

## 4.2.21

EE25BTECH11018 - DARISY SREETEJ

**Question:**

Find the direction and normal vector for the line

$$F = \frac{9}{5}C + 32 \quad (0.1)$$

**Solution:**

The line can be written as:

$$y = \frac{9}{5}x + 32 \quad (0.2)$$

$$5y - 9x = 160 \quad (0.3)$$

This equation can be expressed in terms of matrices  
Let

$$\mathbf{x} = \begin{pmatrix} x \\ y \end{pmatrix} \quad (0.4)$$

$$\mathbf{n}^T = (-9 \quad 5) \quad (0.5)$$

$$c = 160 \quad (0.6)$$

The line equation can be written as:

$$\mathbf{n}^T \mathbf{x} = c \quad (0.7)$$

Where  $\mathbf{n}$  is the normal vector of the given line

The direction vector of the line can be found by observing the normal vector.

$$\mathbf{m} = \begin{pmatrix} 5 \\ 9 \end{pmatrix} \quad (0.8)$$

This is true because if the director vector is represented as

$$\mathbf{m} = \begin{pmatrix} 1 \\ m \end{pmatrix} \quad (0.9)$$

then the normal vector can be represented as

$$\mathbf{n} = \begin{pmatrix} -m \\ 1 \end{pmatrix} \quad (0.10)$$

This can be verified by the following equation:

$$\mathbf{n}^T \mathbf{m} = 0 \quad (0.11)$$

$$\begin{pmatrix} -9 & 5 \end{pmatrix} \begin{pmatrix} 5 \\ 9 \end{pmatrix} = 0 \quad (0.12)$$

The normal vector of the line is  $\mathbf{n} = \begin{pmatrix} -9 \\ 5 \end{pmatrix}$  The director vector of the line is  $\mathbf{m} = \begin{pmatrix} 5 \\ 9 \end{pmatrix}$

From the figure, it is clearly verified that the theoretical solution matches with the computational solution.

