Solution to 1.1.5

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Question: The normal form of equation of AB is

$$\mathbf{n}^\top(\mathbf{x}-\mathbf{A})=0 \tag{1}$$

where

$$\mathbf{n}^\top\mathbf{m}=\mathbf{n}^\top(\mathbf{B}-\mathbf{A}) \tag{2}$$

Find the normal form of the equation of AB.
Given:

$$\mathbf{A}=\begin{pmatrix}1\\-1\end{pmatrix} \tag{3}$$

$$\mathbf{B}=\begin{pmatrix}-4\\6\end{pmatrix} \tag{4}$$

$$\mathbf{C}=\begin{pmatrix}-3\\-5\end{pmatrix} \tag{5}$$

Solution:
for AB:

$$\mathbf{m}=\mathbf{B}-\mathbf{A} \tag{6}$$

$$=\begin{pmatrix}-4-1\\6+1\end{pmatrix} \tag{7}$$

$$=\begin{pmatrix}-5\\7\end{pmatrix} \tag{8}$$

we have to find $\mathbf{n}$,

$$\mathbf{n}=\begin{pmatrix}0&1\\-1&0\end{pmatrix}\mathbf{m} \tag{9}$$

$$=\begin{pmatrix}0&1\\-1&0\end{pmatrix}\begin{pmatrix}-5\\7\end{pmatrix} \tag{10}$$

$$=\begin{pmatrix}7\\5\end{pmatrix} \tag{11}$$

now the transpose of $\mathbf{n}$ is,

$$\mathbf{n}^\top=\begin{pmatrix}7&5\end{pmatrix} \tag{12}$$

normal form of equation of line AB:

$$\implies \mathbf{n}^\top(\mathbf{x}-\mathbf{A})=0 \tag{13}$$

$$\implies \mathbf{n}^\top\mathbf{x}=\mathbf{n}^\top\mathbf{A} \tag{14}$$

$$\implies \mathbf{n}^\top\mathbf{x}=\begin{pmatrix}7&5\end{pmatrix}\begin{pmatrix}1\\-1\end{pmatrix} \tag{15}$$

$$\implies \begin{pmatrix}7&5\end{pmatrix}\mathbf{x}=2 \tag{16}$$

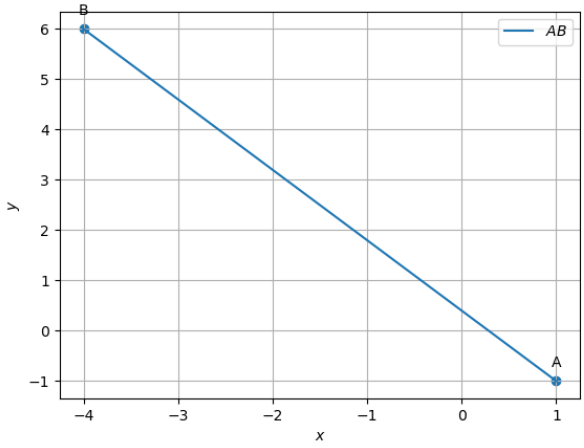

Fig. 0. Line AB