1.3.5. Verify that

$$\left(\mathbf{A} - \mathbf{H}\right)^{\top} \left(\mathbf{B} - \mathbf{C}\right) = 0 \tag{1}$$

**Solution:** We know,

$$\mathbf{A} = \begin{pmatrix} 1 \\ -1 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} -4 \\ 6 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} -3 \\ -5 \end{pmatrix}, \mathbf{H} = \begin{pmatrix} \frac{17}{6} \\ \frac{-5}{6} \end{pmatrix} \tag{2}$$

Then,

$$\left(\mathbf{A} - \mathbf{H}\right)^{\top} \left(\mathbf{B} - \mathbf{C}\right) = \left( \begin{pmatrix} 1 \\ -1 \end{pmatrix} - \begin{pmatrix} \frac{17}{6} \\ \frac{-5}{6} \end{pmatrix} \right)^{\top} \left( \begin{pmatrix} -4 \\ 6 \end{pmatrix} - \begin{pmatrix} -3 \\ -5 \end{pmatrix} \right) \tag{3}$$

$$= \frac{1}{6} \begin{pmatrix} -11 \\ -1 \end{pmatrix}^{\top} \begin{pmatrix} -1 \\ 11 \end{pmatrix} \tag{4}$$

$$= \frac{1}{6} \begin{pmatrix} -11 & -1 \end{pmatrix} \begin{pmatrix} -1 \\ 11 \end{pmatrix} \tag{5}$$

$$= \frac{11 - 11}{6} \tag{6}$$

$$= 0 \tag{7}$$