Directional and Normal Vectors of a Line

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Problem Statement

Question: Find the directional and normal vectors of the line given by:

$$x + y = 4 \tag{1}$$

Setting Up the Equation

The equation of the line can be rearranged as follows:

$$x + y = 4 \tag{2}$$

$$y = 4 - x \tag{3}$$

We can express the line in vector form:

$$\implies \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x \\ 4 - x \end{pmatrix} = \begin{pmatrix} 0 \\ 4 \end{pmatrix} + x \begin{pmatrix} 1 \\ -1 \end{pmatrix} \tag{4}$$

$$X = h + km \tag{5}$$

Here,by comapring with (5) we get:

- A point on the line,

$$h = \begin{pmatrix} 0 \\ 4 \end{pmatrix} \tag{6}$$

- The direction vector, $m = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$

Directional and Normal Vectors

From the vector form, we find:

$$\text{Direction vector, } m = \begin{pmatrix} 1 \\ -1 \end{pmatrix} \tag{7}$$

$$\text{Normal vector, } n = \begin{pmatrix} 1 \\ 1 \end{pmatrix} \tag{8}$$

Information	**Symbolic Form**
Given Line	$X = h + km$
Direction vector	$m = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$
Normal vector	$n = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$

Table: Results

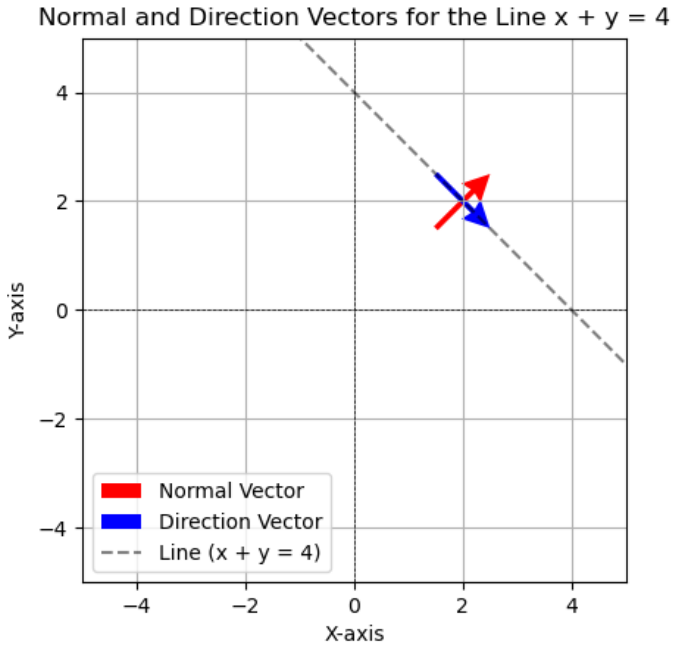

Figure: Caption