4.4.2.14

EE24BTECH11024 - Abhimanyu Koushik

Question:
Find the direction and normal vectors of the given line $x + y = 0$

Variable	Description
m	Direction vector
n	Normal vector
h	Intercept vector
x	Vector which represents points on the line

TABLE I: Variables Used

Solution: The normal vector can be found out as

$$x + y = 0 \tag{1}$$

$$\begin{pmatrix}1 & 1\end{pmatrix}\begin{pmatrix}x\\y\end{pmatrix} = 0 \tag{2}$$

$$\begin{pmatrix}1 & 1\end{pmatrix}\mathbf{x} = 0 \tag{3}$$

$$\mathbf{n}^{\top}\mathbf{x} = 0 \tag{4}$$

$$\mathbf{n} = \begin{pmatrix}1\\1\end{pmatrix} \tag{5}$$

The direction vector can be found out as

$$x = x \tag{6}$$

$$y = -x \tag{7}$$

$$\begin{pmatrix}x\\y\end{pmatrix} = x\begin{pmatrix}1\\-1\end{pmatrix} + \begin{pmatrix}0\\0\end{pmatrix} \tag{8}$$

$$\mathbf{x} = x\begin{pmatrix}1\\-1\end{pmatrix} + \begin{pmatrix}0\\0\end{pmatrix} \tag{9}$$

$$\mathbf{x} = k\mathbf{m} + \mathbf{h} \tag{10}$$

$$\mathbf{m} = \begin{pmatrix}1\\-1\end{pmatrix} \tag{11}$$

Direction vector: $\mathbf{m} = \begin{pmatrix}1\\-1\end{pmatrix}$

Normal vector: $\mathbf{n} = \begin{pmatrix}1\\1\end{pmatrix}$

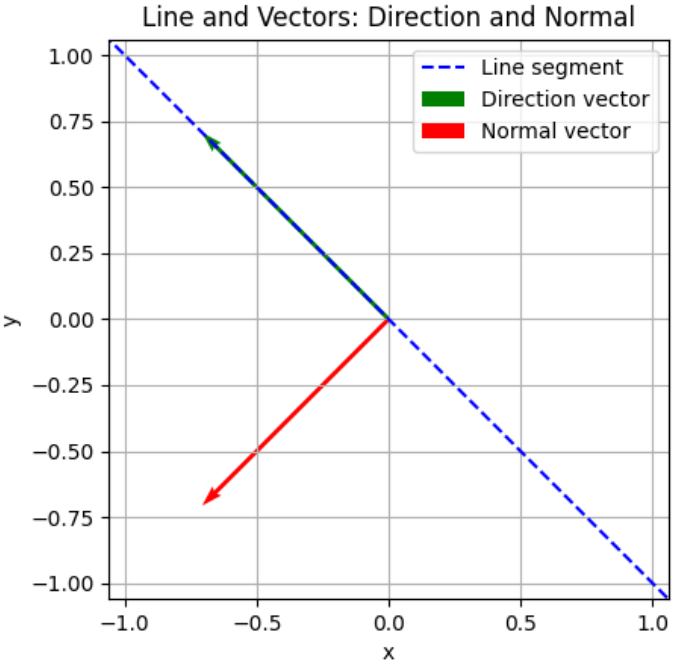

Fig. 1: Plot of the line, Direction Vector and Normal Vector