

## 1.7.8

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**Question:**

Using vectors , prove that the points  $(2, -1, 3)$ ,  $(3, -5, 1)$  and  $(-1, 11, 9)$  are collinear.

**Solution:**

Let

$$\mathbf{A} = \begin{pmatrix} 2 \\ -1 \\ 3 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 3 \\ -5 \\ 1 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} -1 \\ 11 \\ 9 \end{pmatrix} \quad (0.1)$$

For the points to be collinear, the following condition should be satisfied.

$$\text{rank} (\mathbf{B} - \mathbf{A} \quad \mathbf{C} - \mathbf{A}) = 1 \quad (0.2)$$

$$(\mathbf{B} - \mathbf{A} \quad \mathbf{C} - \mathbf{A})^T = \begin{pmatrix} 1 & -4 & -2 \\ -3 & 12 & 6 \end{pmatrix} \quad (0.3)$$

By doing  $R_2 = 3R_1 + R_2$  we get

$$(\mathbf{B} - \mathbf{A} \quad \mathbf{C} - \mathbf{A})^T = \begin{pmatrix} 1 & -4 & -2 \\ 0 & 0 & 0 \end{pmatrix} \quad (0.4)$$

As  $rank = 1$

$\therefore$  The points are collinear

# Graphical Representation

