4-4.2-3

AI24BTECH11003 - Vijaya Sreyas

Question:
Find the direction and normal vectors of the following line: $-2x + 3y = 6$
Solution:

Information	Symbolic Form	Value
Given Line	$\mathbf{X} = \mathbf{h} + k\mathbf{m}$	$-2x + 3y = 6$
Direction Vector	$\mathbf{m}$	$\begin{pmatrix} 3 \\ 2 \end{pmatrix}$
Normal Vector	$\mathbf{n}$	$\begin{pmatrix} -2 \\ 3 \end{pmatrix}$

TABLE 0: Final Information

The equation of the given line is:

$$6 = -2x + 3y \tag{0.1}$$

$$y = 2 + \frac{2}{3}x \tag{0.2}$$

$$\implies \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x \\ \frac{2}{3}x + 2 \end{pmatrix} = \begin{pmatrix} 0 \\ 2 \end{pmatrix} + x \begin{pmatrix} 1 \\ \frac{2}{3} \end{pmatrix} \tag{0.3}$$

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

Thereby yielding the direction vector:

$$\mathbf{m} = \begin{pmatrix} 1 \\ \frac{2}{3} \end{pmatrix} \tag{0.5}$$

From

$$\mathbf{m}^\top \mathbf{n} = 0 \tag{0.6}$$

We get:

$$\mathbf{n} = \begin{pmatrix} -\frac{2}{3} \\ 1 \end{pmatrix} \tag{0.7}$$

Therefore, the direction vector of the line can be given by $\mathbf{m} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and $\mathbf{n} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$.
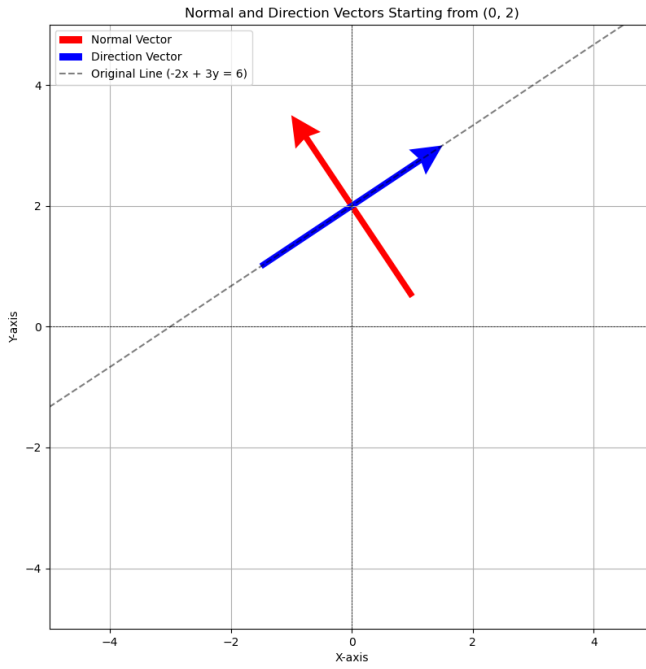
Codes for plotting the vectors:

```
codes/vector_calculator.c
codes/plot_vectors.py
```

Fig. 0.1: Line and Vectors