4-4.2-5

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Question: Find the direction and normal vectors of the line $2x = -5y$.
Solution:

$$y = sx + c \tag{1}$$
$$\implies \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x \\ sx + c \end{pmatrix} \tag{2}$$
$$\implies \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 0 \\ c \end{pmatrix} + x \begin{pmatrix} 1 \\ s \end{pmatrix} \tag{3}$$
$$m = \begin{pmatrix} 1 \\ s \end{pmatrix} \tag{4}$$
$$m^T n = 0 \tag{5}$$
$$n = \begin{pmatrix} -s \\ 1 \end{pmatrix} \tag{6}$$

where m,n are direction and normal vectors.

$$-5y = 2x \tag{7}$$
$$y = \frac{2}{-5}x \tag{8}$$
$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x \\ \frac{2}{-5}x \end{pmatrix} \tag{9}$$
$$\begin{pmatrix} x \\ y \end{pmatrix} = x \begin{pmatrix} 1 \\ \frac{2}{-5} \end{pmatrix} \tag{10}$$
$$m = \begin{pmatrix} 1 \\ s \end{pmatrix} \tag{11}$$
$$\implies m = \begin{pmatrix} 1 \\ -\frac{2}{5} \end{pmatrix} \tag{12}$$
$$m^T n = 0 \tag{13}$$
$$n = \begin{pmatrix} -s \\ 1 \end{pmatrix} \tag{14}$$
$$\implies n = \begin{pmatrix} \frac{2}{5} \\ 1 \end{pmatrix} \tag{15}$$

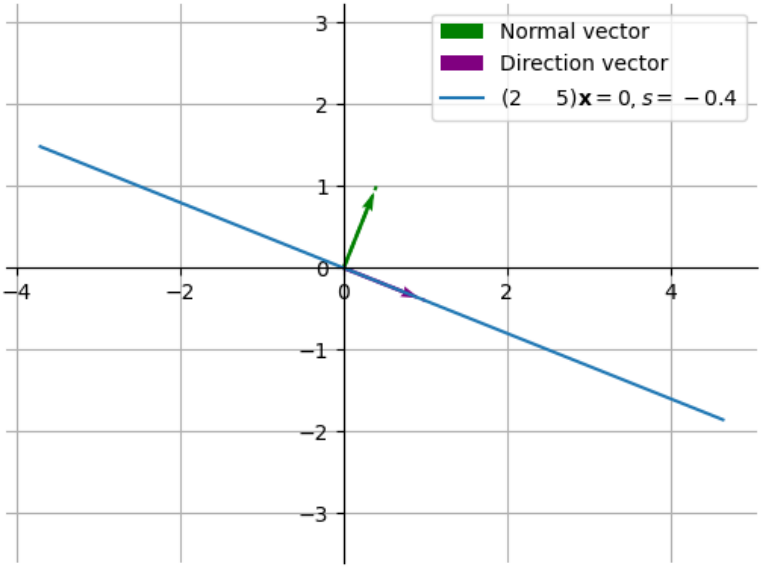

Fig. 0: plot of direction and normal vector