1

Solution to 1.1.5

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Question: The normal form of equation of AB is

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

where

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

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} ,

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

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

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

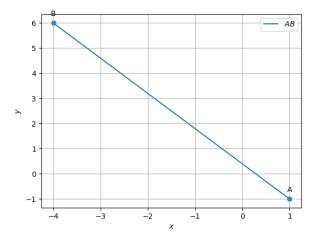


Fig. 0. Line AB

now the transpose of n is,

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

normal form of equation of line AB:

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

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

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

$$\implies (7 \quad 5)\mathbf{x} = 2 \tag{16}$$