AI1110: Assignment 2

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Outline

Question

Q12 - b) : Find the point on straight line $2x + 3y = 6$ which is closest to the origin.

solution

The line can be expressed in vector form as

$$\vec{r} = \lambda \begin{bmatrix} -3 \\ 2 \end{bmatrix} + \begin{bmatrix} 3 \\ 0 \end{bmatrix}$$

(1)

Shortest distance will be along the line perpendicular to given line passing through origin.

So, we are assuming the point P on the line such that

$$P = \begin{bmatrix} a \\ b \end{bmatrix} \tag{2}$$

$$\begin{bmatrix} a \\ b \end{bmatrix} = \lambda \begin{bmatrix} -3 \\ 2 \end{bmatrix} + \begin{bmatrix} 3 \\ 0 \end{bmatrix} \tag{3}$$

$$\begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} 3 - 3\lambda \\ 2\lambda \end{bmatrix} \tag{4}$$

From equality of matrix we can say

$$a = 3 - 3\lambda \tag{5}$$

$$b = 2\lambda \tag{6}$$

Shortest will be along the line which is perpendicular to given line

$$P\begin{bmatrix}-3\\2\end{bmatrix}=\begin{bmatrix}0\\0\end{bmatrix} \tag{7}$$

$$\begin{bmatrix}a\\b\end{bmatrix}\begin{bmatrix}-3\\2\end{bmatrix}=\begin{bmatrix}0\\0\end{bmatrix} \tag{8}$$

$$3a=2b \tag{9}$$

So we get From equation 5 , 6 and 9 we get

$$\lambda=\frac{9}{13}, a=\frac{12}{13}, b=\frac{18}{13} \tag{10}$$

So the point P is

$$\text{P} = \begin{bmatrix}\frac{12}{13}\\\frac{18}{13}\end{bmatrix}$$

Graph