4.7.57

EE25BTECH11060 - V.Namaswi

Question

Find distance of $(3,-5)$ from line 3x-4y-26=0

Solution:

The given line is

$$3x - 4y - 26 = 0$$

This can be written in the form

$$\mathbf{n}^\top \mathbf{x} = c \tag{1}$$

where

$$\mathbf{n} = \begin{pmatrix} 3 \\ -4 \end{pmatrix}, \quad c = 26.$$

Let the point be

$$\mathbf{P} = \begin{pmatrix} 3 \\ -5 \end{pmatrix}.$$

The distance of point $\mathbf{P}$ from the line is

$$d = \frac{|\mathbf{n}^\top \mathbf{P} - c|}{\|\mathbf{n}\|}. \tag{2}$$

Substituting the values,

$$\mathbf{n}^\top \mathbf{P} = \begin{pmatrix} 3 & -4 \end{pmatrix} \begin{pmatrix} 3 \\ -5 \end{pmatrix} \tag{3}$$

$$= 3(3) + (-4)(-5) \tag{4}$$

$$= 9 + 20 = 29. \tag{5}$$

$$\mathbf{n}^\top \mathbf{P} - c \tag{6}$$

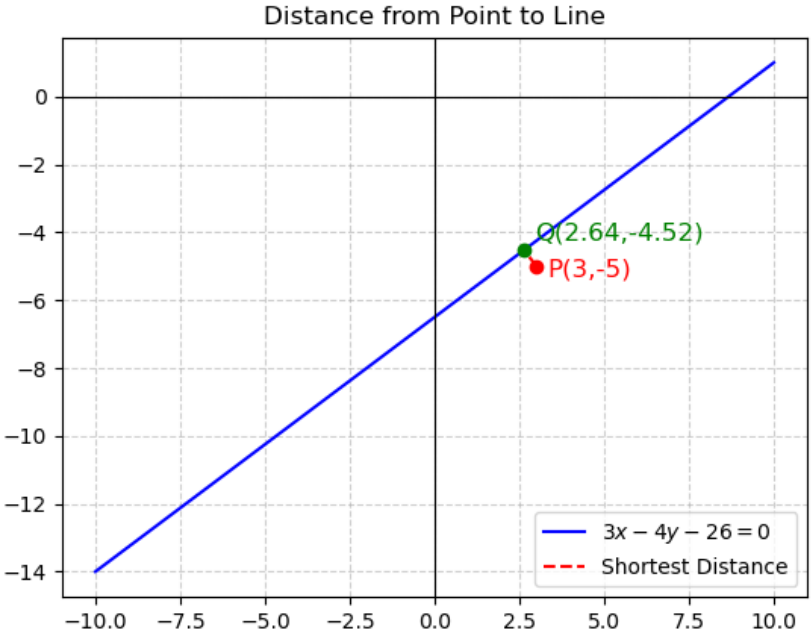
$$= 29 - 26 = 3. \tag{7}$$

$$\|\mathbf{n}\| = \sqrt{3^2 + (-4)^2} \tag{8}$$

$$= \sqrt{9 + 16} = 5. \tag{9}$$

$$So, d = \frac{|3|}{5} = \frac{3}{5}. \tag{10}$$

Refer fig


Distance from Point to Line
Q(2.64,-4.52)
P(3,-5)
3x − 4y − 26 = 0
Shortest Distance
0
−2
−4
−6
−8
−10
−12
−14
−10.0
−7.5
−5.0
−2.5
0.0
2.5
5.0
7.5
10.0