

# 1-1.6-29

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- 1) Show that the points  $A(2, 3, -4)$ ,  $B(1, -2, 3)$ , and  $C(3, 8, -11)$  are collinear.

**Solution:** Given,

$$A = \begin{pmatrix} 2 \\ 3 \\ -4 \end{pmatrix}, B = \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix}, C = \begin{pmatrix} 3 \\ 8 \\ -11 \end{pmatrix}$$

For points  $A, B, C$  to be collinear, the rank of the matrix formed by  $B - A$  and  $C - A$  must be less than 2.

$$\vec{B} - \vec{A} = \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix} - \begin{pmatrix} 2 \\ 3 \\ -4 \end{pmatrix} = \begin{pmatrix} -1 \\ -5 \\ 7 \end{pmatrix} \quad \vec{C} - \vec{A} = \begin{pmatrix} 3 \\ 8 \\ -11 \end{pmatrix} - \begin{pmatrix} 2 \\ 3 \\ -4 \end{pmatrix} = \begin{pmatrix} 1 \\ 5 \\ -7 \end{pmatrix}$$

Now, form the matrix  $M$  as:  $M = \begin{pmatrix} -1 & 1 \\ -5 & 5 \\ 7 & -7 \end{pmatrix}$

The rank of this matrix is 1, since the second column is a scalar multiple of the first. Therefore, the rank of the matrix is less than 2, which implies that the points are collinear.

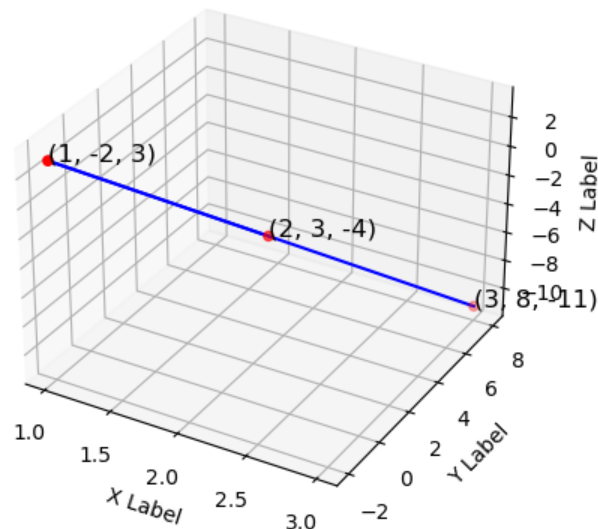


Fig. 1. Graph of Collinear Points