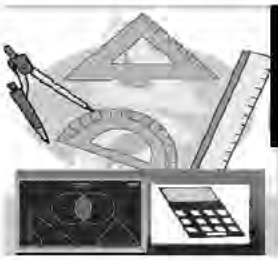
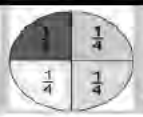
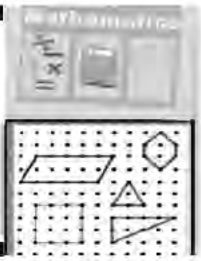


Unit
5

TRIGONOMETRY





Points to Remember

- For triangles with the same set of angles, the ratio of the lengths of the sides is the same.
- The angles of a triangle determines the ratio of the sides. The perpendicular sides of a right triangle with angles 45°, 45°, 90° are equal. To find the length of the hypotenuse, multiply the perpendicular side by $\sqrt{2}$.

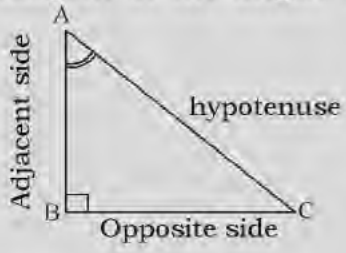
  (Ratio of the sides of this triangle is $1 : 1 : \sqrt{2}$)

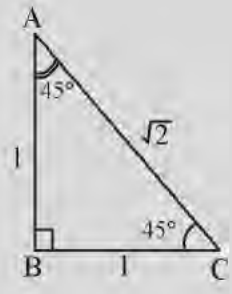
  In a right angled triangle with angles 30°, 60°, 90°, hypotenuse will be two times the length of the side opposite to 30° angle. Also the length of the side opposite to 60° angle will be $\sqrt{3}$ times the length of the side opposite to 30° angle.

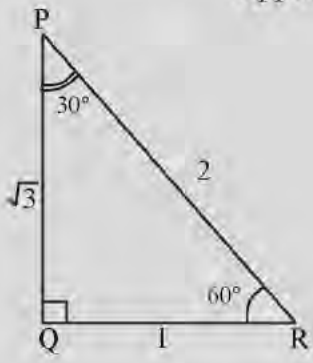
  (Ratio of the sides of this triangle is $1 : \sqrt{3} : 2$)
- In all right triangles with the same angles, the number got by dividing the opposite side of an acute angle by the hypotenuse is the same. It is called the sine of the angle. It is shortened as sin.
- The number got by dividing the adjacent side of an acute angle (Shorter of the two sides containing the angle) by the hypotenuse is also the same. It is called the cosine of the angle. It is shortened as 'cos'.
- The number got by dividing the opposite side of an angle by the adjacent side will be same number. It is called the tangent of the angle. It is shortened as 'tan'.

$$\sin A = \frac{BC}{AC} \qquad \cos A = \frac{AB}{AC}$$

$$\tan A = \frac{BC}{AB}$$



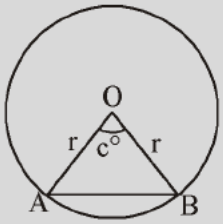




	30°	45°	60°
sin	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$
cos	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$
tan	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$

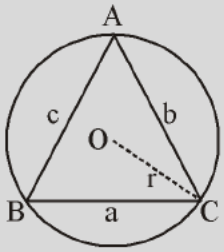
- In a circle, the length of a chord is double the product of the sine of half the central angle and the radius.

  In a circle of radius 'r', the length of the chord with central angle c is $2r \text{ Sin } \left(\frac{c}{2}\right)$

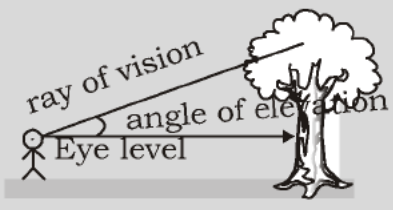


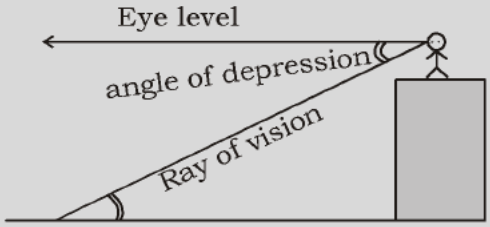
- In any triangle, the ratio of the sides is equal to the ratio of the sines of the angles opposite them.
- The length of the sides of a triangle are the sines of its angles opposite to that side, multiplied by the diameter of its circumcircle. If any angle is greater than the right angle the sine of its supplementary angle should be taken. If the angle is 90° the opposite side is equal to the circum diameter.
- To find the circum diameter, divide the length of one side of a triangle by sine of angle opposite to that side.

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = 2r$$

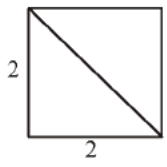
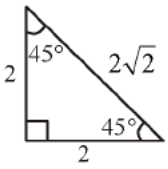
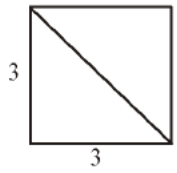
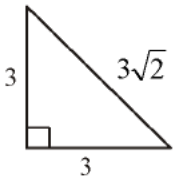
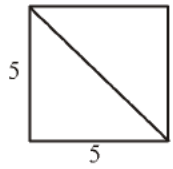
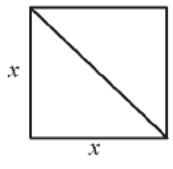
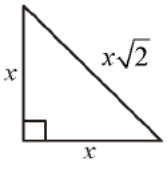


- Heights and distances which cannot be directly measured can be computed using trigonometric ratios.



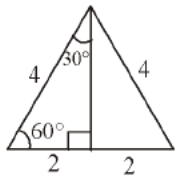
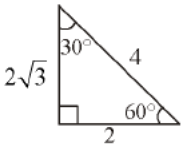
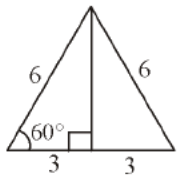
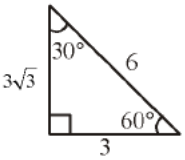
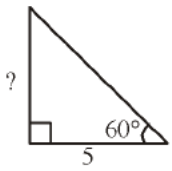
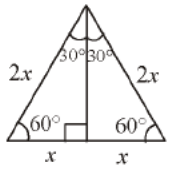
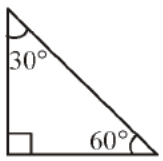


Worksheet 1

Square	Length of diagonal $d = a\sqrt{2}$	Isosceles triangle	Length of sides			Ratio of Sides
			Opposite to 45°	Opposite to 45°	Opposite to 90°	
	$d = 2\sqrt{2}$		2	2	2	$2:2:\sqrt{2} = 1:1:\sqrt{2}$
	$d = 3\sqrt{2}$		—	—	$3\sqrt{2}$	— : — : — = — : — : —
	d = —	———	———	———	———	— : — : — = — : — : —
	$d = x\sqrt{2}$		———	———	———	$x : x : x\sqrt{2}$ = — : — : —

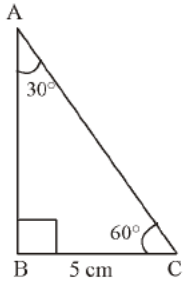
Worksheet 2

Complete the following table.

Equilateral triangle	altitude $h=\frac{a\sqrt{3}}{2}$	Triangle	Length of sides			Ratio of Sides
			Opposite to 30°	Opposite to 60°	Opposite to 90°	
	$h=2\sqrt{3}$		2	$2\sqrt{3}$	4	$2:2\sqrt{3}:4$ $=1:\sqrt{3}:1$
	$h=3\sqrt{3}$		———	———		—:—:— =—:—:—
———	h = ——		———	———	———	—:—:— =—:—:—
	h = ——		———	———	———	$x:\sqrt{3}\,x:2x$ =—:—:—

Worksheet 3

Angles of ΔABC are 30°, 60°, 90°. Calculate the perimeter of the triangle.



Ratio of sides of ΔABC ☐ : ☐ : ☐

Length of the side BC opposite to 30° = ☐

Length of the side AB opposite to 60° = ☐

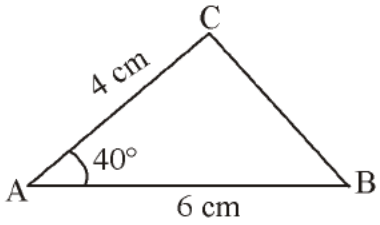
Length of the side AC opposite to 90° = ☐

Perimeter of ΔABC = ☐ + ☐ + ☐

= ☐ + ☐ cm

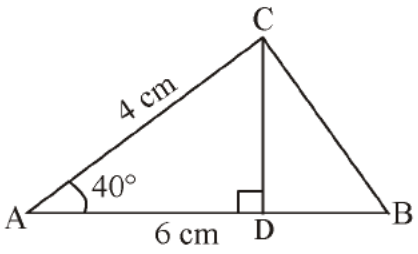
Worksheet 4

i. Find the area of the triangle (Sin 40^0=0.64 Cos40^0 = 0.76)



Draw CD perpendicular to AB.

How to find the length of CD



In the triangle ADC $\angle CAD$ = ☐

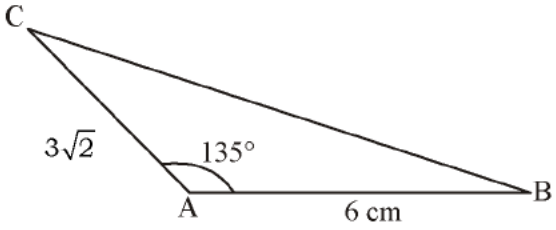
hypotenuse AC = ☐ cm

In right. triangle ADC, Sin 40 = $\frac{CD}{☐}$

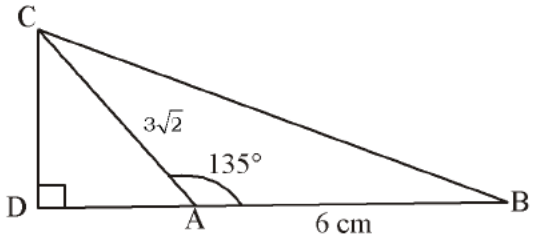
CD = ☐ × ☐ = ☐ cm

Area of Δ ABC = $\frac{1}{2}$ × ☐ × ☐ = ☐ cm^2

ii. Find the area of the triangle.



Extend the line AB backwards.



Draw CD Perpendicular to the extended line AB.

Hypotenuse, AC = ☐cm

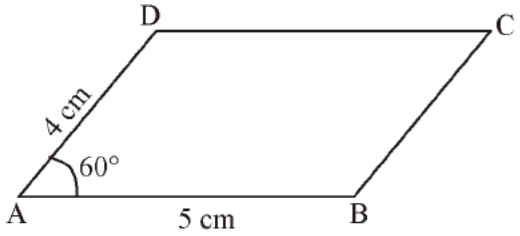
In right angled triangle CDA, ∠CAD = ☐ – ☐ = ☐

In right angled triangle CDA, Sin 45 = $\frac{\square}{\square}$

∴ CD = ☐ cm.

Area of ΔABC = $\frac{1}{2}$ × ☐ × ☐ = ☐ cm^2.

Worksheet 5

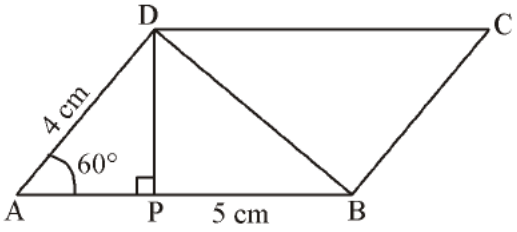


In the parallelogram ABCD, AB = 5 cm, AD = 4 cm, ∠A = 60°

(a) Find the perpendicular distance from D to AB?

(b) Find the area of ABCD?

(c) Find the length of the diagonal BD?



Angles of triangle ΔAPD are 30°, 60°, 90°

PD = $2\sqrt{3}$ cm

Area of ParallelogramABCD = ☐ × ☐ = ☐ cm^2

AP = ☐

BP = AB – Ap

□ – □ = □

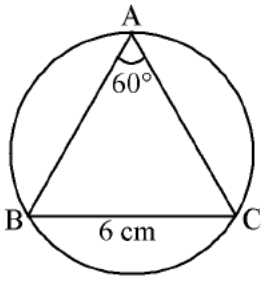
$BD^2 = BP^2 + PD^2$

□ + □ = □

BD = □ cm

Work Sheet - 6

In the figure a triangle and its circum circle are given. Find the diameter of the circle.



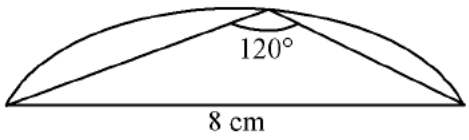
If the diameter is taken as 'd'

$$d = \frac{a}{\sin A}$$

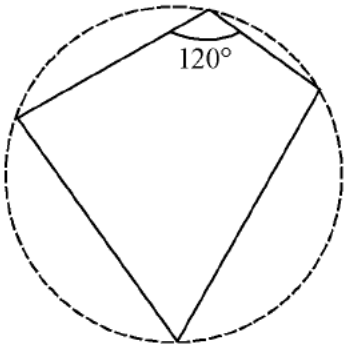
Here, $d = \frac{6}{\sin \square}$

diameter = $\frac{\square}{\square}$ = □ × □ = □

Work Sheet - 7



The figure shows a part of a circle. Find the radius of the circle.



Here the angle on the alternate arc is □

Then, to find out the diameter, we can consider that angle.

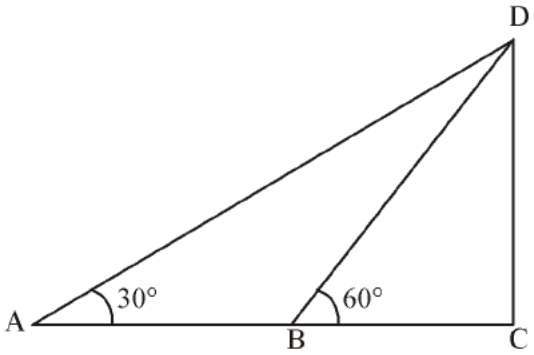
$\therefore$ diameter = $\frac{\square}{\text{Sin}\square} = \frac{\square}{\square}$

$= \square$

$\therefore$ Radius = $\square$

Worksheet - 8

A man saw the top of a tree at an elevation of 30°. Moving 10 meters towards the tree, he sees it at an elevation of 60°. Find the hight of the tree?



In ΔABC

$\angle ABD = \square$

$\angle ADB = \square$

Since AB = 10m, BD = $\square$ m

In ΔBCD $\angle BDC = \square$

Since BD = 10m, BC = $\square$ m

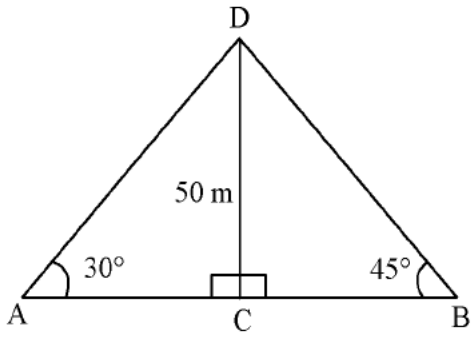
$\therefore$ CD = $\square$ m

$\therefore$ Height of the tree = $\square$ m

Work Sheet - 9

Two persons are standing either side of an eletric post of height 50m. One person see the top of the post at an anagle of elevation 30^0, and other person sees the top of the post at an angle of 45^0.

Fill up the following step find the distance between the person about the rough figure given.



CD - Represent the height of the electric post. The persons are standing at the points A and B.

Consider the triangle BCD

$\angle B = 45^0$, $\angle BCD =$ _____ $\angle BDC$ _____

The ratio of the sides of BCD = _____

BC = _____ = 50m

In right ΔACD, $\angle A = 30^0$, $\angle ACD = \angle ADC$

Ratio of the sides of ACD = _____

Sides opposite to 30^0, CD = _____

Side opposite to 60^0, AC = _____

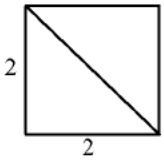
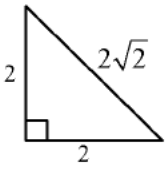
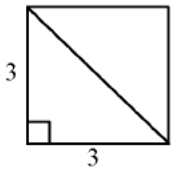
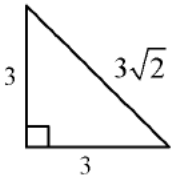
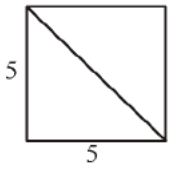
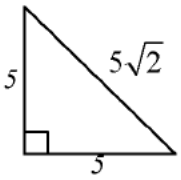
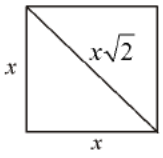
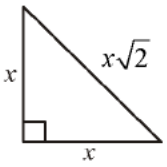
The AC + BC = _____ + _____

= _____

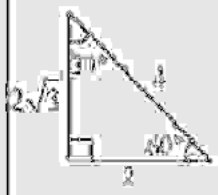
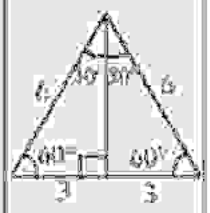
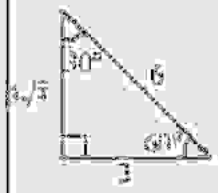
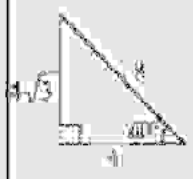
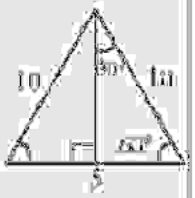
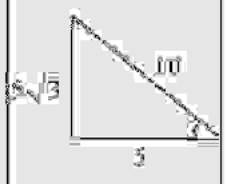
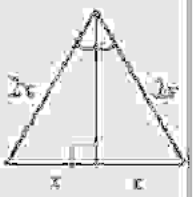
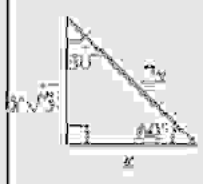
Distance between the two persons, AB = _____

ANSWERS

Worksheet 1

Square	Length of diagonal $d = a\sqrt{2}$	Isosceles triangle	Length of sides			Ratio of Sides
			Angle Opposite to 45°	Angle Opposite to 45°	Angle Opposite to 90°	
	$d = 2\sqrt{2}$		2	2	$2\sqrt{2}$	2:2:2 $\sqrt{3}$ 1 : 1: $\sqrt{3}$
	$d = 3\sqrt{2}$		3	3	$3\sqrt{2}$	3 :3 : $3\sqrt{2}$ = 1 : 1 : $\sqrt{2}$
	d = $5\sqrt{2}$		5	5	$5\sqrt{2}$	5 : 5 : $5\sqrt{2}$ = 1 : 1 : $\sqrt{2}$
	$d = x\sqrt{2}$		x	x	$x\sqrt{2}$	$x : x : x\sqrt{2}$ = 1 : 1 : $\sqrt{2}$

Worksheet 2

Equilateral triangle	altitude $h = \frac{a\sqrt{3}}{2}$	Triangle	Length of sides			
			Angle opposite to 30°	Angle opposite to 60°	Angle opposite to 90°	Ratio of Sides
	$h = 2\sqrt{3}$		2	$2\sqrt{3}$	4	$2 : 2\sqrt{3} : 4$ $= 1 : \sqrt{3} : 2$
	$h = 3\sqrt{3}$		3	$3\sqrt{3}$	6	$3 : 3\sqrt{3} : 6$ $= 1 : \sqrt{3} : 2$
	$h = 4\sqrt{3}$		4	$4\sqrt{2}$	8	$4 : 4 : \sqrt{3} = 8$ $= 1 : \sqrt{3} : 2$
	$h = 5\sqrt{3}$		5	$5\sqrt{3}$	10	$5 : 5\sqrt{3} : 10$ $= 1 : \sqrt{3} : 2$
	$h = x\sqrt{3}$		x	$x\sqrt{3}$	$2x$	$x : x\sqrt{3} : 2x$ $= 1 : \sqrt{3} : 2$

Worksheet 3

$1 : \sqrt{3} : 2$

BC = 10cm

AB = $10\sqrt{3}$ cm

AC = 20cm

Perimeter = $10 + 10\sqrt{3} + 20 = \left(30 + 10\sqrt{3}\right)$cm

Worksheet 4

(a) $\angle AED = 90^0$

$\angle ADE = 30^0$

AD = 4cm

AE = 2cm

DE = $2\sqrt{3}$ cm

AB = 8cm

Area of parallelogram

ABCD = $8 \times 2\sqrt{3} = 16\sqrt{3}$ sq.cm

(b) $\angle P = 180 - 120 = 60°$

$\angle PTS = 90°$

$\angle PST = 30°$

PS = QR = 4 cm

PQ = 8 cm

PS = 4 cm, PT = 2 cm, ST = $2\sqrt{3}$ cm

Area of parallelogram PQRS

PQ $\times$ ST = 8 $\times$ $2\sqrt{3}$ = $16\sqrt{3}$ sq.cm

Worksheet 5

$\angle ADB = 90^0$

$\angle B = 30^0$

$\angle BAD = 60^0$

BC = 8cm

AB = 6cm

AD = 3cm

Area = $\frac{8 \times 3}{2}$ = 12 sq.cm

Worksheet 6

$d = \frac{6}{\sin 60}$

diameter = $\frac{6}{\frac{\sqrt{3}}{2}} = 6 \times \frac{2}{\sqrt{3}} = \frac{3 \times 2 \times 2}{\sqrt{3}}$

$$= \frac{\sqrt{3}\times\sqrt{3}\times 2\times 2}{\sqrt{3}} = 4\sqrt{3}$$

Worksheet 7

60^0

Diameter = $\dfrac{8}{\sin 60}$

$$= \frac{8}{\frac{\sqrt{3}}{2}} = 8\times\frac{2}{\sqrt{3}} = \frac{16}{\sqrt{3}} \text{ cm}$$

Worksheet 8

$\angle PCB = 180 - \boxed{60} = \boxed{120}$

$\angle PBC = 180 - \left(\boxed{30} + \boxed{120}\right)$

$= \boxed{30}$

PCB is an isosceles triangle

BC = PC = 40cm

$\angle ABC = 30^0$

Ratio of the sides of $\triangle ACB = 1:\sqrt{3}:2$

BC = 40m

AC = 20m

AB = $20\sqrt{3}$ m

Width of the River : AC = 20m

Height of the tree : AB = $20\sqrt{3}$ m

Worksheet 9

$\angle BCD = 90^0$ $\angle BDC = 45^0$

$\angle BCD$ is isosceles right triangle

Ratio of the sides of $\triangle BCD = 1:1:\sqrt{2}$

BC = CD = 50m

$\angle ACD = 90^0$, $\angle ADC = 60^0$

Ratio of the sides of $\triangle ACD = 1 : \sqrt{3} : 2$

CD = 50m

AC = $50\sqrt{3}$

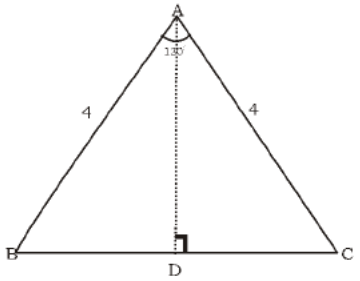
AC + BC = $50\sqrt{3}$ + 50

$= 50\left(\sqrt{3}+1\right)$

Distance between two persons, AB = $50\left(\sqrt{3}+1\right)$ m

Additional Questions for pratice

1



In the figure AB=AC= 4cm

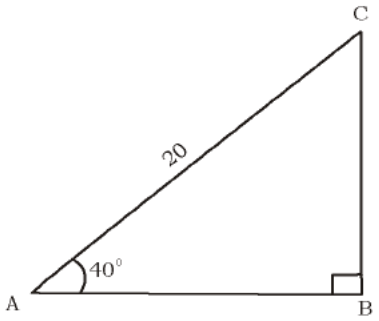
$\angle A = 120^0$

a) $\angle B$ =.....

b) Find the perpendicular distance from A to BC.

c) Find the perimeter of the ΔABC

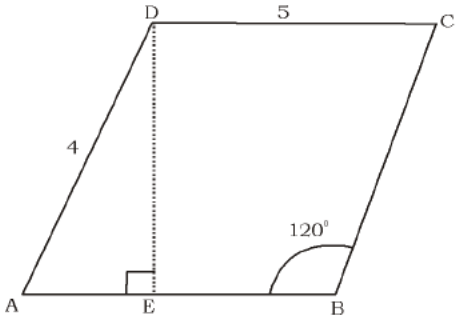
2.



In right triangle ABC ൽ $\angle A = 40^0$, and AC=40cm. Calculate the length of BC

(Sin40=0.64, Cos=0.76)

3. In the figure ABCD is a parallelogram with CD=5cm, AD=4cm, $\angle B = 120^0$

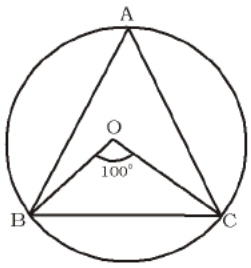


a) Find $\angle A$

b) Find the length of DE

c) Calculate the area of the parallelogram ABCD

4.

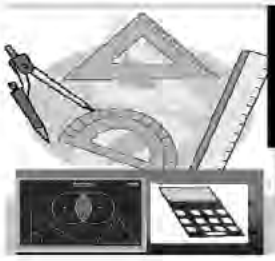


In the figure, radius of the circle with centre O is 7 cm. $\angle BOC = 100^0$

a) Find $\angle A$

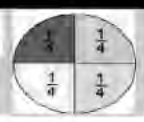
b) Find the length of BC. (Sin50 = 0.76, Cos50 = 064, tan50 = 1.19)

5. A boy sees the top of a tower at an elevation of 60^0. Stepping 20 metres back, he sees it at an elevation of 30^0. Find the height of the tower.



Unit 6

COORDINATES



Things to Remember

- Two measures are needed to locate a point in a plane. These measures are called the coordinates of that point. To locate a point in a plane, imagine two mutually perpendicular lines called the axes. The horizontal line is called the x-axis and vertical line is called the y-axis.
- The distance of a point from the y-axis is called its x-coordinate and the distance from x-axis is called its y-coordinate.

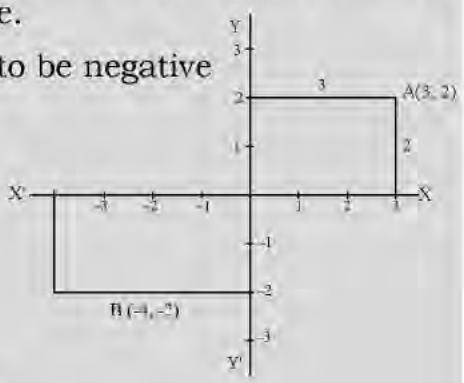
  Distances to the left or downwards is taken to be negative

  x-coordinate of A=3

  y-coordinate of A=2

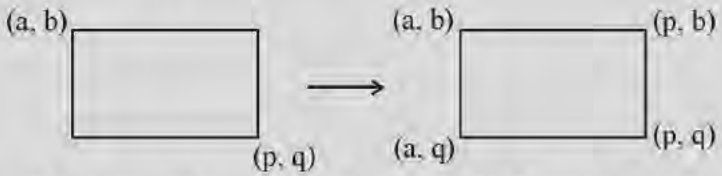
  Coordinates of A=(3,2)

  Coordinates of B=(-4,-2)



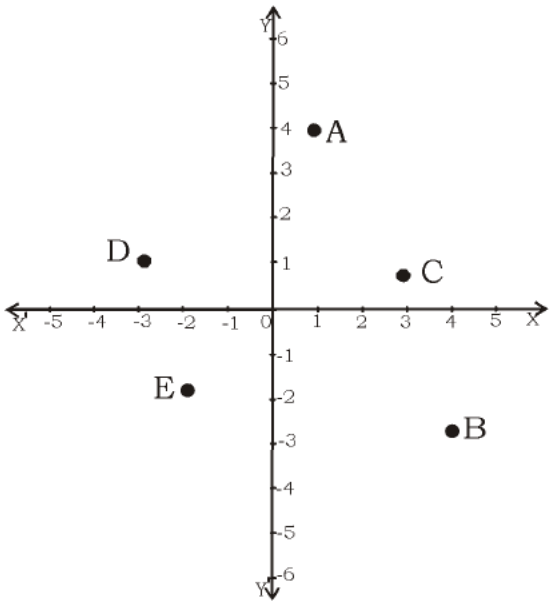
- y-coordinate of any point on the x-axis is 0.

  x-coordinate of any point on the y-axis is 0.
- y-coordinates of all points on a line parallel to x-axis are equal.
- x-coordinates of all points on a line parallel to y-axis are equal.
- If the sides of a rectangle are parallel to the axes, then from the coordinates of one pair of opposite vertices, the coordinates of the other pair of opposite vertices can be found.



- The distance between the points (x_1, y) and (x_2, y) on a line parallel to the x-axis is $|x_1 - x_2|$
- The distance between the points (x, y_1) and (x, y_2) on a line parallel to the y-axis is $|y_1 - y_2|$
- The distance between any two points (x_1, y_1) and (x_2, y_2) is $\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$
- The distance of a point (x,y) from the origin is $\sqrt{x^2 + y^2}$.

Worksheet 1



(a) x-coordinate of A= .....

(b y-coordinate of A= .....

(c) Cordinate A = (....., ...)

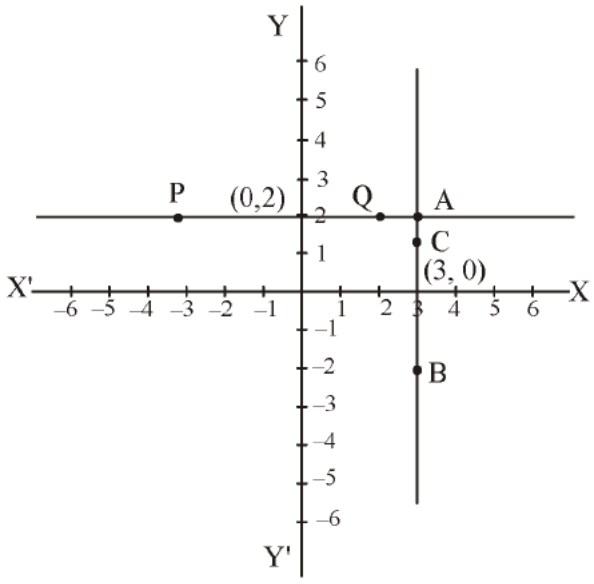
(d) Coordinates of B= (....., ...)

(e) Coordinate of C= (....., ...)

(f) Coordinate of D = (....., ...)

(g) Coordinates of E = (....., ...)

Worksheet 2



In the picture, the line AB drawn through the point (3,0) and parallel to the y-axis. Also the line PQ drawn through the point (0,2) and parallel to the x-axis.

(a) x-coordinate of any point on the line AB= .....

(b y-coordinate of the point A= .....

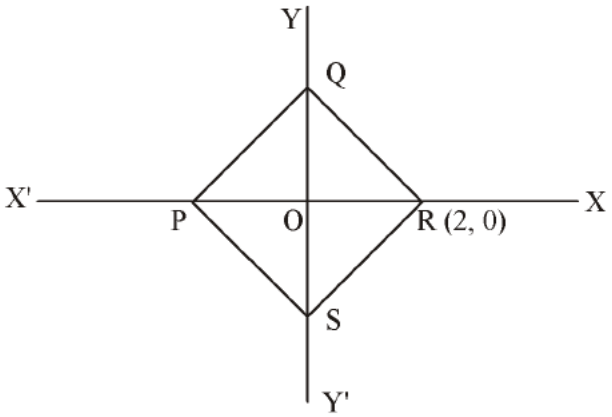
(c) Write the coordinates of A,B and C

(d) y-coordinate of any point on the line PQ=.....

(e) x-coordinates of the point P = ...

(f) Write the coordinates of P and Q.

Worksheet-4



In the picture PQRS is a square and the coordinates of R are (2,0)

(a) Coordinates of Q = (0,_____)

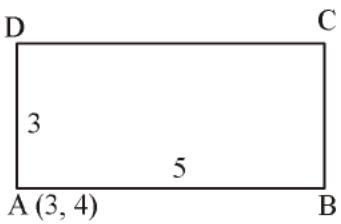
(b) Coordinates of P = (____, ____)

(c) Coordinates of S = (____,_____)

(d) Length of the diagonal = _____

(e) Length of one side of the square = _____

Worksheet-4



In the rectangle ABCD, AB=5 units, AD=3 units and its sides parallel to the coordinate axes. Write the coordinates of the vertices.

Coordinates of B = (3+ ___, 4)

= (____, 4)

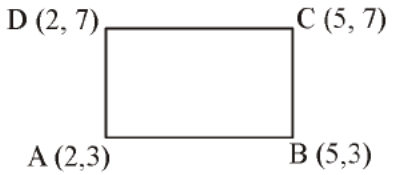
Coordinaes of C = (____, 4+____)

= (____, ___)

Coordinates of D =(____,___)

Worksheet-5

In the figure ABCD is a rectangle.



a. Length of AB=Distance between A and B. = $|\square - \square| = \square$

b. CD = $\square$

c. Length of AD= $|\square - \square| = \square$, BC= $\square$

d. Length of the diagonal, AC = $\sqrt{(\square-\square)^2 + (\square-\square)^2}$

$= \sqrt{\square + \square}$

$= \square$

Worksheet-6

A circle with centre at orgin, (0,0), is passing through the point (4,0)

a) Distance betwen the points (0,0) and (5,0) = $|\square - \square|$

$= \square$

Diameter of the circle

b) Other two points on the circle = ($\square$, $\square$), ($\square$, $\square$)

c) Distance between the two points (0,0), (3,4)

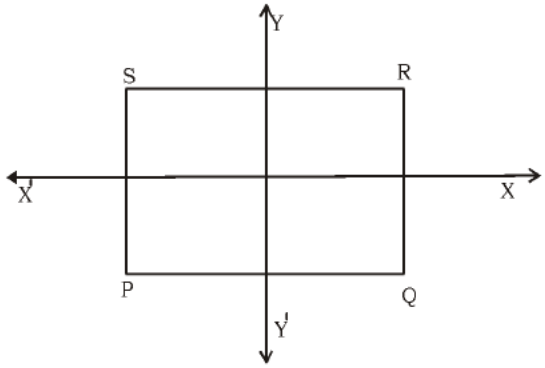
$= \sqrt{\square^2 + \square^2} = \sqrt{\square + \square} = \square$

$\square$ is the radius.

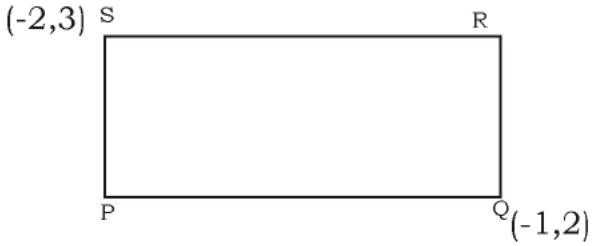
d) $\therefore$ the point (3,4) is $\square$ the circle. (inside/outside)

Pratice Questions

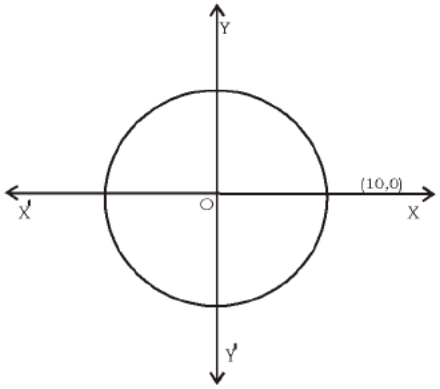
1. In the figure PQRS is a square. The axes are drawn through the midpoints of its sides. The length of its sides is 8 units. Write the coordinates of its vertices.



2. In the picture, sides of the rectangle are parallel to the axes. Write the coordinates of other two vertices.



3. The centre of the circle shown is the origin and the radius is 13 units.
   a) Check whether each of the points (12,5) 10,6) is inside, outside or on the circle.
   b) Write the coordinates of two other points on the circle.



4. A (5,3) is a point on a line parallel to X - axis.
   a) Write the coordinates of any other point on the sameline.

b) Find the distance of that point from A

5. Show that (0.5), (5,10), (6,3) are the vertices of an isosceless triangle.

6. (3,-1) is a point on the circle with centre at (6,3).

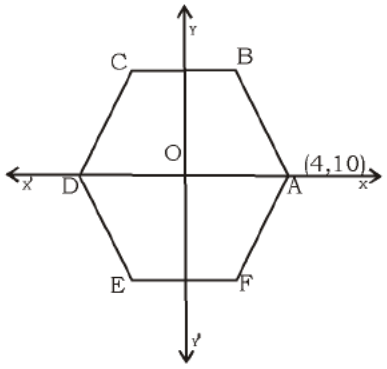
   a) What is the radius of the circle?

   b) Find the coordinates of the points of intersection of the circle with x-axis.

7. a) Draw the co ordinate axex and mark the points A(3,0), B(3,2), C(-3,2), D(-3,-2), E(0,+3), F(3,-2)

   b) Join B, C, D, F in order. Which type of quadrilateral is BCDF?

8. In the picture ABCDEF is a regular hexagen. Coordinates of A is (4,0). Find the Coordinates of other vertices.



ANSWERS

Worksheet 1

(a) 1

(b) 4

(c) (1,4)

(d) (4,-3)

(e) (3,1)

(f) (-3,1)

(g) (-1, -2)

Worksheet 2

(a) 3

(b) 2

(c) A(3,2), B (3,-1), C(3,1)

(d) 2

(e) -3

(f) P=(-3,2), Q=(2,2)

Worksheet 3

(a) Coordinates of Q =(0,4)

(b) Coordinates of P =(-2,0)

(c) Coordinatesw of S =(0,-2)

(d) Length of the diagonal = 2+2=4

(e) Length of the side of the square = $\sqrt{2^2+2^2}$

= $\sqrt{4+4} = \sqrt{8}$

Worksheet 4

(a) Coordinates of B = (3+5,4)

= (8,4)

(b) Coordinates of C = (8,4+3)

= (8,7)

(c) Coordinates of D = (3,7)

Worksheet 5

a) Length of AB=|5–2|=3

b) CD=3

c) Length of AD = |7–3|=4

BC=4

d) Length of the diagonal, AC= $\sqrt{(5-2)^2+(7-3)^2}$

$= \sqrt{3^2+4^2}$

$= \sqrt{25}$

$= 5$

Worksheet 6

a) |5–0| = 5

b) Radius = 5

c) $\sqrt{3^2+4^2} = \sqrt{9+16} = 5$

d) $\therefore$ (3,4) is a point on the circle.

Answers

1. R = (4,4)
   S = (-4,4)
   P = (-4,-4)
   Q = (4,-4)
2. P(-2,-2)
   R(1,3)
3. a) $\sqrt{12^2+5^2} = 13$
   (12,5) is on the circle.
   $\sqrt{10^2+6^2} = \sqrt{136} < 13$
   $\therefore$ (10,6) Inside the circle.
   b) (13,0) -13,0) or
4. a) (2,3) ie, (x,3)
   b) |5–2|=3

5. Distance between (0,5), (5,10) $= \sqrt{(5-0)^2+(10-5)^2}$

$= \sqrt{25+25} = \sqrt{50} = 5\sqrt{2}$

Distance between (5,10), (6,3) $= \sqrt{(6-5)^2+(3-10)^2}$

$= \sqrt{1+49} = \sqrt{50} = 5\sqrt{2}$

Distaqnce between (0,5), (6,3) $= \sqrt{(6-0)^2+(3-5)^2}$

$= \sqrt{36+4} = \sqrt{40}$

Two sides are equal $\therefore$ It is an isosceless triangle.

6. a) Radius$= \sqrt{(6-3)^2+(3--1)^2}$

$= \sqrt{9+16} = 5$

b) $(x-6)^2+(0-3)^2 = 5^2$

$(x-6)^2+9 = 25$

$(x-6)^2 = 25-9$

$= 16$

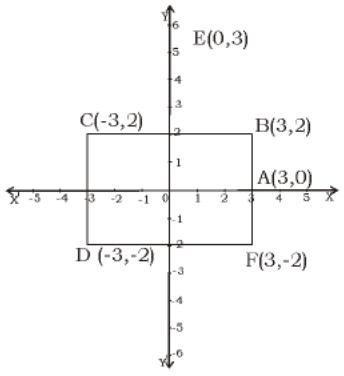
$x-6 = \pm 4$

$x = 6 + 4, 6 - 4$

$= 10, 2$

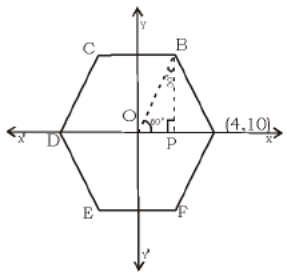
$\therefore$ It cuts the X - axis at (10,0) and (2,0)

9. a)



b) Rectangle

10.



OB = 4

$\therefore$ OP= 2

BP = $2\sqrt{3}$

B(2, $2\sqrt{3}$)

C = (-2, $2\sqrt{3}$)

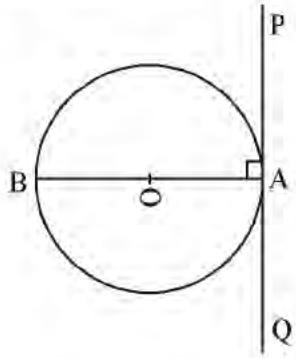
D = (-4, 0)

E = (-2, $-2\sqrt{3}$)

F = (2, $-2\sqrt{3}$)

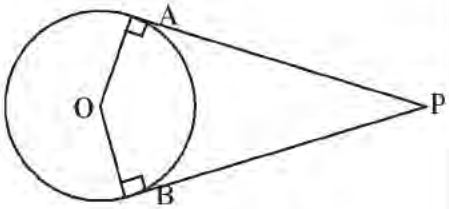
Points to Remember

- A tangent at a point to a circle is perpendicular to the diameter through that point



$AB \perp PQ$

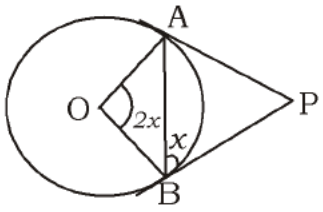
- A quadrilateral formed by joining the centre of the cirlce, two points on that cirlce, and the point of intersection of two tangents at these points is cyclic.



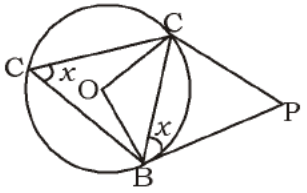
The quadrilateral PAOB is a cyclic quadrilateral

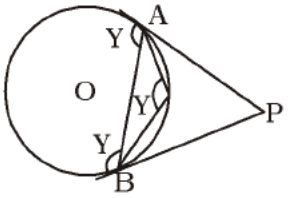
$\angle AOB + \angle P = 180^0$

- An angle formed by two radii of a circle through two points and the angle formed by the two tangents through these points are supplementary.
- The angle made by a chord and the tangent at its end point is half the the central angle of the chord.

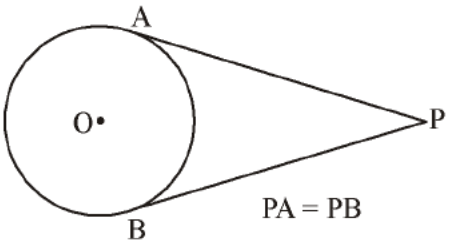


In a circle, the angle which a chord makes with tongent at one end on any side is equal to the angle which it makes on the part of the circle on the other side.



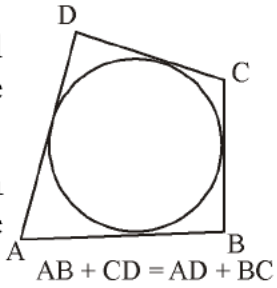


- Two tangents can be drawn from an exterior point of a circle. These two tangents will be equal in length.

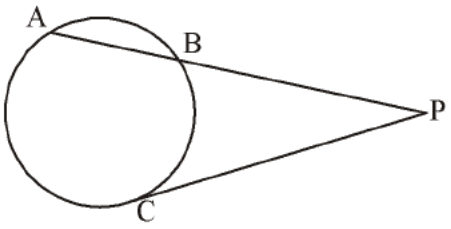


- The sum of the opposite sides of a quadrilateral formed by the tangents at four points of a circle are equal.

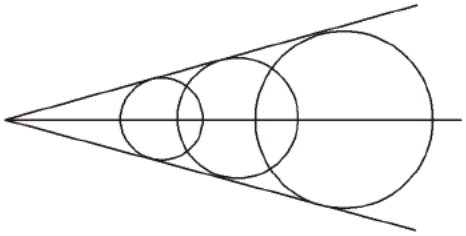
  Conversely, if the sum of the opposite sides of a quadrilateral are equal, then we can draw a circle with the four sides as tangents to the circle.



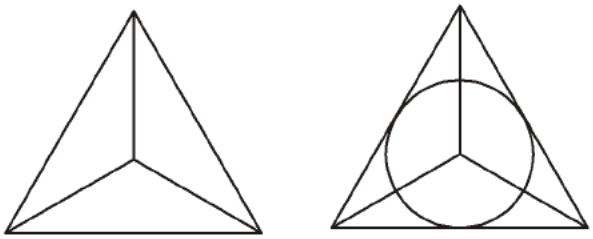
- In the figure, the tangent at C and the chord AB extended meet at P Then $PA \times PB = PC^2$



- The centre of a circle which touches two intersecting lines is in the bisector of the angle formed by these lines.

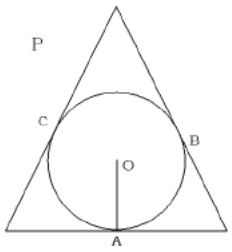


- In any triangle, the angle bisectors meet at a point. We can draw a circle with this point as centre and touching the three sides of the triangle. This circle is called the incircle of the triangle. The perpendicular distance from this centre to a side is the radius of the in circle.



- The radius of the in circle of a triangle is the quotient obtained when the area of the triangle is divided by its semi perimeter.

$$r = \frac{A}{S}$$

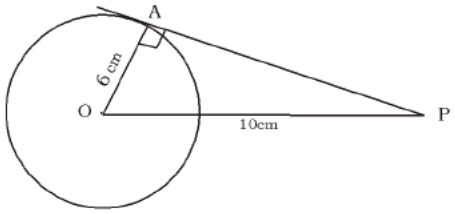


A - Area of the triangle

S- Semi perimeter of the triangle $S = \frac{a+b+c}{2}$

Worksheet - 1

In the figure, 'O' is the centre of the circle and radius 6cm, OP=10cm. Find the length of the tangent?



In the figure,

OA = 6cm

OP = 10cm

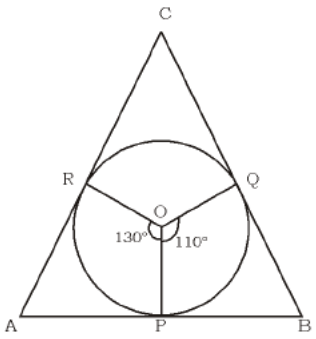
AP = $\sqrt{\square^2 - \square^2}$

= $\sqrt{\square - \square}$

= $\sqrt{\square}$

= $\square$cm

Work Sheet - 2



In the figure, O is the centre of the circle. $\angle POQ = 110^0$, $\angle POR = 130^0$. The sides AB, BC, and AC are tangents to the circle. Find all the angles of ΔABC

Since $\angle POR = 130^0$, $\angle A$ = □−130^0

= □

$\angle POQ = 110^0$, $\angle B$ = □ − □

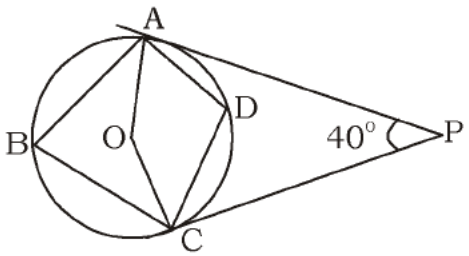
= □

$\angle C$ = 180^0−(□+□)

= □ − □

= □

Work Sheet - 3



In the figure O is the centre, PA and PC are tangents to the circle..

$\angle APC = 40^0$

a) What is $\angle ABC$?

b) What is $\angle ADC$?

a) $\angle ADC = \square - 40^0 = \square$

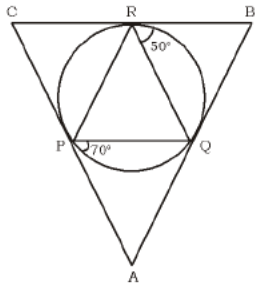
$\angle ABC = ½ \times \angle AOC = ½ \times \square = \square$

b) $\angle ADC = C80^0 - \square = \square$

Worksheet 4

In the figure, AB, BC and AC are tangents to the circle.

$\angle APQ = 70^0, \angle BRQ = 50^0$



a) Find all angles of triangle PQR?

b) Find all angles of triangle ABC?

a) In the triangle PQR

$\angle BRQ = 50^0, \angle P = \square$

$\angle APQ = 50^0, \angle R = \square$

$\angle Q = 180 - (\square + \square)$

$= 180 - \square$

$= \square$

b) $\angle AQP = 70^0$

$\angle A = 180 - (\square + \square)$

$= 180 - \square$

$= \square$

$\angle BQR = 50^0, \angle B = \square - (50+\square)$

$= \square - \square$

$= \square$

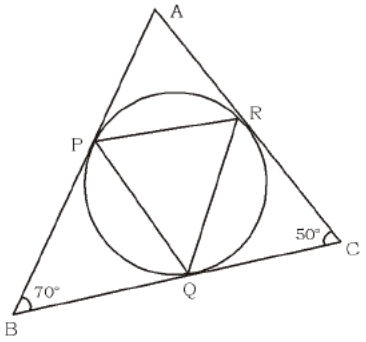
$\angle C = 180 - (\square+\square)$

$= 180 - \square$

$= \square$

Worksheet - 5

In the figure AB, BC and AC are tangents to the circle $\angle ABC = 70^0$, $\angle ACB = 50^0$. Find all angles of ΔPQR



$\angle ACB = 50^0, \angle CQR = \frac{180 - \square}{2}$

$= \square$

$\therefore \angle P = \square$

$\angle ABC = 70^0, \angle BPQ = \frac{180 - \square}{2}$

$= \square$

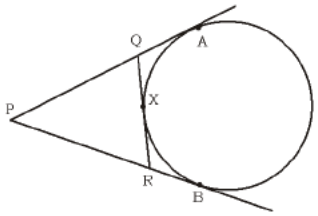
$\therefore \angle R = \square$

$\angle Q = 180 - (\square+\square)$

$= 180 - \square$

$= \square$

Worksheet - 6



In the figure PA, PB are tangents to the circle PA=20cm. Find perimeter of ΔPQR?

In the figure QA = QX

RB = RX

PA = 20cm

Perimeter of ΔPQR = PQ + QR + PR

= PQ + QX + RX + PR

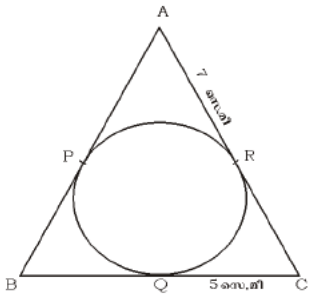
= PQ + □ + □ + PR

= □ + □

= □ + □

= □ cm

Worksheet 7



In the figure, AB, BC, and CD are tengents to the circle AR=7cm, PB=4cm, QC=5cm. Find the perimeter of ΔABC

PA = □ cm

BQ = □ cm

CR = □ cm

AB = AP + PB

= □ + □

= □ cm

BC = BQ + QC =

= □+□

= □ cm

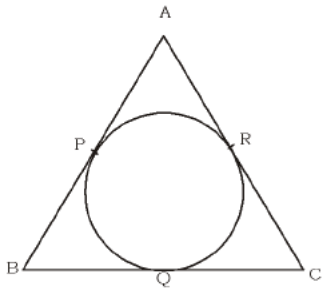
AC =□ + □ =□cm

Perimeter of ΔABC =AB + BC + AC

= □ + □ + □

= □ cm

Worksheet - 8



In the figure the incircle of ΔABC touches the sides AB, BC, and AC at points P,Q and R respectively. If AB=12cm, BC=10cm, AC=14cm

a) What is the length of AP?

b) What is the length of BQ?

c) What is the length of CR?

a) AP = x , PB = 12 – □

BQ = 12 – □

CR = 14 – □

QC = □ – □

BQ + QC = BC

$\square - 2x = \square$

$-2x = \square - \square$

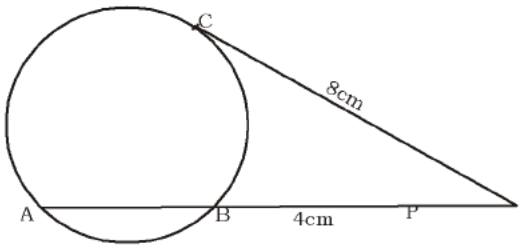
$x = \square$

b) AP = $\square$cm

BQ = $\square$cm

CR = $\square$cm

Worksheet 9



In the figure, P is the point of intersector of the extended churd AB and the tangent through C. PB=4cm, PC=8cm

a) Find the length of AB?

b) Find the length of PA?

a) $PA \times PB = PC^2$

$(AB + PB)PB = PC^2$

$(AB + \square) \times \square = 8^2 = 64$

$AB + \square = \frac{64}{\square} = \square$

AB = $\square - \square = \square$cm

b) PA = PB + AB = $\square + \square = \square$ cm

Worksheet 10

A triangle with lengths of sides 8cm, 6cm, 10cm and area 24Sq.cm. Find the radius of the circle touching the sides of this triangle?

Aria of the triangle (A) = $\square$ Sq.cm

Perimeter of the triangle = □ + □ + □

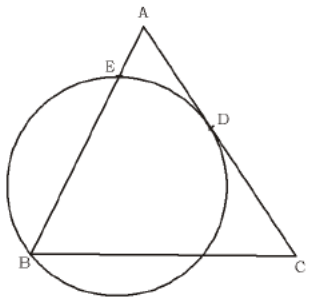
= □ cm

S = $\frac{\square}{2}$ = □ ച.സെ.മീ

Radius of the circle $r = \frac{A}{S}$

= $\frac{\square}{\square}$ = □ സെ.മീ

Worksheet - 11



In the figure AB = AC. A circle passing through B intersect AB at E. The circle touches AC at its midpoint D.

Prove that AB = 4AE.

AE × AB = $\square^2$

AD = $\frac{\square}{2}$ Since D is the midpoint of AC

AE × AB = $\left[\frac{\square}{2}\right]^2 = \left[\frac{\square}{2}\right]^2$ Since AB = AC

= $\frac{\square^2}{4}$

AE = $\frac{\square}{4}$

□ = 4 □

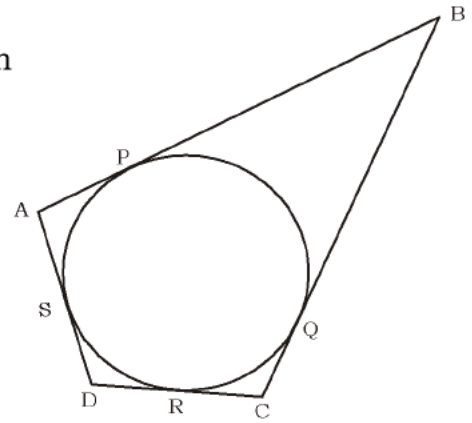
Worksheet - 12

The sides of the quadrilateral ABCD touches the circle at P, Q, R, S

a) Prove that AB + CD = AD + BC

b) If AB = 12cm, CD = 8cm AD = 14cm

Find BC



a) Tangents draw from an external point to the circle are equal in length

AP = ☐, BP = ☐, CR = ☐, DR = ☐

From the figure AB + CD = ☐ + ☐ + ☐ + ☐

= ☐ + ☐ + ☐ + ☐

= AD + BC

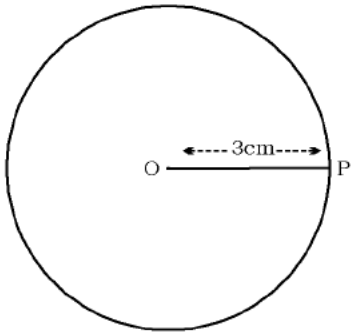
b) BC = ☐ + ☐ − ☐ = ☐

Constructions

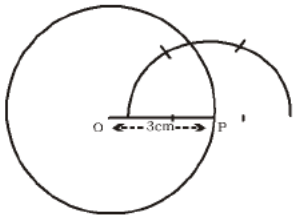
1. Draw a circle of radius 3cm and mark a point on it. Draw the tangent through this point

Ans :

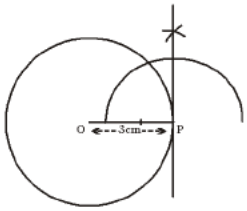
Step 1 : Draw a circle of radius 3cm



Step 2 : Draw the semicircle with centre P as shown in the figure and mark two points with same length on it.



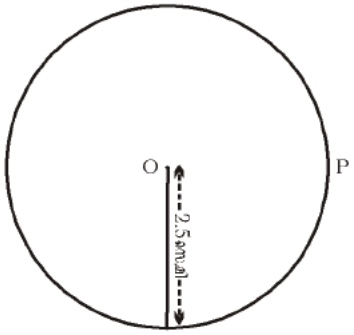
Step 3 : Mark a point equidistant from the merked points as shown in the figure and draw a line through P and this point



2. Draw a circle of radius 2.5cm. Draw a triangle with two angles 50°, 70° and the sides of the triangle touching the circle.

Ans.

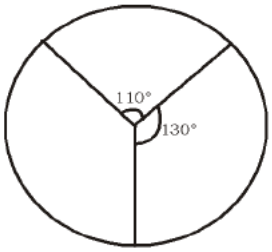
Step 1 : Draw a circle of radius 2.5cm



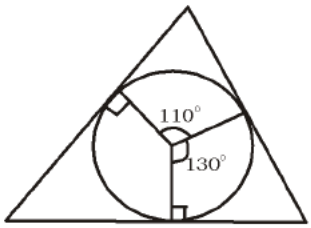
Step 2 : $180^0-50^0=130^0$

$180^0-70^0=110^0$

Draw centre angles with measures 130^0 and 110^0 as shown in the figure.



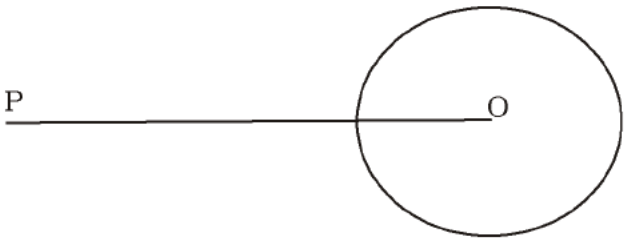
Step3 : Draw a lines perpendicular to the rand points of the radius as shown the figure



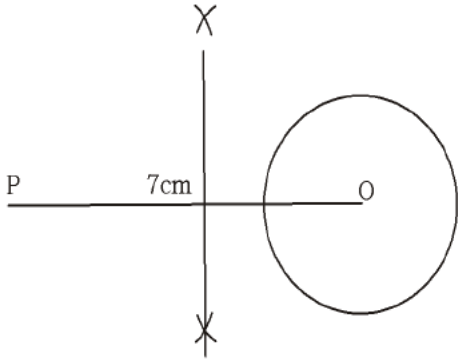
3. Draw a circle of radius 2.5cm and mark a point 7cm away from its centre. Draw the tangent to the circle from this point and measure it lengths.

Ans :

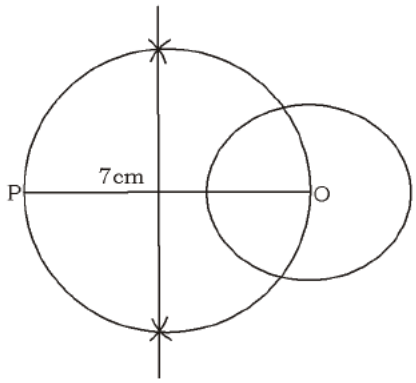
Step 1 : Draw a circle of radius 3cm. Mark a point 7cm away from its centre



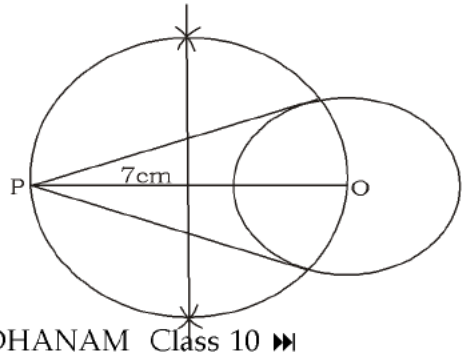
Step 2 : Draw perendicular bisector of the line OP



Step 3 : Draw a circle with centre at the point intersection of the perpendicular biscetor and the line OP passing through the points 'O' and P



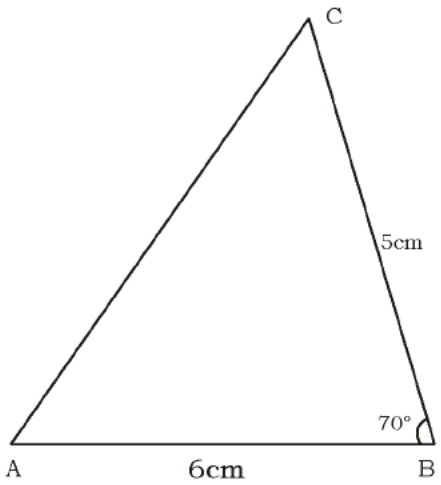
Step 4 : Draw tengents from P to the points which cuts the circles as shown below.



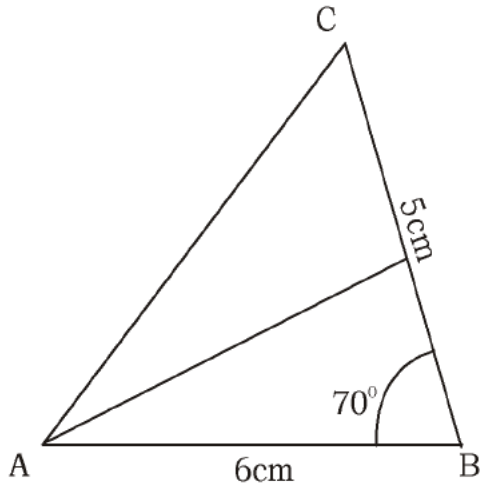
4. In ΔABC AB = 6cm, $\angle B = 70°$, BC=5cm. Draw triangle ABC and then draw a circle touching the sides of this triangle.

Ans :

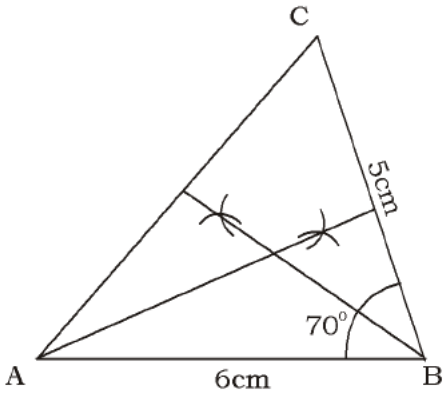
Step 1 : Draw the triangle ABC with given measures.



Step 2 : Draw the bisector of $\angle A$.



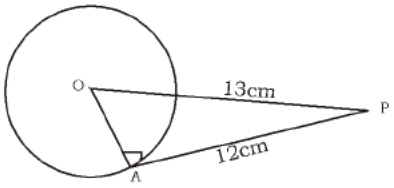
Step 3 : Draw the bisector of $\angle B$



Step 4 : Draw a circle with centre at the point of intersection of the bisectors touching the sides of the triangle.

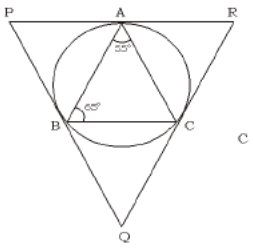
Pratice problems

1.



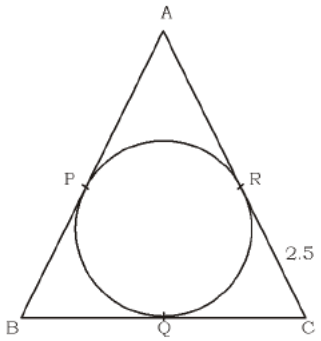
In the figure 'O' is then centre of the circle. PA=12cm OP=13 cm. What is the radius of the circle?

2.



In the figure, the cercumcircle of ΔPQR is the incircle of ΔPQR $\angle B = 65^0, \angle A = 55^0$. Find the angles of ΔPQR.

3.



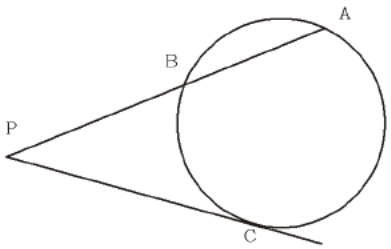
In the figure AB=15cm, BC=17cm, AC=14cm

a) Find the length of PA?

b) Find the length of BQ?

c) Find the length of CR?

4.



In the figure, the chord AB extended and the tangent through C intercet at the point P. PB = 8cm, AB=10cm

a) What is the length of PA?

b) What is the length of PC?

5. Length of penpendicular sides of a right triangle are 12cm and 16 cm

a) Find the area of this triangle.

b) Find the perimeter of this triangle.

c) What is the inner radius of this triangle?

6. Draw a circle of radius 3.5cm. Mark a point P on it and draw tangent through P.

7. Draw a circle of radius 3cm. Mark a point P at a distance 8cm from the centre of the circle. Draw tengents from P.

8. Draw a circle of radius 2.5cm. Draw a triangle with two angles 50^0, 70^0 with sides touching the circle.

9. In ΔABC, AB=7cm, BC=6cm, AC=5cm. Draw ΔABC and draw a circle touching the sides of this triangle.

Answers

1. R = (4,4)
   S = (-4,4)
   P = (-4,-4)
   Q = (4,-4)

2. P(-2,-2)
   R(1,3)

3. a) $\sqrt{12^2+5^2}=13$
   (12,5) is on the circle.
   $\sqrt{10^2+6^2}=\sqrt{136}<13$
   $\therefore$ (10,6) Inside the circle.
   b) (13,0) -13,0) or

4. a) (2,3) ie, (x,3)
   b) |5–2|=3

5. Distance between (0,5), (5,10) $= \sqrt{(5-0)^2+(10-5)^2}$
   $= \sqrt{25+25}=\sqrt{50}=5\sqrt{2}$
   Distance between (5,10), (6,3) $= \sqrt{(6-5)^2+(3-10)^2}$

$= \sqrt{1+49} = \sqrt{50} = 5\sqrt{2}$

Distaqnce between (0,5), (6,3) $= \sqrt{(6-0)^2+(3-5)^2}$

$= \sqrt{36+4} = \sqrt{40}$

Two sides are equal $\therefore$ It is an isosceless triangle.

6. a) Radius$= \sqrt{(6-3)^2+(3--1)^2}$

$= \sqrt{9+16} = 5$

b) $(x-6)^2+(0-3)^2 = 5^2$

$(x-6)^2+9 = 25$

$(x-6)^2 = 25-9$

$= 16$

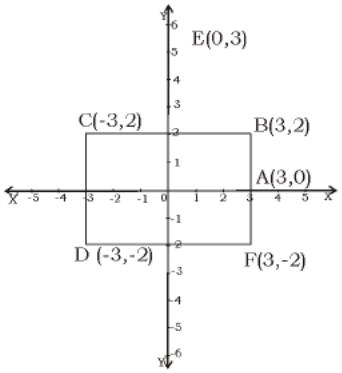
$x-6 = \pm 4$

$x = 6 + 4, 6 - 4$

$= 10, 2$

$\therefore$ It cuts the X - axis at (10,0) and (2,0)

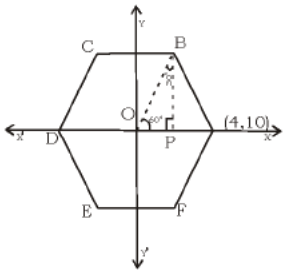
7. a)



b) Rectangle

.

8



OB = 4

$\therefore$ OP= 2

BP = $2\sqrt{3}$

B(2, $2\sqrt{3}$)

C = (-2, $2\sqrt{3}$)

D = (-4, 0)

E = (-2, $-2\sqrt{3}$)

F = (2, $-2\sqrt{3}$)

Answers

Worksheet - 1

AP = $\sqrt{10^2 - 6^2}$

= $\sqrt{100 - 36}$

= $\sqrt{64}$

= 8 cm

Worksheet - 2

$\angle A$ = $180^0 - 130^0$

= 50^0

$\angle B$ = $180^0 - 110^0$

$= 70^0$

$\angle C = 180^0 - (50^0 + 70^0)$

$= 180^0 - 120^0$

$= 60^0$

Worksheet - 3

a) $\angle AOC = 180^0 - 40^0 = 140^0$

$$\angle ABC = \frac{1}{2} \times \angle AOC = \frac{1}{2} \times 140^0$$

$= 70^0$

b) $\angle ADC = 180^0 - 70^0$

$= 110^0$

Worksheet - 4

a) $\angle P = 50^0$

$\angle R = 70^0$

$\angle Q = 180^0 - (50^0 + 70^0)$

$= 180^0 - 120^0$

$= 60^0$

b) $\angle AQP = 70^0$

$\angle A = 180^0 - (70^0 + 70^0)$

$= 180^0 - 140^0$

$= 40^0$

$\angle BQR = 50^0$

$\angle B = 180^0 - (50^0 + 50^0)$

$= 180^0 - 100^0$

$= 80^0$

$\angle C = 180^0 - (80^0 + 40^0)$

$= 180^0 - 120^0$

$= 60^0$

Worksheet - 5

$$\angle CQR = \frac{180^0 - 50^0}{2}$$

$$= 65^0$$

$$\therefore \angle P = 65^0$$

$$\angle BPQ = \frac{180^0 - 70^0}{2} = \frac{110^0}{2}$$

$$\therefore \angle R = 55^0$$

$$\angle Q = 180^0 - (65^0 + 55^0)$$

$$= 180 - 120^0 = 60^0$$

Worksheet - 6

Perimeter = PQ + QR + PR

= PQ + QX + RX + PR

= PQ + QA + RB + PR

= PA + PB

= 20 + 20

= 40 cm

Worksheet - 7

PA = 7 cm

PB = 4 cm

CR = 5 cm

AB = PA + PB

= 7 + 4

= 11cm

BC = BQ + QC

= 4 + 5

= 9cm

AC = 7 + 5

= 12cm

Perimeter = 11 + 9 + 12

= 32 cm

Worksheet - 8

a) AP = x then PB = $12 - x$

BQ = $12 - x$

CR = $14 - x$

BQ + QC = BC

$12 - x + 14 - x = 10$

$16 - 2x = 10$

$-2x = 10 - 26 = -16$

$$x = \frac{-16}{-2} = 8 \text{ cm}$$

b) AP = 8

BQ = 12 – 8 = 4 cm

Cr = 14 – 8 = 6 cm

Worksheet - 9

a) $PA \times PB = PC^2$

$(AB + PB) \times PB = PC^2$

$(AB + 4) \times 4 = 8^2 = 64$

$$AB + 4 = \frac{64}{4} = 16$$

AB = 16 – 4 = 12cm

b) PA = PB + AB = 4 + 12 = 16cm

Worksheet - 10

Area of the triangle A = 24

Perimeter of the triangle = 8 + 6 + 10

= 24

$$= \frac{24}{2} = 12 \text{cm}$$

Radium of the circle r $= \frac{A}{S}$

$= \frac{24}{12}$

$= 2$ cm

Worksheet - 11

$AE \times AB = AD^2$

$AD = \frac{AC}{2}$ Since D is the midpoint of AC

$AE \times AB = \left[\frac{AC}{2}\right]^2 = \left[\frac{AB}{2}\right]^2 = \frac{AB^2}{4}$ since AB = AC

$AE = \frac{AB}{4}$

$AB = 4AE$

Work Sheet - 12

Tangents drawn from an external point to the circle are equal in length.

a) AP = AS

BP = BQ

CR = CQ

DR = DS

From the figure

AB + CD = AP + BP + CR + DR

= AS + BQ + CQ + DS

= AS + DS + BQ + CQ

= AD + BC

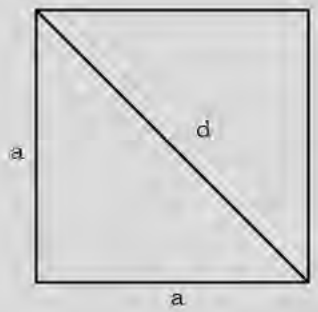
b) BC = AB + CD – AD = 12 + 8 – 14 = 20 – 14 = 6cm

Unit 8

SOLIDS

Points to Remember

SQUARE



If the length of a side of a square is 'a' unit, then

Perimeter = 4a

Area = a^2

length of diagonal (d) = $\sqrt{2}\,a$

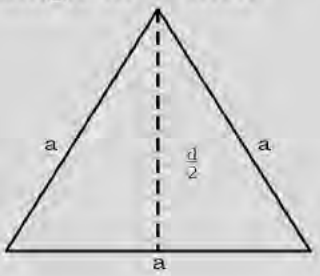
The length of diagonal of a square is 'd' unit then

Length of one side (a) = $\frac{d}{\sqrt{2}}$

Area (a^2) = $\frac{d^2}{2}$

EQUILATERAL TRIANGEL

Length of one side of an equilaternal triangle is 'a' then

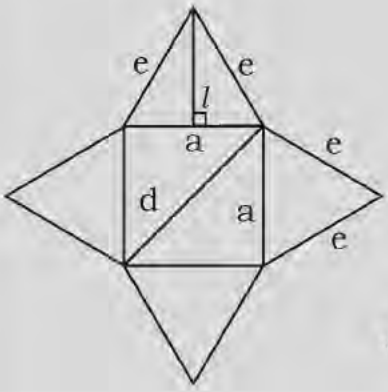


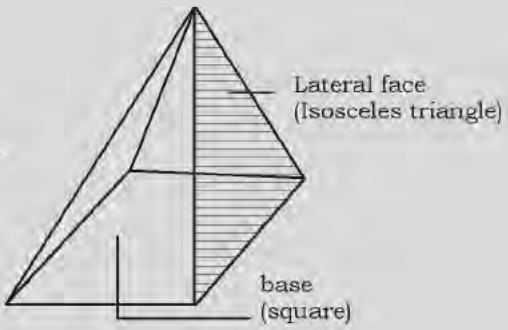
Perimeter = 3a

Area = $\frac{\sqrt{3}a^2}{4}$

Height (h) = $\frac{\sqrt{3}a}{2}$

SQUARE PYRAMID



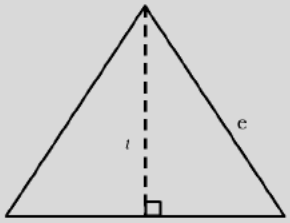


A square pyramid is a solid with base square and lateral face isosceles triangle.

Relation between base edge (e), slant height (l) and base edge(a)

$$e^2 = l^2 + \left(a/2\right)^2$$

$$\therefore l = \sqrt{e^2 - \left(a/2\right)^2}$$



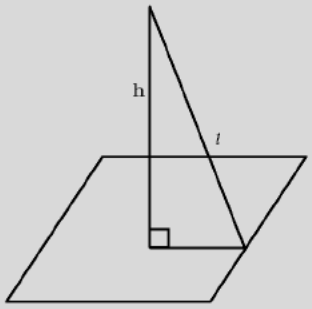
Relation betweeb base edge (a) , slant height (l) and height (h)

$$l^2 = h^2 + \left(a/2\right)^2$$

$$l = \sqrt{h^2 + \left(a/2\right)^2}$$

$$h = \sqrt{l^2 - \left(a/2\right)^2}$$

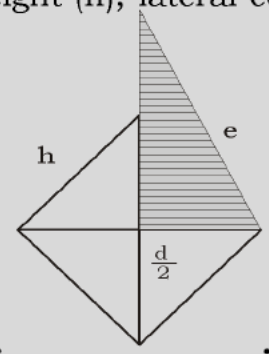
$$a/2 = \sqrt{l^2 - h^2}$$



Relation between height (h), lateral edge (e) base diagonal (d)

$$e^2 = h^2 + \left(d/2\right)^2$$

$$\therefore h = \sqrt{e^2 - \left(d/2\right)^2}$$



Area and volume of a square pyramid

Base area = a^2

Base perimeter = 4a

Area of one lateral face = $4 \times \frac{1}{2} al$

Lateral surface Area = $4 \times \frac{1}{2} al = 2\ al$

Total surface area = $a^2 + 2al$

Volume $= \frac{1}{3} \times$ Base area $\times$ h

$= \frac{1}{3} \times a^2 \times h$

If base edge and leateral edge of a square pyramid are equal then lateral faces are equilaternal triangles.

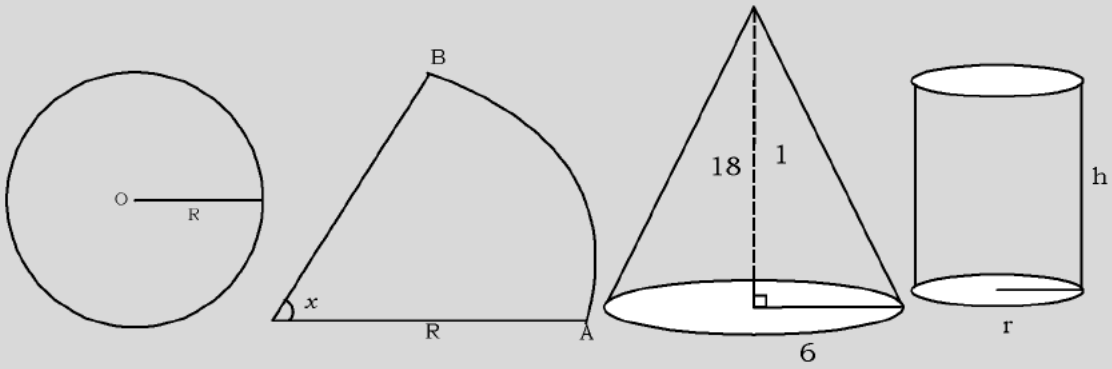
If e = a then

$$l = \frac{\sqrt{3}}{2} \times a$$

$$h = \frac{a}{\sqrt{2}}$$

Then total surface area = $a^2 + \sqrt{3}a^2$

Cone



Circle

Area of a circle with radius 'R' = πR^2

Circumference of the circle = $2\pi R$

Sector

Length the sector with radius (R) = $\frac{x}{360} \times 2\pi R$

Area of the sector = $\frac{x}{360} \times \pi R^2$

Cylineder

Volume = $\pi r^2 h$

When a sector is curved (bent) in to a cone,

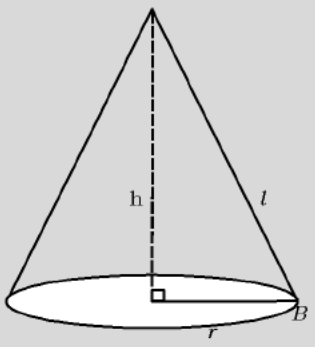
The radius of the sector = Slant height of the cone

Area of the sector = C.S.A of the cone

$$\frac{x}{360} = \frac{r}{R} \text{ OR } \frac{x}{360} = \frac{r}{l}$$

Retation between height (h)

Slant height (l), base radius (r) of a cone



$$l^2 = h^2 + r^2$$

$$l = \sqrt{h^2 + r^2}$$

$$h = \sqrt{l^2 - r^2}$$

$$r = \sqrt{l^2 - h^2}$$

Area and volume of a cone

Base perimeter = $2\pi r$

Curved surface area = πrl

Total surface area = $\pi r^2 + \pi rl$

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

Sphere

If We slice a sphere, we get a circle. If we slice a sphers into exact halves, we get a circle whose centre, radius and diameter are those of the sphers itself. A sphere has only one face.

If the radius of sphere is 'r'

Surface Area = $4\pi r^2$

Volume = $\frac{4}{3}\pi r^3$

Hemisphere

If we slice a sphere into exact halves, we get two hemispheres. A hemispherse has two faces. One flat face and one curved face.

If the radius of a hemisphere is 'r'

Surface Area = $3\pi r^2$

Volume = $\frac{2}{3}\pi r^3$

Worksheet 1

Measures of some square pyramids are given in a table. Complete the table.

Length of Base edge (a)	**Half the length of base edge** $\left(a/2\right)$	**height (h)**	**Slant height** (*l*)
12	____	8	____
____	3	____	5
____	12	____	13
____	____	15	17
____	15	20	____

Worksheet 2

Length of one base edge (a)	**Half the length of** base edge $\left(a/2\right)$	**Slant height** (l)	**Lateral edge** (e)
8	____	____	5
____	6	____	10
____	____	____	13
24	____	____	25
40	16	____	20

Worksheet 3

Base edge and leateral edge of a square pyramid are equal and length of one edge is 6cm. Find slant height and height?

a = ———— cm

$l = \frac{\sqrt{3}}{2} \times$ ____ h = $\frac{a}{\sqrt{2}}$

$= \frac{\sqrt{3}}{2} \times$ ____ = $\frac{\quad}{\sqrt{2}}$

= ____ $\sqrt{3}$ = ____ $\times \sqrt{2}$

Worksheet 4

The base edge and slant height of a square pyramid are 12cm, 15cm. Find L.S.A and T.S.A

a = —— cm l = cm

Base area (a^2) = ——

Lateral surface area = (2al) = ——

Total surface area = $a^2 + 2al$

= —— + —— = —— cm^2

Worksheet 5

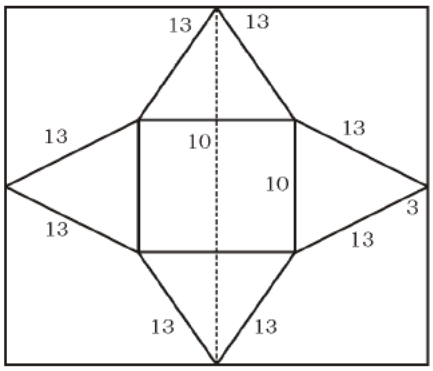
Length and breadth of a rectangler paper sheet are 40cm and 34cm. From the centre of the paper sheet the marked portion is cut and folded.

a) What is the shape of paper folded?

b) What is the area of the paper which is cut and fold?

Name of the solid = ————

Area of the square = a^2



Height of the triangle shape = $\sqrt{(\ )^2-(\ )^2}$

$= \sqrt{\_\_\_\_ - \_\_\_\_}$

$= \sqrt{\_\_\_\_\_}$

= ——— cm

Area of one triangle = $\frac{1}{2} \times b \times h$

$= \frac{1}{2} \times \_\_\_\_ \times \_\_\_\_$

= ——— cm^2

Area of the cutout portion = Area of square + 4× Area of triangle

= ——— + 4× ———

= ——— + ———

= ——— cm^2

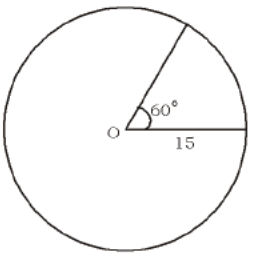
Worksheet 6

A sector is cut out from a circle of radius 24cm with central angle 60°. The sector is bent into a cone than find the radius of the sector.

a) Slant height of the cone ———

b) Radius the cone (r)———

l = R =——— cm

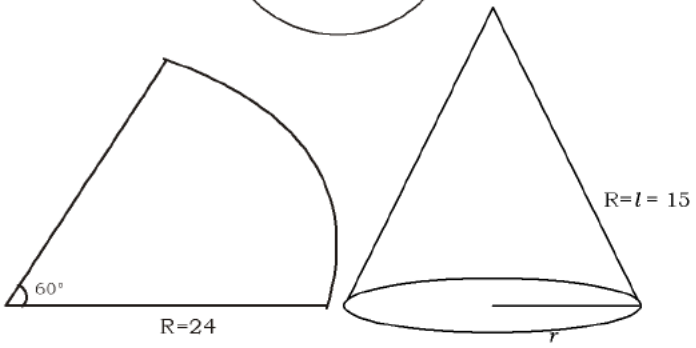


$\frac{x}{360} = \frac{r}{R}$

$\frac{\square}{360} = \frac{r}{\square}$

$r \times 360 = \square \times \square$

$r = \frac{\square \times \square}{360} = \square$



Worksheet 7

Base radius and height of a cone are 20cm and 15cm, then find its volume.

r = _____ cm h = _____cm

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

$= \frac{1}{3} \times \pi \times$ ____$^2 \times$ ____

= ____ × ____ = ____ cm^3

Worksheet 8

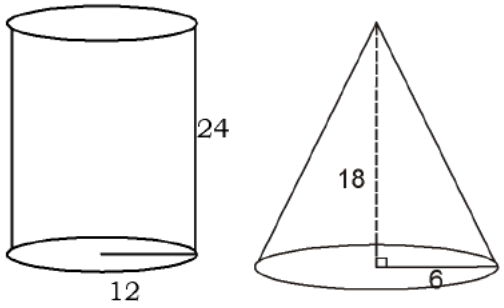
A solid metalic cylinder of height 24 cm and base radius 12 cm is melted and recast into cones of height 6cm and radius 18cm. How may cones can be made?

Cyliner

r = 12 cm h = 24 cm

$v = \pi \times r^2 h$

$= \pi \times$ ——— × ——— cm^3



Cone

r = 6 cm

h = 18 cm

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

$= \frac{1}{3} \times \pi$ ____ $^2 \times$ ____

$= \pi \times$ ____ × ____

No.of the cone = $\frac{\text{Volume of cycliner}}{\text{Volume of cone}} = \frac{\pi \times \_\_\_\_ \times \_\_\_\_}{\pi \times \_\_\_\_ \times \_\_\_\_} =$ _____

Worksheet 9

Some measurements of cones are given. Complete the table.

Sl. No	**Stant height (*l*)**	**Height (*h*)**	**Radius (*r*)**	**Curved Surface Area**	**Total surface Area**	**Volume**
1	5	__	3	_____	_____	_____
2	15	9	__	_____	_____	_____
3	__	16	12	_____	_____	_____
4	25	__	20	_____	_____	_____

Worksheet 10

A sector of central angle 60° is cut from a circle of radius 12cm and rolled up into a cone. Find

a) Slant height

b) Radius of cone

c) Curved surface area

d) Slant height (l) = Radius of sector = _____

b) $x = 60°$

$$\frac{x}{l} = \frac{x}{360}$$

$$\frac{r}{12} = \frac{60}{360}$$

r × _____ × _____

r = _____

c) Curved surface area = π rl = _____ × _____ = _____

Worksheet 11

A sector is rolled up to form a cone with radius 15cm and slant height 25cm. Then find.

a) Radius of sector

b) Central angle of the sector

c) Volume of cone

a) Radius of sector = Slant height of cone = _____

r = _____

b) Let central angle = x

$$\frac{r}{l} = \frac{x}{360}$$

x × _____ = _____ × _____

x = _____

c) Let height of cone = h

h = $\sqrt{l^2 - r^2}$

= _____

= _____

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

= _____

Worksheet - 12

The surface area of a solid sphere is 120 square centimeters. If it is cut into two halves, what would be the surface area of each hemisphere?

Surface Area of the shere = □

$4\pi r^2$ = □

πr^2 = $\frac{\square}{4}$

= □sq.cm

Surface Area of Hemisphere = $3\pi r^2$

= 3 × □

= □ sq.cm

Worksheet - 13

The base radius and length of a metalic cylinder are 4cm and 10cm. If it is melted and recast into spheres of radius 2cm each, how many spheres can be made?

Metal cylinder

radius = r = □cm

height = h = □ cm

volume = $\pi r^2 h$

= π ×□×□

= □ cubic cm

Sphere

radius, r = □ cm

Volume = $\frac{4}{3}\pi r^3$

= $\frac{4}{3}\pi \times$ □

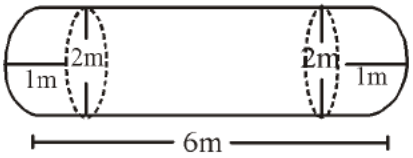
= $\frac{4}{3}\pi \times$ □

= □ cubic cm

Number of spheres = $\frac{\text{Volume of cylinder}}{\text{Volume of one sphere}} = \frac{\square}{\square} = \square$

Worksheet - 14

The picture shows the dimensions of a petrol tank. How many litres of petrol can it hold?



This shape is one cylinder and two hemispheres

Hemisphere

radius = r = 1m

volume = $\frac{2}{3}\pi r^3$

$= \frac{2}{3} \times \pi \times \square$

$= \frac{2}{3}\pi$ Cubic metre

Cylinder

radius = r = 1cm

height = h = 6 – (1 + 1)

$= 6 - \square$

$= \square$

Volume $= \pi r^2 h$

$= \pi \times \square \times \square$

$= \square$ Cubic metre

Volume of petrol tank = volume of 2 hemispheres + volume of cylinder

$= 2 \times \frac{2}{3}\pi + 4\pi$

$= \frac{4\pi}{3} + \frac{12\pi}{3}$

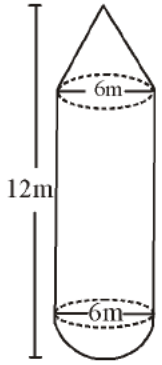
$= \frac{16\pi}{3}$ Cubic metre

$= \frac{16\pi}{3} \times 1000$ litre

$= \frac{16000\pi}{3}$ litre

Worksheet - 15

The picture shows the shape of a boiler. Total height of the boiler is 12 m and diameter is 6 meters, height of the cylindrical part is 6 meters.



a) What is the height of the cone?

b) What is the capacity of the boiler?
($1m^3$ = 1000 litres)

a) Height of the cone = 12– (6+3)
= 12 – □
= □ m

b) This shape contains a cyclinder, a cone and a hemisphere

Cone

radius = r = □ m

height = h = □m

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

$= \frac{1}{3}\pi \times \square \times \square$

$= \frac{1}{3}\pi \times \square$

$= 9\pi\ m^3$

Cylinder

radius = r = □ m

height = h = □m

volume = $\pi r^2 h$

$= \pi \times \square \times \square$

$= 54\pi\ m^3$

Hemispher

radius = r = □ m

volume = $\frac{2}{3}\pi r^3$

$= \frac{2}{3}\pi \times \square$

$= 18\pi\ m^3$

Total volume of boiler = volume of cone + volume of cylinder + volume of hemisphere.

radius = $9\pi + 54\pi + 18\pi =$ □ m^3

$= 81\pi \times 1000$ litre

= □ litre

ANSWERS

Worksheet 1

Complete the table

Length of Base edge	half the length of base edge	height	Slant height
12	6	8	10
6	3	4	5
24	12	5	13
16	8	15	17
30	15	20	25

Worksheet 2

Length of one basic edge (a)	Half the length of Basic edge	Slant height	Lateral edge
8	4	3	5
12	6	8	10
24	12	5	13
40	20	15	25
32	16	12	20

Worksheet 3

a = 6cm

$l = \frac{\sqrt{3}}{2} \times a$ $\qquad$ $h = \frac{a}{\sqrt{2}}$

$= \frac{\sqrt{3}}{2} \times 6$ $\qquad$ $= \frac{6}{\sqrt{2}}$

$= 3\sqrt{3}$ cm $\qquad$ $= 3\sqrt{2}$ cm

Worksheet 4

a =12 cm l = 15 cm

Base area (a^2) = 12^2 = 144

Lateral Surface Area = (2al) = 2 ×12×15 = 360cm^2

Total Surface Area = a^2 + 2al = 144 + 360 = 504cm^2

Worksheet 5

a) Name of the folded shape is square pyramid

b) Area of square (a^2) =10^2

= 100cm^2

Height of the triangle (l) = $\sqrt{13^2 - 5^2}$

= $\sqrt{109 - 25}$

= $\sqrt{144}$

= 12 cm

Area of one triangle = $\frac{1}{2}al$

= $\frac{1}{2} \times 10 \times 12$

= 60 cm^2

Area of the cut portion = Area of square + 4× Area of triangle

= 100 + (4× 60)

= 100 + 240

= 340 cm^2

Worksheet 6

a) l = R = 24cm

b) $\frac{x}{360} = \frac{r}{R}$

$\frac{60}{360} = \frac{r}{24}$

$\frac{1}{6} = \frac{r}{24}$

6 ×r = 1 × 24

r = $\frac{24}{6}$ = 4cm

Worksheet 7

r =20cm h =15cm

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

$= \frac{1}{3} \times \pi \times 20^2 \times 15$

$= \pi \times 400 \times 5 = 2000\pi \text{ cm}^3$

Worksheet 8

Volume of cylinder = $\pi r^2 h$

$= \pi \times 12^2 \times 24$

$= 3456\pi \text{ cm}^3$

Volume of cone $= \frac{1}{3} \times \pi r^2 h$

$\frac{1}{3} \times \pi \times 6^2 \times 18$

$= 216\pi$

No. of cones = $\frac{\text{Volume of cylinder}}{\text{Volume of cone}} = \frac{3456\pi}{216\pi} = 16$

Worksheet 9

Sl. No	**Stant height (*l*)**	**Height (*h*)**	**Radius (*r*)**	**Curved Surface Area**	**Total surface Area**	**Volume**
1	5	4	3	15π	24π	12π
2	15	9	12	180π	32π	43π
3	20	16	12	240π	384π	76π
4	25	15	20	500π	900π	2000π

Worksheet 10

a) l = 12 scm

b) $x = 60°$

$\frac{r}{12} = \frac{60}{360}$

r = $\frac{12 \times 60}{360} = 2$ cm

c) Curved surface area = πrl

$= \pi \times 2 \times 12 = 24\pi$ sq. cm

Worksheet 11

a) Radius of sector (R) $= l =$ 25 cm

b) $\frac{r}{l} = \frac{x}{360}$

$x = \frac{360 \times 15}{25}$

$= 216^0$

c) h = $\sqrt{l^2 - r^2}$

$= \sqrt{25^2 - 15^2}$

$= \sqrt{625 - 225} = \sqrt{400} = 20$ cm

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

$= \frac{1}{3} \pi \times 15^2 \times 20$

$= 1500\pi$ cubic cm

Worksheet - 12

Surface Area of the shere = 120 sq.cm

$4\pi r^2 = 120$

$\pi r^2 = 30$ sq.cm

Surface Area of Hemisphere $= 3\pi r^2$

$= 3 \times 30$

$= 90$ sq.cm

Worksheet - 13

cylinder

radius = r = 4cm

height = h = 10 cm

volume = $\pi r^2 h$

$= \pi \times 4^2 \times 10$

$= \pi \times 160$

$= 160\pi$ cubic cm

Sphere

radius, r = 2 cm

Volume = $\frac{4}{3}\pi r^3$

$= \frac{4}{3}\pi \times 2^3$

$= \frac{4}{3}\pi \times 8$

$= \frac{32\pi}{3}$ cubic cm

Number of spheres = $\frac{\pi \times 160}{\frac{4}{3}\pi \times 18}$

$= \frac{3}{4} \times 20$

$= 15$

Worksheet - 14

Hemisphere

radius = r = 1m

volume $= \frac{2}{3} \times \pi \times 1^3$

$= \frac{2}{3}\pi$ Cubic metre

Cylinder

radius = r = 1cm

height = h = 6 – (1 + 1)

= 6 – 2

= 4m

Volume $= \pi r^2 h$

$= \pi \times 1^2 \times 4$

$= 4\pi$ Cubic metre

Volume of petrol tank $= 2 \times \frac{2}{3}\pi + 4\pi$

$$= \frac{4\pi}{3} + \frac{12\pi}{3}$$

$$= \frac{16\pi}{3} \text{ Cubic metre}$$

$$= \frac{16\pi}{3} \times 1000 \text{ litre}$$

$$= \frac{16000\pi}{3} \text{ litre}$$

Worksheet - 15

a) Height of the cone = 12– (6+3)
= 12 – 9
= 3 m

Cone

radius = r = 3 m
height = h = 3m

volume $= \frac{1}{3}\pi \times 3^2 \times 3$

$= \frac{1}{3}\pi \times 9 \times 3$

$= 9\pi \text{ m}^3$

Cylinder

radius = r = 3 m
height = h = 6m

volume = $\pi r^2 h$

$= \pi \times 3^2 \times 6$

$= 54\pi \text{ m}^3$

Hemisphers

radius = r = 3 m

volume = $\frac{2}{3}\pi r^3$

$= \frac{2}{3}\pi \times 3^3$

$= 18\pi \text{ m}^3$

Total volume of boiler $= 9\pi + 54\pi + 18\pi$

$= 81\pi \text{ m}^3$

$= 81\pi \times 1000$ litre

$= 81000$ litre

MORE PRATICE PROBLEMS

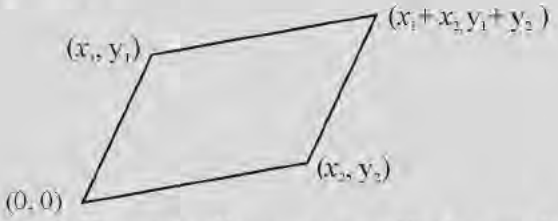
1. Radius of two spheres are in the ratio 2:3
   a. Find the ratio of their surface areas.
   b. Find the ratio of their volumes
2. What is the slant height of a cone of base perimeter 12π cm and height 8cm. Ans: 10
3. What is the surface area of largest sphere that can be carved out from a cube of side 10cm? Ans. 314 cm^2
4. A metal piece in the form of a cone of base radius 3cm is melted and recast into a sphere of radius 4cm. Find the height of cone. $(\frac{256}{9})$
5. Lateral surface area of a square pyramid with base are a 196 sq.cm is 700 sq.cm. Find its
   a) Base edge
   b) Slant height
   c) Height 14cm, 25cm, 24cm
6. A solid metal cylinder of base radius 8cm and gheight 17cm is melted and recast into solid hemispheres of radius 2cm, How many such hemisphere can be made? (144)
7. The edge of a cube is 12cm. Find the volume of the largest sphere that can be curved out from it. (288π cubic centimeter)
8. All edges of a square pyramid are equal. Total length of all edges is 96cm. Find the volume of the square pyramid? ($288\sqrt{2}\ \text{cm}^3$)
9. Slant height of cone is 20cm, radius 10cm. What should be the radius and central angle of the sector? (r=10cm, angle = 180^0)
10. Radius of a cone is 10cm, volume 3140 cubic centimeter. Calculate total surface area.

Unit 9

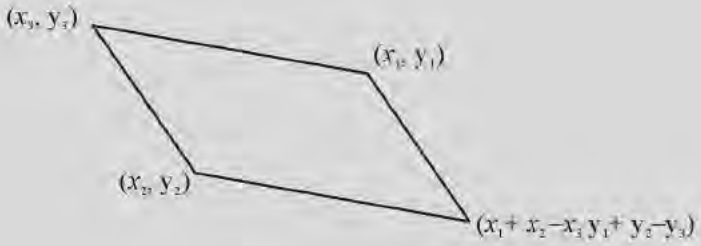
GEOMETRY AND ALGEBRA

Points to Remember

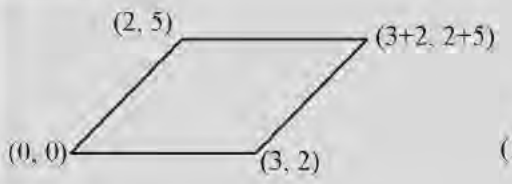
- The fourth vertex of the parallelogram with two adjacent sides are the lines formed by joining the origin with the points $(x_1, y_1)$and (x_2, y_2) is $(x_1 + x_2,\ y_1 + y_2)$.

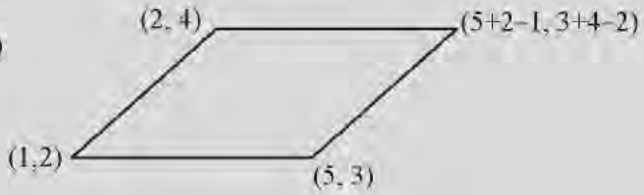


- The fourth vertex of the paralleogram with two adjacent sides are the lines formed by joining the points (x_1, y_1) and (x_2, y_2) with (x_3, y_3) is $(x_1 + x_2 - x_3, y_1 + y_2 - y_3)$



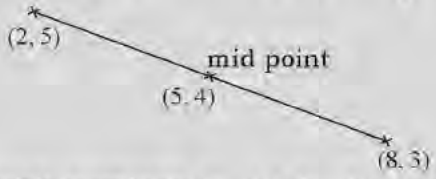
Example:





- The mid point of the line joining (x_1, y_1) and (x_2, y_2) is $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

Eg:



- The centroid of the triangle with vertices (x_1, y_1) (x_2, y_2) and (x_3, y_3) is $\left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}\right)$.

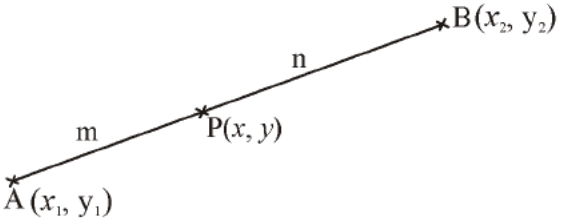
Eg: The centroid of the triangle with vertices (2, 1), (5, 3) and (8, 2)

$\left(\frac{2+5+8}{3}, \frac{1+3+2}{3}\right) = (5,\ 2)$

- If the point P(x, y) divides the line segment joining the points (x_1, y_1) and (x_2, y_2) in the ratio, m : n then

$$x = x_1 + \frac{m}{m+n}(x_2 - x_1)$$

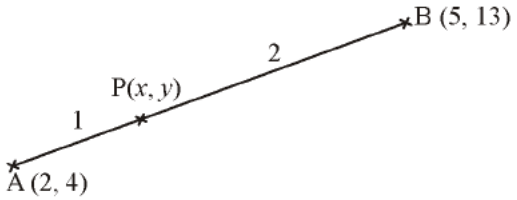
$$y = y_1 + \frac{m}{m+n}(y_2 - y_1)$$



If the point P(x, y) divide the line AB in the ratio 1:2, then

$$x = 2 + \frac{1}{3} \times (5-2) = 2 + \frac{1}{3} \times 3 = 2 + 1 = 3$$

$$y = 4 + \frac{1}{3}(13-4) = 4 + \frac{1}{3} \times 9 = 4 + 3 = 7$$



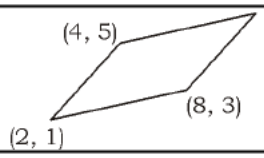
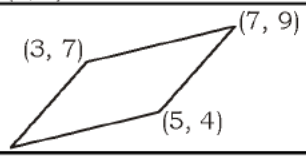
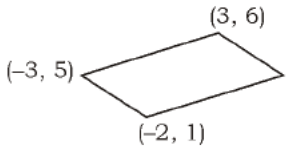
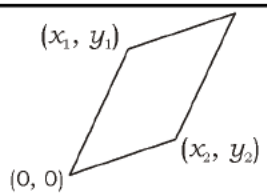
- In any line which is not parallel to the axes, the change in y is proportional to the change in x. In this case, the proportionality constant is the slope of this line.
- Slope of the line joining (x_1, y_1) and (x_2, y_2) is $\frac{y_2 - y_1}{x_2 - x_1}$

  Eg: Slope of the line joining (2, 3) and (8, 6) is $\frac{6-3}{8-2} = \frac{3}{6} = \frac{1}{2}$
- The constant relation between the x-coordinate and y-coordinate of any point on a line is called its equation.
- The equation of the line joining (x_1, y_1) and (x_2, y_2) is $\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$
- The constant relation between the x-coordinate and y-coordinate of any point on a circle is called its equation.
- The equation of the circle with centre as the origin and radius 'r' is $x^2 + y^2 = r^2$
- The equation of the circle with centre (x_1, y_1) and radius 'r' is $(x - x_1)^2 + (y - y_1)^2 = r^2$
- If (x_1, y_1), (x_2, y_2) and (x_3, y_3) are three vertices of a triangle then co-ordinates of the centroid = $\left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3} \right)$
- In any line which is not parallel to the axes, the change in y is proportional to the change in x. In this case, the proportionality constant is the slope of this line.
- Slope of the line joining (x_1, y_1) and (x_2, y_2) is $\frac{y_2 - y_1}{x_2 - x_1}$
- The constant relation between the x-cordinate and y-coordinate of any point on a line is the equation of the line.

- The equation of the line joining (x_1, y_1) and (x_2, y_2) is $\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$
- The constant relation between the x-coordinate and y -coordinate of any point on a circle is the equation of the circle.
- The equation of the circle with centre at the origin and radius 'r' is $x^2 + y^2 = r^2$.
- The equation of the circle with centre (x_1, y_1) and radius 'r' is $(x - x_1)^2 + (y - y_1)^2 = r^2$

Worksheet - 1

In the following table, write the co-ordinates of the fourth vertex.

Parallelogram	Co-ordinates of fourth vertex
	(8 + 4 – 2, 5 + 3 – 1) = (10, 7)
	
	
	

Worksheet - 2

In the following table, given the co-ordinates of the points A and B. Find the co-ordenates of the midpoint of the line AB

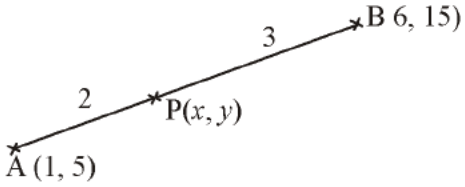
Co-ordinats of the points A and B	Co-ordinates the midpoints of the line AB		
	x- Co-ordinates	y-Co-ordinates	Co-ordinates of the midpoints
(3, 8), (5, 6)	$\frac{3+5}{2} = 4$	$\frac{8+6}{2} = 7$	(4, 7)
(5, –2) , (3, 8)			
(–2, –6). (–4, –10)			
(4, 3), (7, 5)			
$\left(\frac{1}{2}, \frac{1}{3}\right)\left(\frac{3}{2}, \frac{5}{3}\right)$			

Worksheet - 3

If A (1, 5) and B(6, 15) then find the coordinates of the point which divide the line AB in the ratio 2:3

Let P (x, y) be the point dividing the line AB in the ratio 2:3

AP = $\frac{\square}{\square\square}$ part of AB.



x- coordinate of A = $\square$

Difference between the x- coordinates of A and B

= $\square$ – $\square$ = $\square$

x- coordinate of P $= 1 + \frac{2}{5} \times 5$

= $\square$ + $\square$

= $\square$

y-coordinate of A = $\square$

Difference between the y-co-ordinates of A and B

= $\square$ – $\square$ = $\square$

y-coordinate of P $= 5 + \frac{2}{5} \times 10$

= $\square$ + $\square$

= $\square$

∴ Co-ordinates of P = ($\square$, $\square$)

Worksheet - 4

Find the slope of the line joining the points (3, 5), (6, 7)

Slope of the line = $\frac{7-5}{6-3} = \frac{2}{3}$

Complete the table given below

Two points on a line	***x*- difference**	***y*- difference**	**slope of the line**
(2, 5) (6, 7)	4	2	$\frac{2}{4} = \frac{1}{2}$
(3, 7), (6, 9)			
(3, 6), (4, 9)			
(–1, 4), (1, 2)			

Worksheet - 5

Check whether the points A(2, 3), B(4, 4) and C(8, 6) lie on a line

x - co-ordinate of A = ☐

x-co-ordinate of B = ☐

Difference between the x - coordinates of A and B = ☐ – 2

= ☐

y-coordinate of A = ☐

y-coordinate of B = ☐

Difference between the y-coordinates of A and B = ☐ – ☐

= ☐

$\therefore$ Slope of the line AB $= \frac{1}{2}$

Difference between the x-coordinates of B and C = ☐ – ☐

= ☐

Difference between the y-coordinates of B and C = ☐ – ☐

= ☐

$\therefore$ Slope of the line BC = $\frac{\square}{\square} = \frac{\square}{\square}$

Slopes of the lines AB and BC are equal ☐/not equal ☐

$\therefore$ The points A, B and C lie on a line ☐/not lie on a line ☐

Worksheet - 6

Find the equation of the line joining the points (2, 4), (5, 6)

Slope of the line = $\frac{6-4}{5-2} = \frac{2}{3}$

If (x, y) is a point on this line, then the slope of the line joining the points

(2, 4) and (x, y) in $\frac{y-4}{x-2} = \frac{2}{3}$

$\therefore$ the equation of this line is

$$\frac{y-4}{x-2} = \frac{2}{3}$$

$$2(x-2) = 3(y-4)$$

$$2x-4 = 3y-12$$

$$2x-3y-4+12=0$$

$2x - 3y + 8 = 0$

Complete the following table.

Two points on a line	Slope of the line	Equation of the line
(2,5), (4,6)	$\frac{1}{2}$	$\frac{y-5}{x-2} = \frac{1}{2}$ $1(x-2) = 2(y-5)$ $x-2 = 2y-10$ $x-2y-2+10 = 0$ $x-2y+8 = 0$
(2, 3), (4, 6)		
(1, 3), (5, 4)		
(–2, 4), (4, 5)		

Worksheet - 7

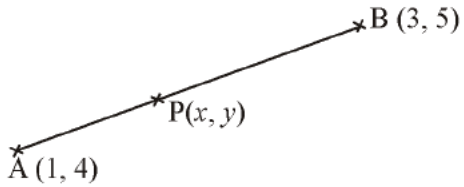
Find the equation of the line joining the points (1, 4) and (3, 5)

Let A (1, 4) and B (3, 5)

When we move from A to B

the x-co-ordinate is increased by ☐

y-co-ordinate is increased by ☐



When x-coordinate is increased by ☐ the y-co-ordinate is increased by ☐

The rate of increase in y with the increase in x, ie, the slope of this line = $\frac{\square}{\square}$

Now consider the points A and P,

the x-co-ordinate is increased by x – ☐

y-co-ordinate is increased by y – ☐

Since the rate of increase in y-coordinate with the increase in x-coordinate is always same at everywhere in a line

$$\frac{y-\square}{x-\square} = \frac{\square}{\square}$$

From this we get ☐ $(x -$ ☐$) =$ ☐ $(y -$ ☐$)$

Simplifying this, we get $x -$ ☐$y +$ ☐ $= 0$

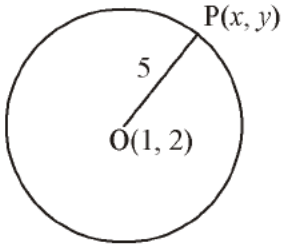
This is the equation of the line

Worksheet - 8

Find the equation of the circle with centre (1,2) and radius 5 unit

Let P(x, y) is a point on this circle.

Difference between the x-co-ordinates of O and P = $x - \square$



Difference between the y-co-ordinates of O and P = $y - \square$

length of the line OP = 5 unit

$$\sqrt{(x-\square)^2+(y-\square)^2}=5$$

$$(x-\square)^2+(y-\square)^2=25$$

$x^2 - \square x + \square + y^2 - \square y + \square = 25$

Simplify this we get

$x^2 + y^2 - \square x - \square y - \square = 0$

This is the equation of this circle

$x^2 - \square\, x + \square + y^2 - \square y + \square = 9$

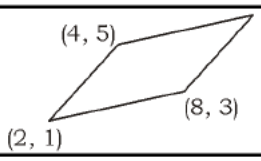
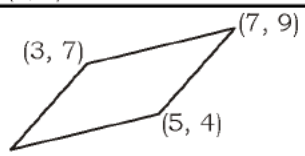
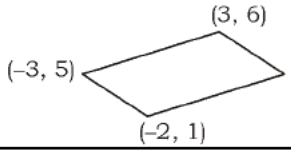
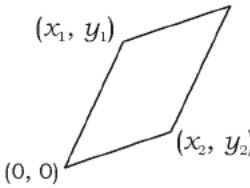
Simplifying this we get.

$x^2 + y^2 - \square x - \square y - \square = 0$

This is the equation of the circle.

ANSWERS

Worksheet - 1

Parallelogram	Co-ordinates of fourth vertex
	(10, 7)
	(1, 2)
	(4, 2)
	$(x_1 + x_x, y_1 + y_2)$

Worksheet - 2

Co-ordinats of the points A and B	Co-ordinates the midpoints of the line AB		
	x- Co-ordinate	*y*-Co-ordinate	Co-ordinates of the midpoints
(2, 7), (4, 5)	3	6	(3, 6)
(5, –2) , (3, 8)	4	3	(4, 3)
(–2, –6). (–4, –10)	–3	–8	(–3, –8)
(4, 3), (7, 5)	$11/2$	4	$(11/2, 4)$
$(1/2, 1/3)(3/2, 5/3)$	1	1	(1, 1)

Worksheet - 3

Co-ordinates of P (3, 9)

Work Sheet - 4

Two points on a line	*x*- difference	*y*- difference	slope of the line
(2, 5) (6, 7)	4	2	$\frac{2}{4} = \frac{1}{2}$
(3, 7), (6, 9)	3	2	$\frac{2}{3}$
(3, 6), (4, 9)	1	3	$3/1 = 3$
(–1, 4), (1, 2)	2	2	$\frac{-2}{2} = -1$

Worksheet -5

Slope of AB = $\frac{1}{2}$

Slope of BC = $\frac{1}{2}$

Slopes of AB and BC are equal

A, B, C are on a line.

Worksheet - 6

Two points on a line	**Slope of the line**	**Equation of the line**
(2,5), (4,6)	$\frac{1}{2}$	$\frac{y-5}{x-2} = \frac{1}{2}$ $1(x-2) = 2(y-5)$ $x-2 = 2y-10$ $x-2-2+10 = 0$ $x-2y+8 = 0$
(2, 3), (4, 6)	$\frac{3}{2}$	$\frac{y-3}{x-2} = \frac{3}{2}$ $3\ (x-2) = 2\ (y-3)$ $3x-6 = 2y-6$ $3x-2y = 0$
(1, 3), (5, 4)	$\frac{1}{4}$	$\frac{y-3}{x-1} = \frac{1}{4}$ $1(x-1) = 4(y-3)$ $x-1 = 4y-12$ $x-4y+11 = 0$
(–2, 4), (4, 5)	$\frac{1}{6}$	$\frac{y-4}{x-(-2)} = \frac{1}{6}$ $1(x+2) = 6(y-4)$ $x+2 = 6y-24$ $x-6y+26 = 0$

Worksheet - 7

Slope of the line = $\frac{1}{2}$

$$\frac{y-4}{x-1}=\frac{1}{2}$$

$x - 2y + 7 = 0$, is the equation of the line.

Worksheet - 8

Equation of the circle,

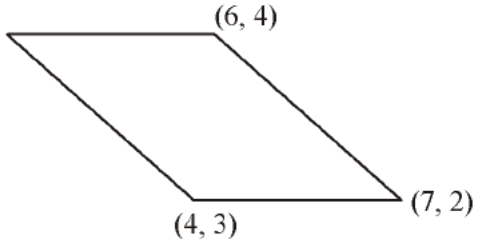
$(x-1)^2 + (y-2)^2 = 5^2$

$x^2 - 2x + 1 + y^2 - 4y + 4 = 25$

$x^2 + y^2 - 2x - 4y - 21 = 0$

PRACTICE QUESTIONS

1. Find the co-ordinates of the fourth vertex of the following parallelogram



2. Find the co-ordinates of the centroid of the triangle with vertices (-2, 4), (4,5) and (2,2).
3. If the co-ordinates of A and B are (2,5)and (8,15) respectively, then
   a. Find the co-ordinates of the midpoint of AB.
   b. Find the co-ordinates of the point P on this line such that AP: PB = 3:2
4. Prove that the points (2,3), (4,6) and (8,12) are on the same line.
5. Find the equation of the line joining (4,1) and (3, 7). Write the equation of the line parallel to this line and passes through (2,3)
6. a. Find the equation of the line passes through (1, 3) with slope 2.
   b. Check whether the point (3,7) is on this line.
7. The equation of a line is 2x-3y+6=0
   a. Find the coordinates of the points of intersection of this line with the axes.
   b. Also find the slope of this line
8. The equations of two lines are 2x +y – 6 = 0 and 2x +y +4 = 0
   a. Find the coordinates of any two points on each of these lines

b. Prove that these two lines are parallel.

9. Write the equation of the circle with centre as the origin and radius 5 unit.

10. Form the equation of the circle with centre as (2,1) and the radius 4 unit.

ANSWERS

1. Co-ordinates of fourth vertex = (4+6 – 7, 3 + 4 – 2) = (3, 5)

2. Centroid is $\left(\frac{-2+4+2}{3}, \frac{4+5+2}{3}\right)$ $= \left(\frac{4}{3}, \frac{11}{3}\right)$

3. a. Co-ordinates of the midpoint = $\left(\frac{2+8}{2}, \frac{5+15}{2}\right)$

$= (5, 10)$

b. x - coordinate of P = $2+\frac{3}{5}(8-2)$

$= 2+\frac{3}{5}\times 6$

$= 2+\frac{18}{5}$

$= 2+3\frac{3}{5}$

$= 5\frac{3}{5}$

y co-ordinate of P $= 5+\frac{3}{5}(15-5) = 5+\frac{3}{5}\times 10$

$= 5 + 6$

$= 11$

$\therefore$ Coordinates of P $= \left(5\frac{3}{5}, 11\right)$

4. Slope of the line joining (2, 3) and (4, 6)

$= \frac{6-3}{4-2}$

$= \frac{3}{2}$

Slope of the line joining (4, 6) and (8, 12)

$= \frac{12-6}{8-4}$

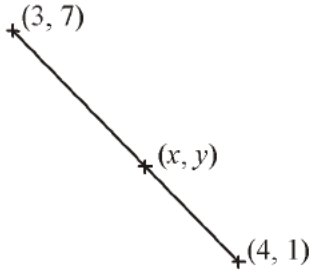
$$= \frac{6}{4} = \frac{3}{2}$$

Since the slopes are equal, the three points lie on the same line

5. Slope of the line joining (4,1) and (3,7) =

$$= \frac{7-1}{3-4} = -6$$

If (x, y) is a point on this line



$$\frac{y-1}{x-4} = -6$$

$$-6(x-4) = y-1$$

$$-6x + 24 = y - 1$$

$$6x + y - 25 = 0$$

which is the equation of this line

Slope of a line parallel to this line = –6

If (2, 3) is a point on this line

$$\frac{y-3}{x-2} = -6$$

$$-6x + 12 = y - 3$$

$$6x + y - 15 = 0,$$

which is the equation of the parallel line

6. a. Let (x, y) is a point on the line passes through (1, 3) and with slope 2.

$$\frac{y-3}{x-1} = 2$$

$$2x - 2 = y - 3$$

$$2x - y + 1 = 0$$

b. Consider the point (3,7)

$2x - y + 1 \Rightarrow 2 \times 3 - 7 + 1 = 6 - 7 + 1 = 0$

$\therefore$ point (3,7) is on this line.

7. Equation of the line is $2x - 3y + 6 = 0$

a. Let this line intersect the x-axis at $(x, 0)$

Then $2x - 3 \times 0 + 6 = 0$

$\therefore 2x + 6 = 0$

$\therefore x = -3$

$\therefore$ The point of intersection of this line with the x-axis is (–3, 0)

Let this line intersect the y-axis at (0, y)

Then $2\times0 - 3y + 6 = 0$

$\therefore -3y + 6 = 0$

$\therefore y = 2$

$\therefore$ The point of intersection of this line with the y-axis is (0,2)

b. Slope of the line $= \frac{2-0}{0-(-3)} = \frac{2}{3}$

8 a. In the equation $2x + y - 6 = 0$,

when $x = 0$, $y - 6 = 0$

$\therefore y = 6$

when $y = 0$, $2x - 6 = 0$

$\therefore x = 3$

$\therefore$ Two points on this line are (0, 6) and (3, 0)

In the equation $2x + y + 4 = 0$

when $x = 0$, $y + 4 = 0$

$\therefore y = -4$

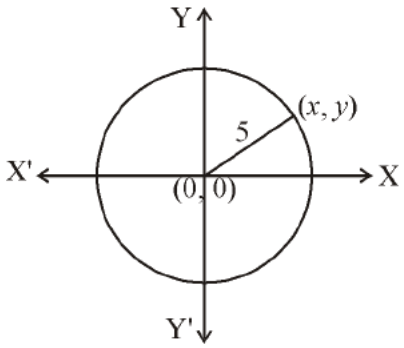
$y = 0$, $2x + 4 = 0$

$\therefore x = -2$

$\therefore$ Two points on this line are (0, –4) and (–2, 0)

b. In the equations $2x + y - 6 = 0$ and $2x + y + 4 = 0$, the difference is only in the constant term. So these two lines are parallel.

9.



If (x,y) is a point on this circle, then the equation of the circle is

$x^2 + y^2 = 5^2$

ie. $x^2 + y^2 = 25$

10. If (x, y) is a point on this circle, then the distance between (x, y) and (2, 1) is 4 unit.

$$\sqrt{(x-2)^2 + (y-1)^2} = 4$$

$$(x-2)^2 + (y-1)^2 = 16$$

$$x^2 - 4x + 4 + y^2 - 2y + 1 = 16$$

$$x^2 + y^2 - 4x - 2y + 5 - 16 = 0$$

$$x^2 + y^2 - 4x - 2y - 11 = 0$$

which is the equation of this circle.

POLYNOMIALS

Points to Remember

- If $p(x) = q(x) \times r(x)$ then the polynomials $q(x)$, $r(x)$ are factors of $p(x)$

  Example: $p(x) = x^2 - 1 = (x + 1)(x - 1)$

  $\therefore$ $(x + 1)$ and $(x - 1)$ are factors of $x^2 - 1$

- If $p(a) = 0$ then $(x - a)$ is a factor of the polynomial $p(x)$, a is the solution of the equation $P(x)=0$

  Example: If $p(5) = 0$ then $(x - 5)$ is a factor of $p(x)$. 5 is the solution of $P(x) = 0$

- If $p(x)$ can be written as $p(x) = (x - a_1)(x - a_2) \ldots (x - a_n)$ then the numbers $a_1, a_2, \ldots\ldots a_n$ are solutions of the equation $p(x) = 0$

  Example: If $p(x) = (x - 1)(x - 2)(x - 3)$ then 1, 2, 3 are solutions of the equation $p(x) = 0$

Worksheet - 1

Is $(x - 2)$ a factor of the polynomial $p(x) = x^2 - 5x + 6$.

$p(x) = x^2 - 5x + 6$

$p(2) = \square^2 - 5 \times \square + 6$

$= \square - \square + 6$

$= \square$

$\therefore (x - 2)$ is a factor of $p(x)$ yes $\square$ / No $\square$

Worksheet - 2

Write $x^2 - 7x + 12$ as the product of two first degree polynomials.

$x^2 - 7x + 12 = (x - a)(x - b)$

$x^2 - 7x + 12 = x^2 - (a + b)x + ab$

$a + b = \square$, $ab = \square$

$a = \square$

$b = \square$

$\therefore x^2 - 7x + 12 = (x - \square)(x - \square)$

Worksheet - 3

For all numbers x and y, we have $x^2 - y^2 = (x+y)\ (x-y)$

by using this, $x^2 - 9 = x^2 - 3^2 = (x+3)(x-3)$

$(x+3)$ and $(x-3)$ are factors of $x^2 - 9$

Fill up the following table.

Second degree polynomial p(x)	$x^2 - y^2$ **from**	**Factor form of p(x)** $[(x+y)\ (x-y)$form$]$	**Factors of p(x)**
$x^2 - 4$	$x^2 - 2^2$	$(x+2)\ (x-2)$	$x+2,\ x-2$
$x^2 - 25$	_____	_____	___, ___
$x^2 - 3$	$x^2 - \left(\sqrt{3}\right)^2$	_____	___, ___
$x^2 - 10$	_____	_____	___, ___
$4x^2 - 16$	$(2x)^2 - 4^2$	_____	___, ___
$9x^2 - 36$	_____	_____	___, ___
$x^2 - 1/9$	$x^2 - \left(1/3\right)^2$	_____	___, ___
_____	_____	_____	___, ___

Worksheet - 4

$p(x) = x^2 + 7x + 12$

a) Write p(x) as the product of two first degree polynomials.

b) What are the solutions of the equation p(x) = 0

Let $x^2 + 7x + 12 = x^2 + (a+b)x + ab$

a + b = 7

ab = 12

a = 4, b = 3

$x^2 + 7x + 12 = x^2 + (4+3)x + (4\times 3)$

$= (x+4)\ (x+3)$

b) $p(x) = (x+4)\ (x+3)$

$= [x-(-4)]\ [x-(-3)]$

∴ The solutions of the equation p(x) = 0 are –4 and –3

Fill up the following table.

Second degree polynomial p(x)	**Factor form of p(x)**	**Factors of p(x)**	**Solutions of the equation p(x) = 0**
$x^2+11x+10$	$(x+1)\ (x+10)$	$x+1,\ x+10$	–1, –10
$x^2+8x+15$	_____	_____, _____	_____, _____
$x^2-7x+12$	$(x-3)\ (x-4)$	_____, _____	__3__, _____
$x^2-8x+12$	_____	_____, _____	_____, _____
$x^2+12x-13$	$(x+13)\ (x-1)$	_____, _____	–9, _____
$x^2-12x-13$	_____	_____, _____	_____, _____

Worksheet - 5

Factor pf $P(x) - P(a)$ is $x-a$

p(x) = $x^2-8x+12$

a) What number is p(3) ?

b) Write p(x) – p(3) as the product of two first degree polynomials.

a) p(3) = 3^2 – (8 × □) + 12

= 9 – 24 + □

= □

b) p(x) – p(3) = $\left(x^2-8x+10\right)$ – □

= x^2-8x+8

= (x–□) (x–□)

Worksheet - 6

a) Write $x^2-2x-35$ as the product of two first degree polynomials.

Consider the equation $x^2-2x-35=0$

a = □, b = □, c = □

b^2-4ac = $□^2$ – 4 × □ × □

= □ – □

= □

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

$$= \frac{□\ \pm\sqrt{□}}{2\times□}$$

$= \frac{\square}{\square}$ or $\frac{\square}{\square}$

$= \square$ or $\square$

$x^2 - 2x - 35 = (x + \square)(x - \square)$

Worksheet - 7

Prove that the polynomial x^2+2x+2 cannot be written as the product of first degree polynomials.

Consider the equation $x^2+2x+2=0$

a = $\square$, b = $\square$, c = $\square$

$b^2 - 4ac = \square^2 - 4 \times \square \times \square$

$= \square - \square = \square$

Since $b^2 - 4ac$ <0, the equation $x^2+2x+2=0$ has no solution.

So the polynomial x^2+2x+2 cannot be factored into a product of first degree polynomials.

Worksheet - 8

In the polynomial $2x^2+kx+4$, what number must be taken as k to get a polynomial for which $(x-1)$ is a factor?

$p(x)=2x^2+kx+4$

$(x-1)$ is a factor, if p(1) = $\square$

$2\times\square^2 + k\times \square + \square = 0$

$1 + k + \square = 0$

$k + \square = 0$

$k = \square$

Answers

Worksheet - 1

$P(2) = 2^2-5\times2 + 6$

$= 4-10+6$

$= 0$

$P(2)=0$, $(x-2)$ is a factor of $P(x)$ Yes

Worksheet - 2

a+b =-7 ab=12

a = -4

b = -3

$\therefore x^2-7x+12 = (x-4)(x-3)$

Worksheet- 3

Second degree polynomial p(*x*)	$x^2 - y^2$ **form**	**Factor form of p(*x*)** $[(x+y)\ (x-y)\text{form}]$	**Factors of p(*x*)**
x^2-4	x^2-2^2	$(x+2)\ (x-2)$	$x+2,\ x-2$
x^2-25	x^2-5^2	$(x+5)\ (x-5)$	$x+5,\ x-5$
x^2-3	$x^2-\left(\sqrt{3}\right)^2$	$(x+\sqrt{3})\ (x-\sqrt{3})$	$x+\sqrt{3},\ x-\sqrt{3}$
x^2-10	$x^2-\left(\sqrt{10}\right)^2$	$(x+\sqrt{10})\ (x-\sqrt{10})$	$x+\sqrt{10},\ x-\sqrt{10}$
$4x^2-16$	$(2x)^2-4^2$	$(2x+4)\ (2x-4)$	$2x+4,\ 2x-4$
$9x^2-36$	$(3x)^2-6^2$	$(3x+6)\ (3x-6)$	$3x+6,\ 3x-6$
$x^2-\frac{1}{9}$	$x^2-\left(\frac{1}{3}\right)^2$	$\left(x+\frac{1}{3}\right)\ \left(x-\frac{1}{3}\right)$	$x+\frac{1}{3},\ x-\frac{1}{3}$

Worksheet - 4

Second degree polynomial p(*x*)	**Factor form of p(*x*)**	**Factors of p(*x*)**	**Solutions of the equation p(*x*) = 0**
$x^2+11x+10$	$(x+1)\ (x+10)$	$x+1,\ x+10$	$-1,\ -10$
$x^2+8x+15$	$(x+3)\ (x+5)$	$x+3,\ x+5$	$-3,\ -5$
$x^2-7x+12$	$(x-3)\ (x-4)$	$x-3,\ x-4$	$3,\ 4$
$x^2+4x-12$	$(x-2)\ (x+6)$	$x-2,\ x+6$	$2,\ 6$
$x^2+12x-13$	$(x+13)\ (x-1)$	$x-1,\ x+13$	$1,\ -13$
$x^2-12x-13$	$(x+1)\ (x-13)$	$x+1,\ x-13$	$-1,\ 13$

Worksheet - 5

$P(3) = 3^2-(8\times3)+12$

$= 9-24+12$

$= -3$

$P(x) - P(3) = (x^2-8x+12) - -3$

$= x^2 - 8x+15$

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

Worksheet - 6

a = 1, b = –2, c = -35

$b^2-4ac = (-2)^2-4\times1\times-35$

$= 4+140$

$= 144$

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

$= \frac{2\pm\sqrt{144}}{2\times1}$

$= \frac{2+12}{2}$ or $\frac{2-12}{2}$

= 7 or -5

$x^2-2x-35=(x+7)\ (x-5)$

Worksheet - 7

a = 1, b = 1, c = 2

$b^2-4ac = 2^2-(4\times1\times2)$

= 4–8=-4<0

Worksheet- 8

p(1) = 0

$2\times1^2+k\times1+4=0$

2 + k + 4 = 0

k + 6 = 0

k = – 6

PRACTICE PROBLEMS

1. Consider the polynomial $p(x) = x^2 - 5x + 4$
2. Consider the polynomial $p(x) = x^2 - 5x + 6$

   Is $(x - 2)$ a factor of $p(x)$? why ?
3. Write $x^2 - 3x + 2$ as the product of two first degree polynomials
4. If $(x - 2)$ is a factor of the polynomial $2x^2 + kx - 4$,then what is the value of k ?
5. If $(x - 1)$ and $(x - 2)$ are factors of the polynomial $x^3 - 6x^2 + ax + b$, find the values of a and b.
6. Write a second degree polynomial with $x+1$ is a factor.
7. Write x^2-81 as the product of two first degree polynomials
8. $P(x)=2x^2+5x-10$. Calculate P(2) factor of P(x)–P(2) is?

9. If $(x-1)$ is a factor of the polynomial $ax^2 + bx + c$ then what is the value of $a + b + c$?

10. Prove that the polynomial $x^2 + 3x + 3$ cannot be written as the product of two first degree polynomials.

ANSWERS

1. a) $P(1) = 1^2 - (5 \times 1) + 4 = 1 - 5 + 4$

$= -4 + 4 = 0$

b) $P(1) = 0$, $\therefore$ *(x–1)* is a factor of *P(x)*

2. $p(x) = x^2 - 5x + 6$

$p(2) = 2^2 - 5 \times 2 + 6$

$= 4 - 10 + 6$

$= 0$

b. Since $p(2) = 0$, $(x-2)$ is a factor of $p(x)$

3. $p(x) = x^2 - 3x + 2$

Let $x^2 - 3x + 2 = (x - a)(x - b)$

$\therefore \quad x^2 - 3x + 2 = x^2 - (a + b)x + ab$

$\therefore \quad a + b = 3$

$ab = 2$

$a = 2$

$b = 1$

$\therefore \quad x^2 - 3x + 2 = (x - 2)(x - 1)$

4. $P(2) = 2 \times 2^2 + (k \times 2) - 4 = 0$

$= 8 + 2k - 4 = 0$

$2k + 4 = 0$

$2k = -4$

$K = {}^{-4}\!/_{2} = -2$

5. Since $(x-1)$ and $(x-2)$ are factors of the polynomiel $p(x) = x^3 - 6x^2 + ax + b$, we have $p(1) = p(2) = 0$

$p(1) = 1^3 - 6 \times 1^2 + a \times 1 + b = 0$

$\therefore 1 - 6 + a + b = 0$

$-5 + a + b = 0$

$a + b = 5$ ——— (1)

$p(2) = 2^3 - 6 \times 2^2 + a \times 2 + b = 0$

$\therefore 8 - 6 \times 4 + 2a + b = 0$

$8 - 24 + 2a + b = 0$

$-16 + 2a + b = 0$

$\therefore \quad 2a + b = 16$ ——— (2)

(2) - (1), $\quad a = 11$

From (1), $\quad b = 5 - 11 = -6$

$\therefore \; a = 11, b = -6$

6. $(x+1)(x-1) = x^2 - 1$ *or*

$(x+1)x = x^2 + x$

$(x+1)(x+2) = x^2 + 3x + 2$

7. $x^2 - 81 = x^2 - 9^2$

$= (x+9)(x-9)$

8. $P(2) = 2 \times 2^2 + (5 \times 2) - 10$

$= 8 + 10 - 10$

$= 8$

$P(x) - P(2) = 2x^2 + 5x - 18$ Factor of $P(x) - P(2) = x - 2$

9. $p(x) = ax^2 + bx + c$

Since $(x - 1)$ is a factor of $p(x)$, we have $p(1) = 0$

$p(1) = a \times 1^2 + b \times 1 + c = 0$

$a + b + c = 0$

That is the value of $a + b + c$ is 0.

10. Consider the second degree equation $x^2 + 3x + 3 = 0$

$$x = \frac{-3 \pm \sqrt{3^2 - 4 \times 1 \times 3}}{2 \times 1}$$

$$= \frac{-3 \pm \sqrt{9 - 12}}{2}$$

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

No such number x exists. Therefore $x^2 + 3x + 3$ cannot be written as the product of two frist degree polynomials.

Points to Remember

- Mean $\Rightarrow \dfrac{\text{Sum of the quantities}}{\text{Number of quantities}}$
- Median $\Rightarrow$ The middle most observation when the observations are arranged either in icreasing or decreasing order.
- If the number of observations is 'n', then the middle most observation is
  a. $\left(\dfrac{n+1}{2}\right)^{th}$ observation, if 'n' is odd,
  b. $\left(\dfrac{n}{2}\right)^{th}$ and $\left(\dfrac{n}{2}+1\right)^{th}$ observations, if 'n' is even .

Activity 1

The scores got by 10 students in a class test are as follows. Find the mean and median of the scores 13, 11, 20, 18, 20, 25, 21, 15, 10, 17

13 + 11 + 20 + 18 + 20 + 25 + 21 + 15 + 10 +17 = ☐

Mean = $\dfrac{\text{Sum of the quantities}}{\text{Number of quantities}} = \dfrac{\square}{\square}$

= 17

Median = 10, ☐, ☐, ☐, ☐, ☐, ☐, ☐, ☐, ☐, 25

Median = $\dfrac{\square+\square}{2} = \square$

Activity 2

The weights in kg of 13 people are as follows. Find the median weight.

66, 56, 83, 29, 43, 58, 53, 70, 50, 30, 45, 89, 57

When the weights are arranged in order

29, 30, 43, 45, 50, 53, 56, 57, 58, 66, 70, 83, 89

Median $\Rightarrow$ Middle most quantity, when the quantities are arranged in order

Middle most quantity = $\square$

$\therefore$ Median = $\square$

Activity -3

Find the median of the following quantities.

5, 7, 9, 5, 5, 9, 4, 6, 3, 5, 4, 5

When the quantities are arranged in order

$\square, \square, \square, \square, \square, \square, \square, \square, \square, \square, \square, \square$

Median $\Rightarrow$ Middle most quantity, when the quantities are arranged in order.

Quantities in the middle $\square, \square$

$$\therefore \text{Median} = \frac{\square + \square}{2}$$

$= \square$

Activity -4

The monthly income of some people in a locality are given in the following table. Find the median of the monthly incomes.

Monthly income	Number of people
2500	6
3000	8
3500	12
4000	20
4500	16
5000	6

Monthly income	Number of peoples
$\square$	6
Upto 3000	$\square$
$\square$	26
Upto 4000	$\square$
$\square$	62
Upto 5000	$\square$

Total number = $\square$

34^{th} and 35^{th} are the middle two quantities. Monthly income of peoples from 27^{th} to 46^{th} is ☐

∴ Monthly income of 34^{th} person = ☐

Monthly income of 35^{th} person = ☐

∴ Median monthly income = $\frac{\square + \square}{2}$

= ☐

Activity -5

The following table gives the age of workers in a company.Find the median age.

Age	Number of workers
35 – 40	9
40 – 45	11
45 – 50	5
50 – 55	8
55 – 60	7
60 – 65	5

Age	Number of workers
below 40	☐
☐	20
below 50	☐
☐	33
below 60	☐
☐	45

Total number of workers = ☐

When the workers are arranged according to their ages, the middle most worker is in the 23^{rd} position.

The ages of 21^{st} worker to 25^{th} worker are in between ☐ and ☐

Number of workers from 21^{st} to 25^{th}= ☐

When we divide the 5 unit difference between 45 and 50 into 15 equal parts, each part- = $\frac{5}{5} = 1$

Age of 21^{st} worker is in the middle of 45 and 46

$$= 45\frac{1}{2}$$

$23 - 21 = \square$

$\therefore$ Age of 23rd worker $= 45\frac{1}{2} + 2 \times 1$

$$= 45\frac{1}{2} + \square$$

$$= 47\frac{1}{2}$$

$\therefore$ $\therefore$ Median age $= 47\frac{1}{2}$

Answers of worksheet

Activity - 1

Sum = 170

Mean $= \frac{170}{10} = 17$

Median

10, 11, 13, 15, 17, 18, 20, 20, 21, 25

Median $= \frac{17+18}{2}$

$= 17.5$

Activity - 2

Middle most quantity $= \left(\frac{13+1}{2}\right)^{th}$ value 7^{th} value

Median = 56

Activity - 3

3, 4, 4, 5, 5, 5, 5, 5, 6, 7, 9, 9

Median $= \frac{5+5}{2}$

$= 5$

Activity - 4

Monthly Icome	No. of peoples
Upto 2500	6
Upto 3000	14
Upto 3500	26
Upto 4000	46
Upto 4500	62
Upto 5000	68

Total Number = 68

Monthly income of peoples 27^{th} 46 is 4000

Monthly income of 34^{th} person = 4000

Monthly income of 35^{th} person = 4000

Median monthly income $= \frac{4000 + 400}{2}$

$= 4000$

Activity - 5

Age	No. of workers
Below 40	9
45	20
50	25
55	33
60	40
65	45

Total No. of workers = 45

Between 45 and 50

No of workers from 21 to 25 is 5

23–21=2

45½+2 = 47½

PRACTICE PROBLEMS

1. Find the mean and median of counting numbers from 1 to 10
2. Find the mean of the following quantities

   610, 625, 618, 625, 621, 615, 610, 620
3. The following are the scores got by some pupils in an examination. Find the median score.

   66, 33, 56, 20, 13, 56, 53, 70, 50, 30, 56, 45, 56
4. The following table gives the daily wages of some workers in a factory. Find the median daily wage

Daily wages (Rs)	Number of workers
400	3
500	7
600	8
700	6
800	5

5. The heights in centimetre of some students in a class are given in the following table. Find the median height.

Height of students (cm)	Number of students
135	5
140	8
145	12
150	11
155	5
160	4

6. The following table gives the scores got by students in a class for mathematics exam.

Score	Number of students
10 - 20	6
20 - 30	8
30 - 40	6
40 - 50	10
50 - 60	11
60 - 70	2
70 - 80	4

Find the median score in the class.

Answers

1. Mean = $\frac{1+2+3+.....+10}{10} = \frac{\frac{10\times11}{2}}{10} = 5.5$

Median =1, 2, 3, 4, 5, 6, 7, 8, 9, 10

$= \frac{5+6}{2} = 5.5$

2. Mean = $\frac{\text{Sum of the quantities}}{\text{Number of quantities}}$

$= \frac{610+625+618+625+621+615+610+620}{8}$

$= \frac{4944}{8} = 618$

3. When the quantities are arranged in order

10,12,20,24,30,35,40,46,52,54,74,80

Median = Middle most quantity, when the quantities are arranged in order

∴ Middle most quantity = 40

Median = 40

3.

Daily wage (Rs.)	Number of workers
Upto 400	3
Upto 500	10
Upto 600	18
Upto 700	24
Upto 800	29

Total workers = 29

Middle most quantity = 15^{-th} quantity

15^{th} quantity = Rs. 600

∴ Midean = Rs. 600

5.

Height	Number of students
upto 135	5
upto 140	13
upto 145	25
upto 150	36
upto 155	41
upto 160	45

Number of quantities = 45

Middle most quantity = 23^{rd} quantity

Heights of the students from 14^{th} to 25^{th} = 145

$\therefore$ Height of 23^{rd} student = 145cm

$\therefore$ Median height = 145cm

6.

Mark	No of Students
Below 20	6
Below 30	14
Below 40	20
Below 50	30
Below 60	41
Below 70	43
Below 80	47

Total No. of students = 47

Middle most student= $\left(\frac{47+1}{2}\right)^{th}$

$= 24^{th}$

No. of students from 21^{st} to 30 = 10

Difference in mark = 50 – 40 = 10

Part of mark each will get = $\frac{10}{10} = 1$

Mark of 21^{st} Student = 40+½=40½

Median mark = 40½+3×1

= 40½+3

= 43½

ASSESSMENT TOOL - Set 1

MATHEMATICS

Time : 2½ Hours | Total Score : 80

Instructions:

- Read the instructions before answering the questions.
- Give explanations wherever necessary.
- First 15 minutes time is cool off time.
- Simplifications using approximate values of $\sqrt{2}$, $\sqrt{3}$, π need to be done only it specifically asked.

Answer any three questions from 1 to 4. Each question carries 2 score

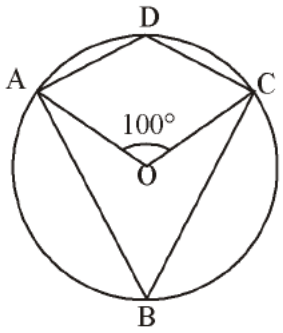
1. (a) Write the common difference of the arithmetic sequence 4,7,10, ...

   (b) Can the difference between any two terms of this sequence can be 25? Why?

2. 'O' is the centre of the circle, $\angle AOC = 100^0$

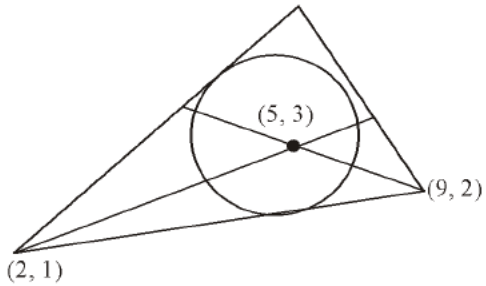
   (a) Write measure of $\angle ABC$

   (b) What is the measure of $\angle ADC$?



3. Consider the polynominel $P(x) = x^2 + x - 6$. Is (x+3) a factor of P(x)? why?

4. The coordinates of two vertices of a triangle are (2,1), (9,2). If (5,3) is the coordinates of the centroid, then write its third vertex



Answer any four questions from 5 to 10. Each question carries 3 scores.

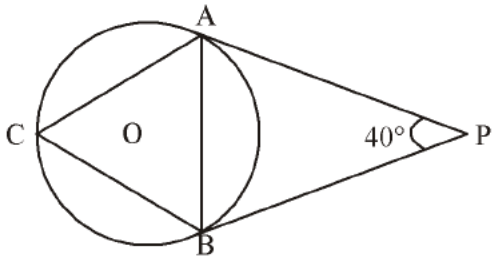
5. The algebraic form of an arithmetic sequence is 4n-1

   (a) What is the common difference ?

   (b) Write its first term

   (c) What is the remainder when each term of this sequence is divided by 4?

6. In the figure, PA and PB are tangents and AC=BC $\angle APB = 40^0$



(a) What is the measure of $\angle ACB$?

(b) Write the measure of $\angle CAB$

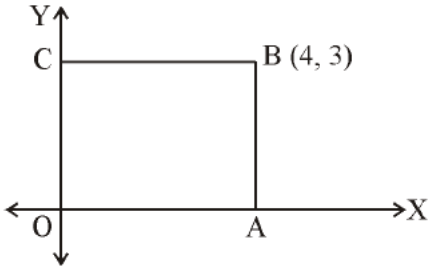
(c) Write the measure of $\angle CBA$

7. The product of two consecutive terms of an arithmetic sequence with common difference 6 is 112

(a) Write down a second degree equation by taking one of the consecutive terms as x.

(b) Write the terms.

8. In the figure OABC is a rectangle. If the co-ordinates of B are (4,3)



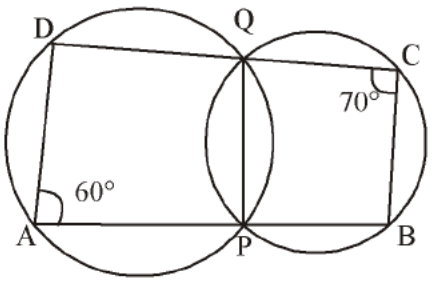
(a) What are the coordinates of O?

(b) What are the coordinates of A?

(c) What are the coordinates of C?

9. In the figure, two circles intersect at P and Q.

$\angle A = 60^0$, $\angle C = 70^0$



(a) What is the measure of $\angle PQD$?

(b) Write the measure $\angle PBC$.

(c) Write the measure of $\angle APQ$ and $\angle$ADQ .

10. The base perimeter of a square pyramid is 24 centimeter and its height is 8 centimeter.

(a) Find length of a base edge

(b) Find its slant height

(c) Calculate its lateral surface area

Answer any eight questions from 11 to 21. Each question carries 4 scores.

11. Find the following sums

    (a) 1+2+3+.....+40

    (b) 3+6+9+.....+120

    (c) 5+8+11+.....+122

    (d) 2+5+8+.....+119

12. Draw a rectangle with width 6 centimeter and height 3 centimeter. Then draw a square of the same area

13. In class, 10 A there are 30 boys and 20 girls. In class 10 B there are 25 boys and 15 girls. One student is to be selected from each class.

    (a) In how many different ways we can select a pair of students?

    (b) What is the probability of both being girls?

    (c) What is the probability of getting one boy and one girl?

    (d) What is the probability of getting atleast one girl?

14. The perimeter of a rectangle is 40 centimeter and its area is 64 square centimeter

    (a) What is the sum of the sides?

    (b) Write down a second degree equation by taking one of the sides as 'x'

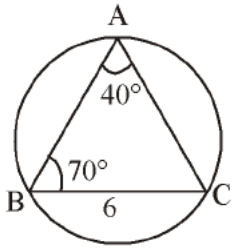
    (c) What are the length of the sides?

15. In the figure $\angle A = 40^0$, $\angle B = 70^0$, BC=6 centimeter

    (a) What is the diameter of the circle?

    (b) What are the length of the sides AB and AC?

    [Sin 40^0 = 0.64 , Sin 70^0 = 0.94]



16. (a) If $P(x) = x^2 + 4x - 12$,what is P (2)?

    (b) Write P(x) as the product of two first degree polynomials

    (c) Find the solutions of the equation $x^2 + 4x - 12 = 0$

17. Draw a circle with radius 2.5 cm. Draw a triangle with two of its angles are 50^0 and 70^0 and sides of the triangle touching the circle.

18. (8,6) is the coordinates of a point on a circle with centre at the origin

    (a) What is the radius of the circle?

    (b) Among the points (0,3) , (7,10) , (-8,-6) which is inside the circle, outside the circle and, on the circle .

19. A cone is made by rolling up a sector with central angle 120 ° and radius 30 centimeter

    (a) Find the radius of the cone

    (b) Find slant height of the cone

    (c) Find its curved surface area

20. a) Find the slope of a line joining the points A(1,3) and B(6,8)

    b) Write the coordinates of the mid point of the line joining A and B

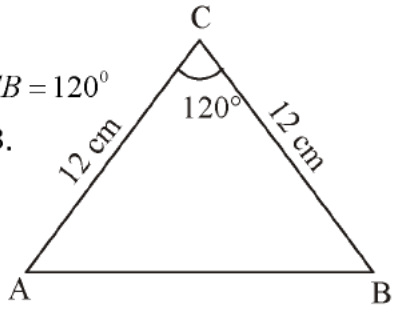
    c) Find the coordinates of the point on the line which divides AB in the ratio 2:3.

21. In triangle ABC. AC=BC=12 centimeter and $\angle ACB = 120^0$

    a) Find the perpendicular distance from C to AB.

    b) What is the length of A,B

    a) What is the area of the triangle ABC



Answer any six questions from 22 to 29. Each question carries 5 score.

22. The angles of a quadrilateral are in arithmetic sequence. The smallest angle is 45^0

    a) What is the some of all the angles of a quadrilateral?

    b) What is the measure of the largest angle?

    c) What is the common difference of the sequence?

    d) Find the measures of the other two angles.

23. A boy standing on the bank of a river sees a tree on the opposite bank at an elevation of 60^0. Stepping 20 meters back, he sees the top at an elevation of 30^0

    a) Draw an appropriate figure based on the given details.

    b) What is the width of the canal?

    c) What is the height of the tree?

24. Draw a circle of radius 3 centimeter. Mark a point P at a distance 7 centimeters away from the centre of the circle. Draw tangents from P to the circle and measure the length of a tangent.

25. If (2, 1) and (10, 7) are the co ordinates of the end points of diameter of a circle.

    a) Write the Co-ordinates of the centre of this circle.

    b) Find the equation of this circle.

    c) Is this circle passing through the origin?

26. A rocket is in the shape of a cylinder with one end is attached with a hemisphere and other end with a cone. Total height of the rocket is 12m,

Common diameter 4 centimeters and the length of cylindrical part is 6m.

a) Find the height of the cone.

b) Find the volume of the rocket.

27. The table below Shows the children in a class sorted according to their marks in mathematics examination.

Marks	Number of children
0 - 20	3
10 - 20	6
20 - 30	9
30 - 40	4
40 - 50	5
50 - 60	8
60 - 70	9
70 - 80	6

If the children are arranged according to their marks.

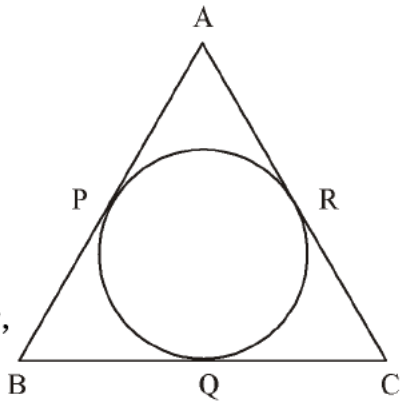
a) Which child has the median mark?

b) What is the assumed mark of the 23rd child?

c) Calculate the median mark of the class.

28. In the figure, AB = 8 centimeter,

BC = 6 centimeter, AC = 10 centimeter



a) Find the lengths of the tangents

AP, BQ and CR

b) If area of ΔABC is 24 square centimeter, find the radius of the circle.

29. Read the following passage understand the mathematical concept in it and answer the question that follow.

Sum of the first three terms of on arithmetic sequence is one and the sum of its first six terms is 3. That is

$x_1 + x_2 + x_3 = 1$ and $x_1 + x_2 + x_3 + \ldots\ldots x_6 = 3$. Then $x_4 + x_5 + x_6 = 2$ and

$x_2 = 1/3$, $x_5 = 2/3$. Then the common difference is $\frac{x_5 - x_2}{3} = \frac{2/3 - 1/3}{3} = 1/9$

First term is $\frac{1}{3} - \frac{1}{9} = \frac{2}{9}$

That is, the sum of the first 3 terms of the arithmetics sequences $\frac{2}{9}, \frac{3}{9}, \frac{4}{9}$ ..... is 1 and the sum of the 1st 6 terms is 3.

a) What is the fourth term of the arithmetic sequence, $\frac{2}{9}, \frac{3}{9}, \frac{4}{9}$.....

b) Find the sum of first 9 term of the sequences.

c) $x_7 + x_8 + x_9 =$ .....

d) $x_{298} + x_{299} + x_{300} =$ .....

e) What is the sum of first 300 terms of the arithmetic sequences $\frac{2}{9}, \frac{3}{9}, \frac{4}{9}$..... ?

ASSESSMENT TOOL - Set 2

MATHEMATICS

Time : 2½ Hours | Total Score : 80

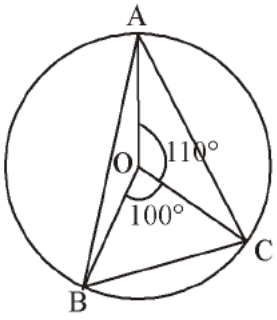
Instructions:

- Read the instructions before answering the questions.
- Give explanations wherever necessary.
- First 15 minutes time is cool off time.
- Simplifications using approximate values of $\sqrt{2}$, $\sqrt{3}$, π need to be done only it specifically asked.

Answer any three questions from 1 to 4

1. a) Write an arithmetic sequence with common difference 4 .
   b) Write its 20^{th} term.

2. 'O' is the centre of the circle $\angle BOC = 100^0$, $\angle AOC = 110^0$
   a) What is the measure of $\angle BAC$?
   b) What is the measure of $\angle ACB$?



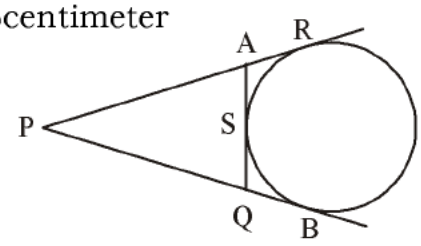
3. a) If $P(x) = x^2 + x$, What is $P(2)$?
   b) Find the number to be added to $P(x)$ to get a polynomial for which $(x-2)$ is a factor ?

4. If (2, 5) is the coordinates of the centre and (6, 8) is the Co-ordinates of a point on the circle. Then write the co ordinates of the other end of diameter through their point.

Answer any four questions from 5 to 10. Each question carries 3 scores.

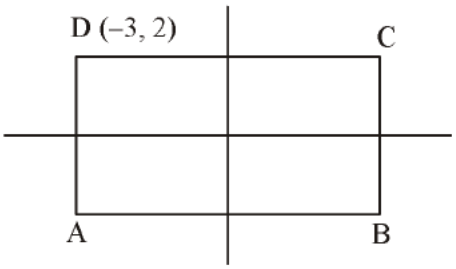
5. Sum of first n terms of an arithmetic sequence is $3n^2+4n$?
   a) What is its common difference?
   b) Write its first term.
   c) Find the sum of first five term.

6. In the figure PA and PB are tangents PA = 15centimeter
   a) Find the length of PB.
   b) Calculate the perimeter of triangle PQR

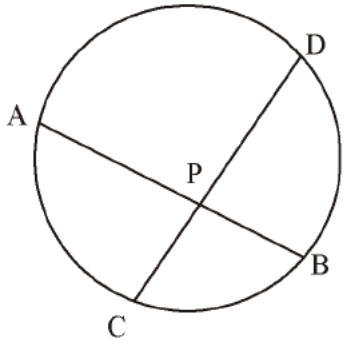


7. The product of two consecutive odd numbers is 675.
   a) Write down a second degree equation by taking one of the odd numbers as 'x'
   b) Which are the numbers?

8. In the figure, ABCD is a rectangle and its sides are parallel to the axes. Origin is the midpoint of the rectangle. The co ordinates of D are (-3, 2)
   a) What are the co ordinates of A?
   b) What are the co ordinates of B?
   c) What are the co ordinates of C?



9. In the figure two chords AB and CD intersect at P. PA = 5centimeter, AB = 9centimeter, PD = 10 centimeter
   a) Find the length of PB
   b) PC×PD=.....
   c) Find the length of CD

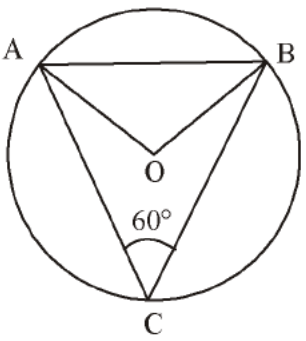


10. Ratio of radius and slant height of a cone is 2:3
    a) What part of the slant height is its base radius?
    b) Find the central angle of the sector that used to make the cone

Answer any eight questions from 11 to 21 each questions carries 4 scores.

11. The sum of first 9 terms of an arithmetic sequence is 108 and sum of first 16 terms is 304.
    a) What is its 5^{th} term?
    b) What is the sum of 5^{th} and 12^{th} terms?
    c) Write its common difference?
    d) Find its algebraic form.

12. In the figure 'O' is the centre of the circle of the circumcircle of the triangle ABC, $\angle C = 60^0$
    a) What is the measure of $\angle AOB$?
    b) Draw a triangle of circum radius 4cm and two of its angles are 60^0 and 50^0



13. A box contains 10 slips numbered 1 to 10 and another box contains 20 slips numbered from 1 to 20. One slip is taken from each box.

    a) In how many different ways we can select a pair of slips, one from each?

    b) What is the probability of both being even?

    c) What is the probability of getting an even number and an odd number?

    d) What is the probability of getting at least one even number.

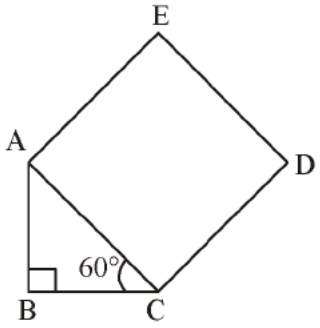
14. The base radius and height of a metal cylinder are 18 centimeters and 24 centimeters respectively. The cylinder is melted and recast into spheres of radius 6 centimeters.

    a) Find volume of the cylinder?

    b) Find volume of cone.

    c) How many spheres can be made?

15. In the figure, $\angle B = 90^0$, $\angle BAC = 30^0$, AB=6 centimeter



    a) What is the measure of $\angle BAC$?

    b) What is the length of the side BC?

    c) What is the area of the square ACDE?

16. If P(x) = x^2 + kx – 6

    a) Find P(-3)

    b) What is the value of K if *(x + 3)* is a factor of *P(x)*

    c) Write *P(x)* as the product of two first degree polynomials.

17. Draw a circle of radius 3cm. Mark a point P at a distance 8 cm away from centre of a circle. Draw tangents from P to the circle.

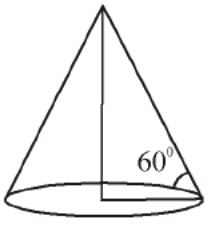
18. A (3, 5), B (9, 13) and C (10, 6) are the vertices of a triangle and AC = BC

    a) Find the length of AB.

    b) Find the co ordinates of the midpoint of the side AB

    c) Find the area of Δ ABC

19. Base radius of a conical vessel is 12cm. Angle formed by its slant height and base radius is 60^0



    a) Find the height of the vessel.

    b) What is its slant height?

    c) How many litres of water can contain the vessel?

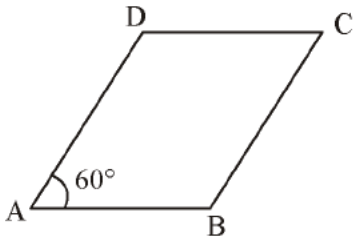
20. A circle is drawn with the line joining (3, 4), and (5, 10) as diameter.

    a) What are the coordinates of the centre the of circle.

b) What is the radius of the circle?

c) Check whether point (7, 8) is inside the circle, outside the circle or on the circle?

21. In the figure ABCD is a parallelogram is given.



a) What is the perpendicular distance between the sides AB and CD?

b) What is the area of the parallelogram?

Answer any six questions from 22 to 29. Each question carries 5 score.

22. Look at the number pattern given bellow.

1

2 3 4

5 6 7 8 9

10 11 12 13 14 15 16

....

....

a) Write down the next line of this pattern.

b) How many numbers are there in the tenth line?

c) Which is the last number in the 9^{th} line?

d) What is the first number in the 10^{th} line?

e) Find the sum of the numbers in the 10^{th} line.

23. A boy standing at the bottom of a tower sees the top of a building at an elevation of 60^0. Climbing on the top of the tower the sees it an elevation of 30^0. If the height of the tower is 70 meters.

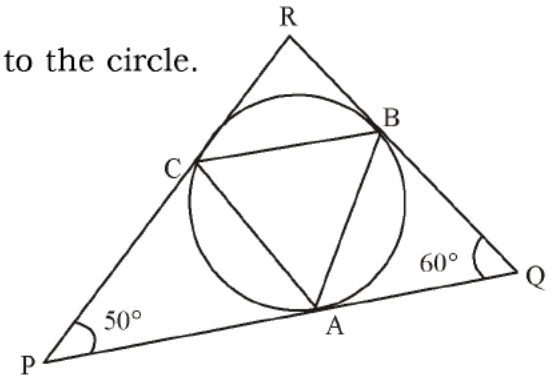
a) Draw an appropriate figure based on the given details.

b) What is the distance between the tower and the building?

c) What is the height of the building?

24. in the figure PQ, QR, PR are tangents to the circle.

$\angle P = 50^0, \angle Q = 60^0$



a) Find the measure of $\angle PRQ$.

b) What is the measure of $\angle RCB$?

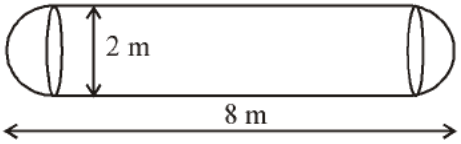
c) Find the measures of triangle ABC.

25. a) Find the equation of the line passing through the points (2, 4) and (5, 6)

    b) Is (8, 8) a point on this line?

    c) Write the Coordinates of the points on this line cut the X- axis.

26. A tank is in the shape of a cylinder, with two hemispheres attached to both ends of a cylinder, common diameter is 2m and total length 8m.



    a) What is the length of the cylinder part?

    b) Find the volume of the hemisphere.

    c) Find the volume of the cylinder.

    d) How many liters of water contain in the tank?

27. The table below shows the workers in the factory sorted according to their daily wages.

Daily wages (In Rupees)	**No. of workers**
400 - 500	7
500 - 600	8
600 - 700	10
700 - 800	9
800 - 900	5
900 - 1000	4
Total	**43**

    a) If workers are arranged according to their wages, which position is taken as median

    b) What will be the assumed wage of 16^{th} worker?

    c) Calculate the median of daily wages?

28. Draw a triangle of sides 6cm, 7cm and 8cm. Draw a circle which touches all sides of the triangle and measure its radian.

29. Read the mathematical concept given below carefully and understand it. Then answer the following questions.

    $1^3 = 1^2$

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

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

    $1^3 + 2^3 + 3^3 + 4^3 = (1 + 2 + 3 + 4)^2$

    .....

    .....

a) Write the line. (1)

b) $1^3 + 2^3 + 3^3 + \ldots\ldots\ldots\ldots + 10^3 = \ldots\ldots\ldots\ldots$ (1)

c) 45^2 is the sum of..... first consecutive odd numbers. (1)

d) 14400 is the sum of the cubes of first..... consecutive natural numbers (1)

e) $1^3 + 2^3 + 3^3 + \ldots\ldots\ldots\ldots + n^3 = \ldots\ldots\ldots\ldots$ (1)