Solution to 1.1.5

Aryan Jain - EE22BTECH11011*

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:

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

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

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

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

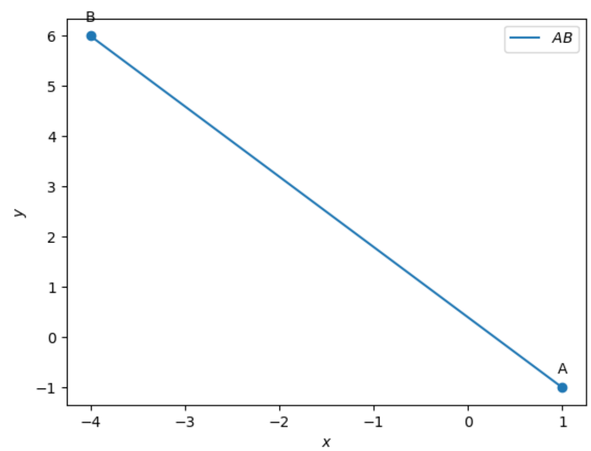

Fig. 0. Line AB