Problem 1.1.5

EE22BTECH11010 - Aryan Bubna

question :The normal form of the equation of **AB** is

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

where

$$\mathbf{n}^\top\mathbf{m}=\mathbf{n}^\top\left(\mathbf{B}-\mathbf{A}\right)=0 \tag{2}$$

or,

$$\mathbf{n}=\begin{pmatrix}0 & 1\\ -1 & 0\end{pmatrix}\mathbf{m} \tag{3}$$

Find the normal form of the equations of **AB BC** and **CA**

Solution: : The normal equation for the side BC is

$$\mathbf{n}^\top\left(\mathbf{x}-\mathbf{B}\right)=0 \tag{4}$$

$$\mathbf{n}^\top\mathbf{x}=\mathbf{n}^\top\mathbf{B} \tag{5}$$

Now our task is to find the $\mathbf{n}$ so that we can find $\mathbf{n}^\top$ As given in the question

$$\mathbf{n}=\begin{pmatrix}0 & 1\\ -1 & 0\end{pmatrix}\mathbf{m} \tag{6}$$

Here $\mathbf{m}=\mathbf{C}-\mathbf{B}$ for side **BC**

$$\implies \mathbf{m}=\begin{pmatrix}-3\\ -5\end{pmatrix}-\begin{pmatrix}-4\\ 6\end{pmatrix} \tag{7}$$

$$\implies \mathbf{m}=\begin{pmatrix}1\\ -11\end{pmatrix} \tag{8}$$

Now as we have obtained vector $\mathbf{m}$ we can use this to obtain vector $\mathbf{n}$

$$\mathbf{n}=\begin{pmatrix}0 & 1\\ -1 & 0\end{pmatrix}\begin{pmatrix}1\\ -11\end{pmatrix} \tag{9}$$

$$\mathbf{n}=\begin{pmatrix}-11\\ -1\end{pmatrix} \tag{10}$$

The transpose of $\mathbf{n}$ is

$$\mathbf{n}^\top=\begin{pmatrix}-11 & -1\end{pmatrix} \tag{11}$$

Hence the normal equation of side BC is

$$\begin{pmatrix}-11 & -1\end{pmatrix}\mathbf{x}=\begin{pmatrix}-11 & -1\end{pmatrix}\begin{pmatrix}-4\\ 6\end{pmatrix} \tag{12}$$

$$\begin{pmatrix}-11 & -1\end{pmatrix}\mathbf{x}=38 \tag{13}$$