

# ASSIGNMENT 1

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**1.5.4** Find distance from **I** to BC.

**Solution:** Given:

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

We know incentre

$$\mathbf{I} = \frac{1}{\sqrt{37} + 4 + \sqrt{61}} \begin{pmatrix} \sqrt{61} - 16 - 3\sqrt{37} \\ -\sqrt{61} + 24 - 5\sqrt{37} \end{pmatrix} \quad (2)$$

Equation of BC:

$$\mathbf{n}^T \mathbf{x} = c \quad (3)$$

$$\begin{pmatrix} 11 \\ 1 \end{pmatrix}^T \mathbf{x} = -38 \quad (4)$$

Distance from **I** to BC

$$= \frac{|\mathbf{n}^T \mathbf{I} - c|}{\|\mathbf{n}\|} \quad (5)$$

$$= \frac{\left| \begin{pmatrix} 11 \\ 1 \end{pmatrix}^T \frac{1}{\sqrt{37} + 4 + \sqrt{61}} \begin{pmatrix} \sqrt{61} - 16 - 3\sqrt{37} \\ -\sqrt{61} + 24 - 5\sqrt{37} \end{pmatrix} + 38 \right|}{\left\| \begin{pmatrix} 11 \\ 1 \end{pmatrix} \right\|} \quad (6)$$

$$= \frac{1}{\sqrt{37} + 4 + \sqrt{61}} \frac{\left| \begin{pmatrix} 11 & 1 \end{pmatrix} \begin{pmatrix} \sqrt{61} - 16 - 3\sqrt{37} \\ -\sqrt{61} + 24 - 5\sqrt{37} \end{pmatrix} + 38 \right|}{\left\| \begin{pmatrix} 11 \\ 1 \end{pmatrix} \right\|} \quad (7)$$

$$= \frac{1}{(\sqrt{37} + 4 + \sqrt{61}) \sqrt{122}} \left| 10\sqrt{61} - 114 - 38\sqrt{37} \right| \quad (8)$$