

1.4.26

EE25BTECH11010 - Arsh Dhoke

Question:

The position vector of the point which divides the join of points $2\mathbf{a} - 3\mathbf{b}$ and $\mathbf{a} + \mathbf{b}$ in the ratio $3 : 1$ is _____.

Solution:

$$\mathbf{P} = 2\mathbf{a} - 3\mathbf{b} \quad (0.1)$$

$$\mathbf{Q} = \mathbf{a} + \mathbf{b} \quad (0.2)$$

Now, the matrix form for \mathbf{P} and \mathbf{Q} is:

$$\begin{pmatrix} \mathbf{P} & \mathbf{Q} \end{pmatrix} = \begin{pmatrix} \mathbf{a} & \mathbf{b} \end{pmatrix} \begin{pmatrix} 2 & 1 \\ -3 & 1 \end{pmatrix} \quad (0.3)$$

Using the section formula, the point \mathbf{R} dividing \mathbf{PQ} in ratio $3 : 1$ is:

$$\mathbf{R} = \frac{3\mathbf{Q} + 1\mathbf{P}}{3 + 1} \quad (0.4)$$

$$\mathbf{R} = \frac{1}{4} \cdot (\mathbf{Q} \quad \mathbf{P}) \begin{pmatrix} 3 \\ 1 \end{pmatrix} \quad (0.5)$$

$$\mathbf{R} = \frac{1}{4} \cdot \begin{pmatrix} \mathbf{a} & 2\mathbf{a} \\ \mathbf{b} & -3\mathbf{b} \end{pmatrix} \begin{pmatrix} 3 \\ 1 \end{pmatrix} \quad (0.6)$$

$$\mathbf{R} = \frac{1}{4} \left(3 \begin{pmatrix} \mathbf{a} \\ \mathbf{b} \end{pmatrix} + \begin{pmatrix} 2\mathbf{a} \\ -3\mathbf{b} \end{pmatrix} \right) \quad (0.7)$$

$$= \frac{1}{4} \begin{pmatrix} 5\mathbf{a} \\ 0 \end{pmatrix} \quad (0.8)$$

$$= \begin{pmatrix} \frac{5\mathbf{a}}{4} \\ 0 \end{pmatrix} \quad (0.9)$$

$$\boxed{\mathbf{R} = \begin{pmatrix} \frac{5\mathbf{a}}{4} \\ 0 \end{pmatrix}} \quad (0.10)$$

Let $\mathbf{a} = 1$ and $\mathbf{b} = 0$.

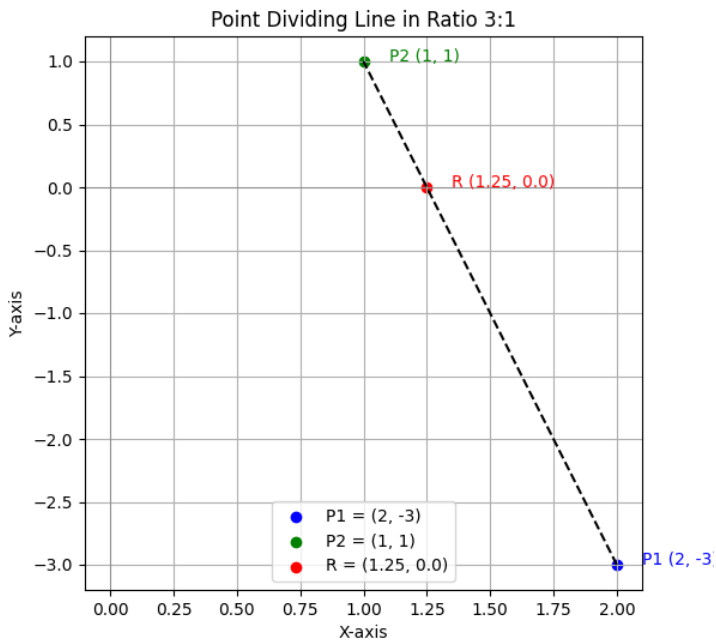


Fig. 0.1. Graph for question 1