

# 1.6.4

EE25BTECH11054 - S.Harsha Vardhan Reddy

**Question:** To show that the vectors  $\mathbf{v}_1 = 2\hat{\mathbf{i}} - 3\hat{\mathbf{j}} + 4\hat{\mathbf{k}}$ ,  $\mathbf{v}_2 = -4\hat{\mathbf{i}} + 6\hat{\mathbf{j}} - 8\hat{\mathbf{k}}$  are collinear.  
**Solution:**

Given vectors  $\mathbf{v}_1$  and  $\mathbf{v}_2$  can be represented as

$$\mathbf{v}_1 = \begin{pmatrix} 2 \\ -3 \\ 4 \end{pmatrix}, \mathbf{v}_2 = \begin{pmatrix} -4 \\ 6 \\ 8 \end{pmatrix} \quad (0.1)$$

We write the vectors as the rows of a matrix:

$$\begin{pmatrix} 2 & -3 & 4 \\ -4 & 6 & -8 \end{pmatrix} \quad (0.2)$$

To show 2 vectors should be collinear,

$$\text{rank}(\mathbf{v}_1 \ \mathbf{v}_2) = 1 \quad (0.3)$$

$$\begin{pmatrix} 2 & -3 & 4 \\ -4 & 6 & -8 \end{pmatrix} \xleftrightarrow{R_2 \rightarrow R_2 + 2R_1} \begin{pmatrix} 2 & -3 & 4 \\ 0 & 0 & 0 \end{pmatrix} \quad (0.4)$$

So the matrix becomes:

$$\begin{pmatrix} 2 & -3 & 4 \\ 0 & 0 & 0 \end{pmatrix} \quad (0.5)$$

**Conclusion:**

Because the rank is 1, the vectors are linearly dependent. Therefore:

$$\mathbf{v}_1 \text{ and } \mathbf{v}_2 \text{ are collinear.} \quad (0.6)$$

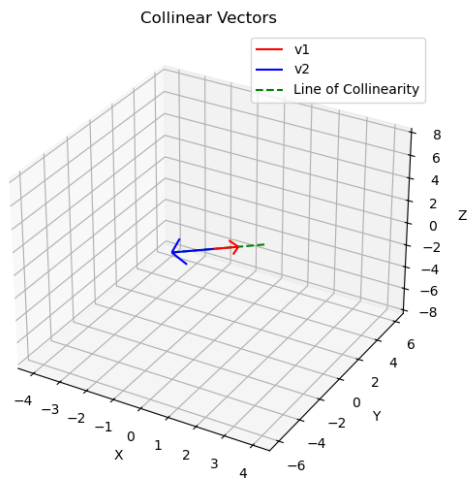


Fig. 0.1