LINE ASSIGNMENT

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IITH - Future Wireless Communication(FWC22089)

Contents

1 Problem

Q.Straight lines 3x+4y=5 and 4x-3y=15 intersect at point A. Points B and C are choosen on these two lines such that AB=AC. Determine the possible equations of the line BC through the point (1,2).

2 Solution

we know that vector equation of the line is

$$\mathbf{n}^\top \mathbf{x} = c \tag{1}$$

The vector equation of the line1 and line2 is

$$\begin{pmatrix} 3 & 4 \end{pmatrix} \mathbf{x} = 2 \tag{2}$$
$$\begin{pmatrix} 4 & -3 \end{pmatrix} \mathbf{x} = 3 \tag{3}$$

Symbol	Co-ordinates
n1	$\begin{pmatrix} 3 \\ 4 \end{pmatrix}$
n2	$\begin{pmatrix} 4 \\ -3 \end{pmatrix}$
omat	$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$
p	$\begin{pmatrix} 1 \\ 2 \end{pmatrix}$

The normal vector for the given vector equations are $\mathbf{n}_1$ and $\mathbf{n}_2$.
from (2) and (3) the direction vectors can be written as,

$$\mathbf{m}_{AB} = \mathbf{omat} * \mathbf{n}_1 \tag{4}$$
$$\mathbf{m}_{AB} = \begin{pmatrix} 4 \\ -3 \end{pmatrix} \tag{5}$$
$$\mathbf{m}_{AC} = \mathbf{omat} * \mathbf{n}_2 \tag{6}$$
$$\mathbf{m}_{AC} = \begin{pmatrix} -3 \\ -4 \end{pmatrix} \tag{7}$$
$$\tag{8}$$

from ΔABC,
we know that the law of vector addition is given by,

$$AB + BC = AC \tag{9}$$
$$\tag{10}$$

By solving (7) we get

$$\mathbf{m}_{BC} = \begin{pmatrix} -7 \\ -1 \end{pmatrix} \tag{11}$$
$$\tag{12}$$

normal vector for the direction vector BC is,

$$\mathbf{n}_3 = \mathbf{omat} * \mathbf{m}_{BC} \tag{13}$$
$$\mathbf{n}_3 = \begin{pmatrix} -1 \\ 7 \end{pmatrix} \tag{14}$$
$$\tag{15}$$

when a line passing through a point the vector equation is,

$$\mathbf{n}_3^\top(\mathbf{x}\text{-}\mathbf{p}) = 0 \tag{16}$$

(17)

By substituting in (16) we get,

$$\begin{pmatrix} -1 & 7 \end{pmatrix}\mathbf{x} = 13 \tag{18}$$

(19)

from ΔABC,
we know that the law of vector addition is given by,

$$AB + AC = BC \tag{20}$$

(21)

By solving (8) we get

$$\mathbf{m}_{BC} = \begin{pmatrix} 1 \\ -7 \end{pmatrix} \tag{22}$$

(23)

normal vector for the direction vector BC is,

$$\mathbf{n}_4 = \mathbf{omat} * \mathbf{m}_{BC} \tag{24}$$

$$\mathbf{n}_4 = \begin{pmatrix} -7 \\ -1 \end{pmatrix} \tag{25}$$

(26)

when a line passing through a point the vector equation is,

$$\mathbf{n}_4^\top(\mathbf{x}\text{-}\mathbf{p}) = 0 \tag{27}$$

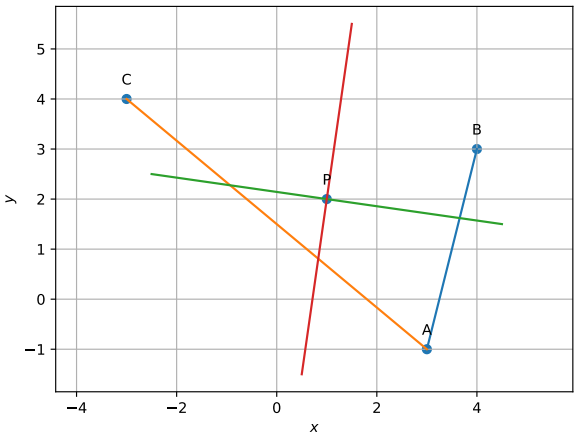
(28)

By substituting in (25) we get,

$$\begin{pmatrix} 7 & 1 \end{pmatrix}\mathbf{x} = 9 \tag{29}$$

(30)

Therefore,the possible equations passing through the point(1,2) are 7y-x=13 and 7x+y=9.



3 Plot

4 Software

We can get the parallel equation of given equation and the plot of two eqtions by executing the following code:

https://github.com/sivaparvathi−tungala/fwc_module_1/tree/main/line