

ICSE Board
Class IX Mathematics
Sample Paper 2

Time: 2½ hrs

Total Marks: 80

General Instructions:

1. Answers to this paper must be written on the paper provided separately.
 2. You will NOT be allowed to write during the first 15 minutes. This time is to be spent in reading the question paper.
 3. The time given at the head of this paper is the time allowed for writing the answers.
 4. This question paper is divided into two Sections.
Attempt all questions from Section A and any four questions from Section B.
 5. Intended marks for questions or parts of questions are given in brackets along the questions.
 6. All working, including rough work, must be clearly shown and should be done on the same sheet as the rest of the answer. Omission of essential working will result in loss of marks.
 7. Mathematical tables are provided.
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SECTION – A (40 Marks)

*(Answer **all** questions from this Section)*

Q. 1.

- (a) Express $0.\overline{001}$ as a fraction in the simplest form. [3]
- (b) Find the median of the following set of numbers: [3]
10, 75, 3, 81, 18, 27, 4, 48, 12, 47, 9, 15
- (c) If the side of a square is $\frac{1}{2}(x+1)$ and its diagonal is $\frac{3-x}{\sqrt{2}}$ units. Find the length of the side of the square. [4]

Q. 2.

- (a) Two concentric circles are of radii 6.5 cm and 2.5 cm. Find the length of the chord of the larger circle which touches the smaller circle. [3]
- (b) Show that the following points A(8, 2), B(5, -3) and C(0, 0) are the vertices of an isosceles triangle. [3]
- (c) If $\sin \theta = \frac{x}{y}$, find the value of $\cos \theta \times \tan \theta$ in terms of x and y. [4]

Q. 3.

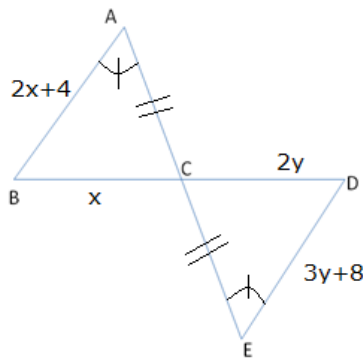
(a) Factorise: $a^2 + b^2 - c^2 - 2ab$ [3]

(b) Prove that : $9^{\log 4} = 16^{\log 3}$ [4]

(c) If $p^{\frac{1}{x}} = p^{\frac{1}{y}} = p^{\frac{1}{z}}$ and $pqr = 1$, prove that $x + y + z = 0$ [3]

Q. 4.

(a) In the following figure, find the value of x and y . [3]



(b) The amount at compound interest which is calculated yearly on a certain sum of money is Rs. 1250 in one year and Rs. 1375 in two years. Calculate the rate of interest. [3]

(c) Construct a rhombus ABCD, given diagonal $AC = 6.0$ cm and height = 3.5 cm. [4]

SECTION – B (40 Marks)

(Answer **any four questions** from this Section)

Q. 5.

(a) Use graph paper for this question:

- i. Draw the graph of $3x - y - 2 = 0$ and $2x + y - 8 = 0$. Take 1 cm = 1 unit on both the axes and plot only three points per line.
- ii. Write down the co-ordinates of the point of intersection. [6]

(b) In the parallelogram ABCD, M is the midpoint of AC, X and Y are points on AB and DC respectively such that $AX = CY$. Prove that

(a) $\triangle AXM$ is congruent to $\triangle CYM$

(b) XMY is a straight line [4]

Q. 6.

(a) In a river, a boat covers 8 km in 40 min while travelling downstream, but takes 60 min for the return journey. If the speed of the boat and the flow of the river are uniform, find the speed of the boat in still water and speed of the stream. [4]

(b) Hamid built a cubical water tank lid for his house, with each outer edge 1.5 m long. He gets the outer surface area of the tank excluding the base covered with square tiles of sides 25 cm. How much will he spend on the tiles, if the cost of the tiles is Rs. 360 per dozen? [3]

(c) Solve: $3p - 2q = 5$, $q - 1 = 3p$ [3]

Q. 7.

(a) If $A = 60^\circ$ and $B = 30^\circ$, verify that [3]

$$\tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

(b) The dimensions of a rectangular field are $120 \text{ m} \times 70 \text{ m}$. The field is to be changed into a garden, leaving a path way of 5 m width around the garden. Find the expenses that are met when the cost per square meter is Rs. 10. [3]

(c) In a rectangle PQRS, prove that $PR^2 + QS^2 = PQ^2 + QR^2 + RS^2 + SP^2$ [4]

Q. 8.

(a) Two chords AB and CD of lengths 5 cm and 11 cm respectively of a circle are parallel to each other, and are on opposite sides of its centre. If the distance between AB and CD is 6 cm, then find the radius of the circle.

(b) If $p + q = 1 + pq$, prove that $p^3 + q^3 = 1 + p^3q^3$ [3]

(c) Construct a histogram of the frequency distribution given below: [4]

Marks obtained	No. of students
Below 15	20
Below 30	35
Below 45	40
Below 60	55
Below 75	65
Below 90	70

Q. 9.

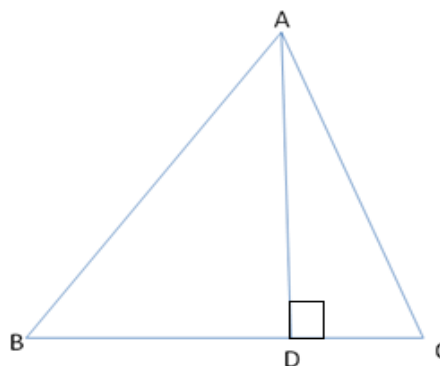
(a) In the given figure, $AD \perp BC$. Prove that

i. $AB > BD$

ii. $AC > CD$

iii. $AB + AC > BC$

[3]

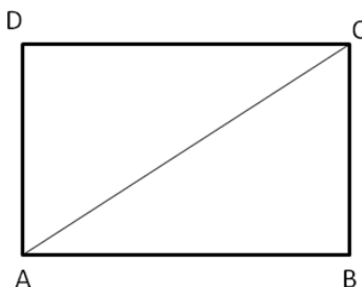


(b) If $\frac{9^n \times 3^2 \times (3^{-n/2})^{-2} - (27)^n}{3^{3m} \times 2^3} = \frac{1}{27}$, prove that $m - n = 1$ [3]

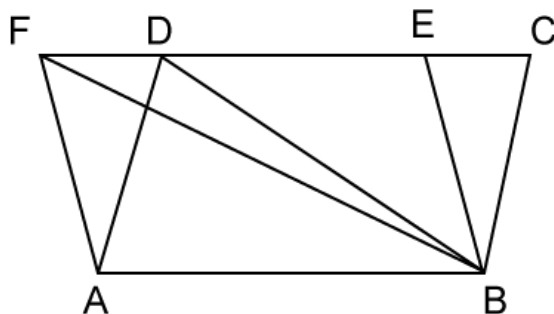
(c) If $x = 30^\circ$, verify that $\tan 2x = \frac{2 \tan x}{1 - \tan^2 x}$ [3]

Q. 10.

- (a) In rectangle ABCD; AB = 15cm and $m\angle BAC = 30^\circ$. Find the length of the BC. [3]



- (b) In the given figure, area of $\parallel\text{gm ABCD}$ is 80 cm^2 . Find (i) $\text{ar}(\parallel\text{gm ABEF})$ (ii) $\text{ar}(\triangle ABD)$ and (iii) $\text{ar}(\triangle BEF)$.



- (c) Two alternate sides of a regular polygon, when produced, meet at right angles. [4]
Find:
i. Each external angle
ii. The number of sides

Q. 11.

(a) Find x: $\sqrt[3]{\frac{p}{q}} = \left(\frac{p}{q}\right)^{3-4x}$ [3]

- (b) If $a + b = 1$ and $a - b = 7$, find the values of [3]
(1) $5(a^2 + b^2)$
(2) a

- (c) In $\triangle AOB$, $A = (0, 4)$, $O = (0, 0)$ and $B = (3, 0)$. By plotting these points on a graph paper, find the area of $\triangle AOB$. [4]

Solution

Time: 2½ hrs

Total Marks: 80

SECTION - A

Q. 1.

(a) Let $x = 0.\overline{001}$

Then, $x = 0.001001001 \dots$ (i)

Therefore, $1000x = 1.001001001 \dots$ (ii)

Subtracting (i) from (ii), we get $999x = 1 \Rightarrow x = \frac{1}{999}$

Hence, $0.\overline{001} = \frac{1}{999}$

(b) On arranging the numbers in ascending order, we get

3, 4, 9, 10, 12, 15, 18, 27, 47, 48, 75, 81

$n = 12$ (even)

$$\begin{aligned}\text{Median} &= \frac{\frac{n}{2}^{\text{th}} \text{ term} + \left(\frac{n}{2} + 1\right)^{\text{th}} \text{ term}}{2} \\ &= \frac{\frac{12}{2}^{\text{th}} \text{ term} + \left(\frac{12}{2} + 1\right)^{\text{th}} \text{ term}}{2} \\ &= \frac{6^{\text{th}} \text{ term} + 7^{\text{th}} \text{ term}}{2} \\ &= \frac{15 + 18}{2} \\ &= 16.5\end{aligned}$$

(c) Given, side of the square = $\left(\frac{x+1}{2}\right)$ units

And diagonal = $\frac{3-x}{\sqrt{2}}$ units = $\sqrt{2}$ side

$$\Rightarrow \frac{3-x}{\sqrt{2}} = \sqrt{2} \left(\frac{x+1}{2}\right)$$

$$\Rightarrow 3-x = x+1$$

$$\Rightarrow 2x = 2 \Rightarrow x = 1$$

$$\therefore \text{length of side} = \frac{x+1}{2} = \frac{1+1}{2} = 1 \text{ unit}$$

Q. 2.

(a)

Since AB is a tangent to the inner circle.

$\angle ODB = 90^\circ$ (tangent is $\perp$ to the radius of a circle)

AB is a chord of the outer circle.

We know that, the perpendicular drawn from the centre to a chord of a circle, bisects the chord.

$$\Rightarrow AB = 2DB$$

In $\triangle ODB$,

By Pythagoras theorem,

$$OB^2 = OD^2 + DB^2$$

$$\Rightarrow 6.5^2 = 2.5^2 + DB^2$$

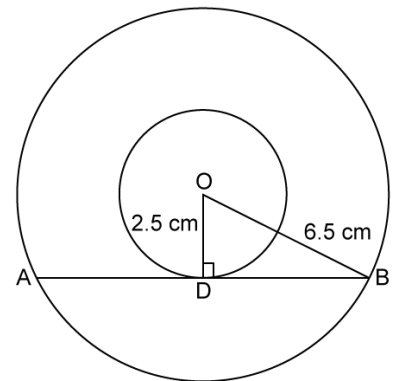
$$\Rightarrow DB^2 = 6.5^2 - 2.5^2$$

$$\Rightarrow DB^2 = 42.25 - 6.25$$

$$\Rightarrow DB^2 = 36 \text{ cm}$$

$$\Rightarrow DB = 6 \text{ cm}$$

$$AB = 2DB = 2(6) = 12 \text{ cm}$$



(b) Given points are A(8, 2), B(5, -3) and C(0, 0).

Using the distance formula, we get,

$$AC = \sqrt{(8-0)^2 + (2-0)^2} = \sqrt{68}$$

$$BC = \sqrt{(5-0)^2 + (-3-0)^2} = \sqrt{34}$$

$$AB = \sqrt{(5-8)^2 + (-3-2)^2} = \sqrt{34}$$

Since, $BC = AB$, $\triangle ABC$ is an isosceles triangle.

(c) By Pythagoras theorem

$$y^2 = x^2 + (\text{Base})^2$$

$$\Rightarrow (\text{Base})^2 = y^2 - x^2$$

$$\Rightarrow \text{Base} = \sqrt{y^2 - x^2}$$

$$\therefore \cos \theta = \frac{\sqrt{y^2 - x^2}}{y}, \tan \theta = \frac{x}{\sqrt{y^2 - x^2}}$$

$$\cos \theta \times \tan \theta = \frac{\sqrt{y^2 - x^2}}{y} \times \frac{x}{\sqrt{y^2 - x^2}} = \frac{x}{y}$$

Q. 3

$$\begin{aligned}
 \text{(a) } a^2 + b^2 - c^2 - 2ab &= a^2 + b^2 - 2ab - c^2 \\
 &= (a-b)^2 - (c)^2 \\
 &= (a-b+c)(a-b-c)
 \end{aligned}$$

(b)

$$\text{Let } x = 9^{\log 4}, y = 16^{\log 3}$$

$$\log x = \log 9^{\log 4}$$

$$\log x = \log 4 \cdot \log 9 \quad \dots (1)$$

$$\log y = 16^{\log 3}$$

$$\Rightarrow \log y = \log 3 \cdot \log 16 = \log 3 \cdot \log 4^2$$

$$\Rightarrow \log y = 2 \log 3 \cdot \log 4$$

$$\Rightarrow \log y = \log 9 \cdot \log 4 \quad \dots (2)$$

$$\Rightarrow \log x = \log y \quad [\text{From (1) and (2)}]$$

$$\text{Hence } x = y$$

(c)

$$\begin{aligned}
 &\left(\frac{81}{16}\right)^{-3/4} \times \left[\left(\frac{25}{9}\right)^{-3/2} \div \left(\frac{5}{2}\right)^{-3}\right] \\
 &= \left(\frac{3^4}{2^4}\right)^{-3/4} \times \left[\left(\frac{5^2}{3^2}\right)^{-3/2} \div \left(\frac{5}{2}\right)^{-3}\right] \\
 &= \left(\frac{3}{2}\right)^{4 \times -3/4} \times \left[\left(\frac{5}{3}\right)^{2 \times -3/2} \div \left(\frac{5}{2}\right)^{-3}\right] \\
 &= \left(\frac{3}{2}\right)^{-3} \times \left[\left(\frac{5}{3}\right)^{-3} \div \left(\frac{5}{2}\right)^{-3}\right] \\
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 &= \left(\frac{3}{2}\right)^{-3} \times \left(\frac{2}{3}\right)^{-3} \\
 &= \left(\frac{3}{2} \times \frac{2}{3}\right)^{-3} \\
 &= (1)^{-3} \\
 &= 1
 \end{aligned}$$

Q. 4.

(a) In $\triangle ABC$ and $\triangle CDE$

$$\angle BAC = \angle CED \quad [\text{Given}]$$

$$AC = EC \quad [\text{Given}]$$

$$\angle ACB = \angle DCE \quad [\text{Vertically opposite } \angle\text{s}]$$

Hence $\triangle ACB \cong \triangle ECD$ [$\because$ ASS – condition of congruency is satisfied]

$$\therefore AB = ED \quad [\text{CPCT}]$$

$$\text{Then, } 2x + 4 = 3y + 8$$

$$2x - 3y = 4 \quad \dots(1)$$

$$\text{Also, } BC = CD$$

$$x = 2y$$

$$x - 2y = 0 \quad \dots(2)$$

Solving (1) and (2), we get

$$x = 8 \text{ and } y = 4$$

(b) Amount at the end of first year = Principal for second year

$$P = \text{Rs. } 1250, A = \text{Rs. } 1375, n = 1, \text{ rate} = r\%$$

$$1375 = 1250 \left(1 + \frac{r}{100} \right)^1$$

$$\frac{1375}{1250} = \frac{100 + r}{100}$$

$$\Rightarrow 125000 + 1250r = 137500$$

$$\Rightarrow 1250r = 137500 - 125000$$

$$\Rightarrow 1250r = 12500 \Rightarrow r = \frac{12500}{1250} = 10\%$$

(c) Steps of construction:

1) Draw a line AP.

2) Now draw $AC = 6 \text{ cm}$ and $CP = 3.5 \text{ cm}$

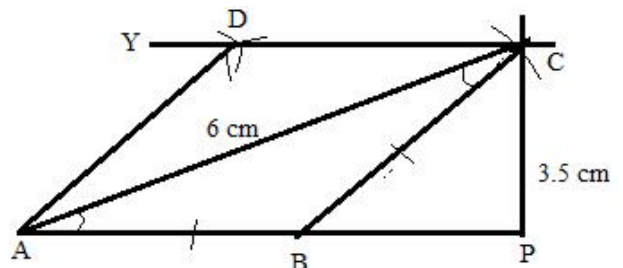
3) Draw a line BC such that $AB = BC$.

4) Now at C draw a line CY parallel to AP.

5) At point C and A, taking radius same as AB draw arcs cutting each other at D.

6) Now join AD.

ABCD is the required rhombus.



SECTION - B

Q. 5.

(a) (i) $3x - y - 2 = 0$

$$\Rightarrow y = 3x - 2$$

Taking convenient value of x

x	0	2	3
y	-2	4	7

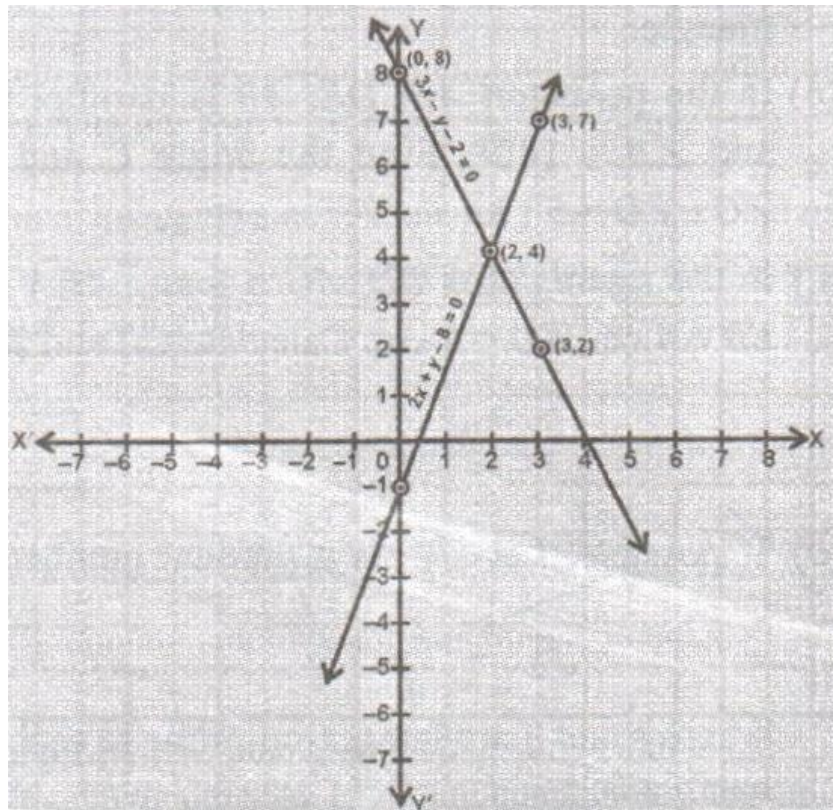
$$2x + y - 8 = 0$$

$$y = 8 - 2x$$

Taking convenient value of x

x	0	2	3
y	8	4	2

Now plot these points on the graph paper,



(ii) The coordinates of the point of intersection are (2, 4).

(b) Given: ABCD is a parallelogram, M is the midpoint of AC, X and Y are points on AB and DC respectively such that $AX = CY$.

To prove: (a) $\triangle AXM \cong \triangle CYM$ (b) XMY is a straight line

Construction: Join XM and MY

Proof:

(a) In $\triangle s$ AMX and CMY

$$AM = MC \text{ [Given]}$$

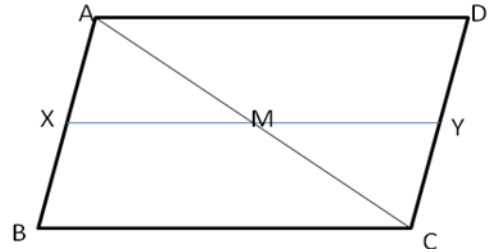
$$AX = CY \text{ [Given]}$$

$$\angle XAM = \angle YCM \text{ [Alternate angles]}$$

$$\text{So, } \triangle AXM \cong \triangle CYM \text{ [SAS]}$$

(b) $\angle AMX = \angle CMY$ [Vertically opposite angles]

$\therefore$ XMY is a straight line.



Q. 6.

(a) Let the speed of boat in still water be = x kmph

And speed of the stream = y kmph

Speed of boat upstream = $(x - y)$ kmph

Speed of boat downstream = $(x + y)$ kmph

$$\text{Time taken for upstream journey} = \frac{8}{x - y}$$

$$\text{Time taken for downstream journey} = \frac{8}{x + y}$$

$$\text{As per the problem, } \frac{8}{x - y} = 1 \text{ hr}$$

$$x - y = 8 \quad \dots(1)$$

Also,

$$\frac{8}{x + y} = \frac{40}{60} = \frac{2}{3}$$

$$x + y = 12 \quad \dots(2)$$

Solving (1) and (2) we get

$$x = 10 \text{ kmph; } y = 2 \text{ kmph}$$

(b) Edge of the cubical tank = 1.5 m = 150 cm

Surface area of the tank = $5 \times 150 \times 150 \text{ cm}^2$

Area of each square tile = side $\times$ side = $25 \times 25 \text{ cm}^2$

$\therefore$ Number of tiles required = $\frac{\text{Surface area of the tank}}{\text{area of each tile}} = \frac{5 \times 150 \times 150}{25 \times 25} = 180$

Cost of 1 dozen tiles, i.e. cost of 12 tiles = Rs. 360

Cost of one tile = Rs. $\frac{360}{12}$ = Rs. 30

Thus, the cost of 180 tiles = 180×30 = Rs. 5400

(c) $3p - 2q = 5$ (1)

$q - 1 = 3p$ (2)

From equation (2),

$$p = \frac{q-1}{3}$$

Substituting the value of p in equation (1), we get

$$3\left(\frac{q-1}{3}\right) - 2q = 5$$

$$\Rightarrow q - 1 - 2q = 5$$

$$\Rightarrow -q = 5 + 1$$

$$\Rightarrow q = -6$$

Substituting the value of q in equation (2) we get,

$$\Rightarrow q - 1 = 3p$$

$$\Rightarrow -6 - 1 = 3p$$

$$\Rightarrow -7 = 3p$$

$$\Rightarrow p = -\frac{7}{3}$$

$$\Rightarrow p = -\frac{7}{3}, q = -6$$

Q. 7.

(a)

$$A = 60^\circ \text{ and } B = 30^\circ$$

$$\Rightarrow A - B = 60^\circ - 30^\circ = 30^\circ$$

$$\therefore \tan(A - B) = \tan 30^\circ = \frac{1}{\sqrt{3}}$$

$$\text{And, } \frac{\tan A - \tan B}{1 + \tan A \tan B} = \frac{\tan 60^\circ - \tan 30^\circ}{1 + \tan 60^\circ \tan 30^\circ}$$

$$= \frac{\sqrt{3} - \frac{1}{\sqrt{3}}}{1 + \sqrt{3} \times \frac{1}{\sqrt{3}}}$$

$$= \frac{\frac{2}{\sqrt{3}}}{2}$$

$$= \frac{1}{\sqrt{3}}$$

$$\therefore \tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

(b) Length of garden = $120 - 2 \times 5$ and breadth = $70 - 2 \times 5$

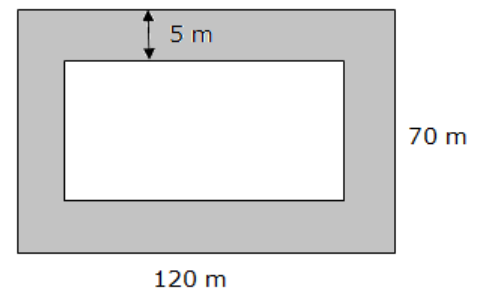
$$\Rightarrow l = 110 \text{ m, } b = 60 \text{ m}$$

$$\text{Area of garden} = l \times b = 110 \times 60 = 6600 \text{ m}^2$$

Given, rate = Rs. 10/m²

$$\therefore \text{Cost} = \text{Area} \times \text{rate}$$

$$\text{Cost} = \text{Rs. } 66000$$



(c) Given: A rectangle PQRS

$$\text{To prove: } PR^2 + QS^2 = PQ^2 + QR^2 + RS^2 + SP^2$$

Proof: In $\triangle PSR$

$$PR^2 = PS^2 + SR^2 \quad \dots(1) \quad [\text{Pythagoras theorem}]$$

In $\triangle QRS$,

$$QS^2 = QR^2 + RS^2 \quad \dots(2)$$

Adding (1) and (2), we get

$$PR^2 + QS^2 = PS^2 + SR^2 + QR^2 + RS^2$$

$$= RS^2 + QR^2 + PS^2 + PQ^2 [\because RS = PQ]$$

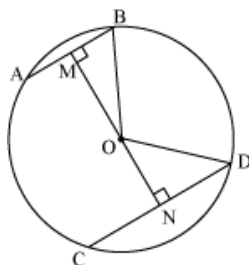
$$PR^2 + QS^2 = PQ^2 + QR^2 + RS^2 + SP^2$$

$$= RS^2 + QR^2 + PS^2 + PQ^2 [\because RS = PQ]$$

$$\therefore PR^2 + QS^2 = PQ^2 + QR^2 + RS^2 + SP^2$$

Q. 8.

(a) Construction: Draw $OM \perp AB$ and $ON \perp CD$. Join OB and OD .



$$BM = \frac{AB}{2} = \frac{5}{2} \text{ and } ND = \frac{CD}{2} = \frac{11}{2} \text{ (Perpendicular from centre bisects the chord)}$$

Let ON be x , so OM will be $6 - x$.

$$\text{In } \triangle OMB, OM^2 + MB^2 = OB^2$$

$$\therefore (6 - x)^2 + \left(\frac{5}{2}\right)^2 = OB^2$$

$$\therefore 36 + x^2 - 12x + \frac{25}{4} = OB^2 \quad \dots(1)$$

$$\text{In } \triangle OND, ON^2 + ND^2 = OD^2$$

$$\therefore OD^2 = x^2 + \left(\frac{11}{2}\right)^2 = x^2 + \frac{121}{4} \quad \dots(2)$$

We have $OB = OD$ $\dots(\text{radii of same circle})$

$$36 + x^2 - 12x + \frac{25}{4} = x^2 + \frac{121}{4} \text{ [From (1) and (2)]}$$

$$\therefore 12x = 36 + \frac{25}{4} - \frac{121}{4} = \frac{144 + 25 - 121}{4} = \frac{48}{4} = 12$$

$$\therefore 12x = 12 \Rightarrow x = 1$$

From equation (2),

$$OD^2 = (1)^2 + \left(\frac{121}{4}\right) = 1 + \frac{121}{4} = \frac{125}{4} \Rightarrow OD = \frac{5}{2}\sqrt{5}$$

Hence, the radius of the circle is $\frac{5}{2}\sqrt{5}$ cm.

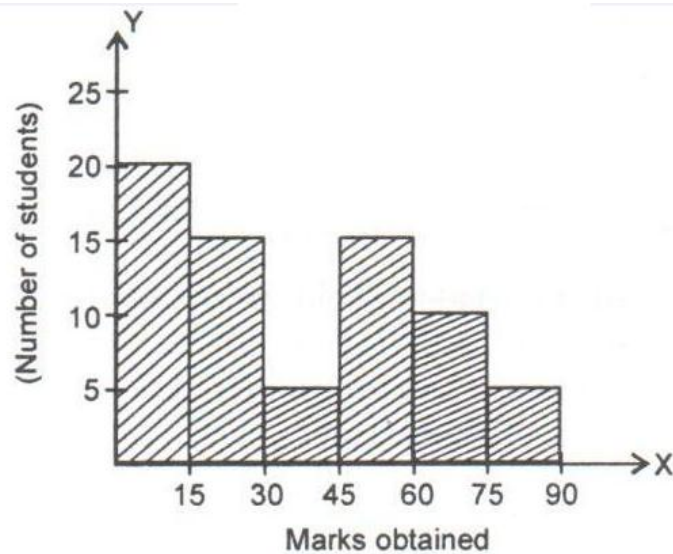
(b) We know,

$$\begin{aligned} p^3 + q^3 &= (p + q)^3 - 3pq(p + q) \\ &= (1 + pq)^3 - 3pq(1 + pq) \\ &= (1 + pq)^3 - 3pq(1 + pq) \\ &= 1 + p^3q^3 + 3pq(1 + pq) - 3pq(1 + pq) \\ &= 1 + p^3q^3 \end{aligned}$$

$$\text{Hence, } p^3 + q^3 = 1 + p^3q^3$$

(c) Rewriting we get the continuous frequency distribution as following:

C.I	Frequency (No. of students)
Below 15	20
15 – 30	$35 - 20 = 15$
30 – 45	$40 - 35 = 5$
45 – 60	$55 - 40 = 15$
60 – 75	$65 - 55 = 10$
75 - 90	$70 - 65 = 5$



Q. 9.

(a) Given: $AD \perp BC$

To prove:

$$AB > BD$$

$$AC > CD$$

$$AB + AC > BC$$

Proof: In $\triangle ABD$, $\angle ADB$ is the greatest angle
[There can be only one right angle]

i. So, the side opposite to $\angle ADB$ in $\triangle ABD$ is greatest

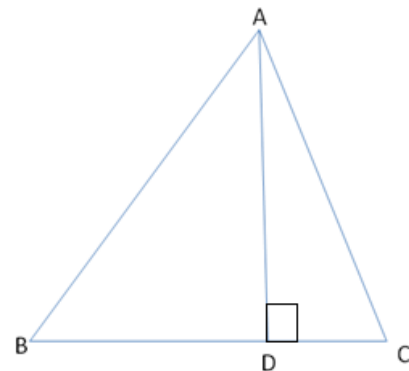
$$\text{i.e., } AB > BD \quad \dots(1)$$

ii. Similarly, $\angle ADC$ is the greatest angle in $\triangle ADC$

$$\text{So, } AC > CD \quad [\angle ADC = 90^\circ] \dots(2)$$

iii. On adding (1) and (2), we get $AB + AC > BD + CD$

$$AB + AC > BC$$



(b) We have,

$$\begin{aligned}
 & \frac{9^n \times 3^2 \times (3^{-n/2})^{-2} - (27)^n}{3^{3m} \times 2^3} = \frac{1}{27} \\
 \Rightarrow & \frac{(3^2)^n \times 3^2 \times 3^{2n/2} - (3^3)^n}{3^{3m} \times 2^3} = \frac{1}{27} \\
 \Rightarrow & \frac{3^{2n} \times 3^2 \times 3^n - 3^{3n}}{3^{3m} \times 2^3} = \frac{1}{27} \\
 \Rightarrow & \frac{3^{2n+2+n} - 3^{3n}}{3^{3m} \times 2^3} = \frac{1}{27} \\
 \Rightarrow & \frac{3^{3n+2} - 3^{3n}}{3^{3m} \times 2^3} = \frac{1}{27} \\
 \Rightarrow & \frac{3^{3n}(3^2 - 1)}{3^{3m} \times 2^3} = \frac{1}{27} \\
 \Rightarrow & \frac{3^{3n} \times 8}{3^{3m} \times 8} = \frac{1}{27} \\
 \Rightarrow & 3^{3n-3m} = 3^{-3} \quad [\text{on equating the exponents}] \\
 \Rightarrow & 3n - 3m = -3 \Rightarrow n - m = -1 \Rightarrow m - n = 1
 \end{aligned}$$

(c) We have,

$$\begin{aligned}
 x &= 30^\circ \Rightarrow 2x = 60^\circ \\
 \therefore \tan 2x &= \tan 60^\circ = \sqrt{3} \\
 \text{And, } \frac{2 \tan x}{1 - \tan^2 x} &= \frac{2 \tan 30^\circ}{1 - \tan^2 30^\circ} \\
 &= \frac{2 \times \frac{1}{\sqrt{3}}}{1 - \left(\frac{1}{\sqrt{3}}\right)^2} \\
 &= \frac{2/\sqrt{3}}{1 - \frac{1}{3}} = \frac{2/\sqrt{3}}{2/3} \\
 &= \frac{2}{\sqrt{3}} \times \frac{3}{2} \\
 &= \sqrt{3} \\
 \therefore \tan 2x &= \frac{2 \tan x}{1 - \tan^2 x}
 \end{aligned}$$

Q. 10.

(a) In $\triangle ABC$, $\tan 30^\circ = \frac{BC}{AB}$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{BC}{15}$$

$$\Rightarrow BC = \frac{AB}{\sqrt{3}} = \frac{15}{\sqrt{3}} = \frac{15\sqrt{3}}{\sqrt{3}} = 5\sqrt{3} \text{ cm}$$

(b)

(i) Given that ABCD is a parallelogram.

So, $AB \parallel DE$. That is, $AB \parallel FE$.

Since the parallelograms have the same base AB, and the height on base AB is equal, the areas of $\parallel\text{gm ABCD}$ and $\parallel\text{gm ABEF}$ will be equal.

$$\text{Hence, } \text{ar}(\parallel\text{gm ABEF}) = \text{ar}(\parallel\text{gm ABCD}) = 80 \text{ cm}^2$$

(ii) We know that the diagonal of a parallelogram, divides the parallelogram into two triangles with equal areas.

$$\text{So, } \text{ar}(\triangle ABD) = \frac{1}{2} \text{ar}(\parallel\text{gm ABCD}) = \frac{1}{2}(80) = 40 \text{ cm}^2$$

(iii) Similarly,

$$\text{ar}(\triangle BEF) = \frac{1}{2} \text{ar}(\parallel\text{gm ABEF}) = \frac{1}{2}(80) = 40 \text{ cm}^2$$

(c) ABCD be a regular polygon

BC and ED when produced meet at P such that $\angle CPD = 90^\circ$

$$\angle CPD = 90^\circ$$

$$\text{Let } \angle BCD = x^\circ$$

$$\text{So, } \angle CDE = x^\circ$$

$$\angle PCD = 180 - x$$

$$\angle PDC = 180 - x$$

In $\triangle CPD$,

$$180^\circ - x^\circ + 180^\circ - x^\circ + 90^\circ = 180^\circ \quad [\text{Sum of all } \angle\text{s of a } \triangle]$$

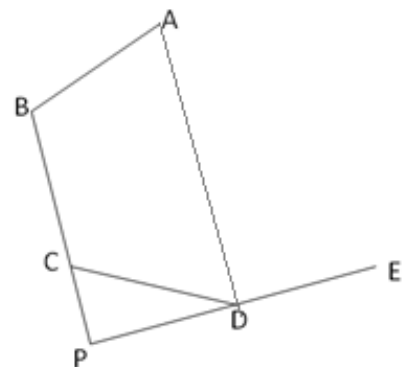
$$270^\circ - 2x^\circ = 0$$

$$2x^\circ = 270^\circ$$

$$x^\circ = 135^\circ$$

$$\text{Each external angle} = 180^\circ - x^\circ = 180 - 135 = 45^\circ$$

$$\text{No. of sides} = \frac{360^\circ}{45^\circ} = 8$$



Q. 11.

(a)

$$\sqrt[3]{\frac{p}{q}} = \left(\frac{p}{q}\right)^{3-4x} = \left(\frac{p}{q}\right)^{4x-3}$$

$$\Rightarrow \left(\frac{p}{q}\right)^{1/3} = \left(\frac{p}{q}\right)^{-3+4x}$$

$$\Rightarrow \frac{1}{3} = -3 + 4x$$

$$\Rightarrow 4x = 3 + \frac{1}{3}$$

$$\Rightarrow 4x = \frac{10}{3}$$

$$\Rightarrow x = \frac{10}{12}$$

$$\Rightarrow x = \frac{5}{6}$$

(b) $a + b = 1$, $a - b = 7$

$$(a + b)^2 - (a - b)^2 = 4ab$$

$$\Rightarrow 1^2 - 7^2 = 4ab$$

$$\Rightarrow 1 - 49 = 4ab$$

$$\Rightarrow 4ab = -48$$

$$\Rightarrow ab = -12 \quad \dots(1)$$

Now, we know that

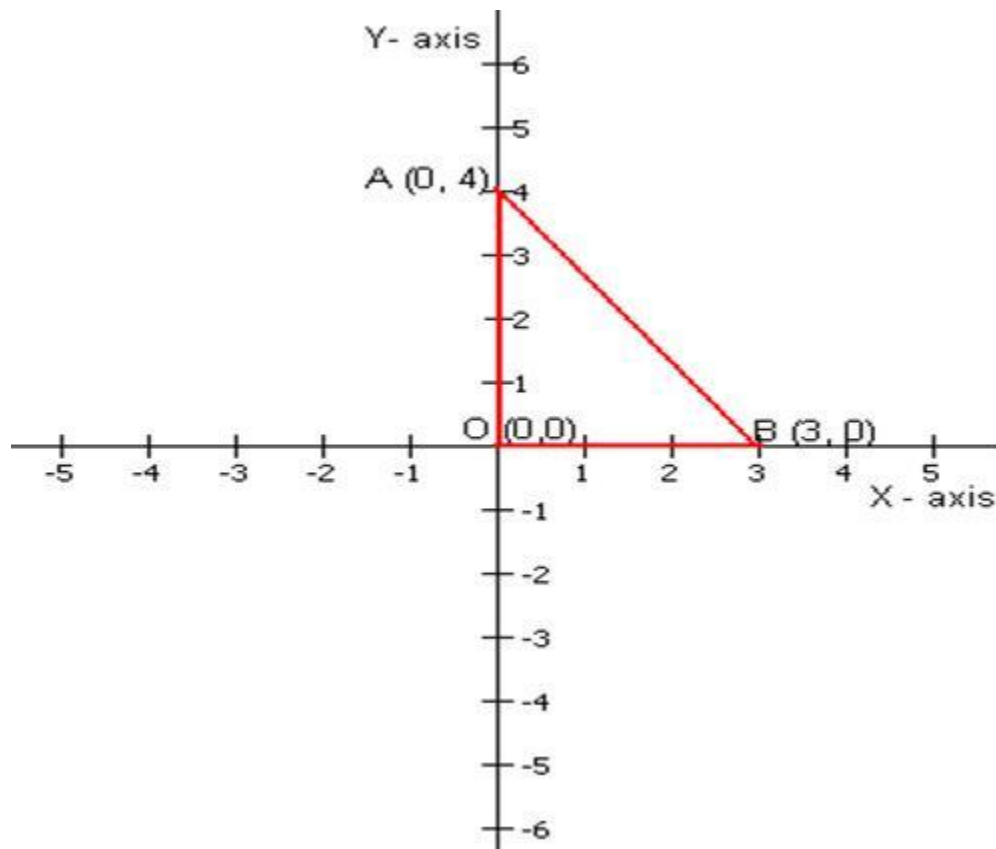
$$a^2 + b^2 = (a + b)^2 - 2ab = 1^2 - 2 \times (-12)$$

$$\Rightarrow a^2 + b^2 = 1 + 24 = 25$$

$$(1) \quad 5(a^2 + b^2) = 25 \times 5 = 125$$

$$(2) \quad ab = -12 \quad [\text{using equation (1)}]$$

(c) The given points A(0, 4), O(0, 0), B(3, 0) can be plotted as follows:



Clearly, AOB is a right-angled triangle.

OA = 4 units, OB = 3 units.

$$\begin{aligned}\text{Area of } \triangle AOB &= \frac{1}{2} \times \text{Base} \times \text{Height} \\ &= \frac{1}{2} \times 3 \times 4 \\ &= 6 \text{ square units}\end{aligned}$$