Matgeo-4.2.2

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Question

Q-4.2.2

Find the direction and normal vectors of the line

$$x - \frac{y}{5} - 10 = 10$$

Find the direction and normal vectors of the line

$$x - \frac{y}{5} - 10 = 10 \tag{1}$$

Rewriting (1),

$$x - \frac{y}{5} = 20 \tag{2}$$

Comparing with the standard form

$$\mathbf{n}^T \mathbf{x} = c, \tag{3}$$

we obtain

$$\mathbf{n} = \begin{pmatrix} 1 \\ -\frac{1}{5} \end{pmatrix}, \quad \mathbf{x} = \begin{pmatrix} x \\ y \end{pmatrix}, \quad c = 20 \tag{4}$$

Solution

Thus, the normal vector is

$$\mathbf{n} = \begin{pmatrix} 1 \\ -\frac{1}{5} \end{pmatrix} \tag{5}$$

From the orthogonality condition,

$$\mathbf{m}^T \mathbf{n} = 0 \tag{6}$$

Let

$$\mathbf{m} = \begin{pmatrix} 1 \\ 5 \end{pmatrix} \tag{7}$$

which satisfies (6).

Solution

Hence, the required vectors are

$$\text{Direction vector: } \mathbf{m} = \begin{pmatrix} 1 \\ 5 \end{pmatrix} \tag{8}$$

$$\text{Normal vector: } \mathbf{n} = \begin{pmatrix} 1 \\ -\frac{1}{5} \end{pmatrix} \tag{9}$$

Plot

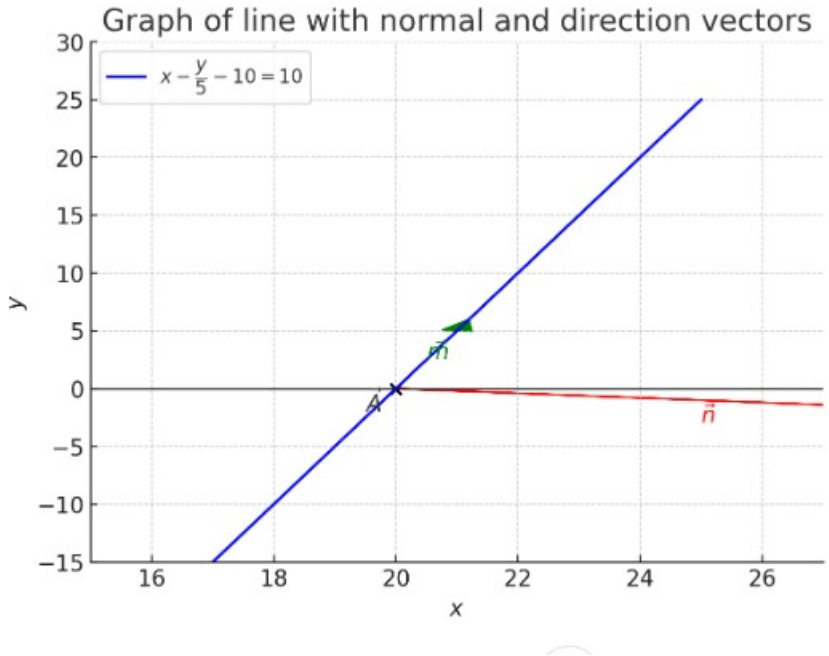

Figure: Line $x - \frac{y}{5} - 10 = 10$ with direction $\mathbf{m}$ and normal $\mathbf{n}$.