ASSIGNMENT 1

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

Solution: Given:

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

We know incentre

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

Equation of *BC*:

$$\mathbf{n}^\top \mathbf{x} = c \tag{3}$$

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

Distance from **I** to *BC*

$$= \frac{\left| \mathbf{n}^\top \mathbf{I} - c \right|}{\|\mathbf{n}\|} \tag{5}$$

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

$$= \frac{\left| \frac{\begin{pmatrix} 11 & 1 \end{pmatrix} \begin{pmatrix} \sqrt{61} - 16 - 3\sqrt{37} \\ -\sqrt{61} + 24 - 5\sqrt{37} \end{pmatrix}}{\sqrt{37}+4+\sqrt{61}} + 38 \right|}{\sqrt{122}} \tag{7}$$

$$= \frac{\left| \frac{10\sqrt{61} - 152 - 38\sqrt{37}}{\sqrt{37}+4+\sqrt{61}} + 38 \right|}{\sqrt{122}} \tag{8}$$

$$= \frac{48\sqrt{61}}{(\sqrt{37} + 4 + \sqrt{61})\sqrt{122}} \tag{9}$$

$$= 1.8968 \tag{10}$$