4.2.4

EE24BTECH11016 - Dhwanith M Doddahundi

Question: Find the direction and normal vectors of the line $x = 3y$

Solution:

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

TABLE 0: Variables Used

$$x - 3y = 0 \tag{0.1}$$

$$\begin{pmatrix} 1 & -3 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = 0 \tag{0.2}$$

$$\mathbf{n}^\top \mathbf{x} = c \tag{0.3}$$

$$\implies \mathbf{n} = \begin{pmatrix} 1 \\ -3 \end{pmatrix} \tag{0.4}$$

$$\mathbf{m}^\top \mathbf{n} = 0 \tag{0.5}$$

$$\begin{pmatrix} 1 & m \end{pmatrix} \begin{pmatrix} 1 \\ -3 \end{pmatrix} = 0 \tag{0.6}$$

$$1 - 3m = 0 \tag{0.7}$$

$$m = \frac{1}{3} \tag{0.8}$$

$$\implies \mathbf{m} = \begin{pmatrix} 3 \\ 1 \end{pmatrix} \tag{0.9}$$

The normal vector and direction vector of line $x = 3y$ are $\mathbf{m}$ and $\mathbf{n}$ respectively,

$$\mathbf{n} = \begin{pmatrix} 1 \\ -3 \end{pmatrix} \tag{0.10}$$

$$\mathbf{m} = \begin{pmatrix} 3 \\ 1 \end{pmatrix} \tag{0.11}$$

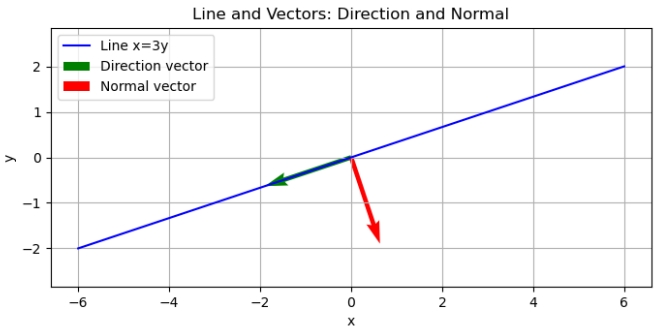

Fig. 0.1: Plot of the line, Direction Vector and Normal Vector