QUESTION : 1.4.2

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1.4.2. Find the intersection **O** of perpendicular bisectors of **AB** and **AC** .

Solution: let us first write the equation of perpendicular bisectors:

from equation 1.4.1.1 we have the equation of perpendicular bisector of a line **BC** as,

$$\left(\mathbf{x} - \frac{\mathbf{B}+\mathbf{C}}{2}\right)(\mathbf{B}-\mathbf{C}) = 0 \tag{1}$$

From equation 1 we have:

1) Equation of perpendicular bisector of **AB**:

$$\mathbf{x}\begin{pmatrix}5 & -7\end{pmatrix} = -25 \tag{2}$$

2) Equation of perpendicular bisector of **AC**:

$$\mathbf{x}\begin{pmatrix}4 & 4\end{pmatrix} = -16 \tag{3}$$

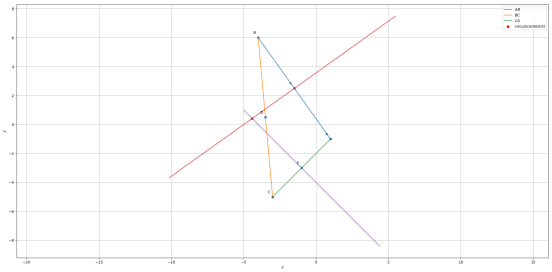

Fig. 2. circumcenter(O)

let us write equations 2 and 3 in augmented matrix form:

Coefficient matrix,

$$\mathbf{A} = \begin{pmatrix}5 & -7\\ 4 & 4\end{pmatrix} \tag{4}$$

Constant matrix,

$$\mathbf{D} = \begin{pmatrix}-25\\ -16\end{pmatrix} \tag{5}$$

$$\mathbf{AD} = \begin{pmatrix}5 & -7 & -25\\ 4 & 4 & -16\end{pmatrix} \tag{6}$$

$R_2 \leftrightarrow R_2 - \frac{1}{5}R_1$

$$\mathbf{AD} = \begin{pmatrix}5 & -7 & -25\\ 0 & \frac{12}{5} & 1\end{pmatrix} \tag{7}$$

$R_1 \leftrightarrow R_1 + \frac{35}{12}R_1$

$$\mathbf{AD} = \begin{pmatrix}5 & 0 & \frac{-265}{12}\\ 0 & 7 & \frac{35}{12}\end{pmatrix} \tag{8}$$

Therefore, we get:

$$\mathbf{O} = \begin{pmatrix}\frac{-53}{12}\\ \frac{5}{12}\end{pmatrix} \tag{9}$$