ICSE SEMESTER 2 EXAMINATION

SAMPLE PAPER - 2

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.

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*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)

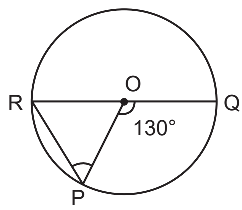
Question 1.

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

(i) The reflection of the point A(5, – 3) in the point P(3, – 2) is:

(a) (– 5, 3) (b) (– 3, 2) (c) (1, – 1) (d) (4, 0)

(ii) O is the centre of the circle and $\angle POQ = 130°$. Find the $\angle OPR$.



(a) 45° (b) 65° (c) 75° (d) 55°

(iii) Find the total surface area of the solid cylinder of diameter 14 cm, height 8 cm.

(a) 112 cm^2 (b) 224 cm^2 (c) 496 cm^2 (d) 660 cm^2

(iv) Evaluate: $(1 + \tan A)^2 + (1 - \tan A)^2$

(a) 0 (b) 2 sec A (c) $2 \sec^2 A$ (d) $2 \tan^2 A$

(v) Which of the following can not be determined graphically?

(a) Mean (b) Median (c) Mode (d) Both (a) and (b)

(vi) The probability of passing students in a class is $\frac{7}{38}$. What is the probability of failure in the class?

(a) $\frac{1}{38}$ (b) $\frac{31}{38}$ (c) $\frac{35}{38}$ (d) $\frac{7}{38}$

(vii) The ratio in which the X-axis divides the line joining the points (– 3, 6) and (2, – 8) is:

(a) 2 : 1 (b) 3 : 2 (c) 2 : 3 (d) 3 : 4

(viii) Two circles touch each other externally at a point C and P is a point on the common tangent at C. If PA and PB are tangent to the circles, then:

(a) PA > PB (b) PA < PB (c) PA = PB (d) None

(ix) The volume of a right circular cone of height 12 cm is 56π cm^3. Find the diameter of its base.

(a) $\sqrt{14}$ cm (b) $2\sqrt{14}$ cm (c) $2\sqrt{5}$ cm (d) 4 cm

(x) The maximum frequent value in a distribution is called:

(a) Mean (b) Median (c) Mode (d) Quartile

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

Question 2.

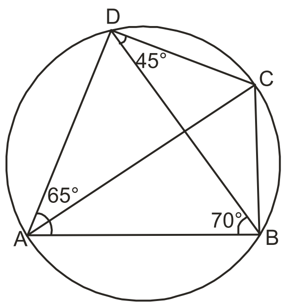
(i) Find the probability of having 53 Sundays in (a) a non-leap year, (b) a leap year.

(ii) A well with 10 m inside diameter is dug 14 m deep. Earth taken out of it is spread all round to a width of 5 m to form an embankment. Find the height of embankment.

(iii) In the given figure, $\angle BAD = 65°$, $\angle ABD = 70°$, $\angle BDC = 45°$.

(a) Prove that AC is a diameter of the circle,

(b) Find $\angle ACB$.



(iv) Show that : $\sqrt{\dfrac{1-\cos A}{1+\cos A}} = \dfrac{\sin A}{1+\cos A}$.

Question 3.

(i) Given a line segment AB joining the points A(– 4, 6) and B(8, – 3). Find :

(a) The ratio in which AB is divided by the Y-axis.

(b) The coordinates of the point of intersection.

(ii) The daily pocket expenses of 200 students in a school are given below :

Pocket Expenses (₹)	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25	25 – 30	30 – 35	35 – 40
No. of students	10	14	28	42	50	30	14	12

Draw a histogram representing the above distribution and estimate the mode from the graph.

(iii) A bag contains 6 red balls and some blue balls. If the probability of drawing a blue ball is twice that of a red balls, find the number of blue balls in the bag.

(iv) A vertical pole and a vertical tower are on the same level ground. From the top of the pole, the angle of elevation of the top of the tower is 60° and the angle of depression of the foot of the tower is 30°. Find the height of the tower, if the height of the pole is 20 m.

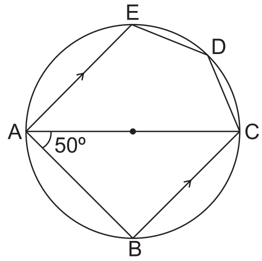
Question 4.

(i) If the line joining the points A(4, –5) and B(4, 5) is divided by the point such that AP/AB = 2/5, find the coordinates of P.

(ii) What is the probability that a number selected from the numbers 1, 2, 3, ……., 25 is a prime number, when each of the given numbers is equally likely to be selected ?

(iii) In the given figure, ABCDE is a pentagon inscribed in a circle such that AC is a diameter and side BC || AE. If $\angle BAC = 50°$, find (Give reasons) :

(a) $\angle ACB$, (b) $\angle EDC$, (c) $\angle BEC$.



(iv) Find the mean of the following distribution by step deviation method :

Class interval	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
Frequency	10	6	8	12	5	9

Question 5.

(i) A point P(5, 3) was reflected in the origin to get the image at P′.

(a) Write down the coordinates of P′,

(b) If M is the foot of the perpendicular from P to X-axis, find the coordinates of M,

(c) If N is the foot of the perpendicular from P′ to X-axis, find the coordinates of N,

(d) Name the figure PMP′N,

(e) Find the area of the figure PMP′N.

(ii) Prove that : (cosec A – sin A) (sec A – cos A).$\sec^2$ A = tan A.

(iii) The mean of the following frequency table is 50. But the frequencies f_1 and f_2 are missing. Find the missing frequencies.

Class	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100	**Total**
Frequency	17	f_1	32	f_2	19	120

(iv) A metallic cylinder has radius 3 cm and height 5 cm. It is made of a metal A. To reduce its weight, a conical hole is drilled in the cylinder and it is completely filled with a lighter metal B. The conical hole has a radius of 3/2 cm and its depth is 8/9 cm. Calculate the ratio of the volume of the metal A to the volume of metal B in the solid.

Question 6.

(i) A straight line passes through the points P(2, – 5) and Q(4, 3). Find :

(a) The slope of the line PQ,

(b) The equation of the line PQ,

(c) The value of p, if PQ passes through the point (p – 1, p + 4).

(ii) The marks obtained by 100 students in a Mathematics test are given below:

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
No. of students	3	7	12	17	23	14	9	6	5	4

Draw an ogive for the given distribution on a graph sheet.

Use ogive to estimate the: (a) Median, (b) Lower quartile.

(iii) Prove that : $\dfrac{\sin\theta\tan\theta}{1-\cos\theta} = 1 + \sec\theta$.

(iv) Use a graph paper for this question.

(a) Plot the points A(– 4, 2) and B(2, 4),

(a) A′ is the image of A when reflected in the Y-axis. Plot it on the graph paper and write the coordinates of A′,

(c) B′ is the image of B when reflected in the line AA′. Write the coordinates of B′,

(d) Write the geometric name of the figure ABA′B′.

Answers

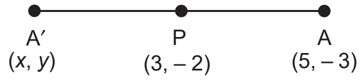
Section-A

Answer 1.

(i) (c) (1, – 1)

Explanation :

If A′(x, y) be the reflection of point A(5, – 3) in the point P(3, – 2), then P will be mid-point of AA′.



$$x = \frac{x_1 + x_2}{2} \text{ and } y = \frac{y_1 + y_2}{2}$$

$$3 = \frac{x + 5}{2} \text{ and } -2 = \frac{y - 3}{2}$$

$\Rightarrow$ $x = 1$ and $y = -1$

$\therefore$ Reflection point will be (1, – 1).

(ii) (b) 65°

Explanation :

Since, Angle subtended by an arc at the centre is twice the angle subtended in the remaining part of the circle.

$\because$ $\angle POQ = 2\angle ORP$

$\Rightarrow$ $\angle ORP = \frac{1}{2}\angle POQ$

$$= \frac{1}{2} \times 130° = 65°$$

$\because$ OP = OR (same radius)

$\Rightarrow$ $\angle OPR = \angle ORP = 65°$.

(iii) (d) 660 cm^2

Explanation :

$$\text{Radius } (r) = \frac{14}{2} = 7 \text{ cm}$$

Height (h) = 8 cm

$\therefore$ Total surface area = $2\pi r(h + r)$

$$= 2 \times \frac{22}{7} \times 7(8 + 7)$$

$$= 44 \times 15 = 660 \text{ cm}^2.$$

(iv) (c) 2 sec^{2}A

Explanation:

$$(1 + \tan A)^2 + (1 - \tan A)^2$$

$\Rightarrow$ $= 2(1^2 + \tan^2 A)$ [$\because$ $(a + b)^2 + (a - b)^2 = 2(a^2 + b^2)$]

$$= 2(1 + \tan^2 A)$$

$= 2\sec^2 A$ (Using identity)

(v) (a) Mean

(vi) (b) $\frac{31}{38}$

Explanation :

$$P(\text{failure}) = 1 - P\ (\text{pass}) \qquad \text{[mutually exclusive]}$$
$$= 1 - \frac{7}{38} = \frac{31}{38}.$$

(vii) (d) 3 : 4

Explanation :

Let the X-axis divides the given line in the ratio $m : 1$. Then the co-ordinates of the point of division are:

$$x = \frac{2m-3}{m+1} \text{ and } y = \frac{-8m+6}{m+1}$$

Since, this is a point on the X-axis. So,

$$\frac{-8m+6}{m+1} = 0$$

$$\Rightarrow \quad -8m + 6 = 0 \text{ or } m = \frac{3}{4}$$

Hence, the X-axis divides the line internally in the ratio 3 : 4.

(viii) (c) PA = PB

Explanation:

$\because$ PA = PC ...(1)

(tangents drawn from an exterior point to a circle are equal)

and PB = PC ...(2)

(tangents drawn from an exterior point to a circle are equal)

$\therefore$ PA = PB [from (1) and (2)]

(ix) (b) $2\sqrt{14}$ cm

Explanation :

$$\text{Volume} = 56\pi$$

$$\Rightarrow \quad \frac{1}{3}\pi r^2 h = 56\pi$$

$$\Rightarrow \quad r^2 = \frac{56 \times 3}{h} = \frac{56 \times 3}{12} = 14$$

$$r = \sqrt{14} \text{ cm}$$

$$\therefore \quad \text{Diameter} = 2r = 2\sqrt{14} \text{ cm.}$$

(x) (c) Mode

Section-B

Answer 2.

(i) (a) In a non-leap year,

No. of days = 365

No. of days in 52 weeks = 52 × 7 = 364

$\therefore$ No. of remaining days = 1

In 52 weeks, there are 52 Sundays.

Let, E be the event of 53rd Sunday.

$\therefore$ n (E) = 1

$\therefore$ n(S) = 7, as there are seven days.

$\therefore$ $$P(E) = \frac{n(E)}{n(S)} = \frac{1}{7}$$

(b) In a leap year, no. of days = 366

$\therefore$ No. of remaining days = 2

Let E be the event of 53rd Sunday

S = {(Mon, Tue), (Tue, Wed), (Wed, Thr), (Thr, Fri), (Fri, Sat), (Sat, Sun), (Sun, Mon)}

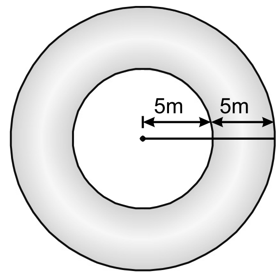
$\therefore$ n(E) = 2, n(S) = 7

$\therefore$ $$P(E) = \frac{2}{7}$$

(ii) Given, diameter of well = 10 m

Radius of well, r = 5 m

Height of well, h = 14 m



$$\text{Volume of the earth dug out} = \pi r^2 h = \frac{22}{7} \times 5 \times 5 \times 14$$

$$= 1100 \text{ m}^3$$

$$\text{Area of embankment} = \pi R^2 - \pi r^2$$

$$= \pi (10)^2 - \pi (5)^2$$

$$= \pi (100 - 25)$$

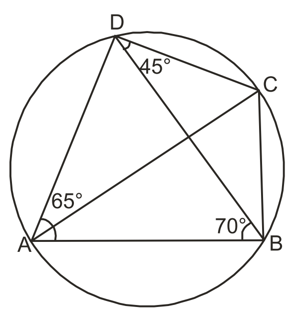
$$= 75 \pi \text{ m}^2$$

$$\text{Height of embankment} = \frac{\text{Volume of the earth dug out}}{\text{Area of embankment}}$$

$$= \frac{1100}{75 \times \frac{22}{7}} = \frac{1100 \times 7}{75 \times 22} = \frac{14}{3} = 4\frac{2}{3} \text{m}$$

Hence, height of embankment is $4\frac{2}{3}$m.

(iii) Given, $\angle BAD = 65°$, $\angle ABD = 70°$ and $\angle BDC = 45°$.



(a) In ΔABD,

$$\angle ADB + \angle BAD + \angle ABD = 180°$$

$$\Rightarrow \quad \angle ADB + 65° + 70° = 180°$$

$$\Rightarrow \quad \angle ADB = 180° - 135° = 45°$$

$$\therefore \quad \angle ADC = \angle ADB + \angle BDC$$

$$= 45° + 45°$$

$$= 90°$$

$\therefore$ AC is a diameter (Angle in a semicircle is 90°). **Hence Proved.**

(b) $\angle ACB = \angle ADB = 45°$ (Angles formed in the same segment)

(iv) To prove : $\sqrt{\dfrac{1-\cos A}{1+\cos A}} = \dfrac{\sin A}{1+\cos A}$

$$\text{L.H.S.} = \sqrt{\frac{1-\cos A}{1+\cos A}}$$

$$= \sqrt{\frac{(1-\cos A)(1+\cos A)}{(1+\cos A)(1+\cos A)}}$$ [Multiplying both numerator and denominator by $\sqrt{1+\cos A}$]

$$= \sqrt{\frac{1-\cos^2 A}{(1+\cos A)^2}}$$

$$= \sqrt{\frac{\sin^2 A}{(1+\cos A)^2}}$$ [$\because \cos^2 A + \sin^2 A = 1$]

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

$$= \frac{\sin A}{1+\cos A} = \text{R.H.S.}$$ **Hence Proved.**

Answer 3.

(i) Given points are A (– 4, 6), B (8, – 3).

(a) Let Y-axis divide AB at (0, y) in the ratio $k : 1$

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

$\Rightarrow$ $$0 = \frac{k \times 8 + 1 \times (-4)}{k+1}$$

$\Rightarrow$ $$0 = 8k - 4$$

$\Rightarrow$ $$8k = 4$$

$\Rightarrow$ $$k = \frac{4}{8} = \frac{1}{2}$$

$\therefore$ The required ratio is $k : 1 = \frac{1}{2} : 1 = 1 : 2.$

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

$$= \frac{1 \times (-3) + 2 \times 6}{1+2}$$

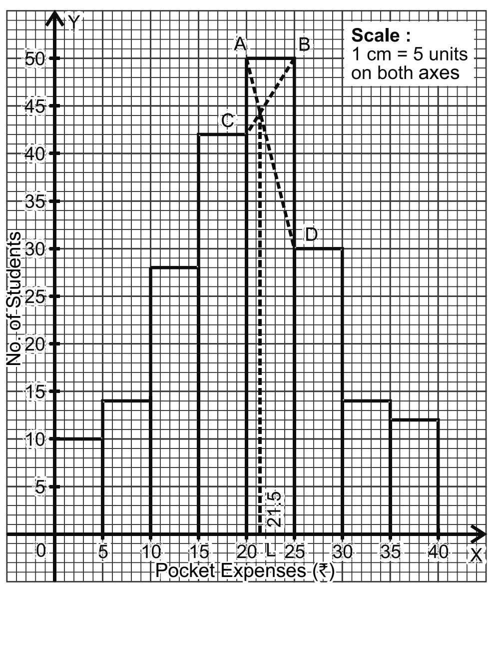
$$= \frac{-3+12}{3} = \frac{9}{3} = 3$$

$\therefore$ The point of intersection = (0, 3).

(ii)

Pocket Expenses (₹)	No. of students
0 – 5	10
5 – 10	14
10 – 15	28
15 – 20	42
20 – 25	50
25 – 30	30
30 – 35	14
35 – 40	12

$\therefore$ Mode = ₹ 21.5



(iii) Given, number of red balls = 6

Let, the number of blue balls be x.

$\therefore$ Total number of balls = $x + 6$

$\therefore$ $n(S) = x + 6$

Let, A be the event of drawing a red ball.

$\therefore$ $n(A) = 6$

$\therefore$ $P(A) = \frac{n(A)}{n(S)} = \frac{6}{x+6}$

Let, B be the event of drawing a blue ball.

$\therefore$ $n(B) = x$

$\therefore$ $P(B) = \frac{n(B)}{n(S)} = \frac{x}{x+6}$

According to question, $P(B) = 2 \times P(A)$

$\Rightarrow$ $\frac{x}{x+6} = 2 \times \frac{6}{x+6}$

$\Rightarrow$ $x = 12$

$\therefore$ The number of blue balls = 12.

(iv) Let, AB be the tower and CD be the pole.

$\therefore$ CD = BE = 20 m

In ΔBCE, $\tan 30° = \frac{BE}{CE}$ $\left[\because \tan\theta = \frac{\text{Perpendicular}}{\text{Base}}\right]$

$\Rightarrow$ $\frac{1}{\sqrt{3}} = \frac{20}{CE}$

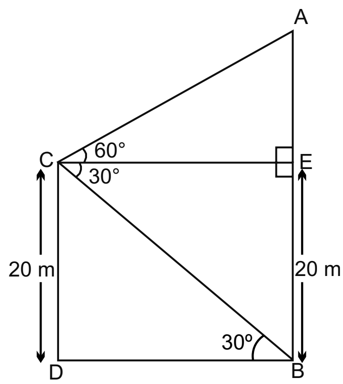
$\Rightarrow$ $CE = 20\sqrt{3}$ m.

In ΔACE, $\tan 60° = \frac{AE}{CE}$

$\Rightarrow$ $\sqrt{3} = \frac{AE}{20\sqrt{3}}$

$\Rightarrow$ $AE = \sqrt{3} \times 20\sqrt{3} = 20 \times 3 = 60$ m

$\therefore$ Height of tower = AE + BE = 60 + 20 = 80 m.



Answer 4.

(i) Given points are A (4, – 5), B (4, 5).

and $\frac{AP}{AB} = \frac{2}{5}$

$\Rightarrow$ $\frac{AP}{PB} = \frac{AP}{AB - AP} = \frac{2}{5-2} = \frac{2}{3}$

$\therefore$ Ratio = 2 : 3

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

$\therefore$ $x = \frac{m_1x_2 + m_2x_1}{m_1 + m_2}$ | $y = \frac{m_1y_2 + m_2y_1}{m_1 + m_2}$

$\Rightarrow$ $x = \frac{2\times4+3\times4}{2+3}$ | $y = \frac{2\times5+3\times(-5)}{2+3}$

$\Rightarrow$ $x = \frac{8+12}{5}$ | $y = \frac{10-15}{5}$

$\Rightarrow$ $x = \frac{20}{5}$ | $y = \frac{-5}{5}$

$\Rightarrow$ $x = 4$ | $y = -1$

$\therefore$ Coordinates of P are (4, – 1).

(ii) Here, $S = \{1, 2, 3, 4, ..., 24, 25\}$

$\therefore \quad n(S) = 25$

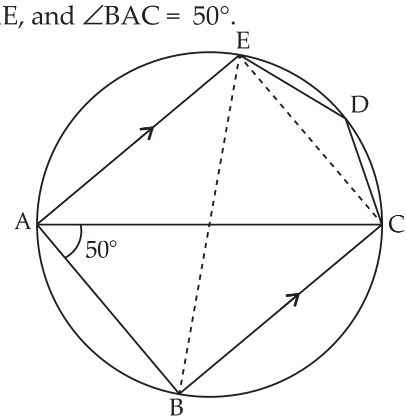
Let, E be the event of selecting a prime number.

$\therefore \quad E = \{2, 3, 5, 7, 11, 13, 17, 19, 23\}$

$\therefore \quad n(E) = 9$

$\therefore \quad P(E) = \frac{n(E)}{n(S)} = \frac{9}{25}$

(iii) Given, AC is diameter, BC ∥ AE, and ∠BAC = 50°.



(a) $\angle ABC = 90°$ [Angle formed in semicircle.]

In ΔABC,

$\angle ACB + \angle BAC + \angle ABC = 180°$ [Angles sum property]

$\Rightarrow \quad \angle ACB + 50° + 90° = 180°$

$\Rightarrow \quad \angle ACB = 180° - 140°$

$\Rightarrow \quad \angle ACB = 40°$

(b) $\angle CAE = \angle ACB$ [Alternate angles as BC ∥ AE]

$\Rightarrow \quad \angle CAE = 40°$

$\therefore \quad \angle EDC + \angle CAE = 180°$ [Sum of opposite angles of a cyclic quadrilateral is 180°.]

$\Rightarrow \quad \angle EDC + 40° = 180°$

$\Rightarrow \quad \angle EDC = 180° - 40°$

$\Rightarrow \quad \angle EDC = 140°$

(c) $\angle BEC = \angle BAC$ [Angles formed in same segment are equal.]

$= 50°$

(iv)

Class interval	Frequency (f)	Mid Value (x)	$d = x - A$	$t = d/i$	ft
20 – 30	10	25	– 20	– 2	– 20
30 – 40	6	35	– 10	– 1	– 6
40 – 50	8	45 = A	0	0	0
50 – 60	12	55	10	1	12
60 – 70	5	65	20	2	10
70 – 80	9	75	30	3	27
	$\Sigma f = 50$				$\Sigma ft = 23$

Let A = 45, $i = 10$

$\therefore \quad \text{Mean} = A + \frac{\Sigma ft}{\Sigma f} \times i = 45 + \frac{23}{50} \times 10 = 45 + 4.6$

$= 49.6$

Answer 5.

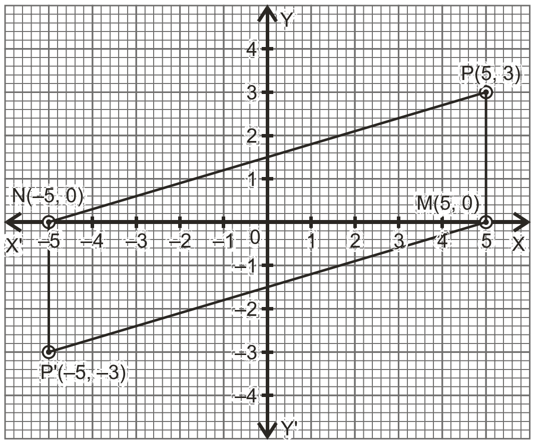
(i) (a) Coordinates of P′ = (– 5, – 3)

(b) Coordinates of M = (5, 0)

(c) Coordinates of N = (–5, 0)

(d) PM P′N is a parallelogram.

(e) Area of PMP′ N = Base × Height = 10 × 3 = 30 square units.



(ii) To prove, (cosec A – sin A) (sec A – cos A) $\sec^2$ A = tan A.

$$\text{L.H.S.} = (\text{cosec A} - \sin A)(\sec A - \cos A)\sec^2 A$$

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

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

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

$$= \frac{\sin A}{\cos A} = \tan A = \text{R.H.S.}$$

Hence Proved.

(iii)

Class	Mid value (x)	Frequency (f)	$d = x - A$	$t = d/i$	ft
0 – 20	10	17	– 40	– 2	– 34
20 – 40	30	f_1	– 20	– 1	$-f_1$
40 – 60	50	32	0	0	0
60 – 80	70	f_2	20	1	f_2
80 – 100	90	19	40	2	38
		$\Sigma f = 68 + f_1 + f_2$			$\Sigma ft = 4 - f_1 + f_2$

Let A = 50, i = 20

Since, $\Sigma f = 120$

$\Rightarrow$ $68 + f_1 + f_2 = 120$

$\Rightarrow$ $f_1 + f_2 = 120 - 68$

$\Rightarrow$ $f_1 + f_2 = 52$ ...(i)

Also, mean = 50

$$\Rightarrow \quad A + \frac{\Sigma ft}{\Sigma f}\times i = 50$$

$$\Rightarrow \quad 50 + \frac{4 - f_1 + f_2}{120}\times 20 = 50$$

$\Rightarrow \qquad \dfrac{4 - f_1 + f_2}{6} = 0$

$\Rightarrow \qquad 4 - f_1 + f_2 = 0$

$\Rightarrow \qquad -f_1 + f_2 = -4$

$\Rightarrow \qquad f_1 - f_2 = 4 \qquad$ ...(ii)

On adding equations (i) and (ii), we get

$\therefore \qquad f_1 + f_2 = 52$

$\qquad\quad f_1 - f_2 = 4$

Adding, $\qquad 2f_1 = 56$

$\Rightarrow \qquad f_1 = 28$

Putting $f_1 = 28$ in equation (i), we have

$$28 + f_2 = 52 \Rightarrow f_2 = 52 - 28 = 24.$$

$\therefore \qquad f_1 = 28, f_2 = 24.$

(iv) For cylinder, radius (r) = 3 cm, height (h) = 5 cm.

$\therefore \qquad \text{Volume} = \pi r^2 h = \dfrac{22}{7} \times 3^2 \times 5 = \dfrac{990}{7}\text{cm}^3$

For cone, $\qquad \text{radius (R)} = \dfrac{3}{2}\text{ cm, height (H)} = \dfrac{8}{9}\text{ cm}$

$\therefore \qquad \text{Volume} = \dfrac{1}{3}\pi R^2 H = \dfrac{1}{3} \times \dfrac{22}{7} \times \left(\dfrac{3}{2}\right)^2 \times \dfrac{8}{9}$

$$= \frac{44}{21}\text{cm}^3$$

$\therefore \qquad \text{Volume of metal A} = \left(\dfrac{990}{7} - \dfrac{44}{21}\right)\text{cm}^3$

$$= \frac{418}{3}\text{cm}^3$$

$\qquad \text{Volume of metal B} = \dfrac{44}{21}\text{cm}^3$

$\therefore$ Volume of metal A : Volume of metal B

$$= \frac{418/3}{44/21} = \frac{418}{3} \times \frac{21}{44} = \frac{133}{2}$$

$$= 133 : 2$$

Answer 6.

(i) Given points, P(2, –5) and Q (4, 3).

(a) $\qquad \text{Slope of PQ } (m) = \dfrac{3 - (-5)}{4 - 2} = \dfrac{8}{2} = 4.$

(b) Let the equation of PQ be $y - y_1 = m(x - x_1)$ which passes through P(2, –5) and has slope (m) = 4.

$\Rightarrow \qquad y - (-5) = 4(x - 2)$

$\Rightarrow \qquad y + 5 = 4x - 8$

$\Rightarrow \qquad 4x - y - 8 - 5 = 0$

$\Rightarrow \qquad 4x - y - 13 = 0$

(c) Since, the line PQ passes through ($p - 1$, $p + 4$), then

$\qquad 4(p - 1) - (p + 4) - 13 = 0$

$\Rightarrow \qquad 4p - 4 - p - 4 - 13 = 0$

$\Rightarrow \qquad 3p - 21 = 0$

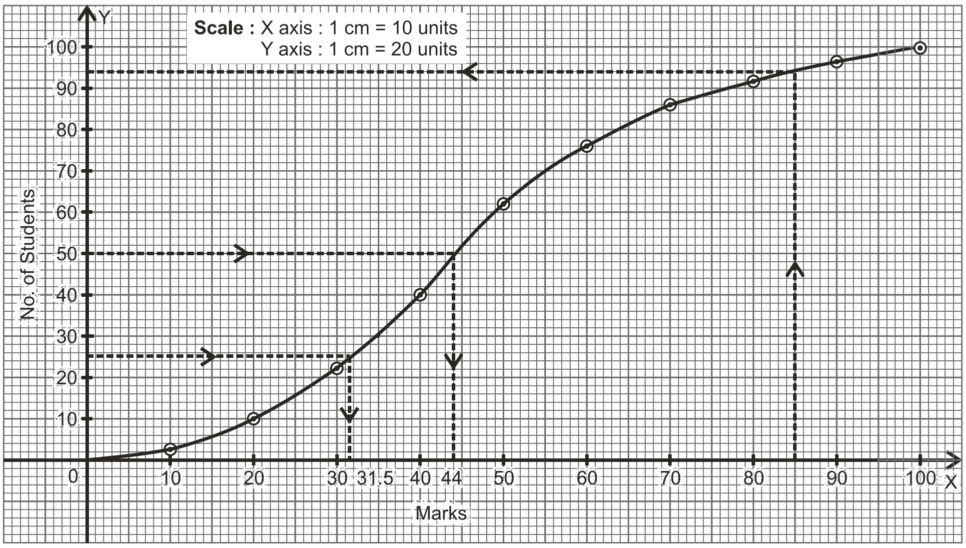
$\Rightarrow \qquad 3p = 21$

$\Rightarrow \qquad p = 7.$

(ii)

Marks	No. of students	*c.f.*
0 – 10	3	3
10 – 20	7	10
20 – 30	12	22
30 – 40	17	39
40 – 50	23	62
50 – 60	14	76
60 – 70	9	85
70 – 80	6	91
80 – 90	5	96
90 – 100	4	100

$\therefore \qquad N = 100$



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

$= 50^{\text{th}}$ observation

$= 44$

(b) $$\text{Lower quartile} = \frac{N}{4}^{\text{th}} \text{ observation}$$

$= 25^{\text{th}}$ observation

$= 31.5$

(iii) $$\text{L.H.S.} = \frac{\sin\theta \tan\theta}{1-\cos\theta}$$

$$= \frac{\sin\theta . \frac{\sin\theta}{\cos\theta}}{1-\cos\theta}$$

$$= \frac{\sin^2\theta}{\cos\theta\,(1-\cos\theta)}$$

$$= \frac{1-\cos^2\theta}{\cos\theta\,(1-\cos\theta)}$$

$$= \frac{(1+\cos\theta)\,(1-\cos\theta)}{\cos\theta\,(1-\cos\theta)}$$

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

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

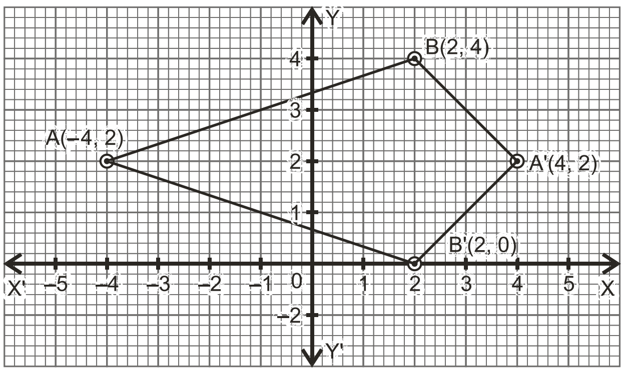
$= 1 + \sec\theta =$ R.H.S. **Hence Proved.**

(iv) (a) On graph

(b) Coordinates of $A' = (4, 2)$

(c) Coordinates of $B' = (2, 0)$

(d) Figure $ABA'B'$ is a kite shaped quadrilateral.



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