

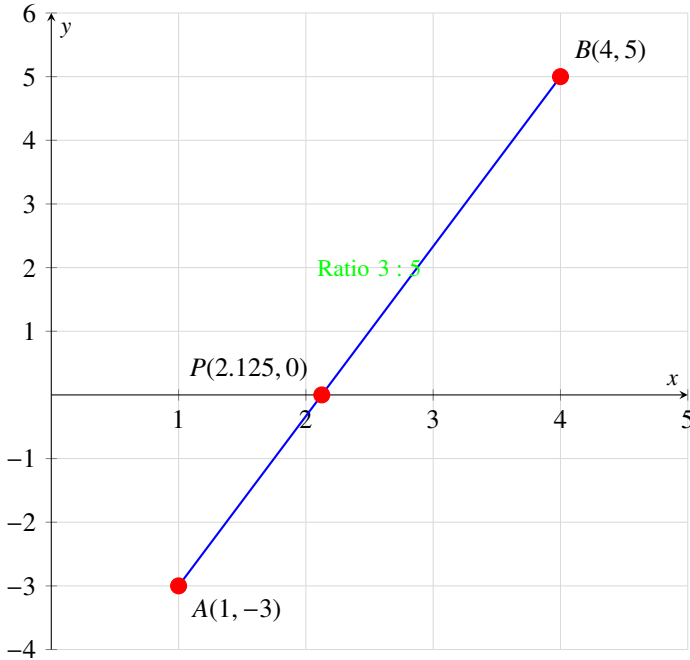
# 1-1.5-32

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## Question:

Find the ratio in which the line segment joining the points  $(1, -3)$  and  $(4, 5)$  is divided by  $X$  axis.

## Solution:



**1. Equation of the Line Segment:** The line segment joining  $A = (1, -3)$  and  $B = (4, 5)$  can be expressed parametrically as:

$$\frac{x - x_1}{x_2 - x_1} = \frac{y - y_1}{y_2 - y_1}$$

where  $(x_1, y_1) = (1, -3)$  and  $(x_2, y_2) = (4, 5)$ .

So,

$$\frac{x - 1}{4 - 1} = \frac{y + 3}{5 + 3}$$

Simplify to:

$$\frac{x - 1}{3} = \frac{y + 3}{8}$$

## 2. Finding Intersection with the $x$ -Axis:

The intersection with the  $x$ -axis occurs when  $y = 0$ . Substitute  $y = 0$  into the parametric equation:

$$\frac{x-1}{3} = \frac{0+3}{8}$$

Simplify:

$$\frac{x-1}{3} = \frac{3}{8}$$

Solving for  $x$ :

$$x-1 = \frac{3 \cdot 3}{8} = \frac{9}{8}$$

$$x = 1 + \frac{9}{8} = \frac{8+9}{8} = \frac{17}{8}$$

Therefore, the point of intersection with the  $x$ -axis is  $\left(\frac{17}{8}, 0\right)$ .

## 3. Using Section Formula to Find Ratio:

Let this point  $\left(\frac{17}{8}, 0\right)$  divide the segment  $AB$  in the ratio  $k : 1$ . The section formula for a point dividing a line segment in the ratio  $k : 1$  is given by:

$$\left(\frac{kx_2 + x_1}{k+1}, \frac{ky_2 + y_1}{k+1}\right)$$

Here, substituting the coordinates  $A = (1, -3)$  and  $B = (4, 5)$ :

$$\left(\frac{k \cdot 4 + 1}{k+1}, \frac{k \cdot 5 - 3}{k+1}\right) = \left(\frac{17}{8}, 0\right)$$

Equate the  $y$ -coordinates:

$$\frac{k \cdot 5 - 3}{k+1} = 0$$

$$k \cdot 5 - 3 = 0$$

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

Now, we need to verify the  $x$ -coordinate:

$$\frac{\frac{3}{5} \cdot 4 + 1}{\frac{3}{5} + 1} = \frac{\frac{12}{5} + 1}{\frac{8}{5}} = \frac{\frac{12+5}{5}}{\frac{8}{5}} = \frac{\frac{17}{5}}{\frac{8}{5}} = \frac{17}{8}$$

This confirms that our ratio  $k = \frac{3}{5}$  is correct.

Hence, the ratio in which the line segment joining the points  $(1, -3)$  and  $(4, 5)$  is divided by the  $x$ -axis is  $3 : 5$ .

$$\text{Ratio} = \frac{3}{5} : 1 = 3 : 5$$