

# 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:**

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

Then,

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

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

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:

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

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

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

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

$$= \frac{1}{4} \begin{pmatrix} 3\mathbf{a} + 2\mathbf{a} \\ 3\mathbf{b} - 3\mathbf{b} \end{pmatrix} \quad (0.8)$$

$$= \frac{1}{4} \begin{pmatrix} 5\mathbf{a} \\ 0 \end{pmatrix} \quad (0.9)$$

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

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

(0.11)

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

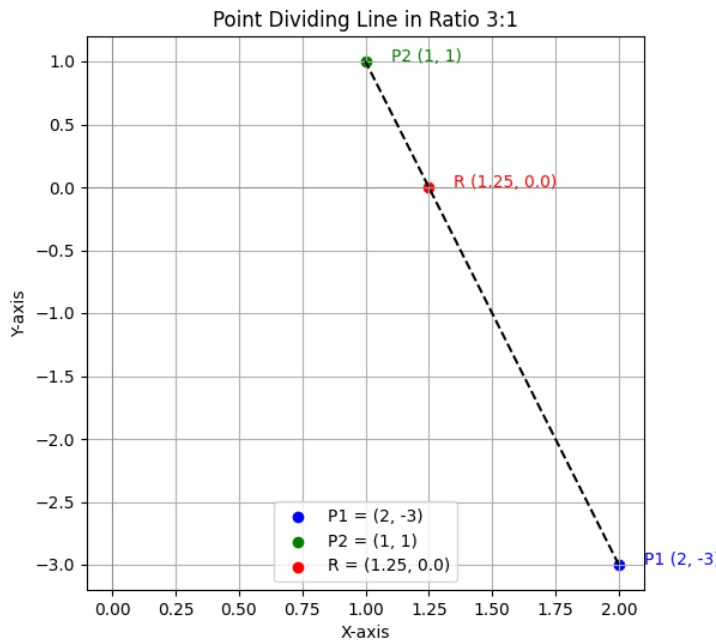


Fig. 0.1. Graph for question 1