2n}{m+n}\right)$$

$$(x, 0) = \left(\frac{2m - 10n}{m+n}, \frac{10m - 2n}{m+n}\right)$$

Comparing the Y-coordinates,

$$\Rightarrow 0 = \frac{10m - 2n}{m+n}$$

$$\Rightarrow 10m - 2n = 0$$

$$\Rightarrow \frac{m}{n} = \frac{2}{10}$$

$$\Rightarrow m : n = 1:5 \quad \text{Ans}$$

(b) Now, using section formula,

$$x = \frac{1 \times 2 + 5 \times -10}{1+5}$$

$$x = \frac{2 - 50}{6}$$

$$x = -8.$$

Hence, coordinates of point P are $(-8, 0)$. Ans

(iii) Given,

$$(x-2)^2 - 5x - 3 = 0$$

$$\Rightarrow x^2 - 4x + 4 - 5x - 3 = 0$$

$$\Rightarrow x^2 - 9x + 1 = 0$$

Comparing with $ax^2 + bx + c = 0$, we get:

$$a = 1, \quad b = -9, \quad c = 1.$$

Using quadratic formula,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\Rightarrow x = \frac{-(-9) \pm \sqrt{(-9)^2 - 4(1)(1)}}{2(1)}$$

$$\Rightarrow x = \frac{9 \pm \sqrt{81 - 4}}{2}$$

$$\Rightarrow x = \frac{9 \pm \sqrt{77}}{2}$$

$$x = \frac{9 \pm 8.775}{2}$$

$$\Rightarrow x = \frac{9 + 8.775}{2} \text{ or } \frac{9 - 8.775}{2}$$

$$\Rightarrow x = \frac{17.775}{2} \text{ or } \frac{0.225}{2}$$

$$\Rightarrow x = 8.8875 \text{ or } 0.1125$$

$$\Rightarrow x = 8.89 \text{ or } 0.113$$

Hence, $x = 8.89$ or 0.113 Ans

(iii) Let the two natural numbers be x and y with $y > x$.

According to the question ; $y - x = 5$

$\Rightarrow y = x + 5$ — (i)

Sum of their reciprocal $= \frac{3}{10}$

$\Rightarrow \frac{1}{x} + \frac{1}{y} = \frac{3}{10}$

$\Rightarrow \frac{1}{x} + \frac{1}{x+5} = \frac{3}{10}$

$\Rightarrow \frac{x+5+x}{x(x+5)} = \frac{3}{10}$

$\Rightarrow 10(2x+5) = 3(x^2+5x)$

$\Rightarrow 20x + 50 = 3x^2 + 15x$

$\Rightarrow 3x^2 - 5x - 50 = 0$

$\Rightarrow 3x^2 - 15x + 10x - 50 = 0$

$\Rightarrow 3x(x-5) + 10(x-5) = 0$

$\Rightarrow (3x+10)(x-5) = 0$

$3x + 10 = 0$ OR $x - 5 = 0$

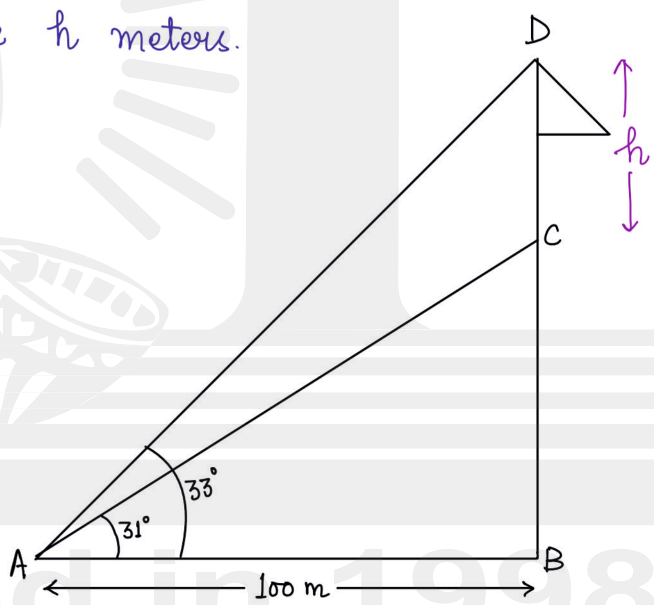
$\underbrace{x = -\frac{10}{3}}_{}$ OR $x = 5$

Not possible as $x \in \mathbb{N}$

$\therefore x = 5, \; y = 10$.

Thus, the two natural numbers are 5 and 10. Ans

Ans 07: (i) Let height of flagpole (DC) be h meters.



In $\triangle ABC$, $\tan 31° = \frac{BC}{AB}$

$\Rightarrow 0.6009 = \frac{BC}{100}$

$\Rightarrow BC = 60.09$ m

Now, in $\triangle ABD$,

$\tan 33° = \frac{DB}{AB}$

$\Rightarrow 0.6494 = \frac{60.09 + h}{100}$

$\Rightarrow 64.94 = 60.09 + h$

$\Rightarrow h = 64.94 - 60.09$

$\Rightarrow h = 4.85$ m ≈ 5

$\therefore$ $\boxed{\text{Height of flagpole} = 5\text{m}}$ Ans

(b) Interest earned by Rohit = ₹600 + ₹800 = ₹1400

Let Rohit deposit ₹P per month.

$$I = \frac{P \times n(n+1)}{2} \times \frac{r}{12 \times 100}$$

$$\Rightarrow 1400 = \frac{P \times \cancel{24} \times \cancel{25}}{\cancel{2}} \times \frac{\cancel{8}\,\cancel{4}\,2}{\cancel{1200}\,\cancel{50}\,\cancel{2}}$$

$$\Rightarrow 1400 = 2P$$

$$\Rightarrow P = ₹700$$

$\boxed{\text{Rohit deposits ₹700 per month.}}$ Ans

(ii) Given, $a_4 = 16$ and $a_7 = 128$

$ar^3 = 16$ — (i) and $ar^6 = 128$ — (ii)

eq^n (ii) $\div$ eq^n (i)

$$\frac{\cancel{a}r^6}{\cancel{a}r^3} = \frac{128}{16} \Rightarrow r^3 = 8$$

$$\Rightarrow r = 2 \Rightarrow \boxed{\text{Common Ratio} = 2}$$ Ans

Put $r=2$ in eq^n (i)

$$\Rightarrow a(2)^3 = 16$$

$$\Rightarrow a = 2 \Rightarrow \boxed{\text{First Term} = 2}$$ Ans

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(iii) (a) On reflecting O, A, B, C on X axis:

O(0,0) ⇒ O(0,0) B(5,3) ⇒ E(5,-3)

A(2,3) ⇒ D(2,-3) C(3,0) ⇒ C(3,0)

(b) On reflecting O, A, B, C through origin

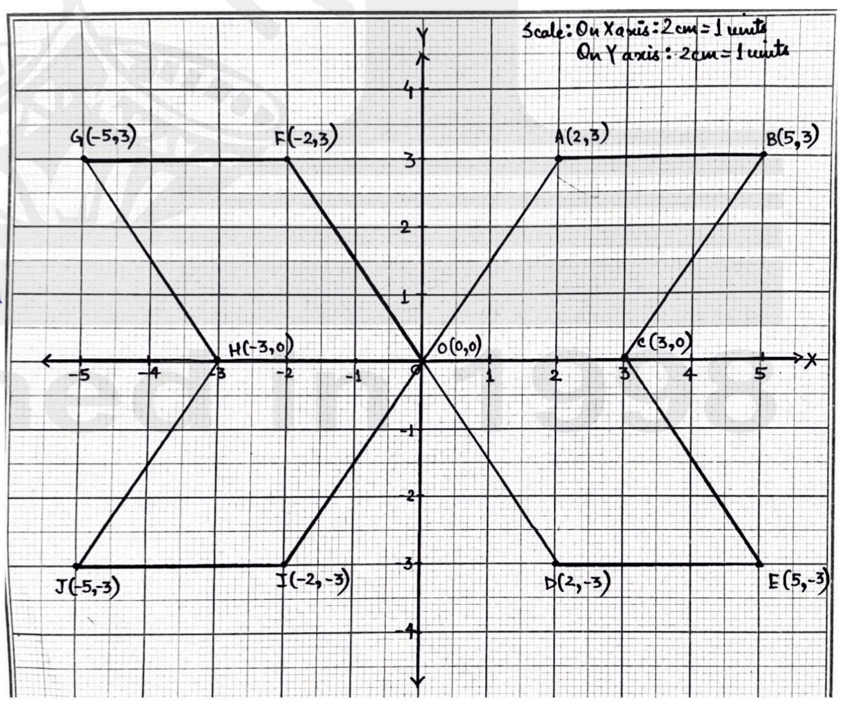
O(0,0) ⇒ O(0,0) B(5,3) ⇒ J(-5,-3)

A(2,3) ⇒ I(-2,-3) C(3,0) ⇒ H(-3,0)

(c) On reflecting O, A, B, C through Y axis

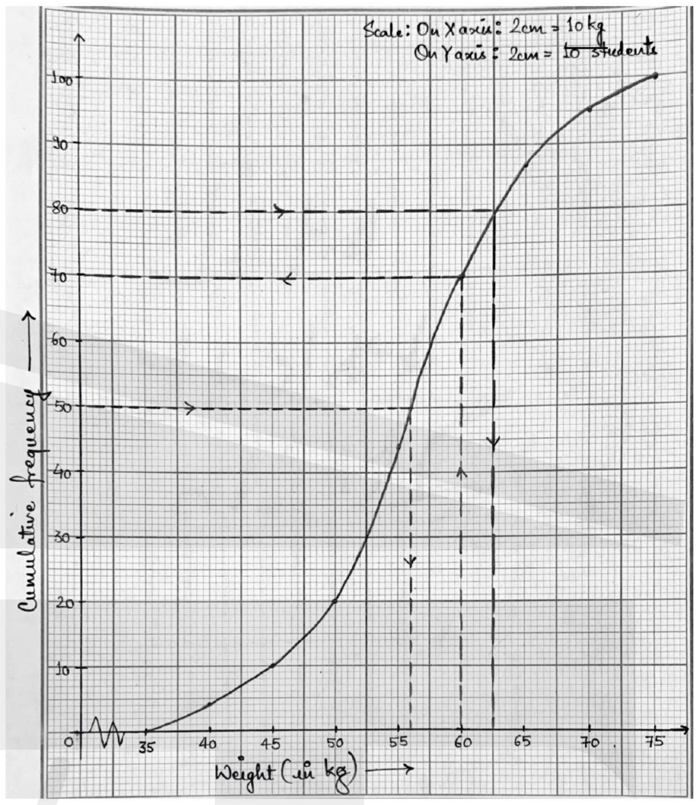
O(0,0) ⇒ O(0,0) B(5,3) ⇒ G(-5,3)

A(2,3) ⇒ F(-2,3) C(3,0) ⇒ H(-3,0)



(ii)

Weight (in kg)	Number of students	Cumulative Frequency
35-40	4	4
40-45	6	10
45-50	10	20
50-55	24	44
55-60	26	70
60-65	17	87
65-70	8	95
70-75	5	100



(a) Here $n = 100$

$$\text{Median} = \left(\frac{n}{2}\right)^{th} \text{obs}^n = \left(\frac{100}{2}\right)^{th} \text{obs}^n$$

$$= 50^{th} \text{obs}^n = 56$$

Hence, $\boxed{\text{median weight} = 56 \text{ kg}}$ Ans

(b) From ogive, number of students weighing 60 kg or more = 30.

$\therefore$ $\boxed{\text{Required percentage} = 30\%}$ Ans

(c) From ogive, weight above which 20% of the student lie = 62.5 kg Ans

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Ans 08: (i) (a) Time = 2 years = 24 months ; $r = 8\%$.

Monthly instalment, P = ₹300 for Vinay

$$I = \frac{P \times n(n+1)}{2} \times \frac{r}{12 \times 100}$$

$$\Rightarrow I = \frac{\cancel{300} \times 24(24+1)}{\cancel{2}} \times \frac{\cancel{8}}{\cancel{1200}}$$

$\Rightarrow$ I = ₹600

Hence, $\boxed{\text{interest earned by Vinay} = ₹600.}$ Ans

Ans 09 (i)

$$-1 < \frac{2x-3}{3} - \frac{x}{5} \leq 1, \; x \in \mathbb{R}$$

$$-1 < \frac{2x-3}{3} - \frac{x}{5} \quad \text{and} \quad \frac{2x-3}{3} - \frac{x}{5} \leq 1$$

$$-1 < \frac{10x-15-3x}{15} \quad \text{and} \quad \frac{10x-15-3x}{15} \leq 1$$

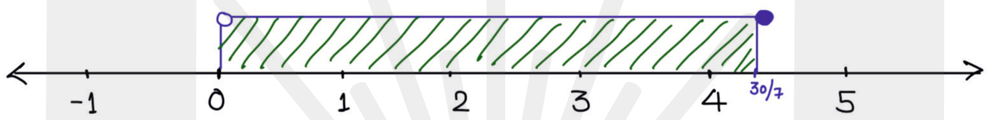
$$-15 < 7x-15 \quad \text{and} \quad 7x-15 \leq 15$$

$$-15+15 < 7x \quad \text{and} \quad 7x \leq 15+15$$

$$0 < 7x \quad \text{and} \quad 7x \leq 30$$

$$0 < x \quad \text{and} \quad x \leq \frac{30}{7}$$

$\therefore$ Solution set $= \left\{ x : 0 < x \leq \frac{30}{7} \text{ as } x \in \mathbb{R} \right\}$ Ans



(ii) (a) Coordinates of $A = (4, 8)$

Coordinates of $B = (-1, 2)$

Coordinates of $C = (6, 2)$

(b) Slope of $AB = \frac{8-2}{4+1} = \frac{6}{5}$

Using condition of parallelism,

Slope of required line $= m_{AB} = \frac{6}{5}$.

Mid point of $AC = \left(\frac{4+6}{2}, \frac{8+2}{2}\right) = (5, 5)$

Thus, equation of required line,

$$\Rightarrow y-5 = \frac{6}{5}(x-5)$$

$$\Rightarrow 5y-25 = 6x-30$$

$$\boxed{6x-5y-5=0} \text{ Ans}$$

(iii) (a) Radius of each solid, $r = 7$ cm.

$h_{cone} = h_{cyl} = 24$ cm.

Slant height of cone, $l = \sqrt{r^2+h^2}$

$$= \sqrt{7^2+24^2}$$

$$= \sqrt{49+576} = 25 \text{ cm.}$$

$P(E) = \frac{165}{300} = \frac{11}{20}$ Ans

(b) Let B be the event of selecting family with one or more girl child.

$\therefore$ Number of favourable outcomes $= 165 + 95 = 260$

$\therefore P(B) = \frac{260}{300} = \frac{13}{15}$ Ans

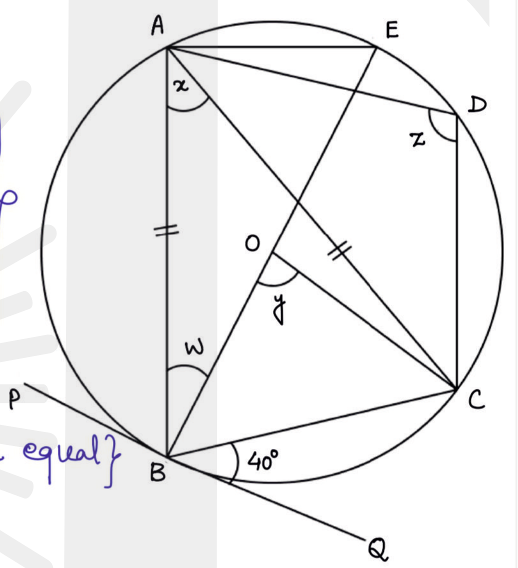
(c) Let C be the event of selecting family with no boy child.

$\therefore$ Number of favourable outcomes $= 95$

$P(C) = \frac{95}{300} = \frac{19}{60}$ Ans

(iii) $\angle BAC = \angle CBQ$ (alternate segment theorem)

$\Rightarrow \boxed{x = 40^\circ}$ Ans



$\angle BOC = 2\angle BAC$ {angle subtended by arc at centre is double of angle subtended by it on remaining part of circumference}

$y = 2 \times 40^\circ$

$\boxed{y = 80^\circ}$ Ans

Since, $AB = AC$

$\angle ABC = \angle ACB$ {angles opp. to equal sides in Δ are equal}

In ΔABC, $\angle BAC + \angle ABC + \angle ACB = 180^\circ$

$\Rightarrow 40^\circ + \angle ABC + \angle ABC = 180^\circ$

$\Rightarrow 2\angle ABC = 140^\circ$

$\Rightarrow \angle ABC = 70^\circ$

$\because OB = OC$ (radii)

$\angle OBC = \angle OCB$ {angles opp to equal sides}

In ΔOBC, $\angle BOC + \angle OBC + \angle OCB = 180^\circ$

$\Rightarrow 80^\circ + \angle OBC + \angle OBC = 180^\circ$

$\Rightarrow 2\angle OBC = 100^\circ$

$\Rightarrow \angle OBC = 50^\circ$

$\therefore w = \angle ABC - \angle OBC$

$w = 70^\circ - 50^\circ$

$\boxed{w = 20^\circ}$ Ans

$\angle ABC + \angle ADC = 180^\circ$

{opp angles of cyclic quadrilateral are supplementary}

$\Rightarrow 70^\circ + z = 180^\circ$

$\Rightarrow z = 180^\circ - 70^\circ$

$\Rightarrow \boxed{z = 110^\circ}$ Ans

$TSA_{sphere} = 4\pi r^2 = 4 \times \frac{22}{7} \times 7^2$

$\boxed{TSA_{sphere} = 616 \text{ cm}^2}$

$TSA_{cyl} = 2\pi r(h+r) = 2 \times \frac{22}{\cancel{7}} \times \cancel{7}(24+7)$

$TSA_{cyl.} = 44 \times 31$

$\boxed{TSA_{cyl} = 1364 \text{ cm}^2}$

$TSA_{cone} = \pi r(l+r) = \frac{22}{\cancel{7}} \times \cancel{7}(7+25)$

$\boxed{TSA_{cone} = 704 \text{ cm}^2}$

$\therefore TSA_{toy} = TSA_{sphere} + TSA_{cyl} + TSA_{cone}$

$= 616 + 1364 + 704$

$= 2684 \text{ cm}^2$

Hence, $\boxed{\text{Total surface area of toy} = 2684 \text{ cm}^2}$ Ans

(b) Given, cost of painting = ₹0.50 / cm².

∴ Total cost of painting the total surface = 2684 × ₹0.50 = ₹1342

Hence, $\boxed{\text{cost of painting} = ₹1342}$ Ans

Ans 10 : (i) (a) $x = \frac{5ab}{a-b}$, $a \neq b$

$\boxed{\frac{x}{a} = \frac{5b}{a-b}}$ Ans

(b) Using componendo and dividendo

$\frac{x+a}{x-a} = \frac{5b+(a-b)}{5b-(a-b)}$

$\boxed{\frac{x+a}{x-a} = \frac{4b+a}{6b-a}}$ Ans

(ii) Total number of families = 300.

(a) Let A be the event of selecting family with one girl child.

∴ Number of favourable outcomes = 165.