4.2.11

EE25BTECH11008 - Anirudh M Abhilash

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Question

Find the direction and normal vectors of the line

$$y = 3x$$

Solution

The equation of the line is

$$y = mx + c \tag{1}$$

Comparing with $y = 3x$,

$$m = 3, \quad c = 0 \tag{2}$$

The vector form of the line is

$$\mathbf{x} = \mathbf{h} + \kappa\mathbf{m} \tag{3}$$

Since the line passes through the origin,

$$\mathbf{h} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \tag{4}$$

Thus,

$$\mathbf{x} = \kappa \begin{pmatrix} 1 \\ 3 \end{pmatrix} \tag{5}$$

By Comparison, the direction vector is

$$\mathbf{m} = \begin{pmatrix} 1 \\ m \end{pmatrix} = \begin{pmatrix} 1 \\ 3 \end{pmatrix} \tag{6}$$

For normal vector $\mathbf{n}$,

$$\mathbf{n}^\top \mathbf{m} = 0 \tag{7}$$

By Solving, the normal vector is

$$\mathbf{n} = \begin{pmatrix} -m \\ 1 \end{pmatrix} = \begin{pmatrix} -3 \\ 1 \end{pmatrix} \tag{8}$$

$$\boxed{\mathbf{m} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}, \quad \mathbf{n} = \begin{pmatrix} -3 \\ 1 \end{pmatrix}}$$

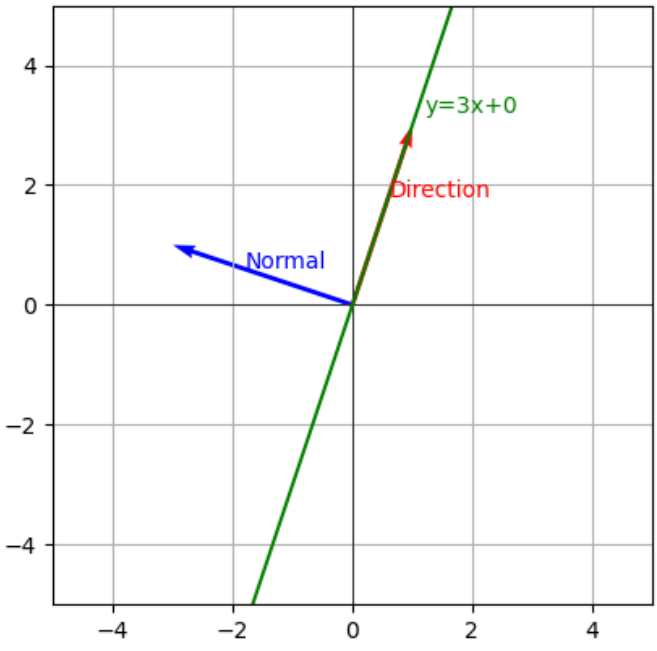

Figure 1: Direction and Normal vectors