



Orienting Yourself: The Use of Coordinates

Lecture - 04

CLASS-

MATH

9TH

UDAY Sir

Physics Wallah

Topics To Be Covered



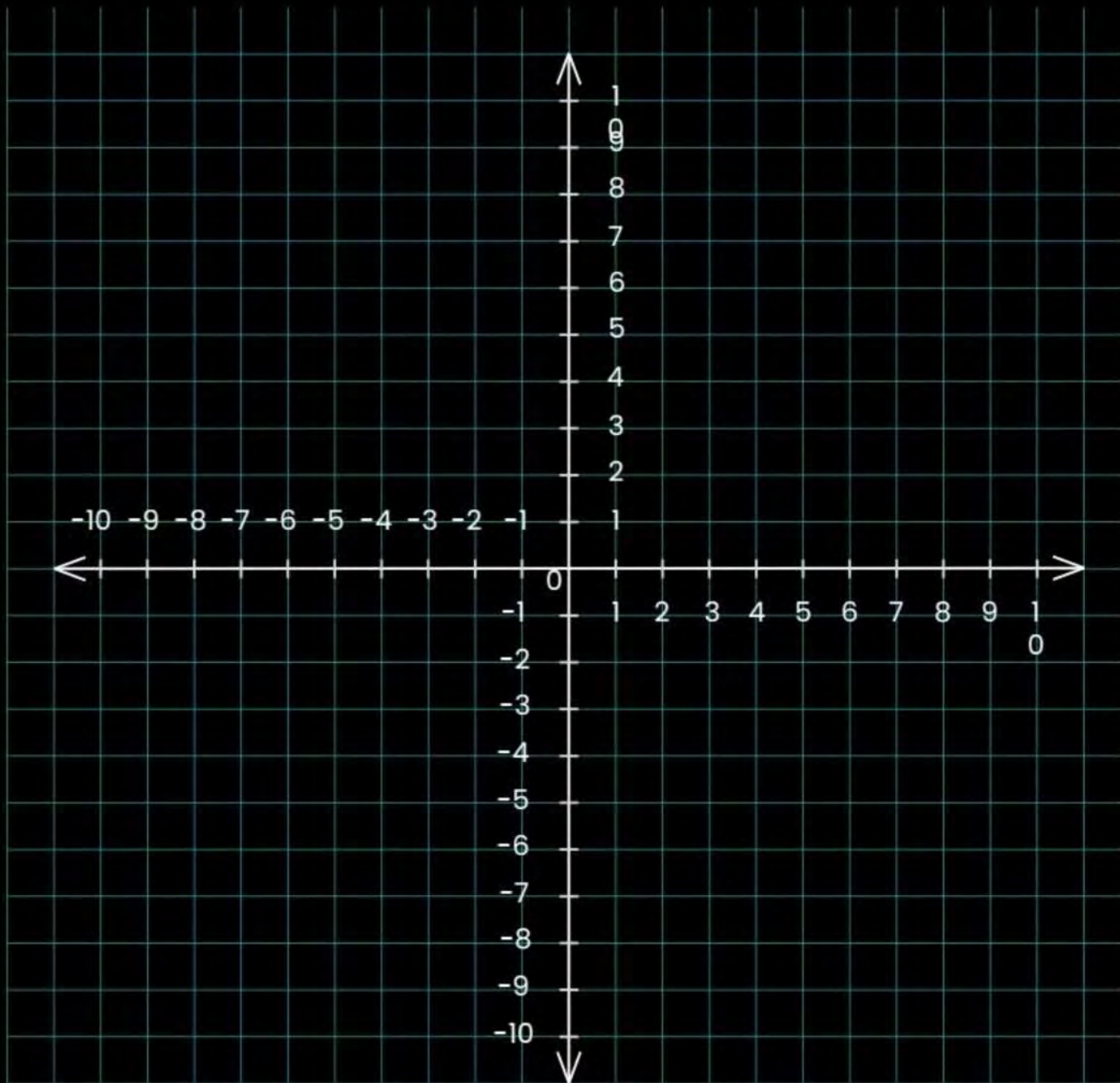
Distance Formula and Mid Point Formula

WELCOME
BACK FIGHTERS

Distance formula

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

$$A(x_1, y_1) \quad B(x_2, y_2)$$



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

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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:

- (a) how many street intersections can be referred to as (4, 3).
 - (b) how many street intersections can be referred to as (3, 4).
15. 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:
- (i) whether any part of either circle lies outside the screen.
 - (ii) whether the two circles intersect each other.
16. Plot the points A (2, 1), B (-1, 2), C (-2, -1), and D (1, -2) in the coordinate plane. Is ABCD a square? Can you explain why? What is the area of this square?

Distance Nikalo

$$A(\underline{x_1}, \underline{y_1})$$

$$B(\underline{x_2}, \underline{y_2})$$

$$\sqrt{(4-7)^2 + (8-3)^2}$$

$$\sqrt{(-3)^2 + (5)^2}$$

$$\sqrt{9 + 25}$$

$$\boxed{\sqrt{34}} \text{ units}$$

QUESTION



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.

$$M[-3, -4]$$

$$A[0, 0]$$

$$G[6, 8]$$

$$MA \rightarrow \sqrt{[0 - (-3)]^2 + [0 - (-4)]^2} = \sqrt{3^2 + 4^2} = \sqrt{25} = \underline{5 \text{ unit}}$$

$$AG \rightarrow \sqrt{[6 - 0]^2 + [8 - 0]^2} = \sqrt{36 + 64} = \sqrt{100} = \underline{10 \text{ unit}}$$

$$MG \rightarrow \sqrt{[6 - (-3)]^2 + [8 - (-4)]^2}$$

$$\sqrt{9^2 + 12^2} = \sqrt{81 + 144} = \sqrt{225} = \boxed{15 \text{ units}}$$

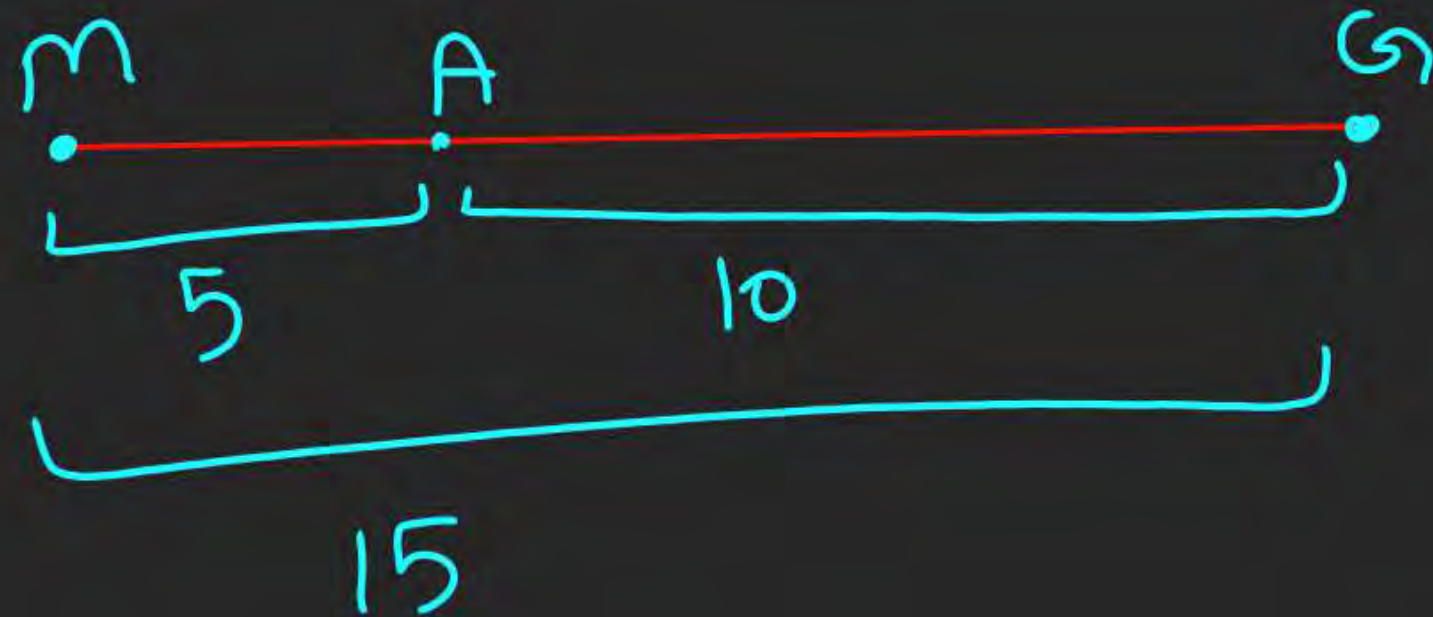
$$MA = 5 \text{ units}$$

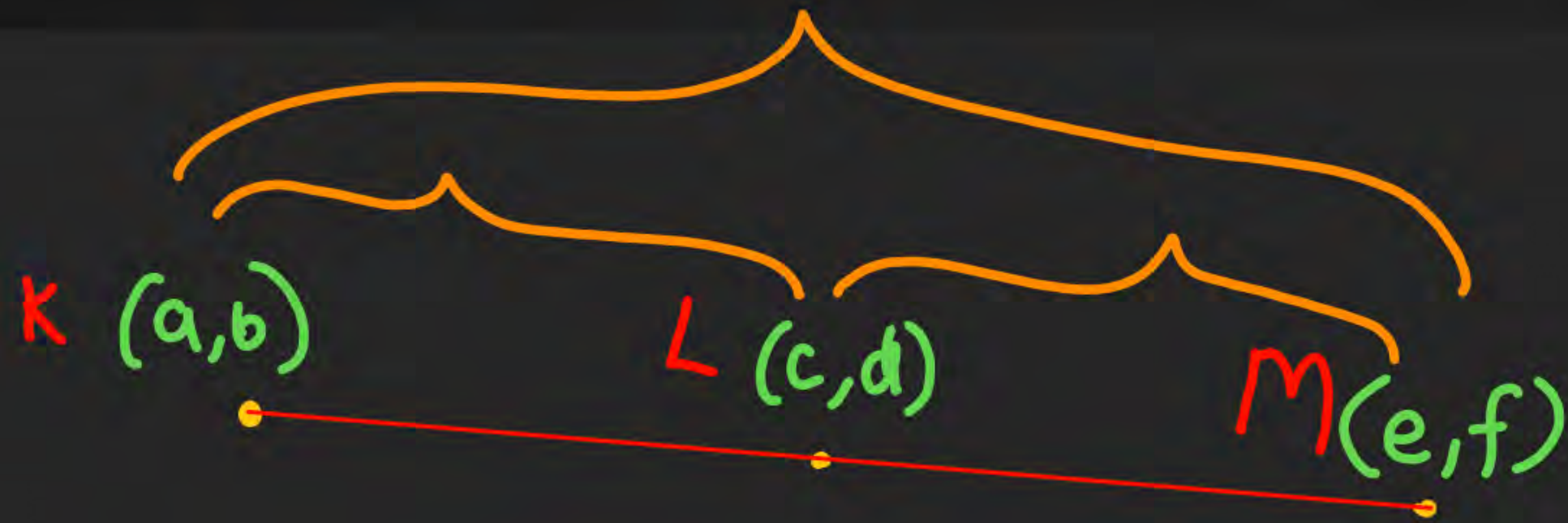
$$AG = 10 \text{ units}$$

$$MG = 15 \text{ units}$$

$$\text{As } MA + AG = MG$$

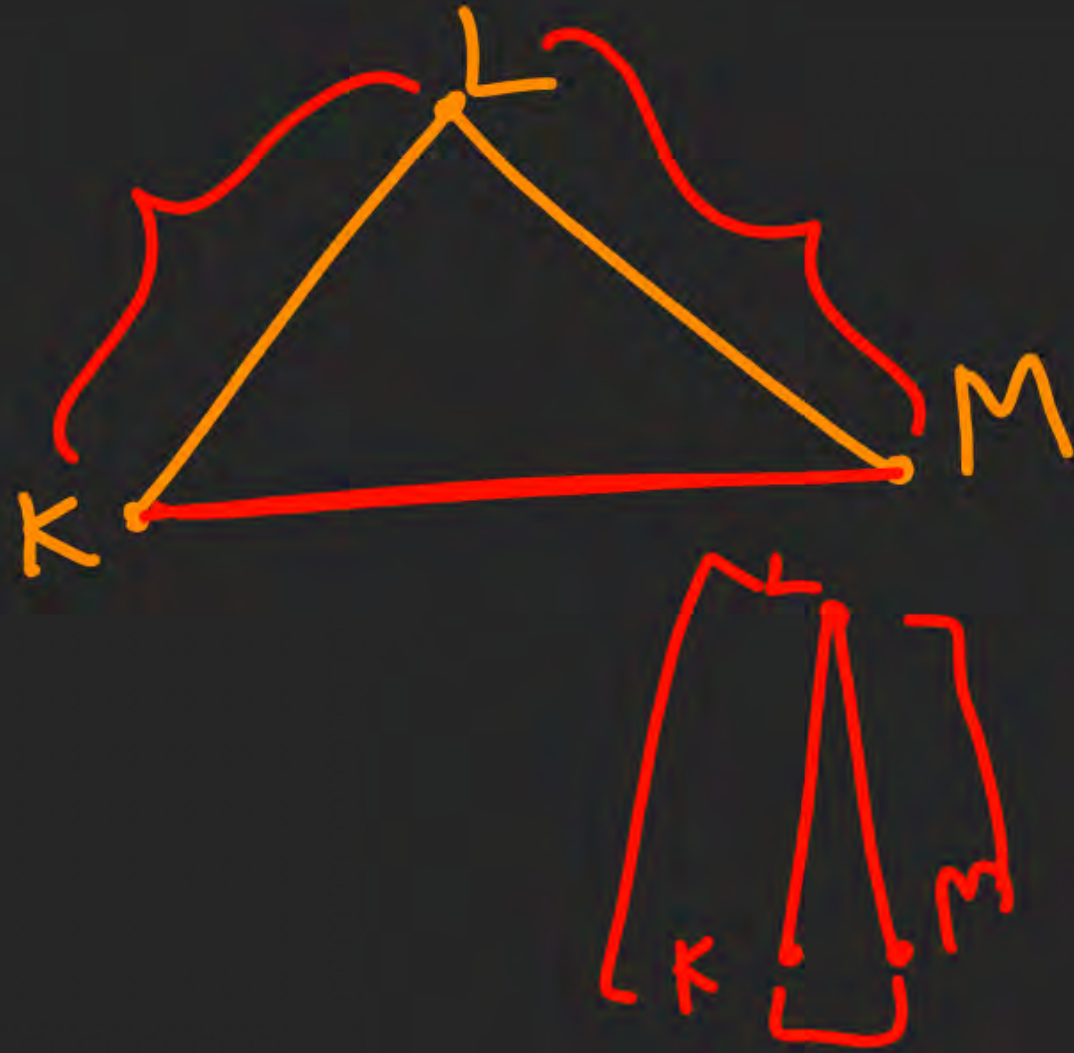
hence M, A, G lie on a Same Straight line





$$KL + LM = KM$$

$$\begin{array}{c} KL \\ \hline KM \end{array} \quad \begin{array}{c} LM \\ \hline KM \end{array}$$



QUESTION

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.

$$R[-5, -1]$$

$$B[-2, -5]$$

$$C[4, -12]$$

$$RB = \sqrt{(-2 - [-5])^2 + (-5 - [-1])^2} = \sqrt{[-2+5]^2 + [-5+1]^2} = \sqrt{9+16} = \sqrt{25} = 5 \text{ unit}$$

$$BC = \sqrt{[4 - [-2]]^2 + [-12 - [-5]]^2} = \sqrt{6^2 + 7^2} = \sqrt{36+49} = \sqrt{85}$$

$$RC = \sqrt{[4 - [-5]]^2 + [-12 - [-1]]^2} = \sqrt{9^2 + [-11]^2} = \sqrt{81+121} = \sqrt{202}$$

Not Collinear

$$\begin{array}{r} 121 \\ 81 \\ \hline 202 \end{array}$$

$$(-4)^2$$

$$\begin{array}{r} 49 \\ 36 \\ \hline 85 \end{array}$$





$$\underbrace{5 \quad \sqrt{85}} \quad \sqrt{202}$$

$$5 + \sqrt{85} \neq \sqrt{202}$$

$$5 + 9.2195 = 14.2195 \dots$$

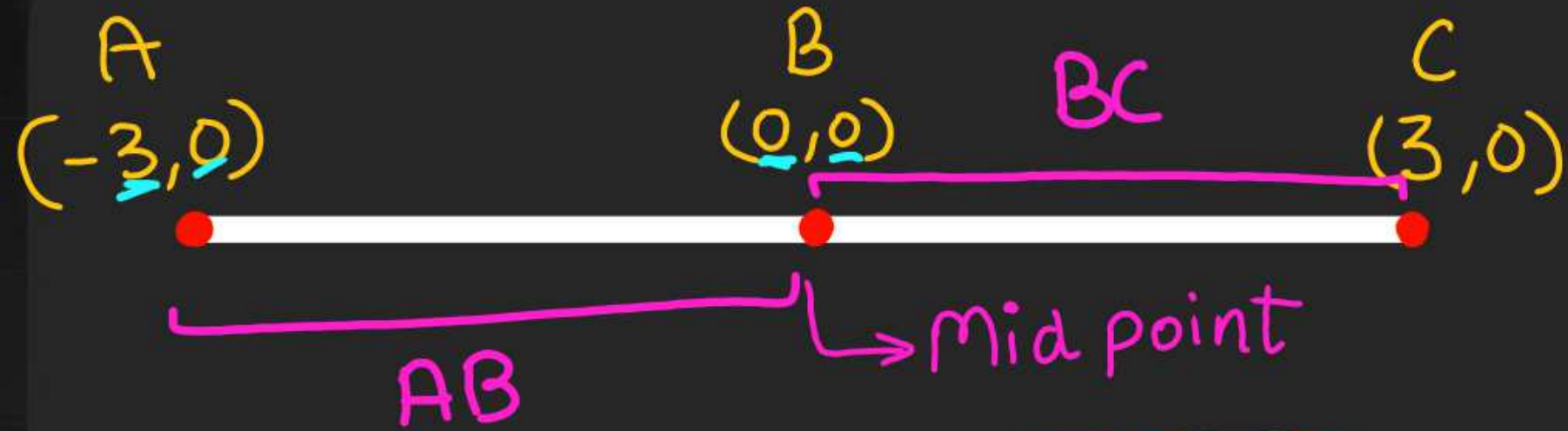
$$14.2195 \dots = 14.2126 \dots$$

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

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

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

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



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

$$\sqrt{3^2 + 0^2} = \sqrt{3^2}$$

$$= \sqrt{9}$$

$$= \textcircled{3}$$

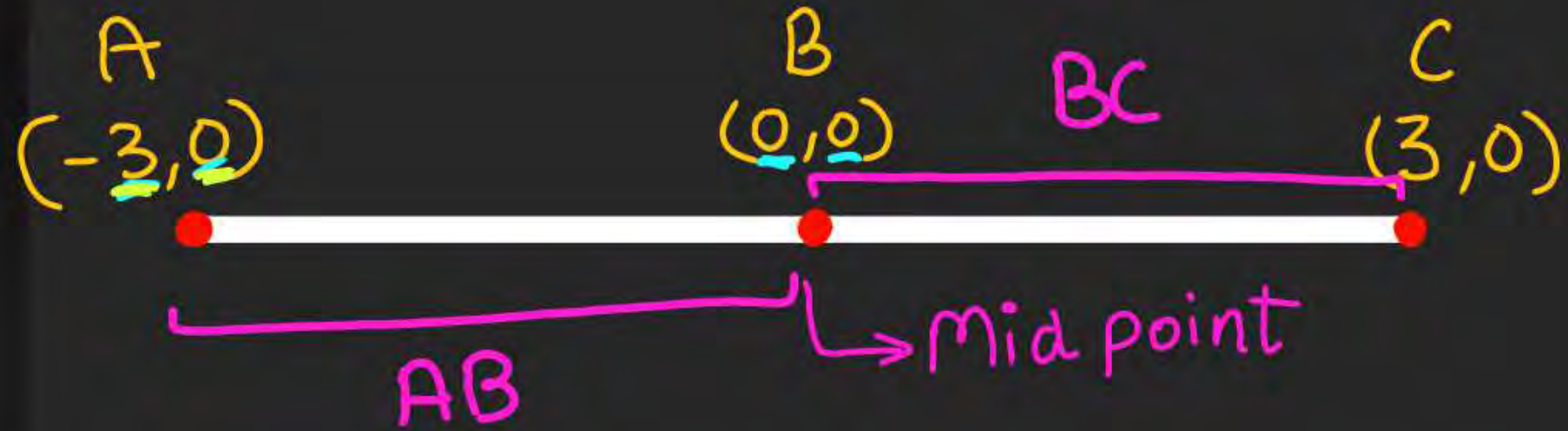
If $AB = BC$

only then B is the
Mid pt. of A and C

$$AB = \sqrt{[0 - [-3]]^2 + [0 - 0]^2}$$

$$\sqrt{3^2 + 0^2} = \sqrt{3^2} = \sqrt{9}$$

$$= \textcircled{3}$$



$[0, 0]$

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

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

$$x = \frac{-3 + 3}{2} = \frac{0}{2} = 0$$

$$y = \frac{0 + 0}{2} = \frac{0}{2} = 0$$

Mid point formula



$A[x_1, y_1]$

Mid pt

$B[x, y]$

$C[x_2, y_2]$

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

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

QUESTION

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.

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

$$y = \frac{3+5}{2} = \frac{8}{2} = 4 \leftarrow [3, 4]$$

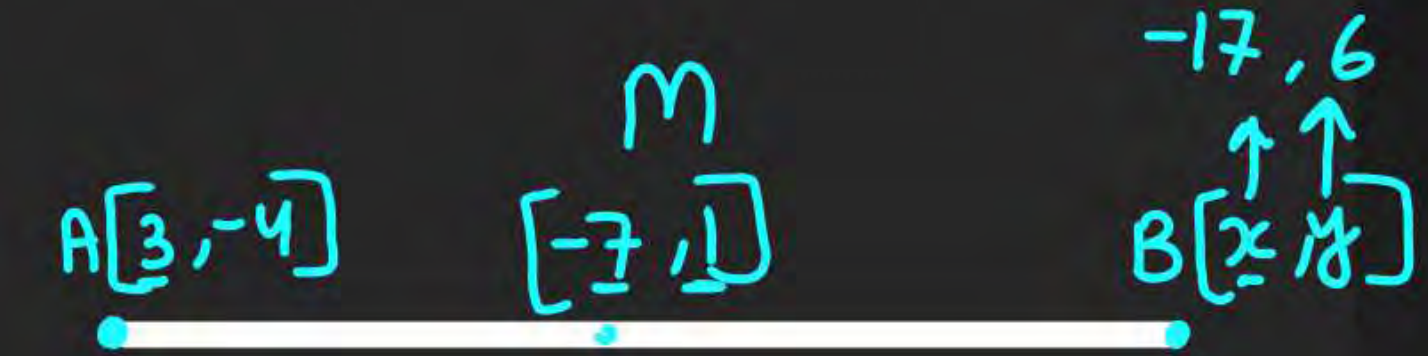
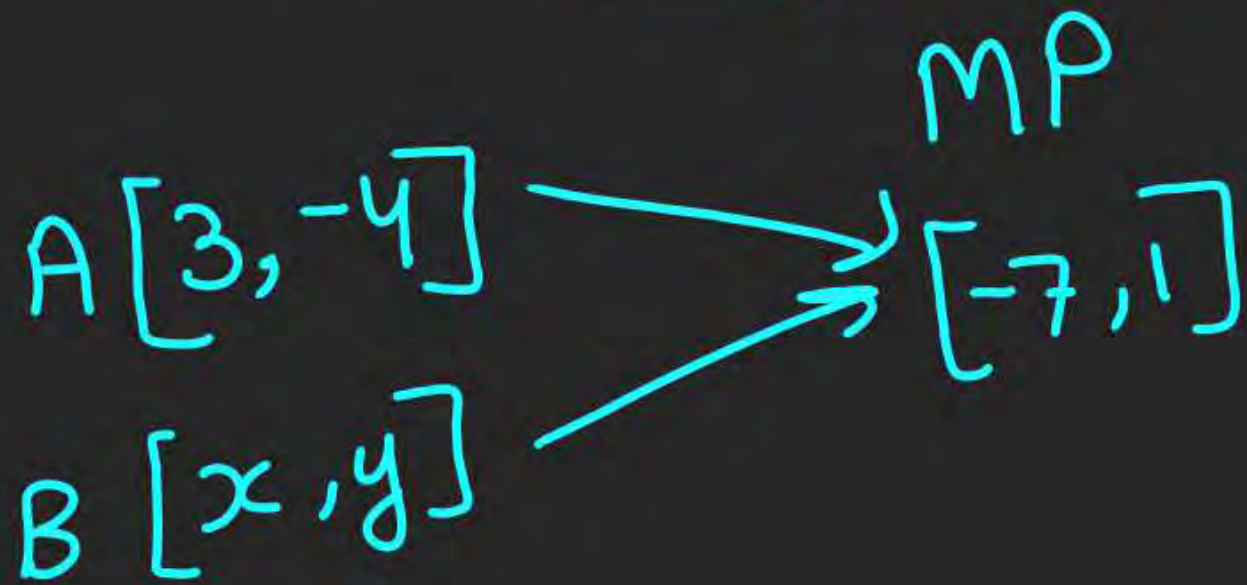
S	M	T	Is M the midpoint of ST? Yes or No	Reason for your answer
<u>(-3, 0)</u>	(0, 0)	<u>(3, 0)</u>	yes	
<u>(2, 3)</u>	(3, 4)	<u>(4, 5)</u>	yes	
<u>(0, 0)</u>	<u>(0, 5)</u>	<u>(0, -10)</u>		
<u>(-8, 7)</u>	<u>(0, -2)</u>	<u>(6, -3)</u>		

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

QUESTION



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).



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

$$-7 = \frac{3 + x}{2} \quad 1 = \frac{-4 + y}{2} \rightarrow 2 = -4 + y$$

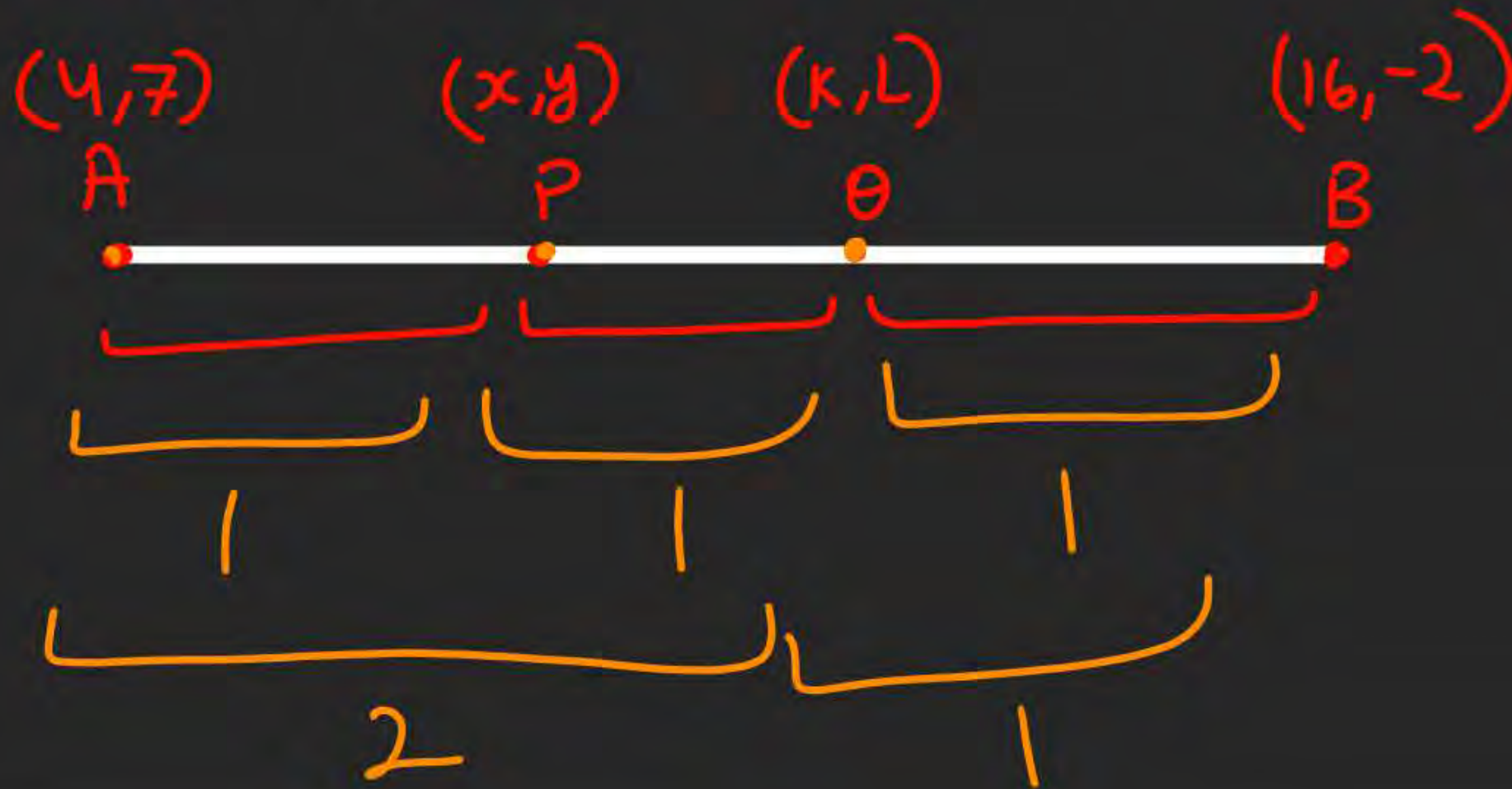
$$2 + 4 = y$$

$$y = 6$$

$$-14 = 3 + x \rightarrow x = -14 - 3 = \boxed{-17}$$

QUESTION

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 $B(16, -2)$.



P is MP of $A \& Q$
 Q is MP of $P \& B$

Thank,
you!