

# AI25BTECH11034 - SUJAL CHAUHAN

## 2.2.27

### question

Find the angle between the pair of lines:

$$\frac{x+3}{3} = \frac{y-1}{5} = \frac{z+3}{4}$$

$$\frac{x+1}{1} = \frac{y-4}{1} = \frac{z+5}{2}$$

**solution**

Given lines can be represented as

$$\mathbf{X} = \begin{pmatrix} -3 \\ 1 \\ -3 \end{pmatrix} + k_1 \begin{pmatrix} 3 \\ 5 \\ 4 \end{pmatrix} \quad (0.1)$$

$$\mathbf{Y} = \begin{pmatrix} -1 \\ 4 \\ -3 \end{pmatrix} + k_2 \begin{pmatrix} 1 \\ 1 \\ 2 \end{pmatrix} \quad (0.2)$$

where  $k_1$  and  $k_2$  are any real numbers.

clearly direction vector of lines are  $\mathbf{m}_1$  and  $\mathbf{m}_2$

$$\mathbf{m}_1 = \begin{pmatrix} 3 \\ 5 \\ 4 \end{pmatrix} \quad (0.3)$$

and

$$\mathbf{m}_2 = \begin{pmatrix} 1 \\ 1 \\ 2 \end{pmatrix} \quad (0.4)$$

angle between them is

$$\cos \theta = \frac{\mathbf{m}_1 \mathbf{m}_2^T}{\|\mathbf{m}_1\| \|\mathbf{m}_2\|} \quad (0.5)$$

so

$$\theta = \cos^{-1} \frac{\mathbf{m}_1 \mathbf{m}_2^T}{\|\mathbf{m}_1\| \|\mathbf{m}_2\|} \quad (0.6)$$

$$\mathbf{m}_1 \mathbf{m}_2^T = \begin{pmatrix} 3 \\ 5 \\ 4 \end{pmatrix} (1 \quad 1 \quad 2) = 16 \quad (0.7)$$

$$|m_1| = \sqrt{50}, |m_2| = \sqrt{6} \quad (0.8)$$

$$\theta = \cos^{-1} \frac{16}{\sqrt{300}} = 22.52^\circ \quad (0.9)$$

Angle between two given line is  $22.52^\circ$

Angle =  $22.52^\circ$

