

4.7.12

EE25BTECH11026-Harsha

Question:

Find the distance of the line $4x - y = 0$ from the point $P(4, 1)$ measured along the line making an angle of 135° with the positive x -axis.

Solution:

Let us solve the given question theoretically and then verify the solution computationally.

According to the question,

$$\text{Equation of target line: } \begin{pmatrix} 4 & -1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = 0 \quad (0.1)$$

and

$$\mathbf{P} = \begin{pmatrix} 4 \\ 1 \end{pmatrix} \quad (0.2)$$

As the direction of line makes an angle of 135° with the $+x$ axis, the unit direction vector of the line is given by

$$\mathbf{m}_0 = \begin{pmatrix} \cos 135^\circ \\ \sin 135^\circ \end{pmatrix} = \begin{pmatrix} -\frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{pmatrix} \quad (0.3)$$

The formula to calculate the distance κ of the target line from the point, along a line is given by

$$\kappa = \frac{c - \mathbf{n}^\top \mathbf{P}}{\mathbf{n}^\top \mathbf{m}_0} \quad (0.4)$$

$$(0.5)$$

$$\therefore \kappa = \frac{-\begin{pmatrix} 4 & -1 \end{pmatrix} \begin{pmatrix} 4 \\ 1 \end{pmatrix}}{\begin{pmatrix} 4 & -1 \end{pmatrix} \begin{pmatrix} -\frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{pmatrix}} \quad (0.6)$$

$$\Rightarrow \kappa = 3\sqrt{2} \text{ units} \quad (0.7)$$

From the figure, it is clearly verified that the theoretical solution matches with the computational solution.

