ICSE SEMESTER 2 EXAMINATION

SAMPLE PAPER - 1

MATHEMATICS

Maximum Marks: 40

Time allowed: One and a half hours

Answers to this Paper must be written on the paper provided separately.

You will not be allowed to write during the first 10 minutes.

This time is to be spent in reading the question paper.

The time given at the head of this Paper is the time allowed for writing the answers.

---

*Attempt **all** questions from **Section A** and **any three** questions from **Section B.***

SECTION A

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

Section-A (Attempt all questions)

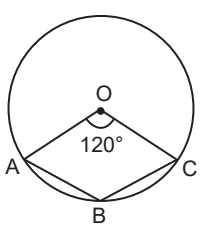
Question 1.

Choose the correct answers to the questions from the given options. (Do not copy the question, write the correct answer only.)

(i) Find the reflection of the point P(6, – 2) in the point of origin:

(a) (– 6, 2) (b) (6, 2) (c) (2, 6) (d) (– 2, – 6)

(ii) If O is the centre of the circle and the measure of arc ABC is 120°, then ∠ABC will be:



(a) 70° (b) 120° (c) 125° (d) 240°

(iii) Find the curved surface area of the solid cylinder of diameter 21 cm and height 15 cm.

(a) 345 cm^2 (b) 315 cm^2 (c) 630 cm^2 (d) 990 cm^2

(iv) Evaluate: $\frac{1}{1+\tan^2 A}+\frac{1}{1+\cot^2 A}$

(a) 0 (b) 1 (c) – 1 (d) None of these

(v) The method used to find the mean of a given data is/are:

(a) Direct method (c) Step deviation method

(b) Assumed mean method (d) All of these

(vi) If a card is drawn from a well-shuffled deck of 52 cards, what is the probability of drawing a Jack?

(a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) $\frac{1}{52}$ (d) $\frac{1}{13}$

(vii) The co-ordinates of the mid-point of the line joining the points (– 6, – 2) and (– 2, 6) are:

(a) (– 4, 2) (b) (4, – 2) (c) (– 2, – 1) (d) (– 8, 4)

(viii) $\angle A$ and $\angle B$ be the angles in the same segment of a circle. Then:

(a) $\angle A > \angle B$ (b) $\angle A = \angle B$ (c) $\angle A < \angle B$ (d) $\angle A = 2\angle B$

(ix) If radius of a cone is 21 cm and height 42 cm, find the volume of the cone.

(a) 19,404 cm^3 (b) 17,205 cm^3 (c) 15,512 cm^3 (d) 14,984 cm^3

(x) If sec A + tan A = m and sec A – tan A = n, the value of mn is:

(a) 0 (b) 1 (c) sec A (d) tan A

Section-B (Attempt any three questions from this Section.)

Question 2.

(i) A bag contains green, yellow and white marbles. The probability of selecting a green marbles at random is 1/4, while the probability of selecting a white marble at random from the bag is 1/3. If there are 10 yellow marbles in the bag, what is the total number of marbles in the bag?

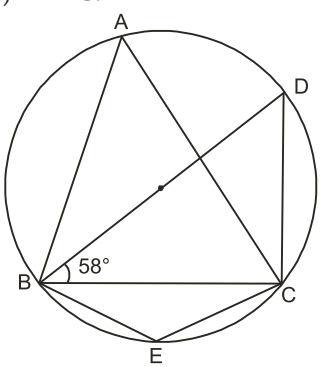
(ii) (a) Using step deviation method, calculate the mean marks of the following distribution.

(b) State the modal class.

Class interval	50 – 55	55 – 60	60 – 65	65 – 70	70 – 75	75 – 80	80 – 85	85 – 90
Frequency	5	20	10	10	9	6	12	8

(iii) In the given figure, $\angle DBC = 58°$, BD is a diameter of the circle.

Calculate: (a) $\angle BDC$, (b) $\angle BEC$, (c) $\angle BAC$.



(iv) Lines $2x$ – by + 5 = 0 and $ax + 3y = 2$ are parallel. Find the relation connecting a and b.

Question 3.

(i) The point P(3, 4) is reflected to P′ in the X-axis and O′ is the image of O (the origin) in the line PP′.

Using graph paper give :

(a) The coordinates of P′ and O′.

(b) The length of the segments PP′ and OO′.

(c) The perimeter of the quadrilateral, POP′O′.

(d) What is the special name of this quadrilateral POP′O′ ?

(ii) Marks obtained by 200 students in an examination are given below :

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90	90 – 100
Frequency	5	11	10	20	28	37	40	29	14	6

Draw an ogive for the given distribution taking 1 cm = 10 marks on one axis and 1 cm = 20 students on the other axis. Using graph, determine :

(a) The median marks,

(b) The number of students who failed if minimum marks required to pass is 40.

(iii) A man stands on the ground at a point A, which is on the same horizontal plane B, the foot of a vertical

pole BC. The height of the pole is 10 m. The man's eye is 2 m above the ground. He observes the angle of elevation of C, the top of the pole as x, where tan $x°$ = 2/5. Calculate the distance AB in metres.

(iv) The mid-point of the line segment joining $(2a, 4)$ and $(-2, 3b)$ is $(1, 2a + 1)$. Find the values of a and b.

Question 4.

(i) Prove that : (cosec θ – sin θ) (sec θ – cos θ) (tan θ + cot θ) = 1.

(ii) Use graph paper for this question. The following table shows the monthly wages of some factory workers.

(a) Using the table, calculate the cumulative frequency of workers.

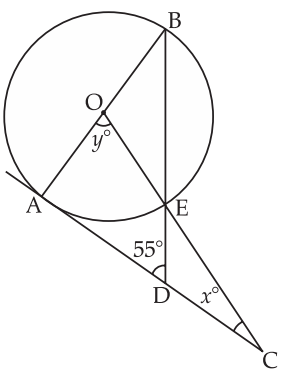
(b) Draw the cumulative frequency curve.

(c) Use your ogive to write down the median wages in rupees.

Wages (in ₹)	6500-7000	7000-7500	7500-8000	8000-8500	8500-9000	9000-9500	9500-10000
No. of workers	10	18	22	25	17	10	8

(iii) A line intersects X-axis at (–2, 0) and cuts off an intercept of 3 from the positive side of Y-axis. Write the equation of the line.

(iv) In the given figure AC is a tangent to the circle with centre O. If ∠ADB = 55°, find x and y. Give reasons for your answer.



Question 5.

(i) The daily profits, in rupees, of 100 shops in a department store are distributed as follows :

Profit per shop in ₹	0 – 100	100 – 200	200 – 300	300 – 400	400 – 500	500 – 600
No. of shops	12	18	27	20	17	6

Draw a histogram of the data given above on graph paper and estimate the mode.

(ii) Tickets numbered from 1 to 20 are mixed up together and then a ticket is drawn at random. What is the probability that the ticket has a number which is a multiple of 3 or 7 ?

(iii) Write down the coordinates of a point P which divides the line joining A(– 4, 1) and B(17, 10) in the ratio 1 : 2. Calculate the distance OP, where O is the origin. In what ratio does the y-axis divide the line AB ?

(iv) The volume of a conical tent is 1232 m^3 and the area of the bare floor is 154 m^2. Calculate :

(a) Radius of the floor, (b) Height of the tent,

(c) Length of the canvas required to cover this conical tent if its width is 2 m

Question 6.

(i) Prove that: (sin θ + cos θ)(tan θ + cot θ) = sec θ + cosec θ.

(ii) Marks obtained by 40 students in a short assessment is given ahead, where a and b are two missing data.

Marks	5	6	7	8	9
No. of students	6	a	16	13	b

If the mean of the distribution is 7.2, find a and b.

(iii) Use graph paper for this question:

(a) Plot the points A(3, 5) and B(– 2, – 4). Use 1 cm = 1 unit on both axes,

(b) A′ is the image of A when reflected in the x-axis. Write down the coordinates of A′ and plot it on the graph paper,

(c) B′ is the image of B when reflected in the y-axis, followed by reflection in the origin. Write down the coordinates of B′ and plot it on the graph paper,

(d) Write down the geometrical name of the figure AA′BB′,

(e) Name two invariant points under reflection in the x-axis.

(iv) A vessel in the form of an inverted cone is filled with water to the brim. Its height is 20 cm and diameter is 16.8 cm. Two equal solid cones are dropped in it so that they are fully submerged. As a result, one-third of the water in the original cone overflows. What is the volume of each of the solid cone submerged ?

Answers

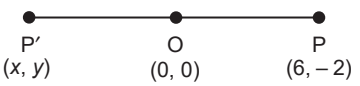
Section-A

Answer 1.

(i) (a) (– 6, 2)

Explanation :

Let P′(x, y) be the reflection of point (6, – 2) in the origin, then the point O will be the mid-point of the segment PP′.



$$\therefore \quad \frac{x+6}{2} = 0 \text{ and } \frac{y-2}{2} = 0$$

$$\Rightarrow \quad x + 6 = 0 \text{ and } y - 2 = 0$$

$$\Rightarrow \quad x = -6 \text{ and } y = 2$$

Hence, the answer is (– 6, 2).

(ii) (b) 120°

Explanation :

$$\text{reflex } \angle AOC = 360° - 120° = 240°$$

$\because$ since, the angle subtended at the centre by an arc of a circle is double the angle which this arc subtends at any remaining part of the circumference.

$$\therefore \quad \text{reflex } \angle AOC = 2 \times \angle ABC$$

$$\Rightarrow \quad \angle ABC = \frac{1}{2} \text{ reflex } \angle AOC$$

$$= \frac{1}{2} \times 240° = 120°.$$

(iii) (d) 990 cm^2

Explanation :

$$\text{Radius } (r) = \frac{1}{2} \times \text{diameter} = \frac{21}{2} \text{ cm}$$

$$\text{Height } (h) = 15 \text{ cm}$$

$\therefore$ Curved surface area $= 2\pi rh$

$$= 2 \times \frac{22}{7} \times \frac{21}{2} \times 15$$

$$= 990 \text{ cm}^2.$$

(iv) (b) 1

Explanation :

$$\frac{1}{1+\tan^2 A} + \frac{1}{1+\cot^2 A}$$

$$= \frac{1}{\sec^2 A} + \frac{1}{\text{cosec}^2 A} = \cos^2 A + \sin^2 A = 1$$

(v) (d) All of these

(vi) (d) $\frac{1}{13}$

Explanation :

Total no. of possible outcomes $n(S) = 52$

Number of favourable outcomes $n(E) = 4$

$\therefore$ Probability of drawing a Jack $= \frac{n(E)}{n(S)} = \frac{4}{52} = \frac{1}{13}$

(vii) (a) (– 4, 2)

Explanation :

The co-ordinates of the mid-point are:

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) \textit{ i.e. } \left(\frac{-6-2}{2}, \frac{-2+6}{2}\right)$$

$$\Rightarrow \left(\frac{-8}{2}, \frac{4}{2}\right) \text{ or } (-4, 2)$$

(viii) (b) $\angle A = \angle B$

Explanation :

The angles at the circumference subtended by the same arc are equal.

(ix) (a) 19,404 cm^3

Explanation :

$$V = \frac{1}{3}\pi r^2 h$$

$$= \frac{1}{3} \times \frac{22}{7} \times 21 \times 21 \times 42 = 19{,}404 \text{ cm}^3.$$

(x) (b) 1

Explanation :

Given, $m = \sec A + \tan A$

and, $n = \sec A - \tan A$

By multiplying to each other, we get

$mn = (\sec A + \tan A)(\sec A - \tan A)$

$mn = \sec^2 A - \tan^2 A = 1$ (using identity)

Section-B

Answer 2.

(i) Let G, W and Y be the events of selecting green, white and yellow marbles respectively.

$\therefore$ $P(G) = \frac{1}{4}, P(W) = \frac{1}{3}$ [Given]

$\therefore$ $P(Y) = 1 - \{P(G) + P(W)\}$

$= 1 - \left(\frac{1}{4} + \frac{1}{3}\right) = 1 - \left(\frac{3+4}{12}\right) = 1 - \frac{7}{12}$

$= \frac{12-7}{12} = \frac{5}{12}$

Let, total number of marbles be x.

Then, $P(Y) = \frac{10}{x}$

$\therefore$ $\frac{5}{12} = \frac{10}{x}$

$\Rightarrow$ $5x = 10 \times 12$

$\Rightarrow$ $x = \frac{10 \times 12}{5} = 24$

$\therefore$ Total number of marbles = 24.

(ii)

Class interval	f	x	$d = x - A$	$t = d/i$	ft
50 – 55	5	52.5	– 15	– 3	– 15
55 – 60	20	57.5	– 10	– 2	– 40
60 – 65	10	62.5	– 5	– 1	– 10
65 – 70	10	67.5 = A	0	0	0
70 – 75	9	72.5	5	1	9
75 – 80	6	77.5	10	2	12
80 – 85	12	82.5	15	3	36
85 – 90	8	87.5	20	4	32
	$\Sigma f = 80$				$\Sigma ft = 24$

Let $A = 67.5$

$i = 5$

(a) $\therefore$ $\text{Mean} = A + \frac{\Sigma ft}{\Sigma f} \times i$

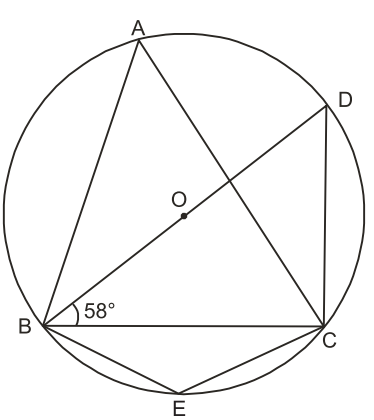
$= 67.5 + \frac{24}{80} \times 5 = 67.5 + 1.5$

$= 69.$

(b) Modal class = 55 – 60 [$\because$ Class interval corresponding to the highest frequency]

(iii) Given, $\angle DBC = 58°$, BD is a diameter of the circle.

$\therefore$ $\angle BCD = 90°$ [Angle formed in a semi-circle]



(a) $\angle BDC + \angle CBD + \angle BCD = 180°$ [Sum of angles of Δ BCD]

$\Rightarrow$ $\angle BDC + 58° + 90° = 180°$

$\Rightarrow$ $\angle BDC = 180° - 148° = 32°$ ...(i)

(b) $\angle BEC + \angle BDC = 180°$ [Opposite angles of cyclic quadrilateral]

$\Rightarrow$ $\angle BEC + 32° = 180°$ [Using equation (i)]

$\Rightarrow$ $\angle BEC = 180° - 32° = 148°$

(c) $\angle BAC = \angle BDC = 32°$ [Angles are in same segment.]

(iv) Given, lines are $2x - by + 5 = 0$ ...(i)

and $ax + 3y = 2$ ...(ii)

From equation (i), $-by = -2x - 5$

$\Rightarrow$ $y = \frac{-2}{-b}x - \frac{5}{-b}$

$\Rightarrow$ $y = \frac{2}{b}x + \frac{5}{b}$

$\therefore$ Its slope $(m_1) = \frac{2}{b}$

From equation (ii), $3y = -ax + 2$

$\Rightarrow$ $y = \frac{-a}{3}x + \frac{2}{3}$

$\therefore$ Its slope $(m_2) = -\frac{a}{3}$

Since, the lines are parallel,

$\therefore$ $m_1 = m_2$

$\Rightarrow$ $\frac{2}{b} = -\frac{a}{3} \Rightarrow ab = -6$

$\Rightarrow$ $a = -\frac{6}{b}$.

Answer 3.

(i) Given, P (3, 4)

(a) The coordinates of P′ = (3, – 4)

The coordinates of O′ = (6, 0)

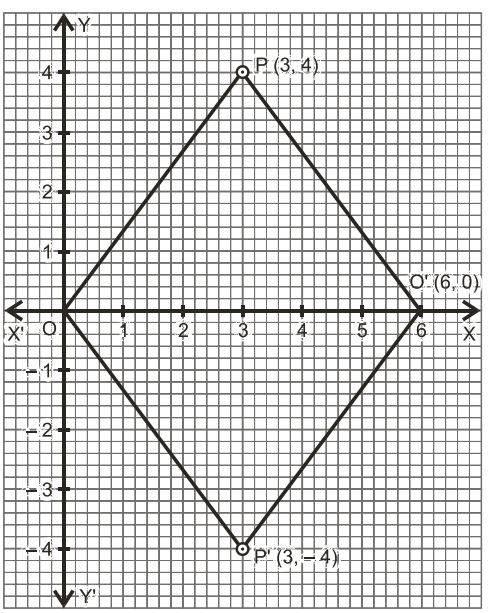
(b) The length of PP′ = $\sqrt{(3-3)^2 + (4+4)^2} = \sqrt{(8)^2}$ = 8 units

The length of OO′ = 0 + 6 = 6 units

(c) The perimeter of POP′O′ = 4 × 5 = 20 units

(Since $OP^2 = 3^2 + 4^2 = 9 + 16 = 25$ $\therefore$ OP = $\sqrt{25}$ = 5 units).

(d) POP′O′ is a rhombus.



(ii)

Marks	No. of students	*c.f.*
0 – 10	5	5
10 – 20	11	16
20 – 30	10	26
30 – 40	20	46
40 – 50	28	74
50 – 60	37	111
60 – 70	40	151
70 – 80	29	180
80 – 90	14	194
90 – 100	6	200

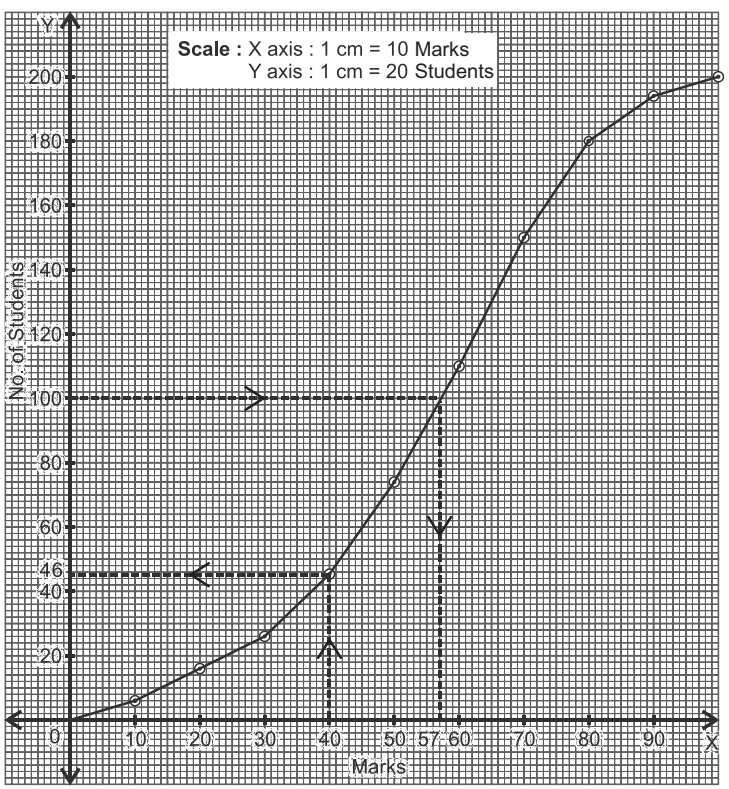
$\therefore$ N = 200 (even)

(a) $\text{Median} = \frac{N}{2}\text{th value}$

= 100th value

= 57 (from ogive)

(b) No. of students scoring less than 40 marks = 45.



(iii) Given, BC = 10 m, AD = 2 m = BE

$\angle CDE = x°$, $\tan x° = \frac{2}{5}$

Let, AB = DE = a

$\therefore$ CE = BC – BE = (10 – 2) m = 8 m

$\therefore$ $\tan x° = \frac{CE}{DE}$ $\left[\because \tan\theta = \frac{\text{Perpendicular}}{\text{Base}}\right]$

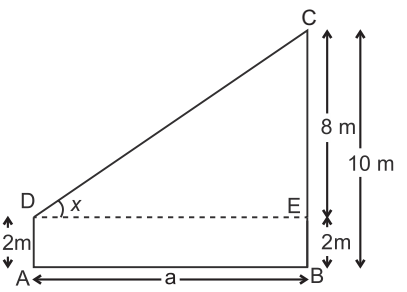
$\Rightarrow \quad \frac{2}{5} = \frac{8}{a}$

$\Rightarrow \quad 2a = 40$

$\Rightarrow \quad a = \frac{40}{2}$

$= 20$

$\therefore$ Distance AB = 20 m.



(iv) Given, points are $(2a, 4)$ and $(-2, 3b)$.

Mid-point is $(1, 2a + 1)$

$\therefore \quad x = \frac{x_1 + x_2}{2}$

$\Rightarrow \quad 1 = \frac{2a + (-2)}{2}$

$\Rightarrow$

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

$2a = 2 + 2$

$\therefore \quad a = \frac{4}{2} = 2$

Also, $y = \frac{y_1 + y_2}{2}$

$\Rightarrow \quad 2a + 1 = \frac{4 + 3b}{2}$

$\Rightarrow \quad 2 \times 2 + 1 = \frac{4 + 3b}{2}$ [Using value of a]

$\Rightarrow \quad 5 \times 2 = 4 + 3b$

$\Rightarrow \quad 3b = 10 - 4$

$3b = 6$

$\Rightarrow \quad b = \frac{6}{3} = 2$

$\therefore \quad a = 2$, and $b = 2$.

Answer 4.

(i) To prove : $(\text{cosec}\,\theta - \sin\theta)(\sec\theta - \cos\theta)(\tan\theta + \cot\theta) = 1$

L.H.S. $= (\text{cosec}\,\theta - \sin\theta)(\sec\theta - \cos\theta)(\tan\theta + \cot\theta)$

$= \left(\frac{1}{\sin\theta} - \sin\theta\right)\left(\frac{1}{\cos\theta} - \cos\theta\right)\left(\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}\right)$

$= \left(\frac{1 - \sin^2\theta}{\sin\theta}\right)\left(\frac{1 - \cos^2\theta}{\cos\theta}\right)\left(\frac{\sin^2\theta + \cos^2\theta}{\sin\theta\cos\theta}\right)$

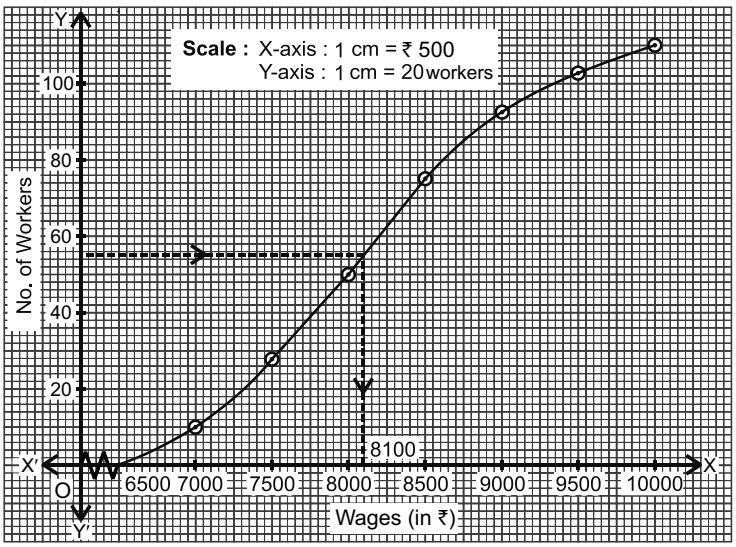
$= \frac{\cos^2\theta}{\sin\theta} \times \frac{\sin^2\theta}{\cos\theta} \times \frac{1}{\sin\theta\cos\theta}$ [$\because \sin^2\theta + \cos^2\theta$]

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

= R.H.S. **Hence Proved.**

(ii)

Wages	Number of workers	*c.f.*
6500 – 7000	10	10
7000 – 7500	18	28
7500 – 8000	22	50
8000 – 8500	25	75
8500 – 9000	17	92
9000 – 9500	10	102
9500 – 10000	8	110



$\therefore$ N = 110 (even)

$\therefore$ $\text{Median} = \frac{N}{2}\text{th value}$

$= \frac{110}{2}$ th value = 55th value = ₹ 8100 (From ogive)

(iii) Given, point is (–2, 0) and y-intercept = 3

$\therefore$ The line passes through (–2, 0) and (0, 3).

Let the equation of the line be,

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$$

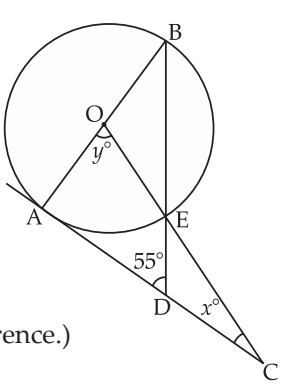
$\Rightarrow$ $$y - 0 = \frac{3 - 0}{0 - (-2)}\{x - (-2)\}$$

$\Rightarrow$ $$y = \frac{3}{2}(x + 2)$$

$\Rightarrow$ $$2y = 3x + 6$$

$\Rightarrow$ $3x - 2y + 6 = 0$ which is the required equation.

(iv) Given, $\angle ADB = 55°$, AC is a tangent, $\angle ACO = x°$, $\angle AOE = y°$.



In ΔABD, $\angle BAD = 90°$ ($\because$ Radius OA is perpendicular to tangent AC)

Also, $\angle ABD + \angle BAD + \angle ADB = 180°$ (Angle sum property)

$\Rightarrow$ $\angle ABD + 90° + 55° = 180°$

$\Rightarrow$ $\angle ABD = 180° - 145° = 35°$

$\therefore$ $\angle AOE = 2 \times \angle ABD$

(Angle formed at centre is twice the angle formed at circumference.)

$\Rightarrow$ $y° = 2 \times 35°$

$\therefore$ $y° = 70°$

In ΔAOC,

$\angle ACO + \angle OAC + \angle AOC = 180°$ [Angle sum property]

$\Rightarrow$ $x° + 90° + 70° = 180°$

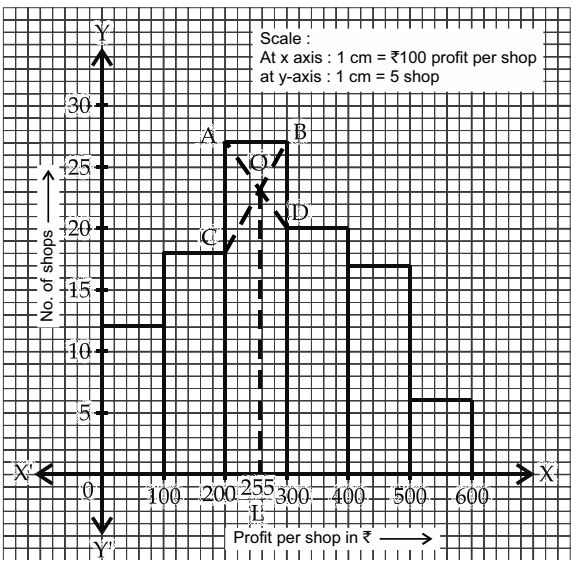
$\Rightarrow$ $x° = 180° - 160° = 20°$

Hence, $x = 20°$ and $y = 70°$.

Answer 5.

(i)

Profit per shop in ₹	Number of shops
0 – 100	12
100 – 200	18
200 – 300	27
300 – 400	20
400 – 500	17
500 – 600	6



$\therefore$ Mode = ₹ 255 (From histogram)

(ii) Tickets are numbered from 1 to 20.

$\therefore$ S = {1, 2, 3, 4,....,19, 20}

$\therefore$ $n(S) = 20$.

Multiple of 3 = 3, 6, 9, 12, 15, 18.

Multiple of 7 = 7, 14.

Let, E be the event of getting a multiple of 3 or 7.

$\therefore$ E = {3, 6, 7, 9, 12, 14, 15, 18}

$\therefore$ $n(E) = 8$

$\therefore$ $P(E) = \frac{n(E)}{n(S)} = \frac{8}{20} = \frac{2}{5}$

(iii) Given points are A(– 4, 1) and B(17, 10) and ratio = 1 : 2.

Let, the coordinates of P be (x, y)

$\therefore$ $x = \frac{m_1x_2 + m_2x_1}{m_1 + m_2}$

$= \frac{1 \times 17 + 2 \times (-4)}{1 + 2}$

$= \frac{17 - 8}{3}$

$= \frac{9}{3}$

$= 3$

$y = \frac{m_1y_2 + m_2y_1}{m_1 + m_2}$

$= \frac{1 \times 10 + 2 \times 1}{1 + 2}$

$= \frac{10 + 2}{3}$

$= \frac{12}{3}$

$= 4$

$\therefore$ The coordinates of P = (3, 4).

$\therefore$ Distance OP = $\sqrt{x^2 + y^2} = \sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5$ units.

Let, y-axis divide the line AB in the ratio k : 1 at the point $(0, y)$.

$\therefore$ $x = \frac{m_1x_2 + m_2x_1}{m_1 + m_2}$

$$\Rightarrow \quad 0 = \frac{k \times 17 + 1 \times (-4)}{k+1}$$

$$\Rightarrow \quad 0 = 17k - 4$$

$$\Rightarrow \quad 17k = 4$$

$$\Rightarrow \quad k = \frac{4}{17}$$

$$\therefore \quad k : 1 = \frac{4}{17} : 1$$

$$= 4 : 17.$$

$\therefore$ The required ratio = 4 : 17

(iv) Given, volume of conical tent = 1232 m^3

Area of floor = 154 m^2

Let r be the radius, h be the height and l be the slant height of the conical tent.

(a) Area of floor = 154 m^2

$$\therefore \quad \pi r^2 = 154$$

$$\Rightarrow \quad \frac{22}{7} \times r^2 = 154$$

$$\Rightarrow \quad r^2 = \frac{154 \times 7}{22} = 49$$

$$\therefore \quad r = 7 \text{ m.}$$

(b) $$\frac{1}{3}\pi r^2 h = 1232.$$

$$\Rightarrow \quad \frac{1}{3} \times \frac{22}{7} \times 7^2 \times h = 1232$$

$$\Rightarrow \quad h = \frac{1232 \times 3 \times 7}{22 \times 49} = 24 \text{ m.}$$

(c) $$l = \sqrt{h^2 + r^2} = \sqrt{24^2 + 7^2}$$

$$= \sqrt{576 + 49} = \sqrt{625} = 25 \text{ m.}$$

$\therefore$ Curved surface area = $\pi rl = \frac{22}{7} \times 7 \times 25 = 550$ m^2

Width of canvas (b) = 2 m

Let l' be the length of canvas.

$$\therefore \quad l' \times 2 = 550$$

$$\Rightarrow \quad l' = \frac{550}{2} = 275 \text{ m}$$

$\therefore$ The length of canvas required = 275 m.

Answer 6.

(i) To prove : $(\sin\theta + \cos\theta)(\tan\theta + \cot\theta) = \sec\theta + \text{cosec}\,\theta$.

$$\text{L.H.S.} = (\sin\theta + \cos\theta)(\tan\theta + \cot\theta)$$

$$= (\sin\theta + \cos\theta)\left(\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}\right)$$

$$= (\sin\theta + \cos\theta)\left(\frac{\sin^2\theta + \cos^2\theta}{\sin\theta\cos\theta}\right)$$

$$= (\sin\theta + \cos\theta)\cdot\frac{1}{\sin\theta\cos\theta} \qquad [\because \sin^2\theta + \cos^2\theta = 1]$$

$$= \frac{\sin\theta + \cos\theta}{\sin\theta\cos\theta} = \frac{\sin\theta}{\sin\theta\cos\theta} + \frac{\cos\theta}{\sin\theta\cos\theta}$$

$$= \frac{1}{\cos\theta} + \frac{1}{\sin\theta}$$

$= \sec\theta + \text{cosec}\,\theta$ = R.H.S. **Hence Proved.**

(ii) Given, mean = 7.2, $\Sigma f = 40$

Marks (x)	No. of Students (f)	fx
5	6	30
6	a	$6a$
7	16	112
8	13	104
9	b	$9b$
	$\Sigma f = 35 + a + b$	$\Sigma fx = 246 + 6a + 9b$

Now, $\Sigma f = 40$

$\Rightarrow$ $35 + a + b = 40$

$\Rightarrow$ $a + b = 40 - 35$

$\Rightarrow$ $a + b = 5$ ...(i)

Also, $\text{Mean} = \frac{\Sigma fx}{\Sigma f}$

$\Rightarrow$ $7.2 = \frac{246 + 6a + 9b}{40}$

$\Rightarrow$ $246 + 6a + 9b = 288$

$\Rightarrow$ $6a + 9b = 288 - 246$

$\Rightarrow$ $6a + 9b = 42$

$\Rightarrow$ $2a + 3b = 14$ ....(ii)

On multiplying equation (i) by 3, and then subtracting equation (ii) from it, we get

$3a + 3b = 15$

$2a + 3b = 14$

Subtracting $\underline{(-)\ \ (-)\ \ (-)}$

$a = 1$

Putting $a = 1$ in equation (i), we get,

$1 + b = 5$

$\Rightarrow$ $b = 5 - 1 = 4$

$\therefore$ $a = 1, b = 4$

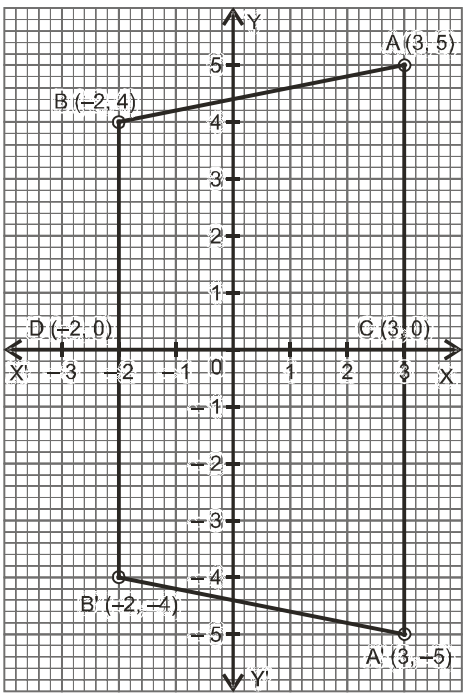
(iii) (a) A(3, 5), B(–2, –4) are plotted on graph.

(b) A(3, 5) $\xrightarrow{R_x}$ A′ (3, – 5)

(c) B(– 2, – 4) $\xrightarrow{R_y}$ (2, – 4) $\xrightarrow{R_0}$ B′(–2, 4)

(d) AA′ B′B is an isosceles trapezium.

(e) Two invariant points under reflection in x-axis are C(3, 0) and D(–2, 0).



(iv) For inverted cone, height (h) = 20 cm, diameter = 16.8 cm

$\therefore$ Radius (r) = 8.4 cm. [$\because$ Radius = Diameter/2]

$\therefore$ Its volume = $\frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 8.4 \times 8.4 \times 20$

$= 1478.4 \text{ cm}^3$

$\therefore$ The volume of water in it = 1478.4 cm^3

$\therefore$ The volume of water that overflows when two equal solid cones are submerged

$= \frac{1}{3} \times 1478.4 \text{ cm}^3$

$= 492.8 \text{ cm}^3$.

$\therefore$ The volume of 2 equal cones = 492.8 cm^3

$\therefore$ The volume of each cone = $\frac{492.8}{2} \text{cm}^3$

$= 246.4 \text{ cm}^3$.

❑❑