

1.5.27

EE25BTECH11039 - Manupati Manideep

Question:

If the coordinates of points **A** and **B** are $(-2, 2)$ and $(2, -4)$ respectively, find the coordinates of **P** such that

$$AP = \frac{3}{7}AB.$$

and **P** lies on line segment AB.

Solution:

We are given:

$$\mathbf{A} = \begin{bmatrix} -2 \\ 2 \end{bmatrix}, \quad \mathbf{B} = \begin{bmatrix} 2 \\ -4 \end{bmatrix}, \quad \mathbf{P} \text{ on } AB \text{ such that } AP = \frac{3}{7}AB.$$

Step 1: Section Formula

$$\mathbf{P} = \mathbf{A} + \frac{AP}{AB}(\mathbf{B} - \mathbf{A})$$

Step 2: Compute $\mathbf{B} - \mathbf{A}$

$$\mathbf{B} - \mathbf{A} = \begin{bmatrix} 2 \\ -4 \end{bmatrix} - \begin{bmatrix} -2 \\ 2 \end{bmatrix} = \begin{bmatrix} 2 - (-2) \\ -4 - 2 \end{bmatrix} = \begin{bmatrix} 4 \\ -6 \end{bmatrix}$$

Step 3: Multiply by $\frac{3}{7}$

$$\frac{3}{7}(\mathbf{B} - \mathbf{A}) = \frac{3}{7} \begin{bmatrix} 4 \\ -6 \end{bmatrix} = \begin{bmatrix} \frac{3}{7} \cdot 4 \\ \frac{3}{7} \cdot (-6) \end{bmatrix} = \begin{bmatrix} \frac{12}{7} \\ -\frac{18}{7} \end{bmatrix}$$

Step 4: Add to \mathbf{A}

$$\mathbf{P} = \begin{bmatrix} -2 \\ 2 \end{bmatrix} + \begin{bmatrix} \frac{12}{7} \\ -\frac{18}{7} \end{bmatrix} = \begin{bmatrix} -2 + \frac{12}{7} \\ 2 + \left(-\frac{18}{7}\right) \end{bmatrix} = \begin{bmatrix} \frac{-14+12}{7} \\ \frac{14-18}{7} \end{bmatrix} = \begin{bmatrix} -\frac{2}{7} \\ -\frac{4}{7} \end{bmatrix}$$

Final Answer

$$\mathbf{P} = \begin{bmatrix} -\frac{2}{7} \\ -\frac{4}{7} \end{bmatrix} \Rightarrow \mathbf{P} \left(-\frac{2}{7}, -\frac{4}{7} \right)$$

Points A, B and P with P on segment AB ($AP = \frac{3}{7} AB$)

