Date: 02/03/2026

Question Paper Code

T26 511

Aakash

Medical | IIT-JEE | Foundations

Corporate Office : AESL, 3rd Floor, Incuspaze Campus-2, Plot-13, Sector-18, Udyog Vihar, Gurugram, Haryana-122015

Time: 3 Hrs.

MATHEMATICS

Max. Marks: 80

ICSE Board Class X Exam (2026)

Answers & Solutions

GENERAL INSTRUCTIONS

Read the following instructions very carefully and follow them:

(i) You will not be allowed to write during first 15 minutes.

(ii) Attempt all questions from Section A and any four questions from Section B.

(iii) Omission of essential working will result in loss of marks.

(iv) The intended marks for questions or parts of questions are given in brackets [ ].

(v) Mathematical tables and graph papers are provided.

SECTION-A (40 Marks)

*(Attempt **all** questions from this Section.)*

1. Choose the correct answers to the questions from the given options. **[15]**

(Do not copy the questions, write the correct answers only.)

(i) $(x+3), 1, (3x-7)$ and –5 are in **proportion**. The value of x is:

(a) –1 (b) 1

(c) –5 (d) 5

Answer (a) **[1]**

Sol. $\frac{x+3}{1} = \frac{3x-7}{-5}$

$-5(x+3) = 3x-7$

$-5x-15 = 3x-7$

$-8x = 8$

$\boxed{x=-1}$

(ii) The marked price of a refrigerator is ₹12,000 and GST paid by the customer is ₹2,160. The rate of GST is:

(a) 5% (b) 12%

(c) 18% (d) 28%

Answer (c) **[1]**

Sol. Let ate of GST be x%

x% of 12000 = 2160

$\frac{x}{100} \times 12000 = 2160$

$x = \frac{2160 \times 100}{12000}$

$x = 18$

(iii) Rakhi's mobile number has the following integers:

1, 6, 9, 8, 9, 1, 7, 8, 9

The mode of the above given data is:

(a) 1 (b) 6

(c) 8 (d) 9

Answer (d) **[1]**

Sol. Mode = 9

(iv) *A* and *B* opened a recurring deposit account in a bank which is paying simple interest at 9% per annum. A deposited ₹1,500 for one year and *B* deposited ₹1,200 for 15 months. The amount invested by:

(a) *A* is ₹27 more than *B* (b) *A* is ₹300 more than *B*

(c) *A* is ₹300 less than *B* (d) Both *A* and *B* are same (₹18.000)

Answer (d) **[1]**

Sol. Amount invested by A = ₹(1500 × 12)

= ₹18000

Amount invested by B = ₹(1200 × 15)

= ₹18000

option (D) is correct.

(v) Find the equation of a line whose y-intercept is 6 and is parallel to x-axis

(a) $y = 6$ (b) $x = 6$

(c) $x + y = 6$ (d) $y - x = 6$

Answer (a) **[1]**

Sol. A line parallel to x-axis

y = constant

y = 6

Option (A) is correct

(vi) Asha buys ₹20 shares of a company which pays 9% dividend at such a price that she gets a return of 12% on her investment. At what price did she buy each share?

(a) ₹20 (b) ₹15

(c) ₹25 (d) ₹18

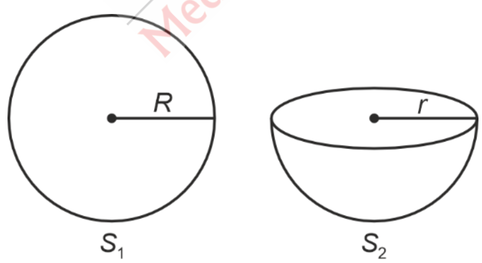
Answer (b) **[1]**

Sol. Market Price $= \left(\frac{1.80 \times 100}{12}\right)$

= ₹15

Option (B) is correct.

(vii) The total surface area of a solid sphere (S_1) and a solid hemisphere (S_2), as shown in the diagram, are equal. The ratio of radii R and r is:



(a) 1 : 1 (b) 2 : 1

(c) $\sqrt{3} : 2$ (d) $2 : \sqrt{3}$

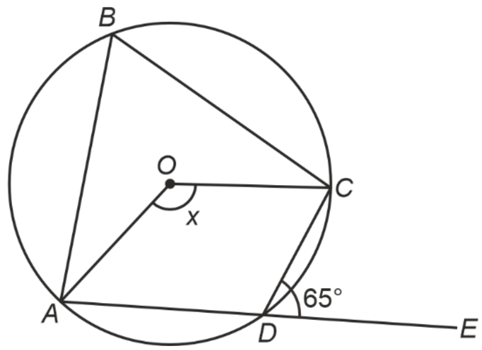
Answer (c) **[1]**

Sol. According to question,

$$4\pi R^2 = 3\pi r^2$$

$$\Rightarrow \quad \frac{R}{r} = \frac{\sqrt{3}}{2}$$

(viii) In the given diagram, O is the centre of the circle and $ABCD$ is a cyclic quadrilateral. If $\angle CDE = 65^\circ$, then the value of x is:



(a) 32.5° (b) 65°

(c) 115° (d) 130°

Answer (d) **[1]**

Sol. $\angle ABC = 180^\circ - \angle ADC = 65^\circ$

$x = 2\angle ABC = 130^\circ$

(ix) The nature of roots of quadratic equation $3x^2 - 6x - 3 = 0$ are:

(a) real and equal (b) real, distinct and rational

(c) real, distinct and irrational (d) no real roots

Answer (c) **[1]**

Sol. $D = (-6)^2 - 4(3)(-3)$

$= 36 + 36$

$= 72$ (not perfect square)

(x) **Assertion (A):** If a die is rolled, the probability of getting a number greater than 6 is $\frac{1}{6}$.

Reason (R): There are six possible outcomes when rolling a die, $\{1, 2, 3, 4, 5, 6\}$.

(a) (A) is true and (R) is false

(b) (A) is false and (R) is true

(c) Both (A) and (R) are true and (R) is the correct explanation of (A)

(d) Both (A) and (R) are true but (R) is not the correct explanation of (A)

Answer (b) **[1]**

Sol. (A) is false and (R) is true.

(xi) If the areas of two similar triangles are in the ratio 9 : 64, then the ratio of their corresponding altitudes is:

(a) 3 : 8 (b) 2 : 1

(c) 9 : 64 (d) 8 : 3

Answer (a) **[1]**

Sol. 3 : 8

{Using properties of similarity $\frac{\text{Area of } \Delta ABC}{\text{Area of } \Delta PQR} == \frac{AB^2}{PQ^2} = \frac{AD^2}{PS^2} = \frac{AC^2}{PR^2} = \frac{BC^2}{QR^2}$ }

(xii) What must be added to $x^3 + 7x^2 + 3x + 2$ so that the result is completely divisible by $(x+2)$?

(a) –40 (b) –16

(c) 16 (d) 40

Answer (b) **[1]**

Sol. Let $p(x) = x^3 + 7x^2 + 3x + 2$

$x + 2 = 0$

$(x = -2)$

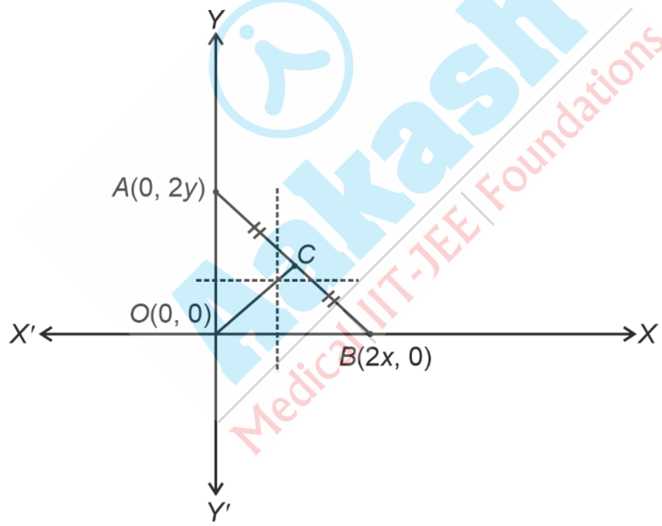
$\therefore$ $p(-2) = (-2)^3 + 7(-2)^2 + 3(-2) + 2$

$= -8 + 28 - 6 + 2$

Remainder = 16

$\therefore$ We should add –16.

(xiii) In the given diagram, ΔAOB is a right-angled triangle and C is the mid-point of AB. The **coordinates** of the point which is **equidistant** from the three vertices of ΔAOB is:



(a) (x, y) (b) (y, x)

(c) $\left(\frac{x}{2}, \frac{y}{2}\right)$ (d) $\left(\frac{2x}{3}, \frac{2y}{3}\right)$

Answer (a) **[1]**

Sol. Circumenter of right-angled triangle is mid-point of hypotenuse.

(xiv) Given matrix $A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$ and matrix $B = \begin{bmatrix} 2 & -4 \end{bmatrix}$. Product AB is a matrix of **order**:

(a) 2×2 (b) 2×1

(c) 1×2 (d) product AB is not possible

Answer (d) **[1]**

Sol. $A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$

$B = [2, -4]$

Product is not possible because Matcix A is of order 2 × 2 and Matrix B is of order 1 × 2.

(xv) **Assertion (A):** The 9th term of a Geometric Progression (G.P.) $6, -12, 24, -48 \ldots$ is a positive term.

Reason (R): The value of $(-2)^8$ is always positive.

(a) (A) is true and (R) is false

(b) (A) is false and (R) is true

(c) Both (A) and (R) are true and (R) is the correct explanation of (A)

(d) Both (A) and (R) are true but (R) is not the correct explanation of (A)

Answer (c) **[1]**

Sol. $6, -12, 24, -48 \ldots$

$a = 6,\ r = -2, n = 9$

$T_n = a \cdot r^{n-1}$

$= 6 \cdot (-2)^{9-1}$

$= 6 \cdot (-2)^8$

$= 6 \times 256$

$= 1536$

2. (i) The fourth and seventh terms of an Arithmetic Progression (A.P.), are 60 and 114 respectively. Find the: **[4]**

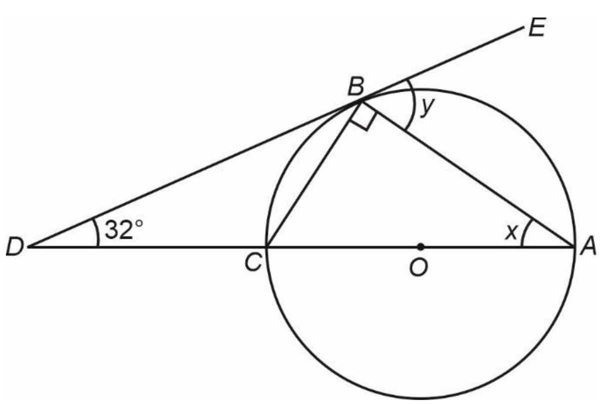
(a) first term and common difference.

(b) sum of its first 10 terms.

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

Find the values of 'a' and 'b'.

(iii) In the given diagram, O is the centre of the circle and the tangent DE touches the circle at B. If, $\angle ADB$ = 32°. Find the values of x and y. **[4]**



Sol. (i) (a) $a_4 = 60$ and $a_7 = 114$ [½]

$a + 3d = 60$ ...(i) [½]

$a + 6d = 114$ ...(ii)

subtract (i) and (2)

$3d - 6d = 60 - 114$ [½]

$-3d = -54$ [½]

$\boxed{d = 18}$ [½]

$\therefore$ $a = 60 - 3d$

$= 60 - 3(18)$

$= 60 - 54$

$\boxed{a = 6}$ [½]

(b) $S_{10} = \frac{10}{2}[2 \times 6 + 9 \times 18]$ [½]

$= 5[12 + 162]$

$= 5 \times 174$

$= 870$ [½]

(ii) $A = \begin{bmatrix} 3 & 1 \\ 5 & 3 \end{bmatrix} B = \begin{bmatrix} -1 & a \\ 3 & -5 \end{bmatrix}$

$AB = \begin{bmatrix} 3 & 1 \\ 5 & 3 \end{bmatrix} \begin{bmatrix} -1 & a \\ 3 & -5 \end{bmatrix}$ [½]

$= \begin{bmatrix} 3 \times (-1) + 1 \times 3 & 3 \times a + 1 \times (-5) \\ 5 \times (-1) + 3 \times 3 & 5 \times a + 3 \times (-5) \end{bmatrix}$ [½]

$= \begin{bmatrix} -3 & +3 & 3a & -5 \\ -5 & +9 & 5a & -15 \end{bmatrix}$ [½]

$= \begin{bmatrix} 0 & 3a - 5 \\ 4 & 5a - 15 \end{bmatrix}$ [½]

$\therefore$ $\begin{bmatrix} 0 & 3a - 5 \\ 4 & 5a - 15 \end{bmatrix} = \begin{bmatrix} b & 7 \\ 4 & 5 \end{bmatrix}$ [½]

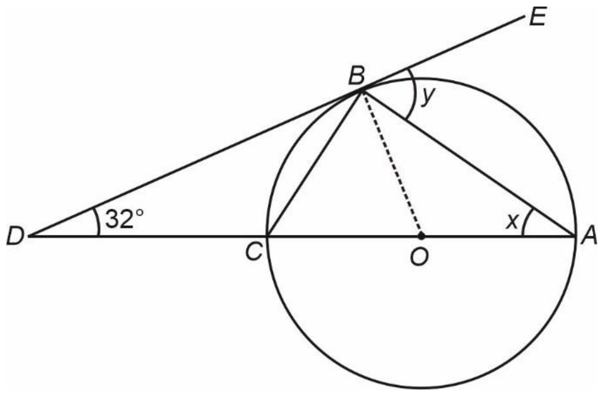
$\Rightarrow$ $b = 0$ [½]

$3a - 5 = 7$

$3a = 12$ [½]

$\boxed{a = 4}$

Also $5 \times 4 - 15 = 5$ (verified) [½]

(iii) 

Join OB

$\angle OBA = \angle OAB = x$ [as $OA = OB$ (radii)] **[½]**

DE is tangent

$\therefore \quad \angle OBE = 90°$ **[½]**

$\therefore \quad x + y = 90°$ …(i) **[½]**

In ΔABD, by exterior angle theorem

$\angle ABE = \angle BDA + \angle BAD$ **[½]**

$y = 32° + x$ **[½]**

or $x - y = -32°$ …(ii) **[½]**

Add (i) and (ii)

$2x = 58°$

$\boxed{x = 29°}$

$\therefore \quad y = 32° + 29° = 61°$ **[½]**

$\therefore \quad x = 29°, y = 61°$ **[½]**

3. (i) The polynomial $kx^3 + 3x^2 - 11x - 6$ when divided by $(x + 1)$, leaves a remainder of 6. **[4]**

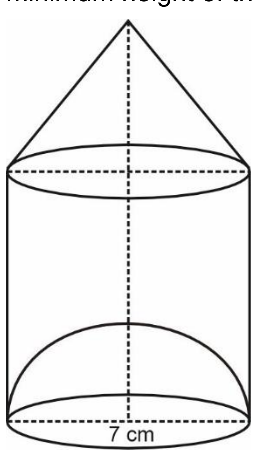
(a) Find the value of k.

(b) Using the value of k factorise completely the polynomial

$kx^3 + 3x^2 - 11x - 6$

(ii) An eye drop bottle is prepared consisting of a hemisphere, a cylinder and a conical **cap**, as shown in the given diagram. **Height** of the cylindrical and conical parts are each, **equal to the diameter** (7 cm). Find the: **[4]**

(a) minimum height of the cylindrical box required to pack this bottle.



(b) volume of the liquid medicine (shaded part) in the bottle. Give your answer to the nearest whole number. $\left(\text{Use } \pi \frac{22}{7}\right)$

(iii) Use ruler and compass for the following construction: **[5]**

(a) construct an equilateral triangle *ABC* of side 5 cm.

(b) construct the circumcircle of ΔABC.

(c) construct the locus of points which are equidistant from *AB* and *BC*. Mark the point where the circumcircle and locus meet, as *D*.

(d) give the geometrical name of quadrilateral *ABCD*.

Sol. (i) (a) $k(-1)^3 + 3(-1)^2 - 11(-1) - 6$

$-k + 3 + 11 - 6 = 0$ **[1]**

$-k + 8 = 0$

$k = 8$ **[1]**

(b) $(x + 1)$ is a factor of given polynomial $8x^3 + 3x^2 - 11x - 6$

$$\begin{array}{l}
x+1\,\big)\,8x^3 + 3x^2 - 11x - 6\,\big(\,8x^2 - 5x - 6 \\
\quad\;\; 8x^3 + 8x^2 \\
\quad\;\; - \quad\; - \\
\hline
\qquad\quad -5x^2 - 11x \\
\qquad\quad -5x^2 - 5x \\
\qquad\quad + \quad\;\; + \\
\hline
\qquad\qquad\quad -6x - 6 \\
\qquad\qquad\quad -6x - 6 \\
\hline
\qquad\qquad\qquad 0
\end{array}$$

[1]

$8x^3 + 3x^2 - 11x - 6$

$= (x + 1)(8x^2 - 5x - 6)$ **[1]**

(ii) (a) Total height = height of conical part + height of cylindrical part

$= 7 + 7$ **[1]**

$= 14$ cm **[1]**

(b) Total volume $= \frac{1}{3}\pi r^2 h_1 + \pi r^2 h_2$

$$= \frac{1}{3}\pi\left(\frac{7}{2}\right)^2 \times 7 + \pi\left(\frac{7}{2}\right)^2 \times 7$$

$$= \pi\left(\frac{1}{3} \times \frac{49}{4} \times 7 + \frac{49}{4} \times 7\right)$$ **[½]**

$$= \frac{22}{7}\left(\frac{343}{12} + \frac{343}{4}\right)$$ **[½]**

$$= \frac{22}{7}\left(\frac{343 - 1029}{12}\right)$$ **[½]**

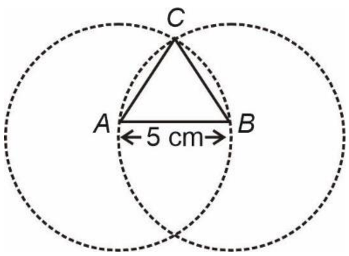
$$= \frac{22}{7} \times \frac{1372}{12}$$

$= 359.33 \text{ cm}^3$ **[½]**

Required shaded volume $359.33 - \frac{2}{3} \times \frac{22}{7}\left(\frac{7}{2}\right)^3$

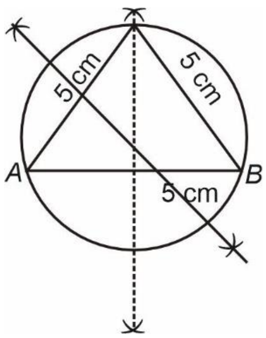
$$= 359.33 - \frac{539}{6} = 269.496 \text{ cm}^3$$

(iii) (a)



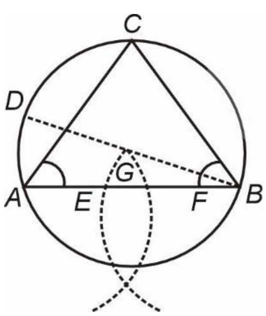
[1]

(b)



[1½]

(c)



[1½]

(d) Kite **[1]**

SECTION-B (40 Marks)

*(Attempt **any four** questions from this Section.)*

4. (i) Prove that: **[3]**

$(\sec\theta - \cos\theta)(\text{cosec}\theta - \sin\theta) = \sin\theta \cos\theta$

(ii) The cost price of a TV set is **₹ 20,000**. The shopkeeper marked it for **₹ 24,000**. He sells it to a customer at a **discount of 10%** on the marked price. If the sale is intra-state and the rate of **GST** is 12%, find the: **[3]**

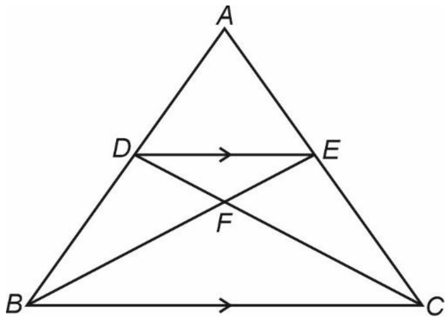
(a) discounted price of the TV set.

(b) amount paid by the customer to clear the bill.

(iii) In the given diagram, $DE \parallel BC$ and $AD : DB = 2 : 3$. **[4]**

(a) Prove that: $\Delta ADE \sim \Delta ABC$ and hence find $DE : BC$

(b) Prove: $\Delta DFE \sim ACFB$



(c) Given, area of ΔDFE = 16 square units, find the area of ΔCFB.

Sol. (i) L.H.S. $= (\sec\theta - \cos\theta)(\text{cosec}\theta - \sin\theta)$

$$= \sec\theta \cdot \text{cosec}\theta - \sec\theta\sin\theta - \cos\theta \cdot \text{cosec}\theta + \sin\theta\cos\theta$$ **[½]**

$$= \frac{1}{\sin\theta} \cdot \frac{1}{\cos\theta} - \frac{1}{\cos\theta} \cdot \sin\theta - \cos \cdot \frac{1}{\sin\theta} + \sin\theta\cos\theta$$ **[½]**

$$= \frac{1}{\sin\theta\cos\theta} - \frac{\sin\theta}{\cos\theta} - \frac{\cos\theta}{\sin\theta} + \frac{\sin\theta\cos\theta}{1}$$ **[½]**

$$= \frac{1 - \sin^2\theta - \cos^2\theta + \sin^2\theta\cos^2\theta}{\sin\theta\cos\theta}$$ **[½]**

$$= \frac{1 - \left(\sin^2\theta + \cos^2\theta\right) + \sin^2\theta \cdot \cos^2\theta}{\sin\theta\cos\theta}$$ **[½]**

$$= \frac{1 - 1 + \sin^2\theta\cos^2\theta}{\sin\theta\cos\theta}$$

$$= \sin\theta\cos\theta$$ **[½]**

= R.H.S.

(ii) Here, CP = ₹20,000, MP = ₹24,000 **[½]**

Discount % = 10% **[½]**

GST = 12% **[½]**

(a) Price after discount = MP – 10% of MP

$$= 24{,}000 - 24000 \times \frac{10}{100}$$ **[½]**

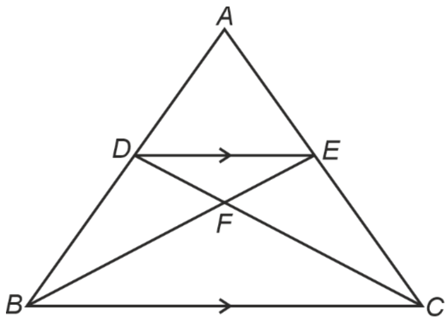
= ₹21,600 **[½]**

(b) Amount paid by customer = 21,600 + 12% of 21,600

= 21,600 + 2592 **[½]**

= ₹24,192

(iii) (a)



$\because$ $DE \parallel BC$

and $AD : DB = 2 : 3$ [Given]

and $\Delta ADE \sim \Delta ABC$ [Given]

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

$\therefore$ $AB = AD + DB = 5x$ [½]

$\therefore$ $\dfrac{AD}{AB} = \dfrac{2x}{3x} = \dfrac{2}{5}$

$\therefore$ $AD : AB = 2 : 5$ [½]

$\because$ $DE \parallel BC$

$\angle ADE = \angle ABC$ [corresponding angles] [½]

$\angle AED = \angle ACB$ [corresponding angles]

$\therefore$ By using AA similarity

$\Delta ADE \sim \Delta ABC$

$\therefore$ By using corresponding sides are proportional

$\dfrac{DE}{BC} = \dfrac{AD}{AB}$

$\dfrac{DF}{BC} = \dfrac{2}{5}$

$\therefore$ $DE : BC = 2 : 5$ [½]

(b) $\Delta DFE \sim \Delta CFB$

$\because$ $DE \parallel BC$ [Given]

$\therefore$ $\angle DFE = \angle CFB$ [V.O.A.] [½]

$\angle DEF = \angle CBF$ [alternate angles $\therefore$ $DE \parallel BC$]

(By using AA similarity) [½]

$\Delta DFE \sim \Delta CFD$

(c) Given area of ΔDFE = 16 sq. units

Using similar triangle properly

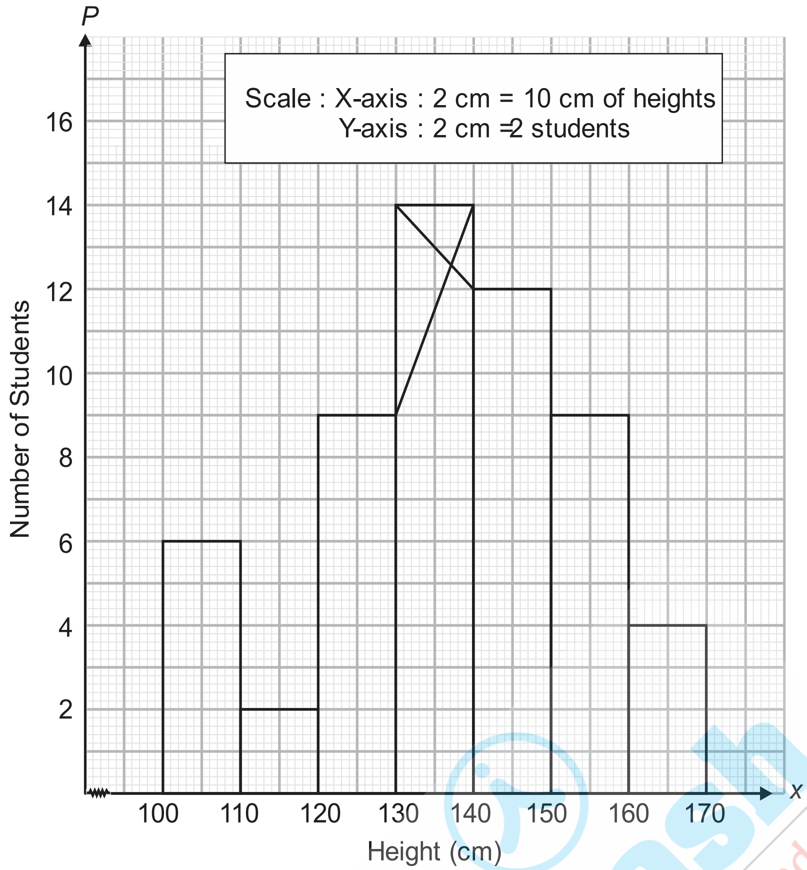
$$\frac{\text{Area of } \Delta DFE}{\text{Area of } \Delta CFB} = \frac{2^2}{5^2} = \frac{4}{25}$$ [½]

$$\frac{16}{\text{Area of } \Delta CFB} = \frac{4}{25}$$

$$\text{Area of } \Delta CFB = \frac{16 \times 25}{4}$$

$= 100$ sq. units [½]

5. (i) The histogram drawn on the graph represents the number of students of different heights (in cm). **[3]**



Using the graph, answer the following:

(a) the number of students whose height is 150 cm and above.

(b) the modal height.

(c) the total number of students.

(ii) $A(-10, -2)$ and $B(2, 10)$ are two end points of a line segment. If AB intersects the x-axis at P, find the: **[3]**

(a) ratio in which 'P' divides AB.

(b) coordinates of point P.

(iii) Solve the quadratic equation $(x-2)^2 - 5x - 3 = 0$ and give your answer correct to 3 significant figures. (Use Mathematical Tables for this question if necessary) **[4]**

Sol. (i) (a) Number of students whose height is 150 cm and above

$= 9 + 4 = 13$ **[1]**

(b) Modal height is given by point of intersection.

$\therefore$ Modal height = 137 **[1]**

(c) Total number of students

$= 6 + 2 + 9 + 14 + 12 + 9 + 4 = 56$ **[1]**

(ii) $\overset{\qquad\qquad K : 1}{\underset{A(-10,\,-2)}{\bullet}\!\!\text{———————}\!\!\underset{P(x,\,0)}{\bullet}\!\!\text{———————}\!\!\underset{B(2,\,10)}{\bullet}}$

Let the coordinates of point P be $(x, 0)$ and Let point P divides AB in the ratio of $K : 1$

(a) By section formula (coordinate) of P are

$$\left(\frac{k\times 2+1\times(-10)}{k+1}, \frac{k\times 10+1\times(-2)}{k+1}\right)$$ **[1]**

By equation y-coordinate

$$0=\frac{10k-2}{k+1}$$

$$\Rightarrow \quad 10k=2 \quad \Rightarrow \quad k=\frac{1}{5}$$

$\therefore$ Ratio = 1 : 5 **[1]**

(b) Coordinates of point P are

$$\left(\frac{\frac{1}{5}\times 2-10}{\frac{1}{5}+1}, 0\right) \quad \left[\text{using } k=\frac{1}{5}\right]$$

$$=\left(\frac{2-50}{1+5}, 0\right)=(-8, 0)$$ **[1]**

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

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

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

$\therefore \quad a=1, b=-9, c=1$ **[1]**

Quadratic formula is

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

$$=\frac{-(-9)\pm\sqrt{(-9)^2-4(1)(1)}}{2(1)}$$ **[1]**

$$=\frac{9\pm\sqrt{81-4}}{2}$$ **[1]**

$$\therefore \quad \frac{9+\sqrt{77}}{2} \text{ and } \frac{9-\sqrt{77}}{2}$$

$$\frac{9+8.77}{2} \text{ and } \frac{9-8.77}{2}$$

$\therefore \quad 8.885$ and 0.115 **[1]**

6. (i) Kabir bought 120 shares of a company with nominal value ₹100, available at a premium of ₹25. Find: **[3]**

(a) the money invested by Kabir in buying these shares.

(b) the rate of dividend, if he received ₹1,080 as dividend from these shares after one year.

(c) his rate of return.

(ii) Find the mean of the following frequency distribution using step-deviation method. **[3]**

Take assumed mean = 28

Class Interval	0 – 8	8 – 16	16 – 24	24 – 32	32 – 40	40 – 48
Frequency	10	20	14	16	18	22

(iii) The difference of two natural numbers is 5 and sum of their reciprocals is $\frac{3}{10}$. Find the two numbers. **[4]**

Sol. (i) (a) Number of shares = 120

Nominal (face) value = ₹100

Market price of one share = 100 + 25 = ₹125 **[½]**

Total investment = 120 × 125

= ₹15,000 **[½]**

(b) Dividend is calculated on face value, not market price

Let rate of divided be r%

Dividend per share = r% of 100 = ₹r

Total dividend from 120 shares = 120r **[½]**

Total dividend given = ₹1080

$$\Rightarrow \quad r = \frac{1080}{120} = 9$$ **[½]**

$\therefore$ Rate of dividend = 9%

(c) $\text{Rate of return} = \frac{\text{Annual income}}{\text{Investment}} \times 100$ **[½]**

$$= \frac{1080}{15000} \times 100$$

= 7.2% **[½]**

(ii) Assumed mean = 28

$h = 8$

class-interval	Frequency f_i	Mid-point (x_i)	$u_i = \frac{x_i - 28}{8}$	$f_i u_i$
0 – 8	10	4	–3	–30
8 – 16	20	12	–2	–40
16 – 24	14	20	–1	–14
24 – 32	16	28	0	0
32 – 40	18	36	1	18
40 – 48	22	44	2	44
Total	$N = \Sigma_{i=1}^{6} f_i = 100$			$\Sigma_{i=1}^{6} f_i u_i = -22$

[1]

$$\bar{u} = \frac{1}{N}\sum_{i=1}^{6} f_i ui = \frac{-22}{100}$$ **[½]**

$\therefore \quad \bar{x} = A + h\bar{u}$ **[½]**

$$= 28 + 8 \times \left(\frac{-22}{100}\right)$$

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

$$= \frac{2800 - 176}{100}$$ **[½]**

$= 26.24$

$\therefore$ Mean = 26.24 **[½]**

(iii) Let the two numbers be x and y

$x - y = 5$ $(x > y)$ **[½]**

$x = 5 + y$ … (i)

$$\frac{1}{x} + \frac{1}{y} = \frac{3}{10} \quad \ldots\text{(ii)}$$ **[½]**

Substitute the value of x from equation (i) to (ii), we get

$$\frac{1}{y+5}+\frac{1}{y}=\frac{3}{10}$$ **[½]**

$$\Rightarrow \frac{2y+5}{y(y+5)}=\frac{3}{10}$$ **[½]**

$$\Rightarrow 10(2y+5)=3y(y+5)$$

$$\Rightarrow 20y+50=3y^2+15y$$ **[½]**

$$\Rightarrow 3y^2-5y-50=0$$ **[½]**

$$\Rightarrow (3y+10)(y-5)=0$$ **[½]**

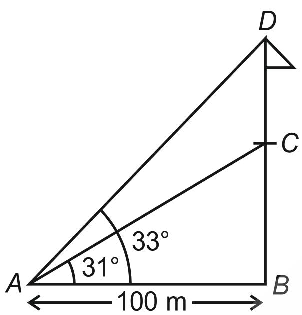
$y=5$ (natural numbers)

$x=y+5=10$ **[½]**

$\therefore$ The two natural numbers are 5 and 10

7. (i) A flagpole is erected at the top of a building. The angle of elevation of the top and foot of the flagpole from a point 100 m away, on the same level as that of the foot of the building, are 33° and 31° respectively. Find the height of the flagpole. Give your answer correct to the nearest metre.

(Use Mathematical Tables for this question.) **[5]**



(ii) Using a graph paper, draw an ogive for the following distribution which shows a record of weight in kilograms of 100 students. **[5]**

Weight (in kg)	Number of students
35 – 40	4
40 – 45	6
45 – 50	10
50 – 55	24
55 – 60	26
60 – 65	17
65 – 70	8
70 – 75	5

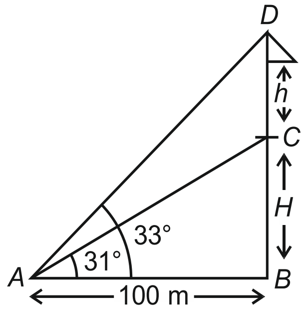
Use your ogive to estimate the following:

(a) the median weight of the students.

(b) percentage of students whose weight is 60 kg or more.

(c) the weight above which 20% of the students lie.

Sol. (i)



Let height of flagpole be h m. **[1]**

Let $BC = H$

In ΔACB

$$\tan 31^\circ = \frac{BC}{AB} = \frac{H}{100}$$ **[1]**

$$H = 100\tan 31^\circ$$

$$H = 100 \times 0.60086$$ **[1]**

$$H = 60.086$$

In ΔADB

$$\tan 33^\circ = \frac{DB}{AB} = \frac{h+H}{100}$$ **[1]**

$$0.6494 \times 100 = h + 60.086$$

$h = 64.94 - 60.086$

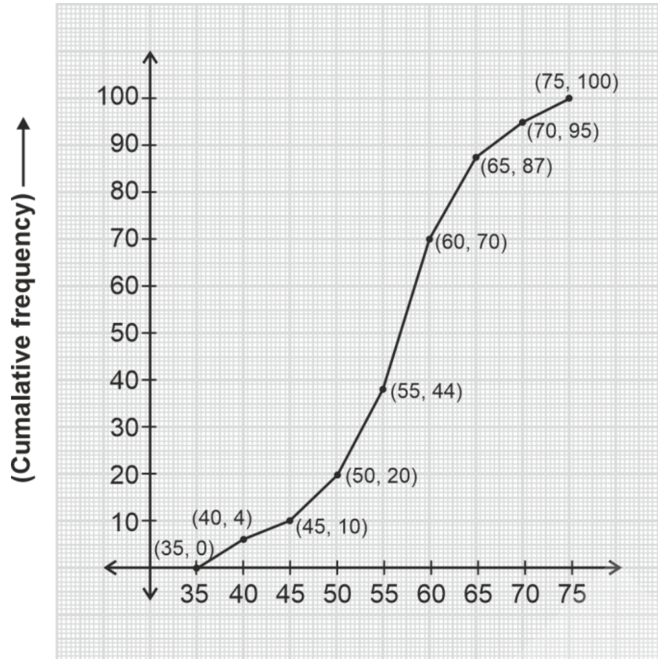
$h = 4.854$ m **[1]**

$h = 5$ m (to nearest metre)

(ii) Let us drew the ogive by 'less than' method

Weight (in kg)	Number of Students	Weight (less than)	cf
35 – 40	4	Less than 40	4
40 – 45	6	Less than 45	10
45 – 50	10	Less than 50	20
50 – 55	24	Less than 55	44
55 – 60	26	Less than 60	70
60 – 65	17	Less than 65	87
65 – 70	8	Less than 70	95
70 – 75	5	Less than 75	100

[1]



Weight (in kg) (Upper limts) ⟶ [2]

(a) Median weight = 56.2 kg [½]

(b) % of students whose weight is 60 kg or more

$= \frac{100-70}{100} \times 100\% = 30\%$ [½]

(c) The weight above which 20% of students lie = 63 kg [1]

8. (i) Rohit and Vinay both opened a recurring deposit account in a bank for 2 years at 8%, simple interest. Vinay deposited ₹300 per month. On maturity, Rohit's interest was ₹800 more than Vinay's interest. Find the: [3]

(a) interest earned by Vinay.

(b) Sum deposited by Rohit every month

(ii) The **fourth** term of a Geometric Progression **(G.P.)** is 16 and its **seventh** term is 128. Find its: [3]

(a) Common Ratio

(b) First term

(iii) Use graph sheet for this question. Take **2 cm = 1 unit** along both x and y axis. Graphically represent parallelogram ***OABC***, where $O(0,0)$, $A(2,3)$, $B(5,3)$ and $C(3,0)$. [4]

Reflect *OABC*:

(a) on the x-axis and name its image as *ODEC*.

(b) through the origin and name its image as *OIJH*.

(c) on the y-axis and name its image as *OFGH*.

Sol. (i) (a) Rohit's interest = $\dfrac{P_1 \times 24 \times 25 \times 8}{2 \times 12 \times 100}$

$= 2P_1$ **[½]**

Vinay's interest = $\dfrac{P_2 \times 24 \times 25 \times 8}{2 \times 12 \times 100}$

$= \dfrac{300 \times 24 \times 25}{300}$ **[½]**

$= \dfrac{600 \times 300}{300}$

= ₹600 **[½]**

(b) $2P_1 = 600 + 800$ **[1]**

$P_1 = 700$ **[½]**

(ii) $T_4 = 16$

$T_7 = 128$

(a) Let first term is a and common ratio is r

$T_4 = a \cdot (r)^{4-1}$

$16 = a \cdot r^3$ ...(i) **[½]**

$T_7 = a \cdot (r)^{7-1}$

$128 = a \cdot (r)^6$ ...(ii) **[½]**

Divide (i) from (ii)

$\dfrac{128}{16} = \dfrac{a \cdot r^6}{a \cdot r^3}$

$r^3 = 8$

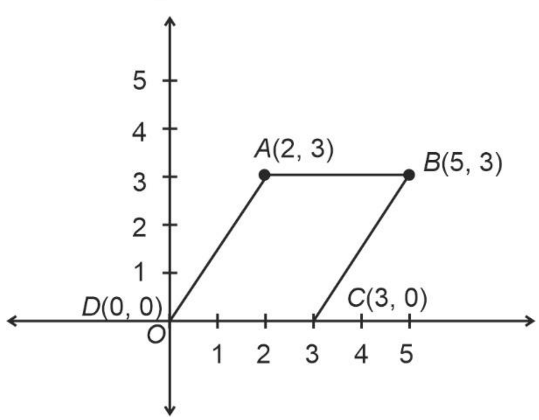
$r = 2$ **[½]**

(b) $16 = a \cdot (2)^3$ **[½]**

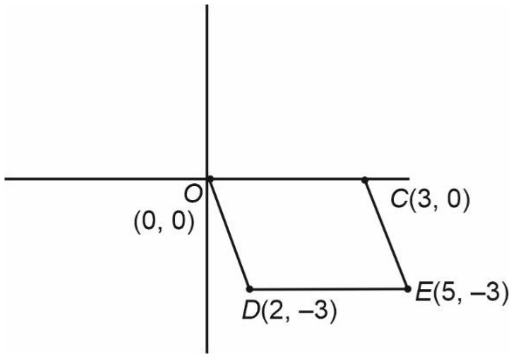
$a = \dfrac{16}{8}$ **[½]**

$= 2$ **[½]**

(iii)



(a)



$A(2,3) \to D(2,-3)$

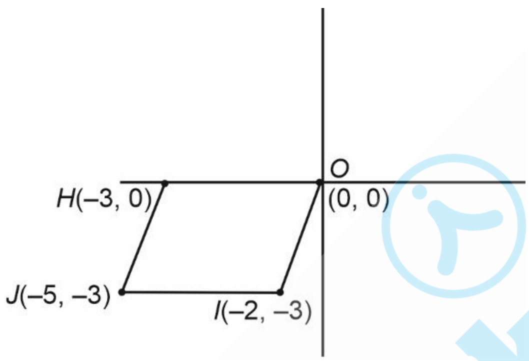
$B(5,3) \to E(5,-3)$ **[1]**

O and *C* remain unchanged quadrilateral *ODEC* is the mirror image of *OABC* in the *x* axis.

$\Rightarrow$ OD || EC and DE || OC **[½]**

$OD \parallel EC, DE = OC$

(b)



$O(0,0) \to O(0,0)$

$A(2,3) \to I(-2,-3)$

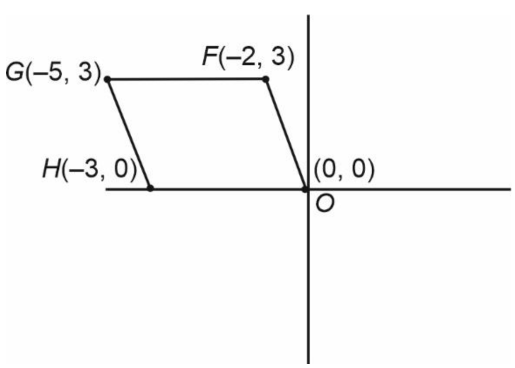
$B(5,3) \to J(-5,-3)$

$C(3,0) \to H(-3,0)$ **[1]**

OI || *JH* and *OI* = *JH*

OIJH is a parallelogram **[½]**

(c)



$O(0,0) \to O(0,0)$

$A(2,3) \to F(-2,3)$

$B(5,3) \to G(-5,3)$

$C(3,0) \to H(-3,0)$ **[½]**

$OF \parallel GH$, $FG \parallel OH$

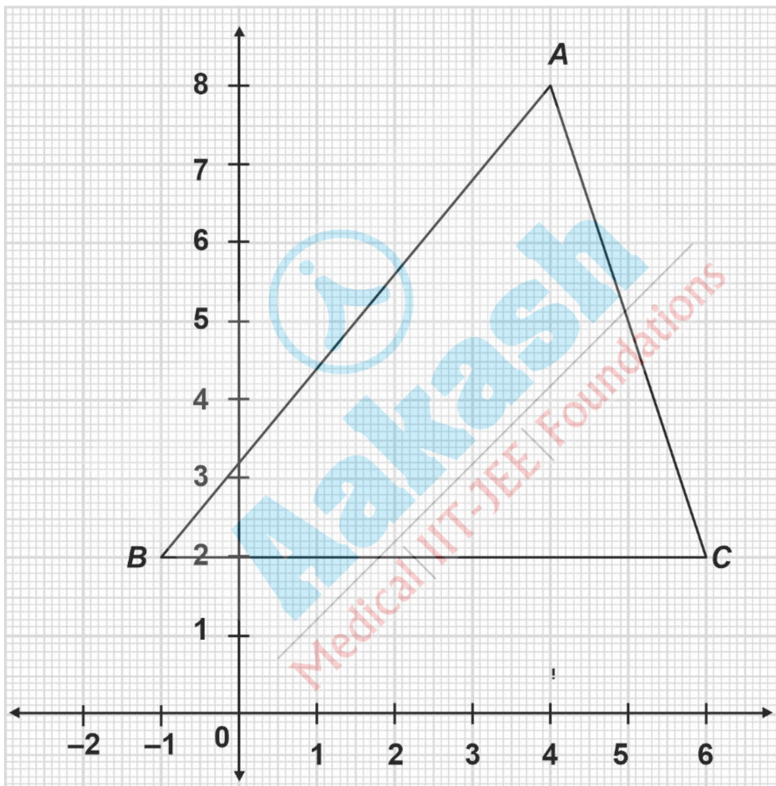
And $OF = GH$, $FG = OH$

OFGH is a parallelogram. **[½]**

9. (i) Solve the following inequation, write the solution set and represent it on the **real number line**. **[3]**

$$-1 < \frac{2x-3}{3} - \frac{x}{5} \le 1,\ x \in \boldsymbol{R}$$

(ii) Use the following graph and answer the given questions: **[3]**



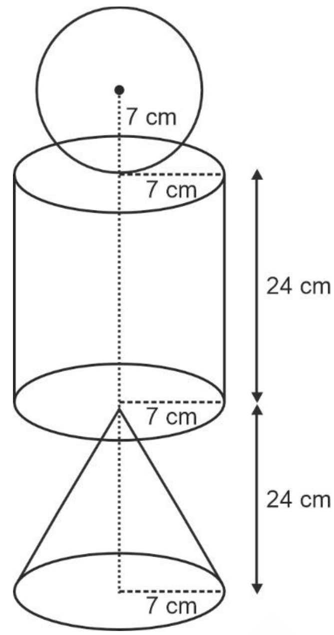
(a) Write the co-ordinates of points ***A***, ***B*** and ***C***.

(b) Find the equation of a line passing through the mid-point of ***AC*** and parallel to ***AB***.

(iii) A solid wooden toy is prepared by joining a cone, a cylinder and a sphere, as shown in the given diagram. The radius of each of the three solids is 7 cm and heights of each of the cone and the cylinder is 24 cm. Find: **[4]**

(a) the **total surface area** of the given solid.

(b) the cost of painting the total surface at the rate of ₹0.50 per cm^2. $\left(\text{Use } \pi = \frac{22}{7}\right)$



Sol. (i) $-1 < \frac{2x-3}{3} - \frac{x}{5} \le 1$ **[½]**

$-1 < \frac{10x-15-3x}{15} \le 1$ **[½]**

$-1 < \frac{7x-15}{15} \le 1$ **[½]**

$-15 < 7x - 15 \le 15$ **[½]**

$0 < 7x \le 30$ **[½]**

$0 < x \le \frac{30}{7}$

$\therefore$ Solution set $= \left(0, \frac{30}{7}\right]$ **[½]**

(ii) (a) Co-ordinates of point A = (4, 8) **[½]**

Co-ordinates of point B = (–1, 2) **[½]**

Co-ordinates of point C = (6, 2) **[½]**

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

$\therefore$ Slope of AB {A(4, 8), B(–1, 2)}

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8-2}{4-(-1)} = \frac{6}{5}$ **[½]**

Now using point-slope form, (mid-point = 5, 5) **[½]**

$y - y_1 = m(x - x_1)$

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

$\boxed{y = \frac{6}{5}x - 1}$

∴ Required equation of a line passing through the mid-point of AC: {5, 5} and parallel to AB is **[½]**

$$\boxed{y = \frac{6}{5}x - 1}$$

(iii) (a) Total surface area of given solid

= T.S.A.of (sphere + cylinder + cone).

$= 4\pi r^2 + 2\pi r(h+r) + \pi r(l+r)$ **[½]**

[slant height $l^2 = h^2 + r^2$

$l = \sqrt{24^2 - 7^2}$ **[½]**

$= \sqrt{625}$

l = 25 cm **[½]**

$= \pi r[4r + 2(h+r) + (l+r)]$ **[½]**

$= \pi r[4r + 2h + 2r + l + r]$

$= \pi r[7r + 2h + l]$ **[½]**

$= \frac{22}{7} \times 7[7 \times 7 + 2 \times 24 + 25]$

$= 22[49 + 48 + 25]$ **[½]**

= 22 × 122

= 2684 cm^2

(b) cost of painting total surface of the given toy = T.S.A × Cost per cm^2 **[½]**

= 2684 × 0.50

= ₹1342 **[½?**

10. (i) If $x = \frac{5ab}{a-b}$, $a \neq b$, **[3]**

(a) Find $\frac{x}{a}$

(b) Using properties of proportion, find $\frac{x+a}{x-a}$

(ii) A survey was conducted on 300 families having 2 children each. The results obtained are given below. **[3]**

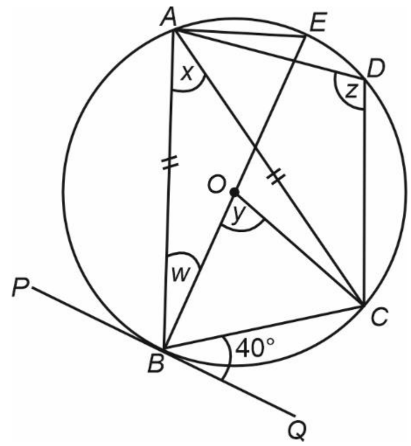
Number of girl child	2	1	0	Total
Number of families	95	165	40	300

(a) One girl child

(b) One or more girl child

(c) No boy child

(iii) In the given figure '*O*' is the centre of the circle. *PQ* is a tangent to the circle at *B* and *AB* = *AC*. If $\angle CBQ$ = 40°, find the unknown angles x, y, z and w. **[4]**



Sol. (i) (a) $x = \dfrac{5ab}{a-b}$

$\Rightarrow \quad \dfrac{x}{a} = \dfrac{5b}{a-b}$ **[1]**

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

Using componendo and dividendo

$$\frac{x+a}{x-a} = \frac{5b+(a-b)}{5b-(a-b)}$$ **[1]**

$$\frac{x+a}{x-a} = \frac{4b+a}{6b-a}$$ **[1]**

(ii) (a) Probability of one girl child = $\dfrac{\text{Favourable number of cases}}{\text{Total number of cases}}$

$$= \frac{165}{300} = \frac{11}{20}$$ **[1]**

(b) Probability of one or more girl child = $\dfrac{165+95}{300}$

$$= \frac{260}{300} = \frac{13}{15}$$ **[1]**

(c) Probability of no boy child (all girl) = $\dfrac{95}{300} = \dfrac{19}{60}$ **[1]**

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

$\Rightarrow \quad x = 40°$ **[1]**

Now, $\angle BOC = 2\angle BAC$ [Angle made by an arc at the centre is double the angle made by it on remaining part of the circle]

$\Rightarrow \quad y = 2 \times x$

$= 2 \times 40° = 80°$ ...(i) **[1]**

Now, $AB = AC$

$\Rightarrow \quad \angle ABC = \angle ACB$

In ΔABC,

$\angle BAC + \angle ABC + \angle ACB = 180°$

$\Rightarrow \quad 40° + \angle ABC + \angle ABC = 180°$ [$\because$ $\angle ABC = \angle ACB$]

$\Rightarrow \quad \angle ABC = \dfrac{180° - 40°}{2} = 70°$ …(ii)

Now, $\angle ABC + \angle ADC = 180°$

$\Rightarrow \quad 70° + z = 180°$ [Opposite angles of cyclic quad]

$\Rightarrow \quad z = 110°$ **[1]**

Now, In ΔOBC,

$OB = OC \Rightarrow \angle OBC = \angle OCB$

$\Rightarrow \quad 80° + 2\angle OBC = 180°$

$\Rightarrow \quad \angle OBC = \dfrac{100°}{2} = 50°$

Now, $\angle OBC + \angle OBA = \angle ABC$

$\Rightarrow \quad 50° + w = 70°$ [Using (ii)]

$\Rightarrow \quad w = 20°$ **[1]**

$x = 40°$

$y = 80°$

$z = 110°$

$w = 20°$

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