

# 1.5.34

EE25BTECH11047 - RAVULA SHASHANK REDDY

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**Question:**

The point  $P$  which divides the line segment joining the points  $A(2, -5)$  and  $B(5, 2)$  in the ratio  $2 : 3$  lies in which quadrant?

**Solution:**

Given:

$$\mathbf{A} = \begin{pmatrix} 2 \\ -5 \end{pmatrix} \quad (1)$$

$$\mathbf{B} = \begin{pmatrix} 5 \\ 2 \end{pmatrix} \quad (2)$$

The point  $P$  dividing the segment  $AB$  in the ratio  $2:3$  internally, has the position vector :

$$\mathbf{P} = \frac{\frac{2}{3}\mathbf{B} + \mathbf{A}}{1 + \frac{2}{3}} \quad (3)$$

Thus by the formula

$$\mathbf{P} = \frac{\frac{2}{3}\begin{pmatrix} 5 \\ 2 \end{pmatrix} + \begin{pmatrix} 2 \\ -5 \end{pmatrix}}{1 + \frac{2}{3}} \quad (4)$$

$$\mathbf{P} = \frac{2\begin{pmatrix} 5 \\ 2 \end{pmatrix} + 3\begin{pmatrix} 2 \\ -5 \end{pmatrix}}{5} \quad (5)$$

$$\mathbf{P} = \frac{\begin{pmatrix} 10 \\ 4 \end{pmatrix} + \begin{pmatrix} 6 \\ -15 \end{pmatrix}}{5} \quad (6)$$

$$\therefore \mathbf{P} = \frac{\begin{pmatrix} 16 \\ -11 \end{pmatrix}}{5}. \quad (7)$$

Therefore the co-ordinates of  $P$  are

$$\left(\frac{16}{5}, -\frac{11}{5}\right).$$

**Solution (Matrix Approach)**

The section formula in vector form:

$$(m+n)\mathbf{P} = m\mathbf{B} + n\mathbf{A}.$$

Here  $m=2$ ,  $n=3$ ,  $m+n=5$ .

$$5\begin{pmatrix} x \\ y \end{pmatrix} = 2\begin{pmatrix} 5 \\ 2 \end{pmatrix} + 3\begin{pmatrix} 2 \\ -5 \end{pmatrix} \quad (8)$$

$$5\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 10 \\ 4 \end{pmatrix} + \begin{pmatrix} 6 \\ -15 \end{pmatrix} = \begin{pmatrix} 16 \\ -11 \end{pmatrix}. \quad (9)$$

This gives the matrix equation:

$$\begin{pmatrix} 5 & 0 \\ 0 & 5 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 16 \\ -11 \end{pmatrix}. \quad (10)$$

Augmented matrix:

$$\begin{pmatrix} 5 & 0 & 16 \\ 0 & 5 & -11 \end{pmatrix} \xrightarrow{R_1 \rightarrow \frac{1}{5}R_1} \begin{pmatrix} 1 & 0 & \frac{16}{5} \\ 0 & 5 & -11 \end{pmatrix} \xrightarrow{R_2 \rightarrow \frac{1}{5}R_2} \begin{pmatrix} 1 & 0 & \frac{16}{5} \\ 0 & 1 & -\frac{11}{5} \end{pmatrix} \quad (11)$$

$$\Rightarrow \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} \frac{16}{5} \\ -\frac{11}{5} \end{pmatrix} = \begin{pmatrix} 3.2 \\ -2.2 \end{pmatrix}. \quad (12)$$

Since  $x > 0$  and  $y < 0$ ,  $P$  lies in the **IV (fourth) quadrant**.

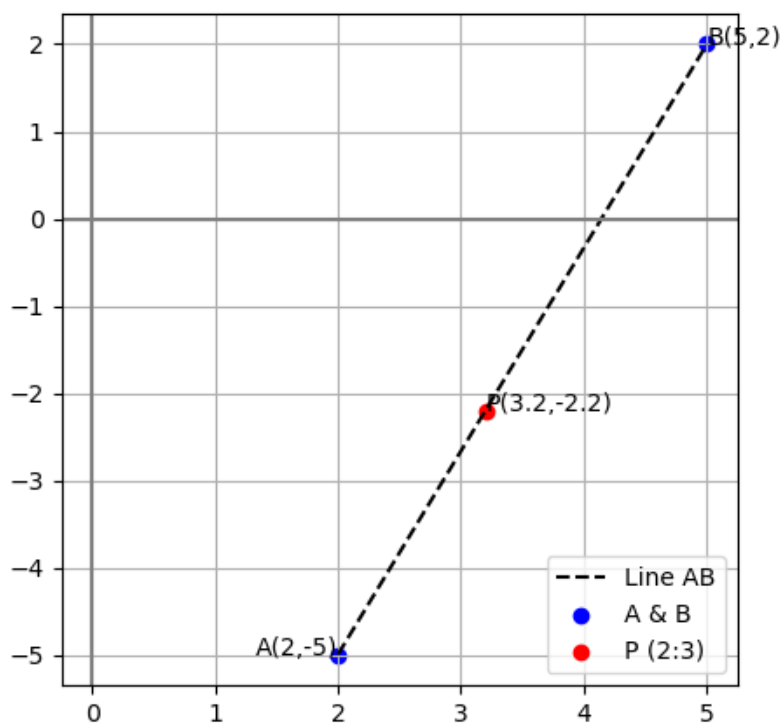


Figure 1

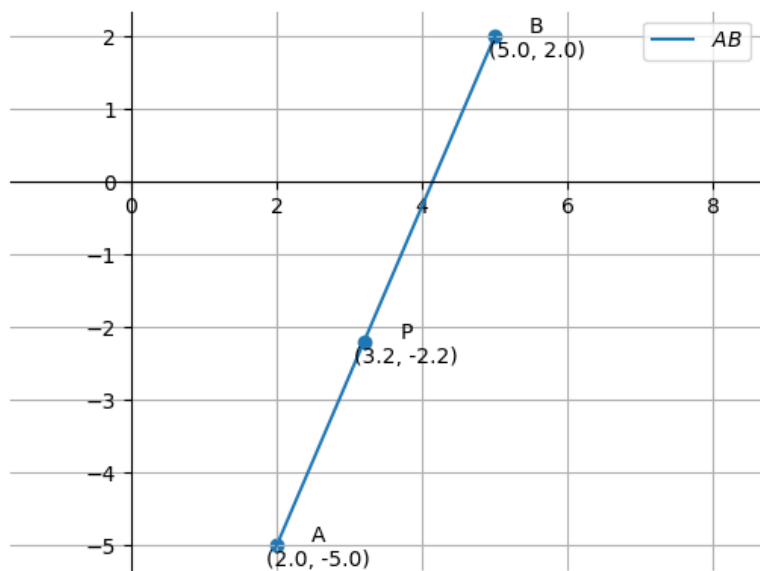


Figure 2