4.5.8

ADUDOTLA SRIVIDYA - EE25BTECH11006

September 30, 2025

Question

The value of λ 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,

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

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

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

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

$$\begin{pmatrix} 3 & 2 \\ -6 & -4 \\ 1 & \lambda \end{pmatrix} \xrightarrow{R_2 \to R_2 + 2R_1} \begin{pmatrix} 3 & 2 \\ 0 & 0 \\ 1 & \lambda \end{pmatrix} \tag{3}$$

Solution

$$R_1 \to \frac{R_1}{3} \implies \begin{pmatrix} 1 & \frac{2}{3} \\ 0 & 0 \\ 1 & \lambda \end{pmatrix} \tag{4}$$

$$R_3 \to R_3 - R_1 \implies \begin{pmatrix} 1 & \frac{2}{3} \\ 0 & 0 \\ 0 & \lambda - \frac{2}{3} \end{pmatrix} \tag{5}$$

For non-trivial solutions

$$\lambda - \frac{2}{3} = 0 \tag{6}$$

conclusion

$$\therefore \lambda = \frac{2}{3} \tag{7}$$

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

Python,C,Python+C codes

codes permalink

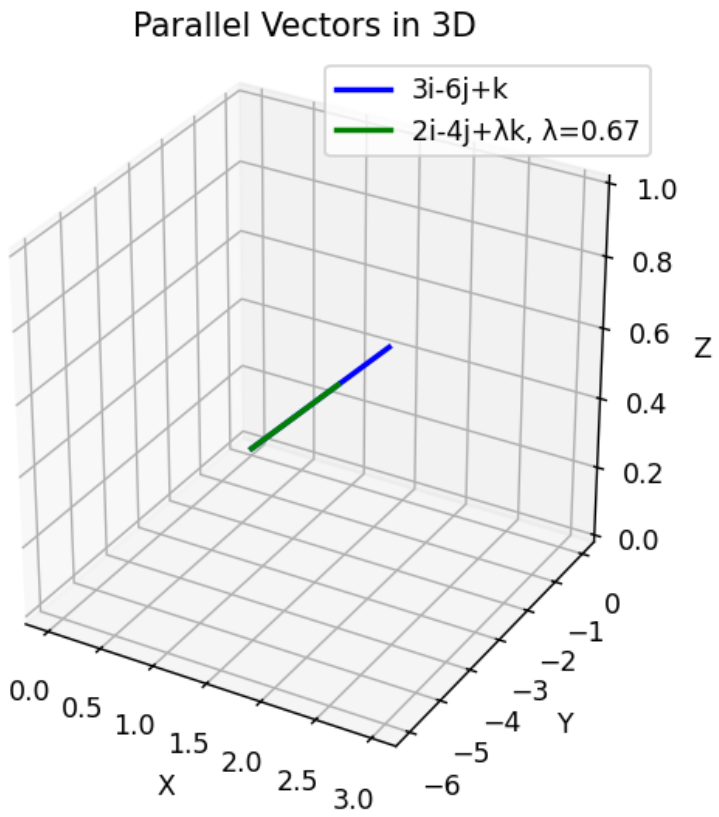

Figure: Vectors $3i - 6j + k$ and $2i - 4j + \lambda k$ (parallel in 3D)