

AI1110 ASSIGNMENT 1

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Q3 (b): M and N are two points on the X axis and Y axis respectively. P(3, 2) divides the line segment MN in the ratio 2:3.

Find:

- (i) the coordinates of M and N
- (ii) the slope of MN.

Solution:

Various paraetres used in this question are:

Symbol	Value	Description
P	$\begin{pmatrix} 3 \\ 2 \end{pmatrix}$	Given point
e₁	$\begin{pmatrix} 1 \\ 0 \end{pmatrix}$	Standard X-axis vector
e₂	$\begin{pmatrix} 0 \\ 1 \end{pmatrix}$	Standard Y-axis vector
M	ae_1	A point on X-axis and $a \in R$
N	be_2	A point on Y-axis and $b \in R$
k	$\frac{2}{3}$	Ratio in which P divides MN

TABLE I
VARIABLES

According to Section formula,

If P divides MN in the ratio k:1, then:

$$\mathbf{P} = \frac{k(\mathbf{N}) + 1(\mathbf{M})}{k + 1} \quad (0.0.1)$$

$$\mathbf{P} = \frac{bk\mathbf{e}_2 + a\mathbf{e}_1}{k + 1} \quad (0.0.2)$$

$$\mathbf{P} = \left(\frac{a}{k + 1} \right) \mathbf{e}_1 + \left(\frac{bk}{k + 1} \right) \mathbf{e}_2 \quad (0.0.3)$$

But we have,

$$\mathbf{P} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$$

Therefore,

$$\left(\frac{a}{k + 1} \right) \mathbf{e}_1 + \left(\frac{bk}{k + 1} \right) \mathbf{e}_2 = \begin{pmatrix} 3 \\ 2 \end{pmatrix} \quad (0.0.4)$$

$$\left(\frac{a}{k + 1} \right) \mathbf{e}_1 + \left(\frac{bk}{k + 1} \right) \mathbf{e}_2 = 3\mathbf{e}_1 + 2\mathbf{e}_2 \quad (0.0.5)$$

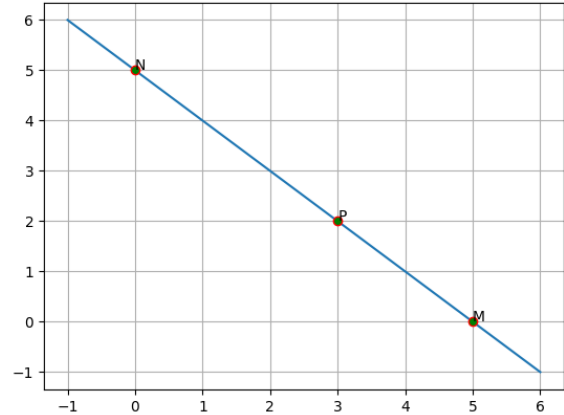


Fig. 0. graph

$$\Rightarrow \frac{a}{k + 1} = 3 \text{ and } \frac{bk}{k + 1} = 2 \quad (0.0.6)$$

$$\Rightarrow a = 3(k + 1) \text{ and } b = \frac{2(k + 1)}{k} \quad (0.0.7)$$

Substituting $k = \frac{2}{3}$, we get:
 $a = 5$ and $b = 5$

$$1) \quad \mathbf{M} = 5\mathbf{e}_1 \text{ and } \mathbf{N} = 5\mathbf{e}_2$$

2)

$$\text{Slope of } MN = \frac{5 - 0}{0 - 5} \quad (0.0.8)$$

$$= -1 \quad (0.0.9)$$