## EE25BTECH11025 - Ganachari Vishwambhar

## **Question:**

Find the value of  $\lambda$  such that the vectors  $\mathbf{a} = 2\mathbf{i} + \lambda \mathbf{j} + \mathbf{k}$  and  $\mathbf{b} = \mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$  are orthogonal. **Solution:** 

Given vectors are:

$$\mathbf{a} = \begin{pmatrix} 2 \\ \lambda \\ 1 \end{pmatrix}, \mathbf{b} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} \tag{1}$$

For two vectors to be orthogonal their dot product should be equal to zero which is equal to product of transpose column matrix  $\mathbf{a}$  and column matrix  $\mathbf{b}$ :

$$\mathbf{a}^T \mathbf{b} = 0 \tag{2}$$

$$\begin{pmatrix} 2 & \lambda & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} = 0 \tag{3}$$

$$2 + 2\lambda + 3 = 0 \tag{4}$$

$$\lambda = \left(\frac{-5}{2}\right) \tag{5}$$

Therefore, the final vectors are:

$$\mathbf{a} = \begin{pmatrix} 2 \\ \left(\frac{-5}{2}\right) \\ 1 \end{pmatrix} \tag{6}$$

$$\mathbf{b} = \begin{pmatrix} 1\\2\\3 \end{pmatrix} \tag{7}$$

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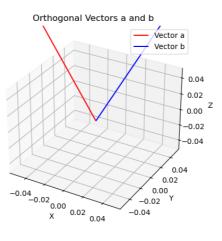


Fig. 1: Plot of orthogonal vectors  ${\bf a}$  and  ${\bf b}$