Matrix Assignment - Lines

Surajit Sarkar

भारतीय प्रौद्योगिकी संस्थान हैदराबाद
Indian Institute of Technology Hyderabad

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I. PROBLEM

One side of a rectangle lies along the line 4x+7y+5=0. Two of its vertices are (-3,1) and (1,1).Find the equation of the other sides.

II. SOLUTION

given

$$\mathbf{A} = \begin{pmatrix} -3 \\ 1 \end{pmatrix} \tag{1}$$

$$\mathbf{C} = \begin{pmatrix} 1 \\ 1 \end{pmatrix} \tag{2}$$

The direction of given line

$$4\mathbf{x} + 7\mathbf{y} + 5 = 0 \tag{3}$$

$$\implies 7\mathbf{y} = -4\mathbf{x} - 5 \tag{4}$$

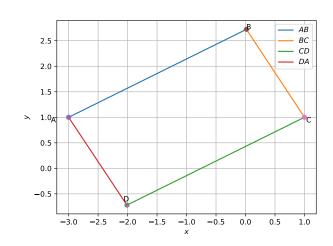$$\implies \mathbf{y} = \frac{-4}{7}\mathbf{x} - \frac{5}{7} \tag{5}$$

$$\implies \mathbf{L} = \mathbf{m} = \begin{pmatrix} 1 \\ \frac{-4}{7} \end{pmatrix} \tag{6}$$

The direction vector of line $\mathbf{AC}$

$$d_{\mathbf{AC}} = \mathbf{A} - \mathbf{C} = \begin{pmatrix} -4 \\ 0 \end{pmatrix} \tag{7}$$

$\mathbf{AC}$ is diagonal of the given rectangle between $\mathbf{AC}$ and $\mathbf{AB}$

where

$$Cos\theta = \frac{\mathbf{m}^\top d_{\mathbf{AC}}}{\|\mathbf{m}\|\|\mathbf{m_{AC}}\|} \tag{8}$$

Vertices for $\mathbf{A}$ and $\mathbf{B}$

$$\mathbf{B} - \mathbf{A} = R_\theta(\mathbf{C} - \mathbf{A})\frac{(\mathbf{A} - \mathbf{C})\,Cos\theta}{\|\mathbf{A} - \mathbf{C}\|} \tag{9}$$

$$\mathbf{D} - \mathbf{A} = R_{\frac{\pi}{2}-0}(\mathbf{C} - \mathbf{A})\,Sin\theta \tag{10}$$

where

$$R = \begin{pmatrix} Cos\theta & -Sin\theta \\ Sin\theta & Cos\theta \end{pmatrix} \tag{11}$$

III. FIGURE

IV. CODE LINK

https://github.com/sssurajit/fwc/blob/main/line/codes/line.py

Execute the code by using the command
python3 line.py