

1.4.1. The equation of the perpendicular bisector of BC is

$$(\mathbf{B} - \mathbf{C})^\top (\mathbf{x} - \frac{\mathbf{B} + \mathbf{C}}{2}) = 0 \quad (1)$$

Substitute numerical values and find the equations of the perpendicular bisectors of AB , BC and CA .

Solution: It is given that

$$\mathbf{A} = \begin{pmatrix} 1 \\ -1 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} -4 \\ 6 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} -3 \\ -5 \end{pmatrix} \quad (2)$$

1. The equation of perpendicular bisector of BC is given as

$$(\mathbf{B} - \mathbf{C})^\top (\mathbf{x} - \frac{\mathbf{B} + \mathbf{C}}{2}) = 0 \quad (3)$$

$$\left(\begin{pmatrix} -4 \\ 6 \end{pmatrix} - \begin{pmatrix} -3 \\ -5 \end{pmatrix} \right)^\top \left(\mathbf{x} - \frac{1}{2} \left(\begin{pmatrix} -4 \\ 6 \end{pmatrix} + \begin{pmatrix} -3 \\ -5 \end{pmatrix} \right) \right) = 0 \quad (4)$$

$$\begin{pmatrix} -1 \\ 11 \end{pmatrix}^\top \left(\mathbf{x} - \frac{1}{2} \begin{pmatrix} -7 \\ 1 \end{pmatrix} \right) = 0 \quad (5)$$

$$(-1 \ 11) \left(\mathbf{x} - \frac{1}{2} \begin{pmatrix} -7 \\ 1 \end{pmatrix} \right) = 0 \quad (6)$$

$$(-1 \ 11) \mathbf{x} = \frac{1}{2} (-1 \ 11) \begin{pmatrix} -7 \\ 1 \end{pmatrix} \quad (7)$$

$$(-1 \ 11) \mathbf{x} = \frac{7 + 11}{2} \quad (8)$$

$$(-1 \ 11) \mathbf{x} = 9 \quad (9)$$

2. Similarly, the equation of the perpendicular bisector of AB is given as

$$(\mathbf{B} - \mathbf{A})^\top (\mathbf{x} - \frac{\mathbf{B} + \mathbf{A}}{2}) = 0 \quad (10)$$

$$\left(\begin{pmatrix} -4 \\ 6 \end{pmatrix} - \begin{pmatrix} 1 \\ -1 \end{pmatrix} \right)^\top \left(\mathbf{x} - \frac{1}{2} \left(\begin{pmatrix} -4 \\ 6 \end{pmatrix} + \begin{pmatrix} 1 \\ -1 \end{pmatrix} \right) \right) = 0 \quad (11)$$

$$\begin{pmatrix} -5 \\ 7 \end{pmatrix}^\top \left(\mathbf{x} - \frac{1}{2} \begin{pmatrix} -3 \\ 5 \end{pmatrix} \right) = 0 \quad (12)$$

$$(-5 \ 7) \left(\mathbf{x} - \frac{1}{2} \begin{pmatrix} -3 \\ 5 \end{pmatrix} \right) = 0 \quad (13)$$

$$(-5 \ 7) \mathbf{x} = \frac{1}{2} (-5 \ 7) \begin{pmatrix} -3 \\ 5 \end{pmatrix} \quad (14)$$

$$(-5 \ 7) \mathbf{x} = \frac{15 + 35}{2} \quad (15)$$

$$(-5 \ 7) \mathbf{x} = 25 \quad (16)$$

3. Similarly, the equation of the perpendicular bisector of AC is given as

$$(\mathbf{A} - \mathbf{C})^\top (\mathbf{x} - \frac{\mathbf{A} + \mathbf{C}}{2}) = 0 \quad (17)$$

$$\left(\begin{pmatrix} 1 \\ -1 \end{pmatrix} - \begin{pmatrix} -3 \\ -5 \end{pmatrix} \right)^\top \left(\mathbf{x} - \frac{1}{2} \left(\begin{pmatrix} 1 \\ -1 \end{pmatrix} + \begin{pmatrix} -3 \\ -5 \end{pmatrix} \right) \right) = 0 \quad (18)$$

$$\begin{pmatrix} 4 \\ 4 \end{pmatrix}^\top \left(\mathbf{x} - \frac{1}{2} \begin{pmatrix} -2 \\ -6 \end{pmatrix} \right) = 0 \quad (19)$$

$$\begin{pmatrix} 4 & 4 \end{pmatrix} \left(\mathbf{x} + \begin{pmatrix} 1 \\ 3 \end{pmatrix} \right) = 0 \quad (20)$$

$$\begin{pmatrix} 4 & 4 \end{pmatrix} \mathbf{x} = - \begin{pmatrix} 4 & 4 \end{pmatrix} \begin{pmatrix} 1 \\ 3 \end{pmatrix} \quad (21)$$

$$\begin{pmatrix} 4 & 4 \end{pmatrix} \mathbf{x} = -4 - 12 \quad (22)$$

$$\begin{pmatrix} 4 & 4 \end{pmatrix} \mathbf{x} = -16 \quad (23)$$

$$4 \begin{pmatrix} 1 & 1 \end{pmatrix} \mathbf{x} = -16 \quad (24)$$

$$\begin{pmatrix} 1 & 1 \end{pmatrix} \mathbf{x} = -4 \quad (25)$$