

# 4.4.2.14

EE24BTECH11024 - Abhimanyu Koushik

Question:

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

Variable	Description
<b>m</b>	Direction vector
<b>n</b>	Normal vector
<b>h</b>	$\begin{pmatrix} 0 \\ c \end{pmatrix}$

TABLE I: Variables Used

**Solution:** The equation of the line is given by,

$$y = mx + c \quad (1)$$

$$y - mx = c \quad (2)$$

$$\begin{pmatrix} -m & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = c \quad (3)$$

$$\mathbf{n}^\top \mathbf{x} = c \quad (4)$$

here,  $\mathbf{n} = \begin{pmatrix} -m \\ 1 \end{pmatrix}$  where  $\mathbf{n}$  is vector perpendicular to line  
given line can be written as

$$x + y = 0 \quad (5)$$

$$\begin{pmatrix} 1 & 1 \end{pmatrix} \mathbf{x} = 0 \quad (6)$$

$$\mathbf{n} = \begin{pmatrix} 1 \\ 1 \end{pmatrix} \quad (7)$$

equation of line in terms of direction vector  $\mathbf{m}$  is,

$$x = x \quad (8)$$

$$y = mx + c \quad (9)$$

$$\mathbf{x} = x \begin{pmatrix} 1 \\ m \end{pmatrix} + \begin{pmatrix} 0 \\ c \end{pmatrix} \quad (10)$$

$$\mathbf{x} = k\mathbf{m} + \mathbf{h} \quad (11)$$

Here

$$x = x \quad (12)$$

$$y = -x \quad (13)$$

$$\mathbf{x} = x \begin{pmatrix} 1 \\ -1 \end{pmatrix} + \begin{pmatrix} 0 \\ 0 \end{pmatrix} \quad (14)$$

$$\mathbf{x} = k \begin{pmatrix} 1 \\ -1 \end{pmatrix} \quad (15)$$

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

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

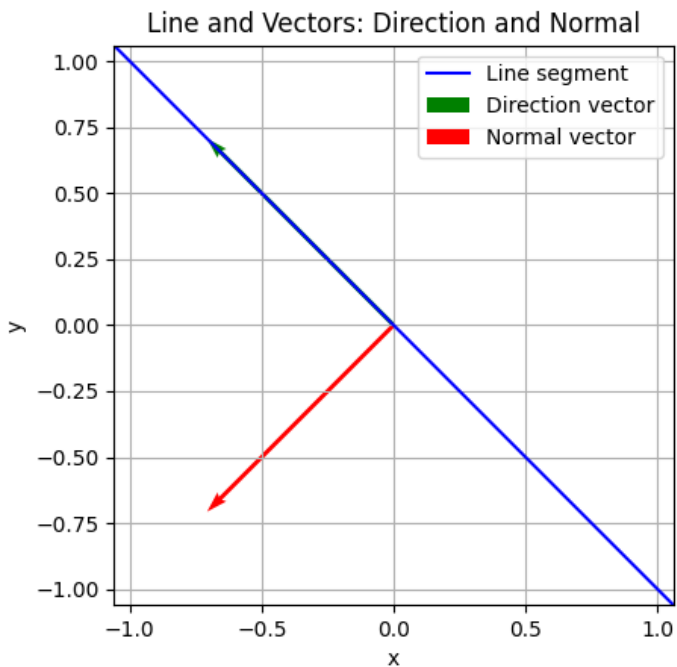


Fig. 1: Plot of the line, Direction Vector and Normal Vector