4-4.2-9

AI24BTECH11005 - Bhukya Prajwal Naik

Question:
Find the directional and normal vectors of the following line: $x + y = 4$. **Solution:**

Information	Symbolic form	Value
Given Line	$\mathbf{X} = \mathbf{h} + k\mathbf{m}$	$x + y = 6$
Direction vector	$\mathbf{m}$	$\begin{pmatrix} 1 \\ -1 \end{pmatrix}$
Normal vector	$\mathbf{n}$	$\begin{pmatrix} 1 \\ 1 \end{pmatrix}$

TABLE 0: Final Information

The equation of the given line is:

$$4 = x + y \tag{0.1}$$

$$y = 4 - x \tag{0.2}$$

$$\implies \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x \\ 4 - x \end{pmatrix} = \begin{pmatrix} 0 \\ 4 \end{pmatrix} + x \begin{pmatrix} 1 \\ -1 \end{pmatrix} \tag{0.3}$$

$$\mathbf{X} = \mathbf{h} + k\mathbf{m} \tag{0.4}$$

Hence we get the direction vector:

$$\mathbf{m} = \begin{pmatrix} 1 \\ -1 \end{pmatrix} \tag{0.5}$$

then we get

$$\mathbf{n} = \begin{pmatrix} 1 \\ 1 \end{pmatrix} \tag{0.6}$$

Hence, the direction vector of the line is given by $\mathbf{m} = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$ and the normal vector is $\mathbf{n} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$.

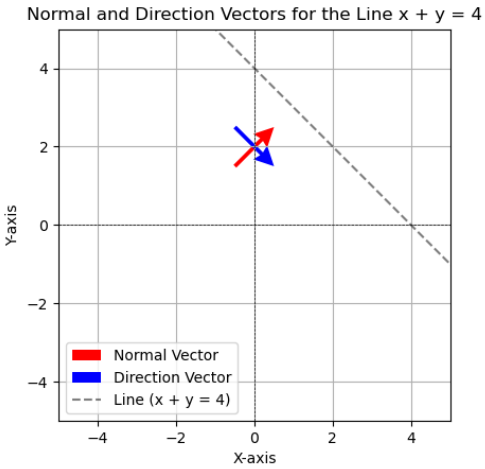

Fig. 0.1: Lines and Vectors