1.5.4 Find the distance from $\mathbf{I}$ to BC.

Solution : We know the value of $\mathbf{I}$ is

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

from the problem 1.5.2 .

The equation of BC from Problem 1.5.1 is:

$$\mathbf{n_2^\top x} + 50 = 0 \tag{2}$$

Let d be the distance between $\mathbf{I}$ and BC, then

$$d = \frac{\left|\mathbf{n_2^\top I} + 50\right|}{||\mathbf{n_2^\top}||} \tag{3}$$

$$d = \frac{\left| \frac{1}{\sqrt{37}+4+\sqrt{61}} \begin{pmatrix} 11, -1 \end{pmatrix} \begin{pmatrix} \sqrt{61}-16-3\sqrt{37} \\ -\sqrt{61}+24-5\sqrt{37} \end{pmatrix} + 50 \right|}{\sqrt{122}}$$

$$= \frac{\frac{12\sqrt{61}-28\sqrt{37}-200}{\sqrt{37}+4+\sqrt{61}} + 50}{\sqrt{122}}$$

$$= \frac{62\sqrt{61}+22\sqrt{37}}{\sqrt{122}(\sqrt{37}+4+\sqrt{61})}$$

$$[20pt] = 3.1272$$