

4.2.15

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Question:

Find the direction and normal vectors of $y = 2x$.

Solution:

The line can be written as:

$$-2x + 1y = 0 \quad (0.1)$$

This equation can be expressed in terms of matrices as:

$$\mathbf{n}^T \mathbf{x} = c \quad (0.2)$$

$$\mathbf{n}^T = \begin{pmatrix} -2 & 1 \end{pmatrix} \quad (0.3)$$

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

$$c = 0 \quad (0.5)$$

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

The direction vector is:

$$\mathbf{m} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}. \quad (0.6)$$

This is true because, if the direction vector is represented as

$$\mathbf{m} = \begin{pmatrix} 1 \\ m \end{pmatrix} \quad (0.7)$$

then the normal vector can be expressed as

$$\mathbf{n} = \begin{pmatrix} -m \\ 1 \end{pmatrix} \quad (0.8)$$

$$\mathbf{n}^T \mathbf{m} = 0 \quad (0.9)$$

$$\begin{pmatrix} -2 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 2 \end{pmatrix} = 0 \quad (0.10)$$

Hence, normal vector $\mathbf{n} = \begin{pmatrix} -2 \\ 1 \end{pmatrix}$ and direction vector $\mathbf{m} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$.

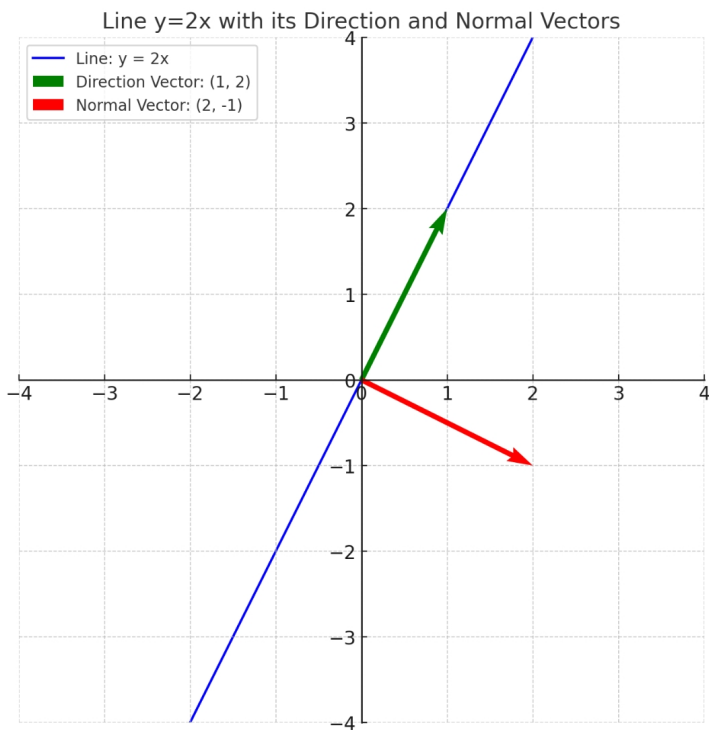


Fig. 0.1: line $y=2x$