ASSIGNMENT 1

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1.5.4 Find distance from **I** to BC.
Solution: Given:

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

We know incentre

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

Equation of BC:

$$\mathbf{n}^\top \mathbf{x} = c \qquad (3)$$

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

Distance from **I** to BC

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

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

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

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