



2027

Orienting Yourself : The Use of Coordinates

Lecture - 04

CLASS-9TH

MATH

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Topics To Be Covered

- 1 More question on distance formula
Mid point formula

A
(x₁, y₁)

B
(x₂, y₂)

$$AB = \sqrt{(y_1 - y_2)^2 + (x_1 - x_2)^2}$$

S.B.S

$$AB^2 = (y_1 - y_2)^2 + (x_1 - x_2)^2$$

Q11

$$P \begin{pmatrix} -5, -2 \\ -7, 8 \end{pmatrix}$$

$$\begin{aligned} PX &= \sqrt{(-2 - 8)^2 + (-5 - -7)^2} \\ &= \sqrt{100 + 4} \\ &= \sqrt{104} \end{aligned}$$

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

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

$$(y-3)^2 = y^2 + 9 - 6y$$

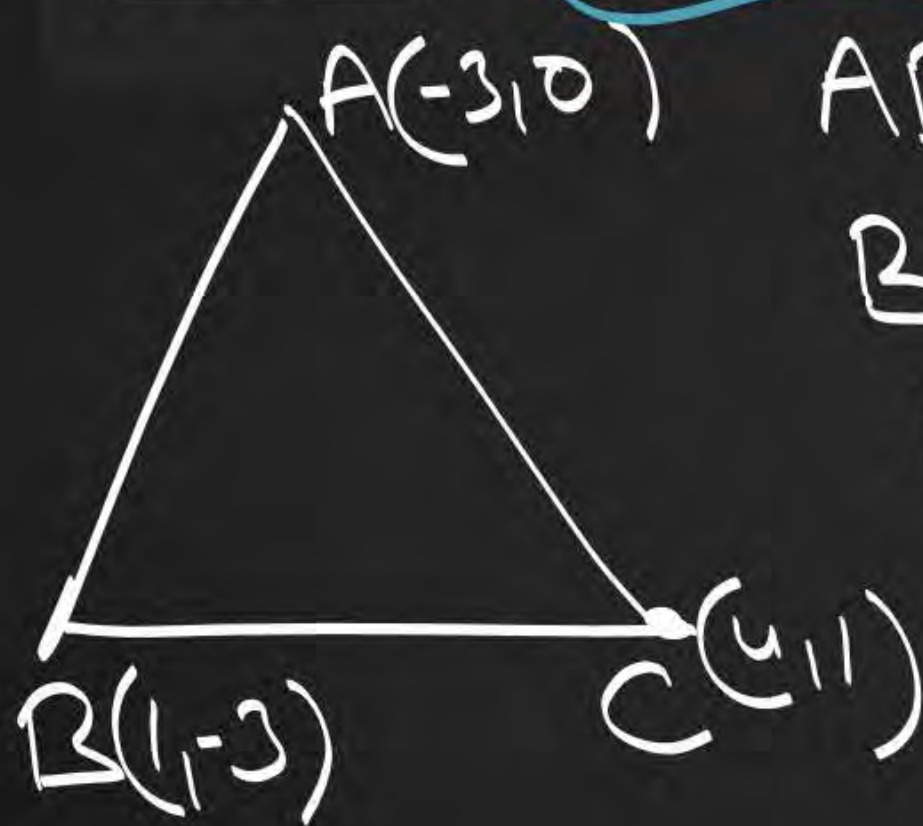
$$(x-4)^2 = x^2 + 16 - 8x$$

(x-axis)
 (x, 0)

y-axis
 (0, y)

QUESTIONS

Prove that the points $A(-3,0)$, $B(1,-3)$ and $C(4,1)$ are the vertices of an isosceles right-angled triangle. Find the area of this triangle.



$$AB = \sqrt{(-3-1)^2 + (0+3)^2} = \sqrt{16+9} = \sqrt{25} = 5$$

$$BC = \sqrt{(1-4)^2 + (-3-1)^2} = \sqrt{9+16} = \sqrt{25} = 5$$

$$AC = \sqrt{(4+3)^2 + (1-0)^2} = \sqrt{49+1} = \sqrt{50}$$

$AB = BC$ → isosceles.

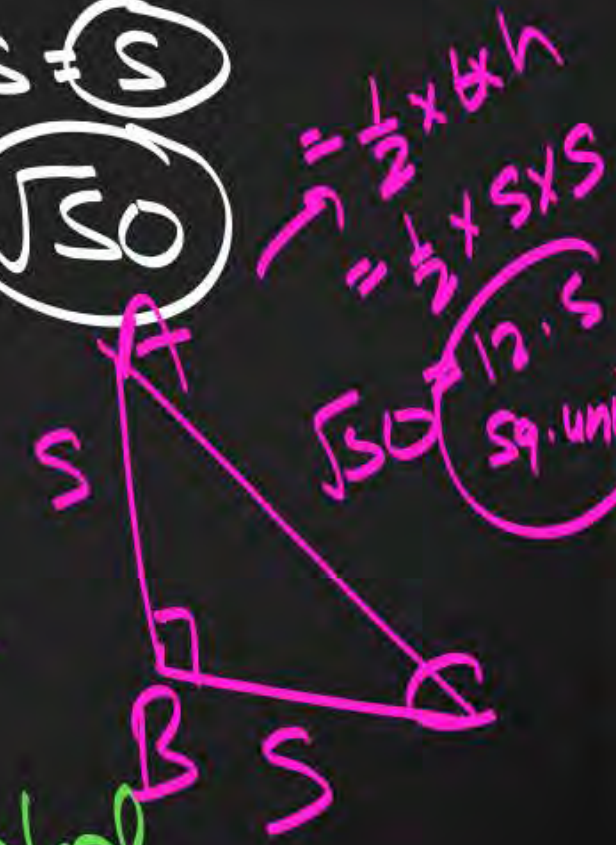
$$5^2 + 5^2 = (\sqrt{50})^2$$

$$25 + 25 = 50$$

$$\therefore AB^2 + BC^2 = AC^2$$

$\therefore \triangle ABC$ is right angled.

#GPK



QUESTIONS



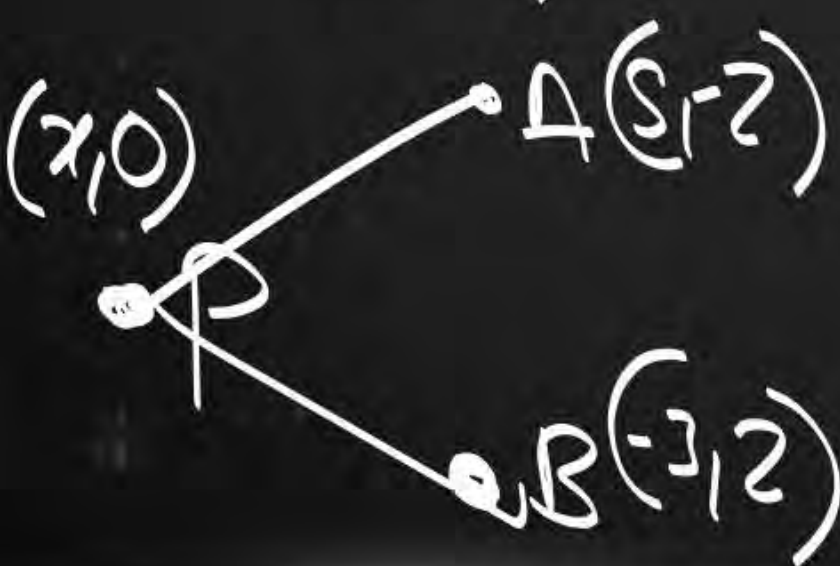
Find the point on x-axis which is equidistant from the points (5, -2) and (-3, 2). - B

Let the point on x-axis = $P(x, 0)$.

$$PA = PB$$

$$\Rightarrow PA^2 = PB^2$$

According to
Question
(ATO)



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

$$4 + x^2 + 25 - 10x = 4 + x^2 + 9 + 6x$$

$$25 - 10x = 9 + 6x$$

$$25 - 9 = 6x + 10x$$

$$16 = 16x$$

$$\frac{16}{16} = x$$

$$1 = x$$

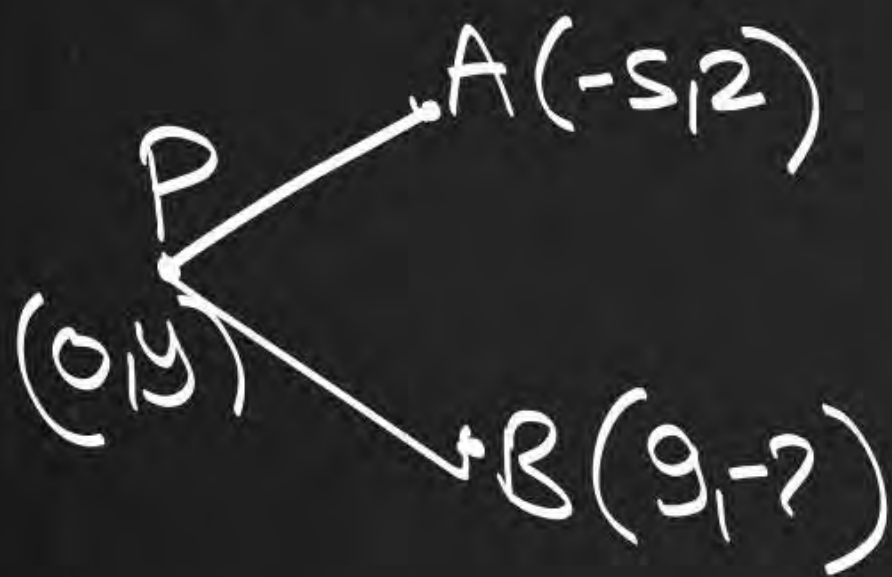
Ans: (1, 0)

QUESTIONS



Find the point on y-axis which is equidistant from the points $(-5, 2)$ and $(9, -2)$.

let the point be $P(0, y)$



ATQ,

$$PA = PB \\ \Rightarrow PA^2 = PB^2$$

$$-4y + 25 = 4y + 81 \\ 25 - 81 = 4y + 4y$$

$$-56 = 8y \\ -7 = y$$

$$(-5 - 2)^2 + (0 - y)^2 = (9 - 2)^2 + (0 - y)^2$$

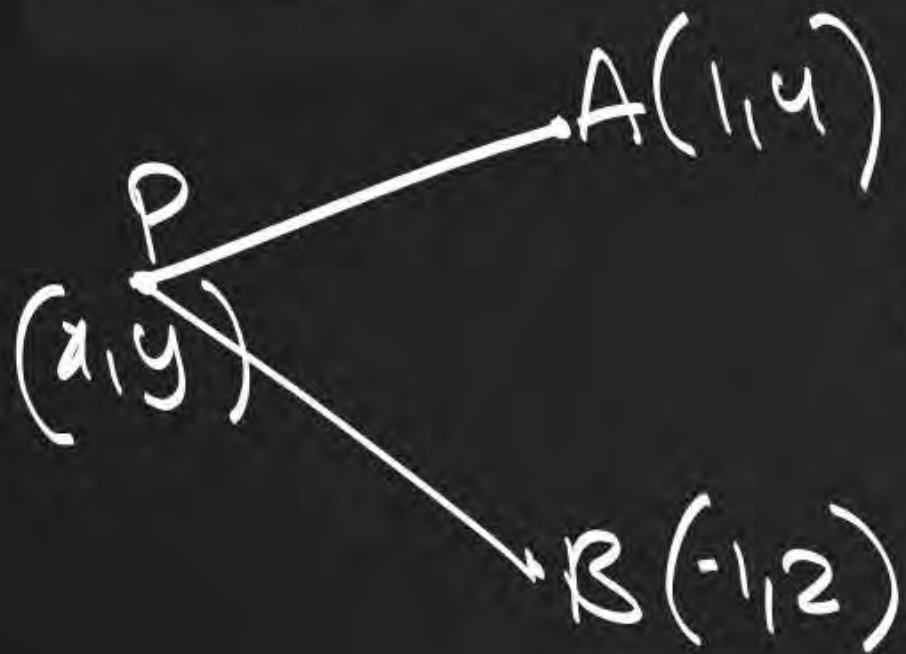
$$\cancel{y^2} + 4 - 4y + 25 = \cancel{y^2} + 4 + 4y + 81$$

Ans: $(0, -7)$

QUESTIONS



Find the relation ^{Equation} between x and y such that the point P(x,y) is equidistant from the points A(1,4) and B(-1,2).



$$PA = PB$$

$$\Rightarrow PA^2 = PB^2$$

$$(y-4)^2 + (x-1)^2 = (y-2)^2 + (x+1)^2$$

$$\cancel{y^2} + 16 - 8y + \cancel{x^2} + 1 - 2x = \cancel{y^2} + 4 - 4y + \cancel{x^2} + 1 + 2x$$

$$16 - 8y - 2x = 4 - 4y + 2x$$

$$16 - 8y - 2x - 4 + 4y - 2x = 0$$

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

$$4(-x - y + 3) = 0$$

$$-x - y + 3 = 0/4$$

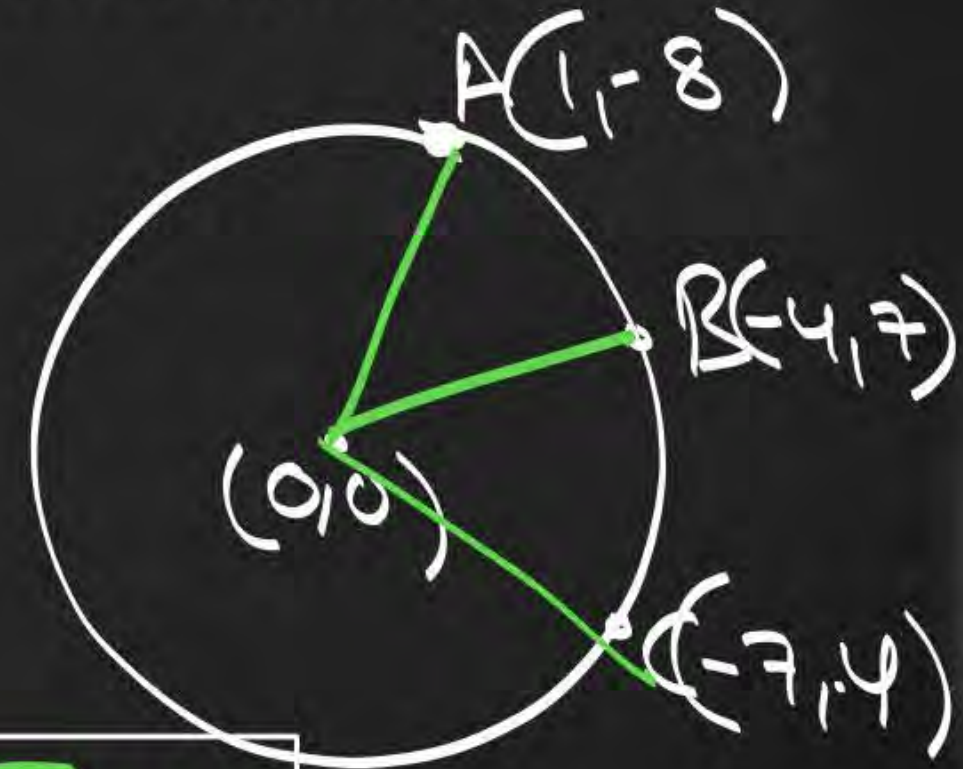
$$-x - y + 3 = 0$$

Ans, $3 = x + y$

(i) Given the points A (1, -8), B (-4, 7) and C (-7, -4), show that they lie on a circle K whose center is the origin O (0, 0). What is the radius of circle K?

(ii) Given the points D (-5, 6) and E (0, 9), check whether D and E lie within the circle, on the circle, or outside the circle K.

$$\begin{aligned} \text{(i)} \quad OA &= \sqrt{(0 - 1)^2 + (0 - (-8))^2} = \sqrt{1 + 64} = \sqrt{65} \\ OB &= \sqrt{(0 - (-4))^2 + (0 - 7)^2} = \sqrt{16 + 49} = \sqrt{65} \\ OC &= \sqrt{(0 - (-7))^2 + (0 - (-4))^2} = \sqrt{49 + 16} = \sqrt{65} \end{aligned}$$



Radius of circle = $\sqrt{65}$ units

$$\therefore OA = OB = OC$$

$\therefore$ A, B and C lie on a circle.

(i) Given the points A (1, -8), B (-4, 7) and C (-7, -4), show that they lie on a circle K whose center is the origin O (0, 0). What is the radius of circle K?

(ii) Given the points D (-5, 6) and E (0, 9), check whether D and E lie within the circle, on the circle, or outside the circle K.

$$OD = \sqrt{(0 - 6)^2 + (0 - 5)^2}$$

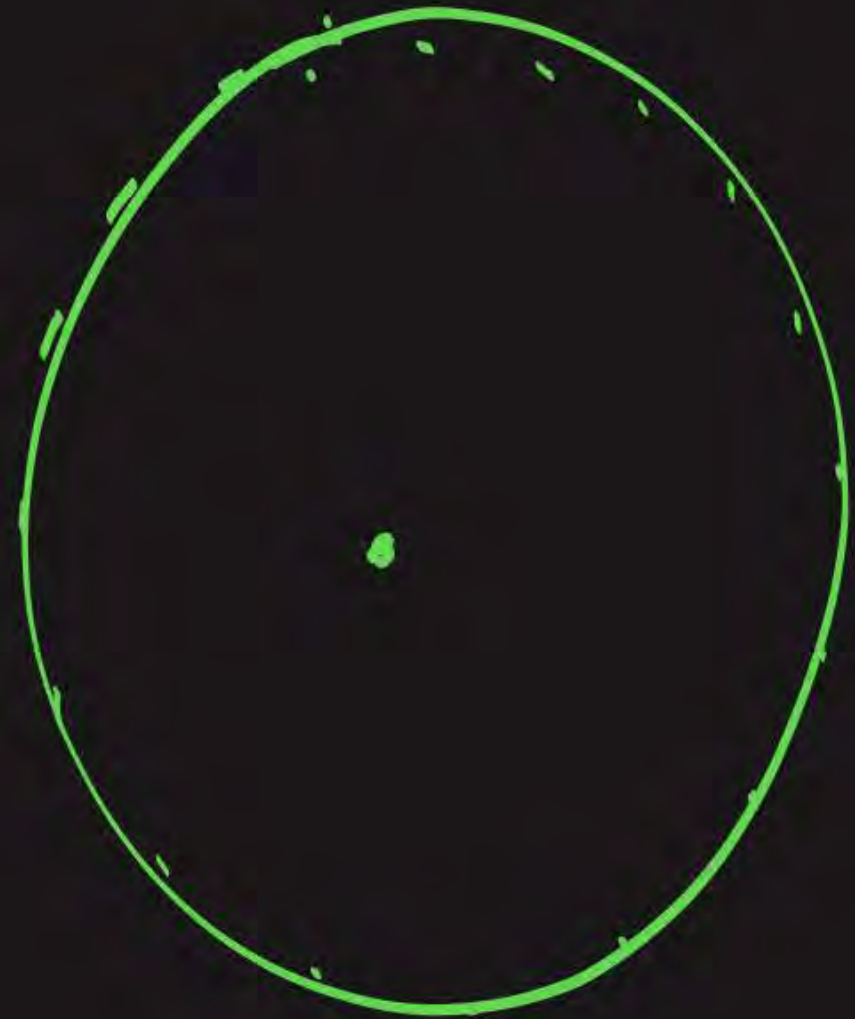
$$= \sqrt{36 + 25} = \sqrt{61} \text{ units.}$$

$OD < r$
∴ D is inside.

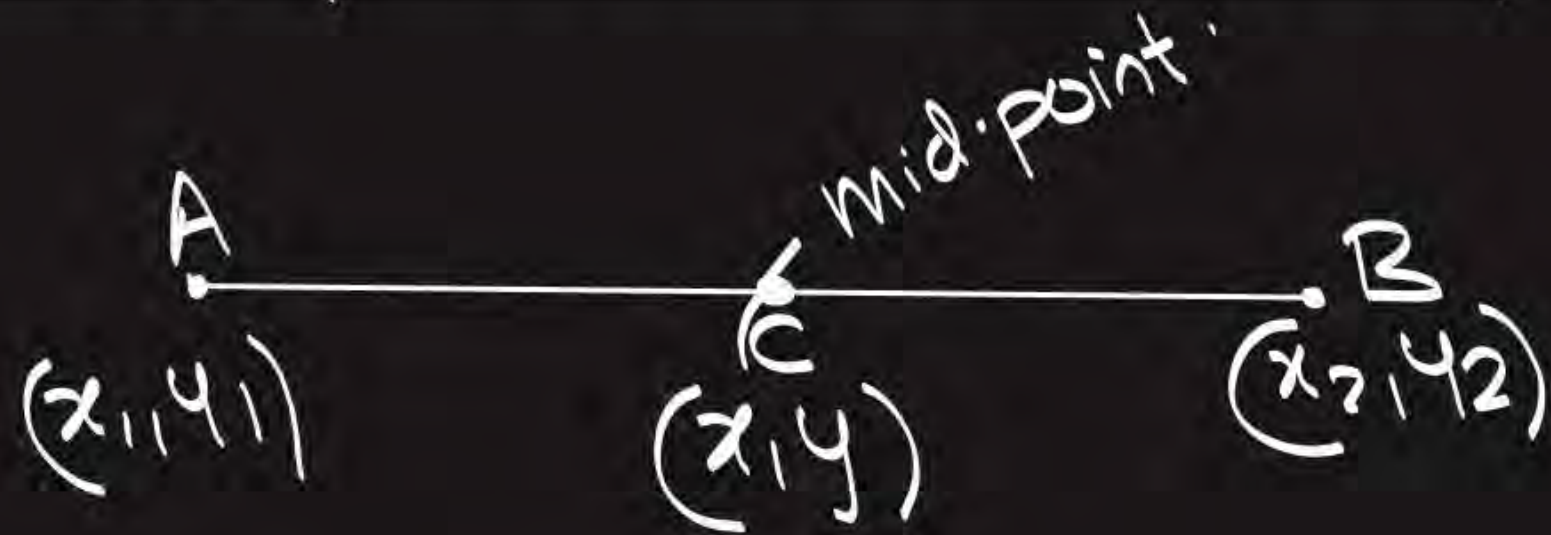
$OE > r$
∴ E is outside.

$$OE = \sqrt{(0 - 9)^2 + (0 - 0)^2} = \sqrt{81} \text{ units.}$$





Mid point Formula



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

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

QUESTIONS

Find the midpoint of the line segment joining:

A (2, 3) and B (8, 7)



$$x = \frac{2+8}{2} = 5$$

$$y = \frac{3+7}{2} = 5$$

QUESTIONS

Use the connection you found to find the coordinates of B given that M $(-7, 1)$ is the midpoint of A $(3, -4)$ and B (x, y) .



$$-7 = \frac{3+x}{2}$$

$$-14 = 3+x$$

$$\boxed{-17 = x}$$

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

$$2 = -4+y$$

$$\boxed{6 = y}$$

QUESTIONS

If $P(-1,1)$ is the midpoint of the line segment joining $A(-3,b)$ and $B(1,b+4)$ then $b=?$



$$1 = \frac{b + b + 4}{2}$$

$$2 = 2b + 4$$

$$-2 = 2b$$

$$\boxed{-1 = b}$$

1 1

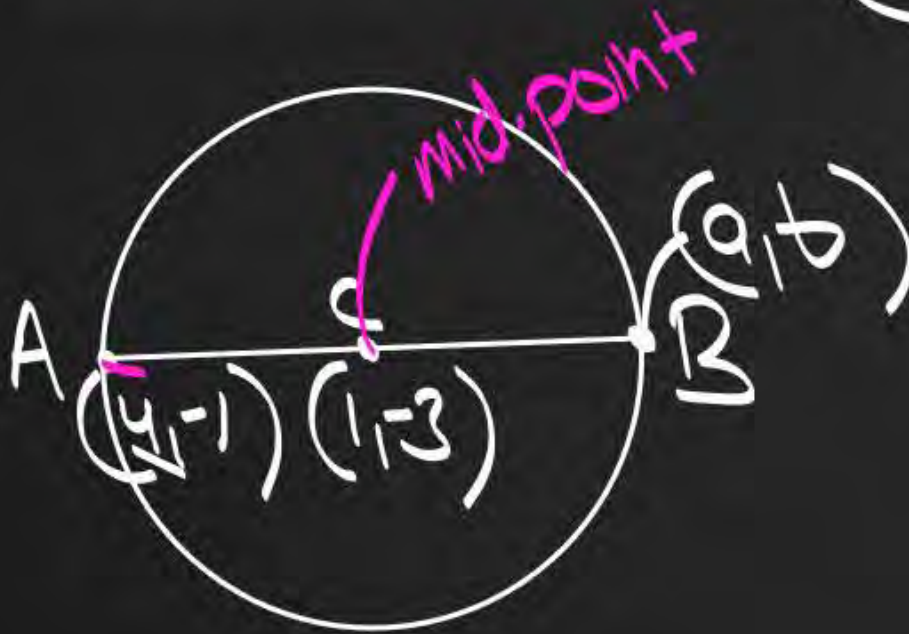
2 -1

3 2

4 0

QUESTIONS

The coordinates of one end point of a diameter AB of a circle are $A(4, -1)$ and the coordinates of the centre of the circle are $C(1, -3)$. Find the coordinates of B. $\rightarrow (a, b)$



By mid-point formula,

$$1 = \frac{4 + a}{2}$$

$$2 = 4 + a$$

$$\boxed{-2 = a}$$

$$-3 = \frac{-1 + b}{2}$$

$$-6 = -1 + b$$

$$\boxed{-5 = b}$$

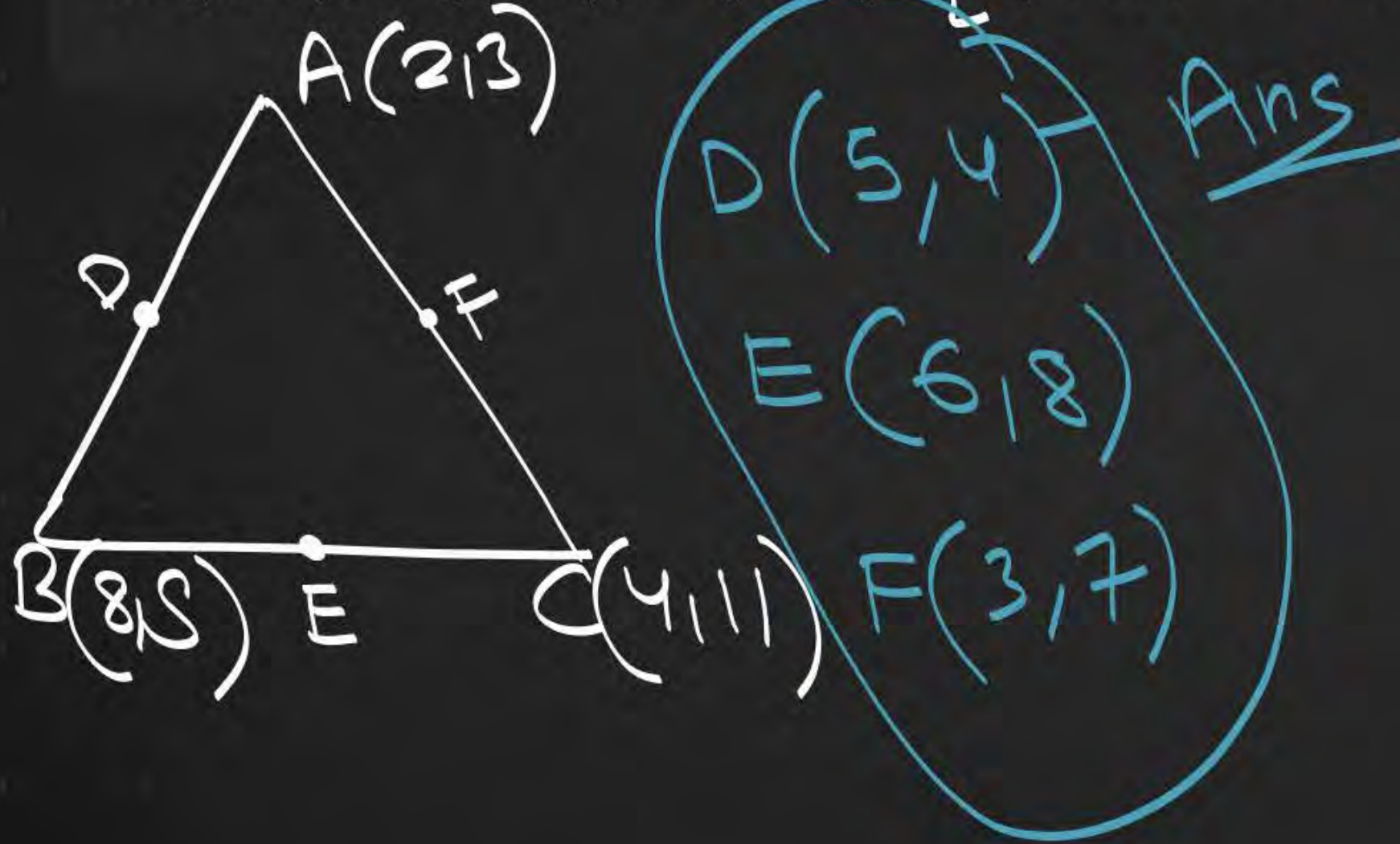
Ans: $B(-2, -5)$

QUESTIONS



The coordinates of the vertices of triangle ABC are:

A (2, 3), B (8, 5), C (4, 11) [Find the coordinates of mid. point].



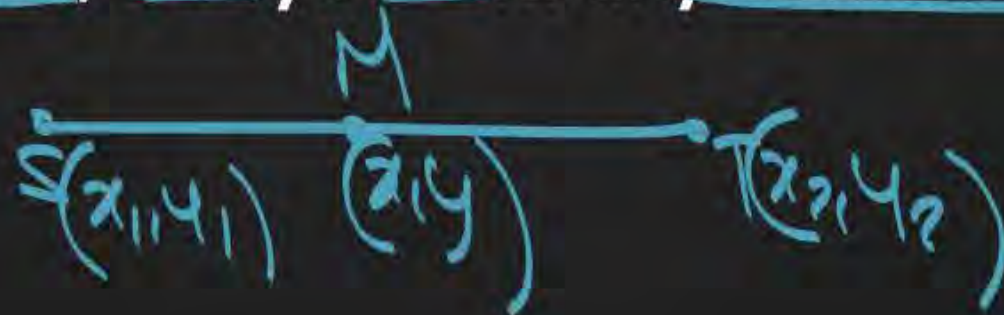
QUESTIONS

The following table shows the coordinates of points S, M and T. In each case, state whether M is the midpoint of segment ST. Justify your answer.

#GPR

S	M	T	Is M the midpoint of ST? Yes or No	Reason for your answer
				
$(-3, 0)$	$(0, 0)$	$(3, 0)$	Yes	By M.P.F
$(2, 3)$	$(3, 4)$	$(4, 5)$		
				
$(0, 0)$	$(0, 5)$	$(0, -10)$		
$(-8, 7)$	$(0, -2)$	$(6, -3)$	No	By N.P.F

When M is the mid-point of ST, can you find any connection between the coordinates of M, S and T?



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

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

END-OF-CHAPTER EXERCISES

- What are the x-coordinate and y-coordinate of the point of intersection of the two axes?
- Point W has x-coordinate equal to -5 . Can you predict the coordinates of point H which is on the line through W parallel to the y-axis? Which quadrants can H lie in?
- Consider the points R (3, 0), A (0, -2), M (-5 , -2) and P (-5 , 2). If they are joined in the same order, predict:
 - Two sides of RAMP that are perpendicular to each other.
 - One side of RAMP that is parallel to one of the axes.
 - Two points that are mirror images of each other in one axis. Which axis will this be?

Now plot the points and verify your predictions.

- Plot point Z (5, -6) on the Cartesian plane. Construct a right-angled triangle IZN and find the lengths of the three sides.

(Comment: Answers may differ from person to person.)

- What would a system of coordinates be like if we did not have negative numbers? Would this system allow us to locate all the points on a 2-D plane?

- Are the points M (-3 , -4), A (0, 0) and G (6, 8) on the same straight line? Suggest a method to check this without plotting and joining the points.

- Use your method (from Problem 6) to check if the points R (-5 , -1), B (-2 , -5) and C (4, -12) are on the same straight line. Now plot both sets of points and check your answers.

- Using the origin as one vertex, plot the vertices of:
 - A right-angled isosceles triangle.
 - An isosceles triangle with one vertex in Quadrant III and the other in Quadrant IV.

- The following table shows the coordinates of points S, M and T. In each case, state whether M is the midpoint of segment ST. Justify your answer.

S	M	T	Is M the midpoint of ST? Yes or No	Reason for your answer
(-3 , 0)	(0, 0)	(3, 0)		
(2, 3)	(3, 4)	(4, 5)		
(0, 0)	(0, 5)	(0, -10)		
(-8 , 7)	(0, -2)	(6, -3)		

When M is the mid-point of ST, can you find any connection between the coordinates of M, S and T?

- Use the connection you found to find the coordinates of B given that M (-7 , 1) is the midpoint of A (3, -4) and B (x, y).

- Let P, Q be points of trisection of AB, with P closer to A, and Q closer to B. Using your knowledge of how to find the coordinates of the midpoint of a segment, how would you find the coordinates of P and Q? Do this for the case when the points are A (4, 7) and B (16, -2).

- Given the points A (1, -8), B (-4 , 7) and C (-7 , -4), show that they lie on a circle K whose center is the origin O (0, 0). What is the radius of circle K?

- Given the points D (-5 , 6) and E (0, 9), check whether D and E lie within the circle, on the circle, or outside the circle K.

- The midpoints of the sides of triangle ABC are the points D, E, and F. Given that the coordinates of D, E, and F are (5, 1), (6, 5), and (0, 3), respectively, find the coordinates of A, B and C.

- A city has two main roads which cross each other at the centre of the city. These two roads are along the North-South (N-S) direction and East-West (E-W) direction. All the other streets of the city run parallel to these roads and are 200 m apart. There are 10 streets in each direction.

- Using 1 cm = 200 m, draw a model of the city in your notebook. Represent the roads/streets by single lines.

- There are street intersections in the model. Each street intersection is formed by two streets—one running in the N-S direction and another in the E-W direction. Each street

intersection is referred to in the following manner: If the second street running in the N-S direction and 5th street in the E-W direction meet at some crossing, then we call this street intersection (2, 5). Using this convention, find:

- how many street intersections can be referred to as (4, 3).
- how many street intersections can be referred to as (3, 4).

- A computer graphics program displays images on a rectangular screen whose coordinate system has the origin at the bottom-left corner. The screen is 800 pixels wide and 600 pixels high. A circular icon of radius 80 pixels is drawn with its centre at the point A (100, 150). Another circular icon of radius 100 pixels is drawn with its centre at the point B (250, 230). Determine:

- whether any part of either circle lies outside the screen.
- whether the two circles intersect each other.

Thank You !

- *Work Hard.*
- *Dream big.*
- *Never give up.*