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:

$$\mathbf{P} = 2\mathbf{a} - 3\mathbf{b} \tag{0.1}$$

$$\mathbf{Q} = \mathbf{a} + \mathbf{b} \tag{0.2}$$

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

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

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

$$\mathbf{R} = \frac{3\mathbf{Q}+1\mathbf{P}}{3+1} \tag{0.4}$$

$$\mathbf{R} = \frac{1}{4}\cdot\begin{pmatrix}\mathbf{Q} & \mathbf{P}\end{pmatrix}\begin{pmatrix}3\\1\end{pmatrix} \tag{0.5}$$

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

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

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

$$= \begin{pmatrix}\frac{5\mathbf{a}}{4}\\ 0\end{pmatrix} \tag{0.9}$$

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

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

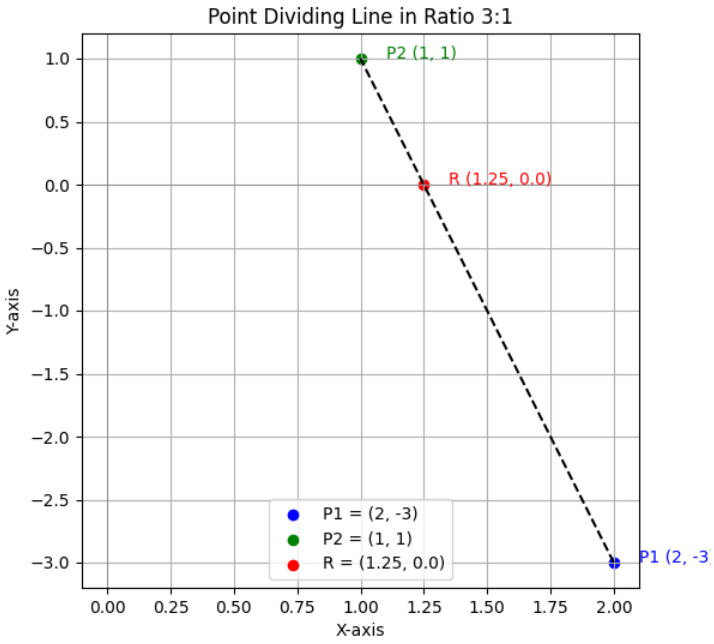

Fig. 0.1: Graph for question 1