Solution to problem 1.1.3

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The points are given as:

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

$$\mathbf{B} = \begin{pmatrix} -4 \\ 6 \end{pmatrix} \tag{2}$$

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

For the Points to be collinear,

$$rank\begin{pmatrix} 1 & 1 & 1 \\ \mathbf{A} & \mathbf{B} & \mathbf{C} \end{pmatrix} = 2 \tag{4}$$

we need to find the rank of the following matrix:

$$\tag{5}$$

$$rank\begin{pmatrix} 1 & 1 & 1 \\ 1 & -4 & -3 \\ -1 & 6 & -5 \end{pmatrix} \tag{6}$$

Converting the matrix in row-echelon form,we get:

$$\tag{7}$$

$$\begin{pmatrix} 1 & 1 & 1 \\ 0 & 1 & \frac{4}{5} \\ 0 & 0 & \frac{-58}{5} \end{pmatrix} \tag{8}$$

We have three non-zero rows, so:

$$\tag{9}$$

$$rank\begin{pmatrix} 1 & 1 & 1 \\ 0 & 1 & \frac{4}{5} \\ 0 & 0 & \frac{-58}{5} \end{pmatrix} = 3 \tag{10}$$

So the points are non-collinear.

$$\tag{11}$$

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