Assignment-2

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Question 1.1.3) Points $\mathbf{A}, \mathbf{B}, \mathbf{C}$ are defined to be collinear if

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

Are the given points in (1.1) collinear?
Solution: Given,

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

$$\begin{pmatrix} 1 & 1 & 1 \\ \mathbf{A} & \mathbf{B} & \mathbf{c} \end{pmatrix} = \begin{pmatrix} 1 & 1 & 1 \\ 1 & -4 & -3 \\ -1 & 6 & -5 \end{pmatrix} \tag{2}$$

$$\begin{vmatrix} 1 & 1 & 1 \\ 1 & -4 & -3 \\ -1 & 6 & -5 \end{vmatrix} = 1\begin{vmatrix} -4 & -3 \\ 6 & -5 \end{vmatrix} - 1\begin{vmatrix} -3 & 1 \\ -5 & -1 \end{vmatrix} + 1\begin{vmatrix} 1 & -4 \\ -1 & 6 \end{vmatrix} \tag{3}$$

$$= 1 \times 38 - 1 \times 8 + 1 \times 2 \tag{4}$$

$$= 32 \neq 0 \tag{5}$$

$$\implies \text{rank}\begin{pmatrix} 1 & 1 & 1 \\ \mathbf{A} & \mathbf{B} & \mathbf{C} \end{pmatrix} = 3 \tag{6}$$

$\mathbf{A}, \mathbf{B}, \mathbf{C}$ are not collinear.