AI1110 ASSIGNMENT 1

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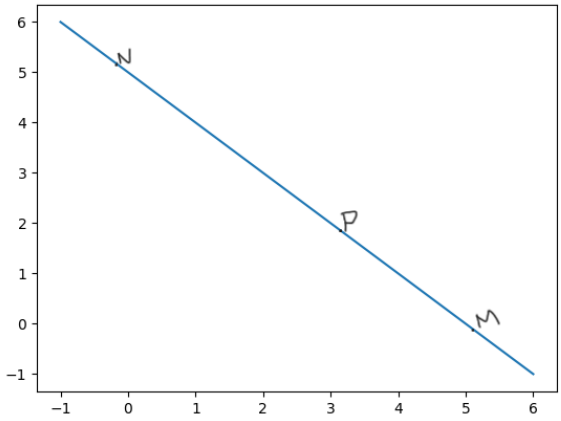
Q3 (b): M and N are two points on the X axis and Y axis respectively. $\mathbf{P}(3,2)$ divides the line segment MN in the ratio 2:3.
Find:
(i)the coordinates of M and N
(ii)the slope of MN.



Solution:
Given,

M and N are two points on X and Y axes respectively.
Define:

$$\mathbf{e_1} = \begin{pmatrix}1\\0\end{pmatrix} \tag{0.0.1}$$

$$\mathbf{e_2} = \begin{pmatrix}0\\1\end{pmatrix} \tag{0.0.2}$$

Let

$$\mathbf{M} = a\mathbf{e_1} \tag{0.0.3}$$

$$\mathbf{N} = b\mathbf{e_2} \tag{0.0.4}$$

P divides MN in the ratio 2:3.
According to Section formula,

$$\mathbf{P} = \frac{2(\mathbf{N}) + 3(\mathbf{M})}{2+3} \tag{0.0.5}$$

$$\mathbf{P} = \frac{2b\mathbf{e_2} + 3a\mathbf{e_1}}{5} \tag{0.0.6}$$

$$\mathbf{P} = \left(\frac{3a}{5}\right)\mathbf{e_1} + \left(\frac{2b}{5}\right)\mathbf{e_2} \tag{0.0.7}$$

But we have,
$\mathbf{P} = \begin{pmatrix}3\\2\end{pmatrix}$
Therefore,

$$\left(\frac{3a}{5}\right)\mathbf{e_1} + \left(\frac{2b}{5}\right)\mathbf{e_2} = \begin{pmatrix}3\\2\end{pmatrix} \tag{0.0.8}$$

$$\left(\frac{3a}{5}\right)\mathbf{e_1} + \left(\frac{2b}{5}\right)\mathbf{e_2} = 3\mathbf{e_1} + 2\mathbf{e_2} \tag{0.0.9}$$

$\implies \frac{3a}{5} = 3$ and $\frac{2b}{5} = 2$

$\implies$ a = 5 and b = 5

(i)$\mathbf{M} = \begin{pmatrix}5\\0\end{pmatrix}$ and $\mathbf{N} = \begin{pmatrix}0\\5\end{pmatrix}$

(ii) Slope of MN = $\frac{5-0}{0-5}$

= -1