ICSE EXAMINATION PAPER - 2024
MATHEMATICS
Class-10th
(Solved)

Maximum Marks: 80
Time allowed: Two and half hours

Answer to this Paper must be written on the paper provided separately.
*You will **not** be allowed to write during first **15** 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 question from **Section A** and **any four** questions from **Section B.***
All working, including rough work, must be clearly shown, and must be done on the same sheet as the rest of the answer.
Omission of essential working will result in loss of marks.
The intended marks for questions or parts questions are given in brackets [ ]
Mathematical tables and graph papers are to be provided by the school.

SECTION-A (40 MARKS)

(Attempt all questions from this Section.)

Question 1 **[15]**

Choose the correct answers to the questions from the given options.

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

(i) For an Intra-state sale, the CGST paid by a dealer to the Central government is ₹ 120. If the marked price of the article is ₹ 2000, the rate of GST is:

(a) 6% **(b)** 10%
(c) 12% **(d)** 16.67%

(ii) What must be subtracted from the polynomial $x^3 + x^2 - 2x + 1$, so that the result is exactly divisible by $(x - 3)$?

(a) – 31 **(b)** – 30
(c) 30 **(d)** 31

(iii) The roots of the quadratic equation $px^2 - qx + r = 0$ are real and equal if:

(a) $p^2 = 4qr$ **(b)** $q^2 = 4pr$
(c) $-q^2 = 4pr$ **(d)** $p^2 > 4qr$

(iv) If matrix $A = \begin{bmatrix} 2 & 2 \\ 0 & 2 \end{bmatrix}$ and $A^2 = \begin{bmatrix} 4 & x \\ 0 & 4 \end{bmatrix}$, then the value of x is:

(a) 2 **(b)** 4
(c) 8 **(d)** 10

(v) The median of the following observations arranged in ascending order is 64. Find the value of x:

27, 31, 46, 52, x, $x + 4$, 71, 79, 85, 90

(a) 60 **(b)** 61
(c) 62 **(d)** 66

(vi) Points A (x, y), B $(3, -2)$ and C $(4, -5)$ are collinear. The value of y in terms of x is:

(a) $3x - 11$ **(b)** $11 - 3x$
(c) $3x - 7$ **(d)** $7 - 3x$

(vii) The given table shows the distance covered and the time taken by a train moving at a uniform speed along a straight track.

Distance (in m)	60	90	y
Time (in s)	2	x	5

The values of x and y are:

(a) $x = 4, y = 150$ **(b)** $x = 3, y = 100$
(c) $x = 4, y = 100$ **(d)** $x = 3, y = 150$

(viii) The 7^{th} term of the given Arithmetic Progression (A.P.):

$$\frac{1}{a}, \left(\frac{1}{a}+1\right), \left(\frac{1}{a}+2\right) \text{....is :}$$

(a) $\left(\frac{1}{a}+6\right)$ **(b)** $\left(\frac{1}{a}+7\right)$
(c) $\left(\frac{1}{a}+8\right)$ **(d)** $\left(\frac{1}{a}+7^7\right)$

(ix) The sum invested to purchase 15 shares of a company of nominal value ₹ 75 available at a discount of 20% is:

(a) ₹ 60 **(b)** ₹ 90
(c) ₹ 1350 **(d)** ₹ 900

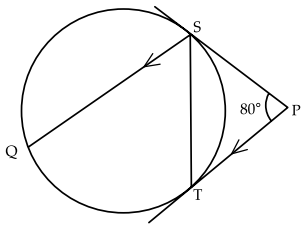
(x) The circumcentre of a triangle is the point which is:

(a) at equal distance from the three sides of the triangle.
(b) at equal distance from the three vertices of the triangle.
(c) the point of intersection of the three medians.
(d) the point of intersection of the three altitudes of the triangle.

(xi) Statement 1: $\sin^2\theta + \cos^2\theta = 1$
Statement 2: $\text{cosec}^2\theta + \cot^2\theta = 1$
Which of the following is valid?

(a) only 1 **(b)** only 2
(c) both 1 and 2 **(d)** neither 1 nor 2

(xii) In the given diagram, PS and PT are the tangents to the circle. SQ || PT and $\angle SPT = 80°$. The value of $\angle QST$ is:

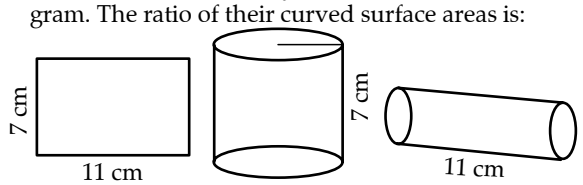


(a) 140°
(b) 90°
(c) 80°
(d) 50°

(xiii) Assertion (A): A die is thrown once and the probability of getting an even number is $\frac{2}{3}$.

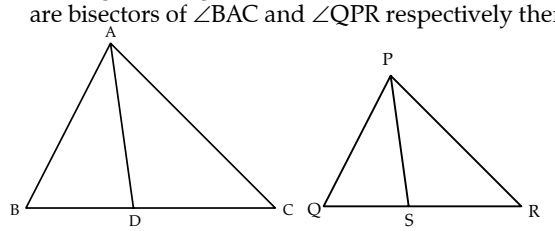
Reason (R): The sample space for even numbers on a die is {2, 4, 6}.
(a) A is true, R is false.
(b) A is false, R is true.
(c) Both A and R are true.
(d) Both A and R and false.

(xiv) A rectangular sheet of paper of size 11 cm × 7 cm is first rotated about the side 11 cm and then about the side 7 cm to form a cylinder, as shown in the diagram. The ratio of their curved surface areas is:



(a) 1:1 **(b)** 7:11
(c) 11:7 **(d)** $\frac{11\pi}{7} : \frac{7\pi}{11}$

(xv) In the given diagram, $\Delta ABC \sim \Delta PQR$. If AD and PS are bisectors of $\angle BAC$ and $\angle QPR$ respectively then:



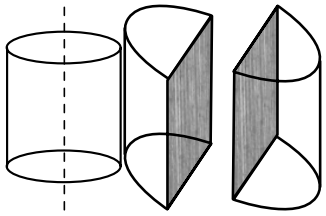
(a) $\Delta ABC \sim \Delta PQS$ **(b)** $\Delta ABD \sim \Delta PQS$
(c) $\Delta ABD \sim \Delta PSR$ **(d)** $\Delta ABC \sim \Delta PSR$

Question 2

(i) $A = \begin{bmatrix} x & 0 \\ 1 & 1 \end{bmatrix}, B = \begin{bmatrix} 4 & 0 \\ y & 1 \end{bmatrix}$ and $C = \begin{bmatrix} 4 & 0 \\ x & 1 \end{bmatrix}$ **[4]**

Find the values of x and y, if $AB = C$.

(ii) A solid metallic cylinder is cut into two identical halves along its height (as shown in the diagram). The diameter of the cylinder is 7 cm and the height is 10 cm. Find: **[4]**
(a) the total surface area (both the halves).
(b) the total cost of painting the two halves at the rate of 30 per cm^2 $\left(\text{Use } \pi = \frac{22}{7}\right)$



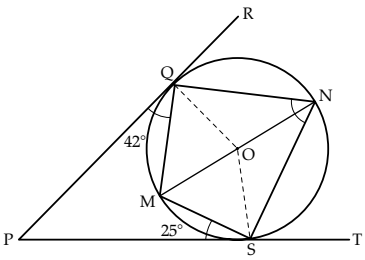
(iii) 15, 30, 60, 120... are in G.P. (Geometric Progression).
(a) Find the n^{th} term of this G.P. in terms of n.
(b) How many terms of the above G.P. will give the sum 945? **[4]**

Question 3

(i) Factorize: $\sin^3\theta + \cos^3\theta$
Hence, prove the following identity: **[4]**

$$\frac{\sin^3\theta + \cos^3\theta}{\sin\theta + \cos\theta} + \sin\theta\cos\theta = 1$$

(ii) In the given diagram, O is the centre of the circle. PR and PT are two tangents drawn from the external point P and touching the circle at Q and S respectively. MN is a diameter of the circle. Given $\angle PQM = 42°$ and $\angle PSM = 25°$. **[4]**



Find:
(a) $\angle OQM$ **(b)** $\angle QNS$
(c) $\angle QOS$ **(d)** $\angle QMS$

(iii) Use graph sheet for this question. Take 2 cm = 1 unit along the a **[5]**
(a) Plot A(0, 3), B(2, 1) and C(4, –1).
(b) Reflect point B and C in y-axis and name their images as B′ and C′ respectively. Plot and write coordinates of the points B′ and C′.
(c) Reflect point A in the line BB′ and name its images as A′.
(d) Plot and write coordinates of point A′.
(e) Join the points ABA′B′ and give the geometrical name of the closed figure so formed.

SECTION-B (40 MARKS)

(Attempt any four questions from this Section.)

Question 4

(i) Suresh has a recurring deposit account in a bank. He deposits ₹ 2000 per month and the bank pays interest at the rate of 8% per annum. If he gets ₹ 1040 as interest at the time of maturity, find in years total time for which the account was held. **[3]**

(ii) The following table gives the duration of movies in minutes. **[3]**

Duration (in minutes)	No. of movies
100 - 110	5
110 - 120	10
120 - 130	17
130 - 140	8
140 - 150	6
150 - 160	4

Using step - deviation method, find the mean duration of the movies.

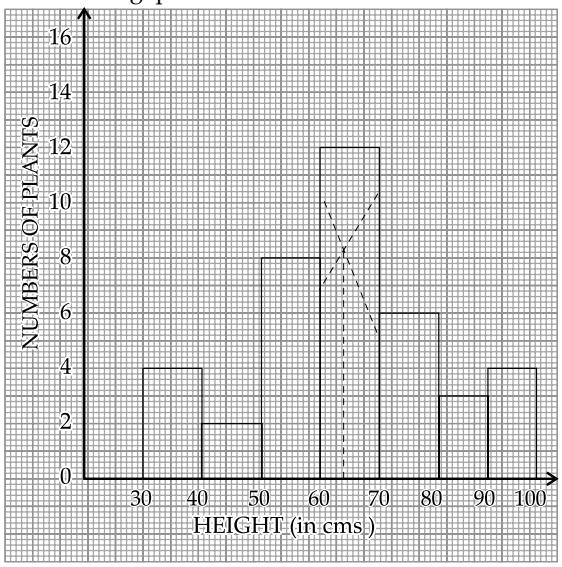
(iii) If $\frac{(a+b)^3}{(a-b)^3} = \frac{64}{27}$ **[4]**

(a) Find $\frac{a+b}{a-b}$

(b) Hence using properties of proportion, find $a : b$.

Question 5

(i) The given graph with a histogram represents the number of plants of different heights in a school campus. Study the graph carefully and answer the following questions: **[5]**



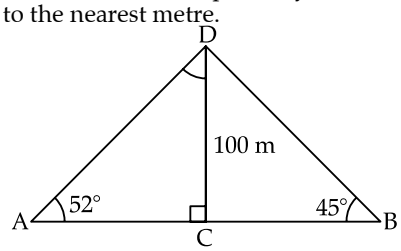
(a) Make a frequency table with respect to the class boundaries and their corresponding frequencies.

(b) State the modal class.

(c) Identify and note down the mode of the distribution.

(d) Find the number of plants whose height range is between 80 cm to 90 cm.

(ii) The angle of elevation of the top of a 100 m high tree from two points A and B on the opposite side of the tree are 52° and 45° respectively. Find the distance AB, to the nearest metre. **[5]**



Question 6

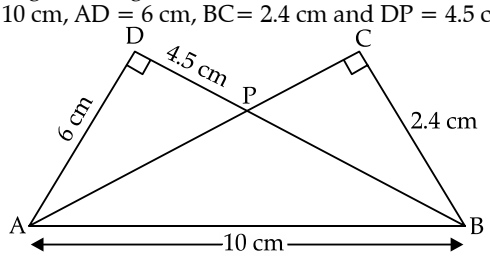
(i) Solve the following quadratic equation for x and give your answer correct up to three significant figures: $2x^2 - 10x + 5 = 0$ **[3]**
(Use mathematical tables if necessary)

(ii) The nth term of an Arithmetic Progression (A.P.) is given by the relation $T_n = 6(7 - n)$. **[3]**
Find:

(a) its first term and common difference

(b) sum of its first 25 terms

(iii) In the given diagram ΔADB and ΔACB are two right angled triangles with $\angle ADB = \angle BCA = 90°$. If AB = 10 cm, AD = 6 cm, BC= 2.4 cm and DP = 4.5 cm **[4]**



(a) Prove that ΔAPD ~ ΔBPC

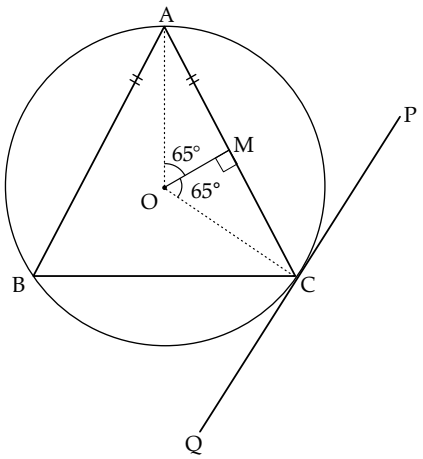
(b) Find the length of BD and PB

(c) Hence, find the length of PA

(d) Find area ΔAPD: area ΔBPC

Question 7

(i) In the given diagram, an isosceles ΔABC is inscribed in a circle with centre O. PQ is a tangent to the circle at C. OM is perpendicular to chord AC and ∠COM = 65°.
Find:



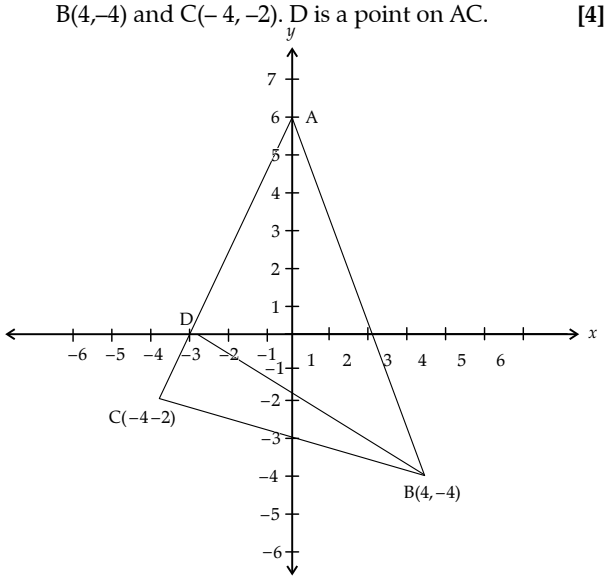
(a) ∠ABC **(b)** ∠BAC

(c) ∠BCQ **[3]**

(ii) Solve the following in equation, write down the solution set and represent it on the real number line.

$$-3 + x \le \frac{7x}{2} + 2 < 8 + 2x, x \in I$$ **[3]**

(iii) In the given diagram, ABC is a triangle, where B(4,–4) and C(– 4, –2). D is a point on AC. **[4]**



(a) Write down the coordinates of A and D.

(b) Find the coordinates of the centroid of ΔABC.

(c) If D divides AC in the ratio $k : 1$, find the value of k.

(d) Find the equation of the line BD.

■■

ANSWERS

SECTION A

1. (i) Option (c) is correct.

***Explanation*:** Given that,

Marked Price, MP = ₹ 2000

For intra-state sale, the CGST paid is ₹ 120

Total GST = CGST + SGST

As it's an intra-state sale,

CGST = SGST

So, Total GST = 2 × CGST

Total GST = 2 × 120 = ₹ 240

$$\text{Total GST} = \frac{\text{Marked Price} \times \text{Rate of GST}}{100}$$

$$\text{Rate of GST} = \frac{240 \times 100}{2000} = 12\%$$

So, the rate of GST for this intra-state sale of goods is 12%.

(ii) Option (d) is correct

***Explanation*:** Given the polynomial,

$P(x) = x^3 + x^2 - 2x + 1$,

For the polynomial to be exactly divisible by $(x - 3)$,

Putting $x = 3$ in the polynomial,

$P(3) = (3)^3 + (3)^2 - 2(3) + 1$

$= 27 + 9 - 6 + 1 = 31$

So, 31 must be subtracted from the polynomial.

(iii) Option (b) is correct

***Explanation*:** Given quadratic equation is $px^2 - qx + r = 0$

On comparing with $ax^2 + bx + c = 0$,

We get, $a = p$, $b = -q$ and $c = r$

For real and equal roots, Discriminant,

$D = b^2 - 4ac = 0$

$\Rightarrow (-q)^2 - 4(p)(r) = 0$

$\Rightarrow q^2 = 4pr$

(iv) Option (c) is correct

***Explanation*:** Given that,

$$A = \begin{bmatrix} 2 & 2 \\ 0 & 2 \end{bmatrix}$$

We have, $$A^2 = \begin{bmatrix} 2 & 2 \\ 0 & 2 \end{bmatrix}\begin{bmatrix} 2 & 2 \\ 0 & 2 \end{bmatrix}$$

$$= \begin{bmatrix} 4+0 & 4+4 \\ 0+0 & 0+4 \end{bmatrix} = \begin{bmatrix} 4 & 8 \\ 0 & 4 \end{bmatrix}$$

On comparing with,

$$A^2 = \begin{bmatrix} 4 & 8 \\ 0 & 4 \end{bmatrix}$$

We get, $x = 8$

(v) Option (c) is correct

***Explanation*:** Given that,

Median of observations 27, 31, 46, 52, x, $x + 4$, 71, 79, 85, 90 is 64

We know that,

For even number of observations, $N = 10$ (here)

$$\text{Median} = \frac{5^{\text{th}}\text{ term} + 6^{\text{th}}\text{ term}}{2}$$

$$\Rightarrow 64 = \frac{x + x + 4}{2}$$

$\Rightarrow 128 = 2x + 4$

$\Rightarrow 124 = 2x$

$\Rightarrow x = 62$

(vi) Option (d) is correct

***Explanation*:** Given that,

Points $A(x, y)$, $B(3, -2)$ and $C(4, -5)$ are collinear.

For collinear points the area of figure formed by these points is zero,

So,

$$\Rightarrow \frac{1}{2}[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)] = 0$$

On putting values,

$\Rightarrow x[(-2) - (-5)] + 3[(-5) - (y)] + 4[(y) - (-2)] = 0$

$\Rightarrow 3x - 15 - 3y + 4y + 8 = 0$

$\Rightarrow 3x + y = 7$

$\Rightarrow y = 7 - 3x$

(vii) Option (d) is correct

***Explanation*:** We know that,

Distance ∝ Time

So, $$\frac{60}{2} = \frac{90}{x} = \frac{y}{5} = k \text{ (constant)}$$

$$\Rightarrow \frac{60}{2} = \frac{90}{x}$$

$\Rightarrow x = 3$

Also, $$\frac{60}{2} = \frac{y}{5}$$

$\Rightarrow y = 150$

Hence, the values of x and y are 3 and 150 respectively.

(viii) Option (a) is correct

***Explanation*:** Given AP is $\frac{1}{a}, \left(\frac{1}{a} + 1\right), \left(\frac{1}{a} + 2\right)...$

First term, $A = \frac{1}{a}$

Common difference,

$$d = \left(\frac{1}{a} + 1\right) - \left(\frac{1}{a}\right) = 1$$

So, 7th term (A_7) of given AP is:

$A_7 = A + (7 - 1)d$

$A_7 = \frac{1}{a} + 6(1)$

$A_7 = \frac{1}{a} + 6$

(ix) Option (d) is correct

***Explanation*:** Given that,

Number of shares, $n = 15$

Nominal value per share = ₹ 75

Discount = 20%

Discounted price per share

= Nominal value per share × (1 – Discount rate)

= ₹ 75 × (1 – 0.20)

= ₹ 75 × 0.80

= ₹ 60

So, each share is being sold for ₹ 60 after the discount.

Sum invested = Price per share × Number of shares

= ₹ 60 × 15

= ₹ 900

(x) Option (b) is correct

***Explanation*:** We know that,

Circumcentre of a triangle is equidistant from all three vertices of the triangle. This means that the distance from the circumcentre to each vertex is the same.

(xi) Option (a) is correct

***Explanation*: Statement 1:** $\sin^2\theta + \cos^2\theta = 1$

This is true.

Statement 2: $\text{cosec}^2\theta + \cot^2\theta = 1$

This statement is invalid because $\text{cosec}^2\theta - \cot^2\theta = 1$

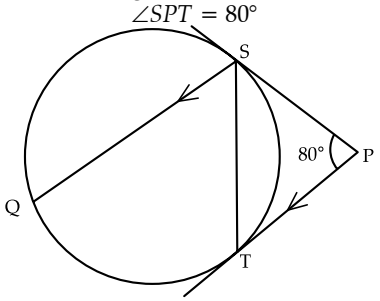
Hence, only statement 1 is valid.

(xii) Option (d) is correct

***Explanation*:** Given that,

PS and PT are tangents and $SQ \parallel PT$

$\angle SPT = 80°$



As $PS = PT$

(Tangents from an external point to a circle are equal)

Also, $\angle PST = \angle PTS$

(Angles opposite to equal sides)

$\angle PST + \angle PTS + \angle SPT = 180°$

(Sum of all angles of triangle)

$\angle PST + \angle PTS + 80° = 180°$

So, $\angle PST = \angle PTS = 50°$

$\angle PTS = \angle QST = 50°$

(alternate angles)

(xiii) Option (b) is correct

***Explanation*:** When a dice is thrown the probability of getting an even number is $\frac{1}{2}$.

Sample space for even numbers on a dice is {2, 4, 6}

So, Assertion is false and reason is true.

(xiv) Option (a) is correct

***Explanation*:** Given that,

Size of rectangular sheet = 11 cm × 7 cm

When it is rotated about side 11 cm then,

Height of cylinder formed, $h = 7$ cm

Let the radius of cylinder formed be R,

Circumference, $2\pi R = 11$ cm

Curved Surface area of cylinder $= 2\pi Rh = 11 \times 7$

$= 77 \text{ cm}^2$

Now, When it is rotated about side 7 cm then,

Height of cylinder formed, $H = 11$ cm

Let the radius of cylinder formed be r,

Circumference, $2\pi r = 7$ cm

Curved Surface area of cylinder $= 2\pi rH = 7 \times 11$

$= 77 \text{ cm}^2$

So, Ratio of their $CSA = 77 : 77 = 1 : 1$

(xv) Option (b) is correct

***Explanation*:** Given that,

$\Delta ABC \sim \Delta PQR$

AD and PS are bisectors of $\angle BAC$ and $\angle QPR$, respectively

Since $\Delta ABC \sim \Delta PQR$

we have, $\angle A = \angle P$

$\angle B = \angle Q$

Or $\frac{1}{2} \times \angle A = \frac{1}{2} \times \angle P$

$\Rightarrow \angle BAD = \angle QPS$

In ΔABD and ΔPQS,

$\angle B = \angle Q$

$\angle BAD = \angle QPS$

So, By AA similarity criteria $\Delta ABD \sim \Delta PQS$.

2. (i) Given that, $A = \begin{bmatrix} x & 0 \\ 1 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 4 & 0 \\ y & 1 \end{bmatrix}$, and $C = \begin{bmatrix} 4 & 0 \\ x & 1 \end{bmatrix}$

Also, $AB = C$

$$AB = \begin{bmatrix} x & 0 \\ 1 & 1 \end{bmatrix}\begin{bmatrix} 4 & 0 \\ y & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 4x+0 & 0+0 \\ 4+y & 0+1 \end{bmatrix}$$

$$= \begin{bmatrix} 4x & 0 \\ 4+y & 1 \end{bmatrix}$$

On comparing with C,

We get,

$\Rightarrow 4x = 4$

$\Rightarrow x = 1$

$\Rightarrow 4 + y = x$

$\Rightarrow 4 + y = 1$

$\Rightarrow y = -3$

So, $x = 1$ and $y = -3$

(ii) Given that, Height of cylinder, $h = 10$ cm

Diameter of cylinder, $d = 7$ cm

Radius of cylinder, $r = \frac{7}{2}$ cm

(a) Total surface area of both halves

= Total surface area of cylindrical part + Area of two rectangular parts

$= 2\pi r(h + r) + 2dh$

$$= 2 \times \frac{22}{7} \times \frac{7}{2} \times \left(10 + \frac{7}{2}\right) + 2 \times 7 \times 10$$

$$= 22 \times \frac{27}{2} + 140$$

$= 297 + 140$

$= 437 \text{ cm}^2$

(b) Rate of painting $= ₹\,30/\text{cm}^2$

Total cost of painting

= Total surface area × Rate of painting

$= 437 \times 30$

$= ₹\,13{,}100$

(iii) Given that, 15, 30, 60, 120… are in G.P.

We have, First term, $a = 15$

Common ratio, $r = \frac{30}{15} = 2$

(a) n^{th} term of GP is a_n

$\Rightarrow a_n = a(r)^{n-1}$

$\Rightarrow a_n = 15 \times (2)^{n-1}$

(b) Given that, Sum, $S = 945$

Let the number of terms taken be n

$$S = \frac{a(r^n - 1)}{r - 1}$$

On substituting the values,

$$945 = \frac{15(2^n - 1)}{2 - 1}$$

$$63 = 2^n - 1$$
$$2^n = 64$$
$$2^n = 2^6$$
$$n = 6$$

So, 6 terms of the GP will give a sum of 945.

3. (i) To factorize: $\sin^3\theta + \cos^3\theta$

We have,

$\Rightarrow \sin^3\theta + \cos^3\theta$

[Using $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$]

$\Rightarrow (\sin\theta + \cos\theta)(\sin^2\theta - \sin\theta\cos\theta + \cos^2\theta)$

$\Rightarrow (\sin\theta + \cos\theta)(1 - \sin\theta\cos\theta)$ …(i)

[As $\sin^2\theta + \cos^2\theta = 1$]

To prove: $\frac{\sin^3\theta + \cos^3\theta}{\sin\theta + \cos\theta} + \sin\theta.\cos\theta = 1$

Taking LHS, $\frac{\sin^3\theta + \cos^3\theta}{\sin\theta + \cos\theta} + \sin\theta.\cos\theta$

Using (i),

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

$$= 1 - \sin\theta.\cos\theta + \sin\theta.\cos\theta$$

$LHS = RHS$ **Hence proved.**

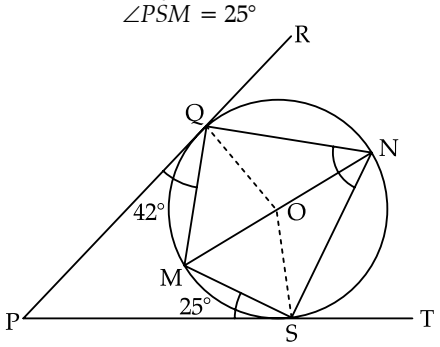
(ii) Given that,

PR and PT are tangents

MN is diameter of circle

$\angle PQM = 42°$

$\angle PSM = 25°$



(a) We have,

$\angle OQP = 90°$

(Radius is perpendicular to tangent at point of contact)

Also, $\angle OQM + \angle PQM = \angle OQP = 90°$

$\Rightarrow \angle OQM + 42° = 90°$

$\Rightarrow \angle OQM = 48°$

Similarly, $\angle OSM = 90° - 25° = 65°$

(b) We know that,

$\angle QNM = 42°$ and $\angle SNM = 25°$

(Alternate segment theorem)

$\angle QNS = \angle QNM + \angle SNM$

$= 42° + 25° = 67°$

(c) $\angle QOS = 2 \times \angle QNS$

(As angle at the center is twice the angle at circumference)

$\angle QOS = 2 \times 67° = 134°$

(d) As QMSN is a cyclic quadrilateral,

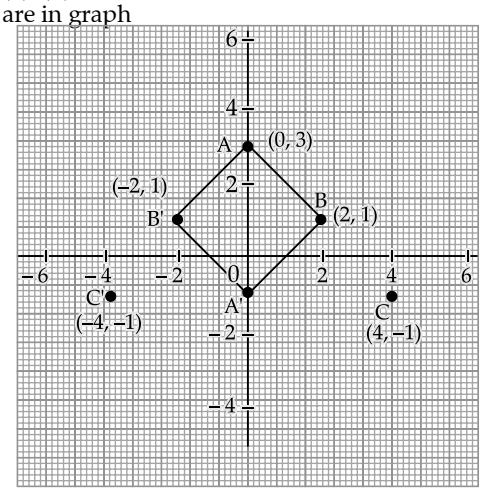
So, $\angle QMS + \angle QNS = 180°$

(Sum of opposite angles of cyclic quadrilateral)

$\Rightarrow \angle QMS + 67° = 180°$

$\Rightarrow \angle QMS = 180° - 67° = 113°$

(iii) (a), (b) are in graph



(c) Coordinates of point B′ are (–2, 1) and C′ are (–4, –1)

(d) Coordinates of point A′ are (0, –1)

(e) The figure ABA′B′ is a square.

SECTION B

4. (i) Given that, Suresh deposits amount, $P = ₹\ 2000$ per month

Rate of interest, $r = 8\%$

Interest, $I = ₹\ 1040$

Let the duration of deposit be n months

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

$$1040 = \frac{2000 \times n(n+1)}{2 \times 12} \times \frac{8}{100}$$

$$n(n + 1) = 156$$
$$12 \times 13 = 156$$

So, $n = 12$

So, total time of deposit is 12 months or 1 year.

(ii) We have,

Duration (in mins)	No. of movies (f)	x_i	$u_i = \frac{x_i - A}{h}$	f_iu_i
100-110	5	105	–2	–10
110-120	10	115	–1	–10
120-130	17	125 = A	0	0
130-140	8	135	1	8
140-150	6	145	2	12
150-160	4	155	3	12

For the given data,

Let Assumed mean, $A = 125$

$\Rightarrow$ Class interval, $h = 10$

Using step-deviation method,

$$\text{Mean} = A + \frac{\sum f_iu_i}{\sum f_i} \times h$$

$$\text{Mean} = 125 + \frac{12}{50} \times 10$$

$$\text{Mean} = 125 + 2.4$$

$$\text{Mean} = 127.4$$

(iii) Given that, $\frac{(a+b)^3}{(a-b)^3} = \frac{64}{27}$

(a) Taking cube root both sides,

$$\frac{(a+b)}{(a-b)} = \frac{4}{3}$$

(b) Applying componendo and dividendo,

$$\frac{(a+b)+(a-b)}{(a+b)-(a-b)} = \frac{4+3}{4-3}$$

$$\Rightarrow \quad \frac{2a}{2b} = \frac{7}{1}$$

$$\Rightarrow \quad \frac{a}{b} = \frac{7}{1}$$

So, $a : b = 7 : 1$

5. (i) (a)

Height (in cms)	Number of plants(frequency)
30-40	4
40-50	2
50-60	8
60-70	12
70-80	6
80-90	3
90-100	4

(b) The modal class is 60 – 70.

(c) From the given histogram, Mode = 64

(d) Number of plants whose height range between 80 – 90 cm is 3.

(ii) From the given figure,

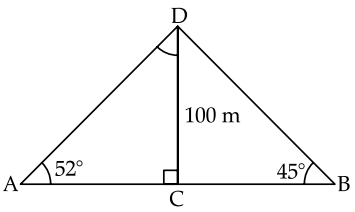
CD be the tower of height 100 m

In ΔADC,

$$\Rightarrow \tan 52° = \frac{DC}{AC}$$

$$\Rightarrow \quad 1.279 = \frac{100}{AC}$$

$$\Rightarrow \quad AC = \frac{100}{1.279}$$



$$\Rightarrow \quad AC = 78.18 \text{ m}$$

Now, In ΔBDC,

$$\Rightarrow \quad \tan 45° = \frac{DC}{BC}$$

$$\Rightarrow \quad 1 = \frac{100}{BC}$$

$$\Rightarrow \quad BC = 100 \text{ m}$$

We know that,

$$AB = AC + BC = 78.18 + 100$$
$$= 178.18 \text{ m or } 178 \text{ m (approx)}$$

6. (i) Given quadratic equation is $2x^2 - 10x + 5 = 0$

On comparing with $ax^2 + bx + c = 0$,

We get, $a = 2$, $b = -10$ and $c = 5$

Also,

Discriminant, $D = b^2 - 4ac = (-10)^2 - 4(2)(5)$
$= 100 - 40 = 60$

Using Quadratic formula,

$$x = \frac{-b \pm \sqrt{D}}{2a}$$

$$x = \frac{10 \pm \sqrt{60}}{4}$$

$$x = \frac{10 \pm 7.7459}{4}$$

$$x = 4.43, 0.563$$

(ii) Given that,

$$T_n = 6(7 - n)$$

(a) Putting $n = 1$,

$$T_1 = 6(7 - 1) = 36$$
$$T_2 = 6(7 - 2) = 30$$
$$T_3 = 6(7 - 3) = 24$$

So,

First term, $a = 36$

Common difference, $d = T_2 - T_1 = 30 - 36 = -6$

(b) $S_{25} = \frac{n}{2}[2a + (n-1)d]$

$$S_{25} = \frac{25}{2}[2 \times 36 + (25 - 1)(-6)]$$

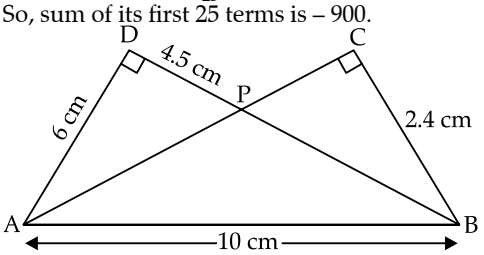
$$S_{25} = \frac{25}{2}[72 - 144]$$

$$S_{25} = \frac{25}{2} \times (-72)$$

$$S_{25} = -900$$

So, sum of its first 25 terms is – 900.

(iii)



Given that,

ΔABD and ΔACB are right angled triangles,

$$\angle ADB = \angle BCA = 90°$$

$AB = 10$ cm, $AD = 6$ cm, $BC = 2.4$ cm and $DP = 4.5$ cm

(a) In ΔAPD and ΔBPC,

We have,

$$\angle ADP = \angle BCP = 90°$$
$$\angle APD = \angle BPC$$
(Vertically opposite angles)

So, By AA similarity

$$\Delta APD \sim \Delta BPC$$

Also, $\frac{AD}{DP} = \frac{BC}{CP}$

$$\frac{6}{4.5} = \frac{2.4}{CP}$$

$$\Rightarrow \quad CP = 1.8 \text{ cm}$$

(b) In right ΔBPC,

$$BP^2 = BC^2 + CP^2$$
$$BP^2 = (2.4)^2 + (1.8)^2$$
$$BP = 3 \text{ cm}$$

And, $BD = DP + PB = 4.5 + 3 = 7.5$ cm

(c) In right ΔADP,

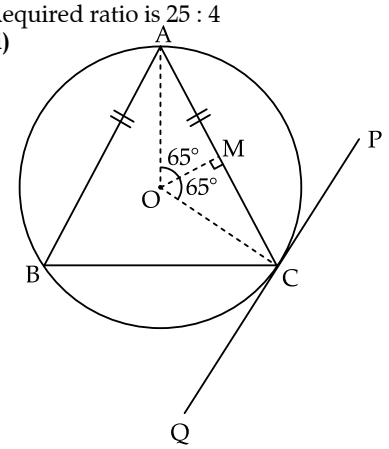
$$PA^2 = AD^2 + DP^2$$
$$PA^2 = 62 + (4.5)^2$$

$PA = 7.5$ cm

(d) Area ΔAPD : Area $\Delta BPC = \dfrac{\frac{1}{2}\times 4.5\times 6}{\frac{1}{2}\times 2.4\times 1.8} = \dfrac{25}{4}$

Required ratio is 25 : 4

7. (i)



Given that, ΔABC is isosceles
OM is perpendicular to AC

$\angle COM = 65°$

We have,

$\angle AOC = \angle AOM + \angle COM$
$= 65° + 65° = 130°$

In ΔMOC,

$\angle MCO = 180° - (90° + 65°) = 25°$

(a) We know that,

$\angle ABC = \dfrac{1}{2} \times \angle AOC$

(Angle at the center is twice the angle at circumference)

$\angle ABC = \dfrac{1}{2} \times 130°$

$\angle ABC = 65°$

(b) As ΔABC is isosceles,

$AB = AC$ and
$\angle ABC = \angle ACB = 65°$

(Angles opposite to equal sides)

In ΔABC,

$\angle ABC + \angle ACB + \angle BAC = 180°$
$65° + 65° + \angle BAC = 180°$
$\angle BAC = 180° - 130°$
$\angle BAC = 50°$

(c) Also,

As $\angle BAC = 50°$
So, $\angle BCQ = 50°$

(Angle made with chord is equal to angle made with tangent)

(ii) Given that, $-3 + x \le \dfrac{7x}{2} + 2 < 8 + 2x$,

x belongs to Integer
Now,

$\Rightarrow \quad -3 + x \le \dfrac{7x}{2} + 2$

$\Rightarrow \quad -3 + x \le \dfrac{(7x+4)}{2}$

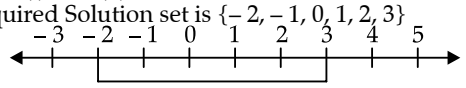
$\Rightarrow \quad -6 + 2x \le 7x + 4$
$\Rightarrow \quad -6 - 4 \le 7x - 2x$
$\Rightarrow \quad -10 \le 5x$
$\Rightarrow \quad -2 \le x$
$\Rightarrow \quad x \ge -2$ ...(i)

Also, $\dfrac{7x}{2} + 2 < 8 + 2x$

$\Rightarrow \quad \dfrac{7x+4}{2} < 8 + 2x$

$\Rightarrow \quad 7x + 4 < 16 + 4x$
$\Rightarrow \quad 7x - 4x < 16 - 4$
$\Rightarrow \quad 3x < 12$
$\Rightarrow \quad x < 4$ ...(ii)

From (i) and (ii),
Required Solution set is $\{-2, -1, 0, 1, 2, 3\}$



(iii) Given that, $B(4, -4)$ and $C(-4, -2)$

(a) Coordinates of A are (0, 6)
Coordinates of D are (– 3, 0)

(b) Centroid (x, y) of ΔABC is

$$(x, y) = \left[\left(\frac{0+4-3}{3}\right), \left(\frac{6-4+0}{3}\right)\right]$$

$$(x, y) = \left(\frac{1}{3}, \frac{2}{3}\right)$$

(c) D divides AC in Ratio k : 1
Using section formula,

$$-3 = \frac{-4k+0}{k+1}$$

$\Rightarrow \quad -3k - 3 = -4k$
$\Rightarrow \quad 4k - 3k = 3$
$\Rightarrow \quad k = 3$

(d) Equation of line BD is

$$(y - 0) = \left(\frac{-4-0}{4-(-3)}\right)(x+3)$$

$$y = \frac{-4}{7}(x+3)$$

$$7y = -4x - 12$$
$$4x + 7y + 12 = 0$$

■■