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

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

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

Now our task is to find the **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**

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

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

Now as we have obtained vector **m**. we can use this to obtain vector **n**

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

The transpose of **n** is

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

Hence the normal equation of side *BC* is

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

$$\implies \begin{pmatrix} -11 & -1 \end{pmatrix} \mathbf{x} = 38 \tag{12}$$

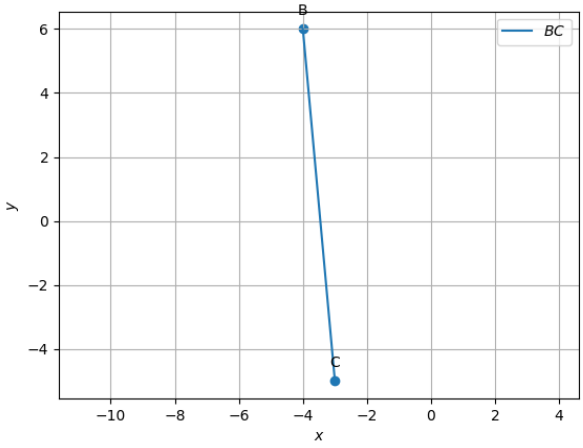

Fig. 0. The line **BC** plotted using python