

# 4.5.8

EE25BTECH11006 - ADUDOTLA SRIVIDYA

**Question:** The value of  $\lambda$  for which the vectors  $3i - 6j + k$  and  $2i - 4j + \lambda k$  are parallel is

- a)  $2/3$    b)  $3/2$    c)  $5/2$    d)  $2/5$

**Solution:**

Given,

$$\begin{pmatrix} 2 \\ -4 \\ \lambda \end{pmatrix} \text{ is parallel to } \begin{pmatrix} 3 \\ -6 \\ 1 \end{pmatrix} \quad (1)$$

If the vectors are parallel, then they are linearly dependent. Hence,

$$\begin{pmatrix} 3 & 2 \\ -6 & -4 \\ 1 & \lambda \end{pmatrix} \mathbf{x} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} \quad (2)$$

To find the condition for non-trivial solutions, perform row reduction on the coefficient matrix:

$$\begin{pmatrix} 3 & 2 \\ -6 & -4 \\ 1 & \lambda \end{pmatrix} \xrightarrow{R_2 \rightarrow R_2 + 2R_1} \begin{pmatrix} 3 & 2 \\ 0 & 0 \\ 1 & \lambda \end{pmatrix} \quad (3)$$

$$R_1 \rightarrow \frac{R_1}{3} \Rightarrow \begin{pmatrix} 1 & \frac{2}{3} \\ 0 & 0 \\ 1 & \lambda \end{pmatrix} \quad (4)$$

$$R_3 \rightarrow R_3 - R_1 \Rightarrow \begin{pmatrix} 1 & \frac{2}{3} \\ 0 & 0 \\ 0 & \lambda - \frac{2}{3} \end{pmatrix} \quad (5)$$

For non-trivial solutions

$$\lambda - \frac{2}{3} = 0 \quad (6)$$

$$\therefore \lambda = \frac{2}{3} \quad (7)$$

Hence, the vectors are parallel when  $\lambda = \frac{2}{3}$ .

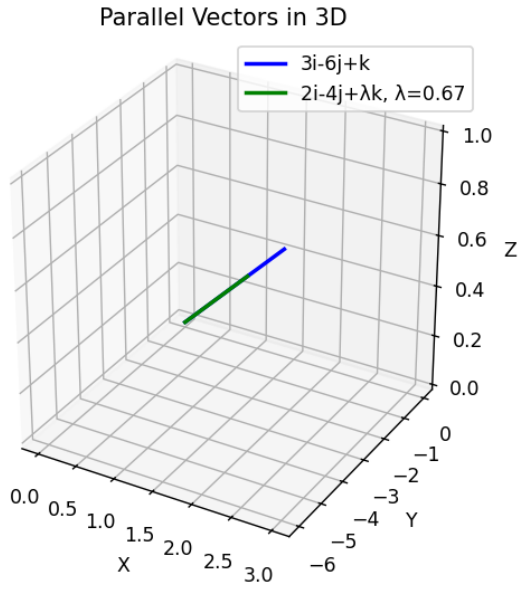


Fig. 0: Vectors  $3i - 6j + k$  and  $2i - 4j + \lambda k$  (parallel in 3D)