1.7.4

AI24BTECH11023 - Tarun Reddy Pakala

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

First, we find the vectors $\overrightarrow{B - A}$ and $\overrightarrow{C - A}$:

$$\overrightarrow{B - A} = B - A = (3 - 2, -5 - (-1), 1 - 3) = (1, -4, -2)$$

$$\overrightarrow{C - A} = C - A = (-1 - 2, 11 - (-1), 9 - 3) = (-3, 12, 6)$$

Next, we construct the matrix using these vectors:

$$\text{Matrix} = \begin{pmatrix} \overrightarrow{B - A} & \overrightarrow{C - A} \end{pmatrix} = \begin{pmatrix} 1 & -3 \\ -4 & 12 \\ -2 & 6 \end{pmatrix}$$

Now, we perform row reduction:

$$\begin{pmatrix} 1 & -3 \\ -4 & 12 \\ -2 & 6 \end{pmatrix} \rightarrow \begin{pmatrix} 1 & -3 \\ 0 & 0 \\ 0 & 0 \end{pmatrix}$$

Since the matrix has rank 1 (only one non-zero row), the points are collinear.
Thus, the points $A(2, -1, 3)$, $B(3, -5, 1)$, and $C(-1, 11, 9)$ are collinear.
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3D Plot of Points