Solution to 1.1.2

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Question: The length of side BA is

$$\|\mathbf{B}-\mathbf{A}\| \triangleq \sqrt{(\mathbf{B}-\mathbf{A})^{\top}\mathbf{B}-\mathbf{A}} \tag{1}$$

where

$$\mathbf{A}^{\top} \triangleq \begin{pmatrix} 1 & -1 \end{pmatrix} \tag{2}$$

Solution: Given:

$$\mathbf{A} = \begin{pmatrix} 1 \\ -1 \end{pmatrix} \tag{3}$$

$$\mathbf{B} = \begin{pmatrix} -4 \\ 6 \end{pmatrix} \tag{4}$$

$$\mathbf{C} = \begin{pmatrix} -3 \\ -5 \end{pmatrix} \tag{5}$$

Now solving for AB,

$$\mathbf{A}-\mathbf{B} = \begin{pmatrix} 5 \\ -7 \end{pmatrix} \tag{6}$$

$$\|\mathbf{A}-\mathbf{B}\| = \sqrt{\begin{pmatrix} 5 & -7 \end{pmatrix}\begin{pmatrix} 5 \\ -7 \end{pmatrix}} \tag{7}$$

$$= \sqrt{(5)^2+(7)^2} \tag{8}$$

$$= \sqrt{74} \tag{9}$$

Now solving for BC,

$$\mathbf{B}-\mathbf{C} = \begin{pmatrix} -1 \\ 11 \end{pmatrix} \tag{10}$$

$$\|\mathbf{B}-\mathbf{C}\| = \sqrt{\begin{pmatrix} -1 & 11 \end{pmatrix}\begin{pmatrix} -1 \\ 11 \end{pmatrix}} \tag{11}$$

$$= \sqrt{(1)^2+(11)^2} \tag{12}$$

$$= \sqrt{122} \tag{13}$$

Now solving for AC,

$$\mathbf{A}-\mathbf{C} = \begin{pmatrix} 4 \\ 4 \end{pmatrix} \tag{14}$$

$$\|\mathbf{A}-\mathbf{C}\| = \sqrt{\begin{pmatrix} 4 & 4 \end{pmatrix}\begin{pmatrix} 4 \\ 4 \end{pmatrix}} \tag{15}$$

$$= \sqrt{(4)^2+(4)^2} \tag{16}$$

$$= \sqrt{32} \tag{17}$$