

4.2.7

EE25BTECH11004 - Aditya Appana

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Question

Find the direction and normal vectors of the line $y - 2 = 0$

Solution

A line can be expressed in two forms:

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

where $\begin{pmatrix} 1 \\ m \end{pmatrix}$ is the direction vector of the line and m is the **slope** of the line.

$$\mathbf{n}^T x = c \quad (2)$$

where \mathbf{n} is the normal vector of the line.

$$\mathbf{n}^T \begin{pmatrix} 1 \\ m \end{pmatrix} = 0 \quad (3)$$

The slope of the line $y - 2 = 0$ is 0, therefore it can be expressed in the first form as:

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 0 \\ 2 \end{pmatrix} + x \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad (4)$$

$\begin{pmatrix} 0 \\ 1 \end{pmatrix}$ is orthogonal to $\begin{pmatrix} 1 \\ 0 \end{pmatrix}$ in \mathbb{R}^2 . Therefore

$$\begin{pmatrix} 0 \\ 1 \end{pmatrix}^T x = 2 \tag{5}$$

Therefore, the direction is $\begin{pmatrix} 0 \\ 1 \end{pmatrix}$, and the normal vector is $\begin{pmatrix} 1 \\ 0 \end{pmatrix}$.