# 4.4.20

AI25BTECH11024 - Pratyush Panda

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**Question:**
Find the distance between the point $(2, 3, 4)$ measured along the line $\frac{x-4}{3} = \frac{y+5}{6} = \frac{z+1}{2}$ from the plane $3x + 2y + 2z + 5 = 0$

**Solution:**

Let the vector **A** be $\begin{pmatrix} 2 \\ 3 \\ 4 \end{pmatrix}$, and the direction vector of the line $\mathbf{b} = \begin{pmatrix} 3 \\ 6 \\ 2 \end{pmatrix}$.

The equation of the plane can be written as;

$$\mathbf{n}^T \mathbf{X} = 1 \qquad where, \ \mathbf{n} = \begin{pmatrix} 3 \\ 2 \\ 2 \end{pmatrix} \tag{0.1}$$

The equation of the line passing through **A** and with the direction vector **b** is;

$$\mathbf{x} = \mathbf{A} + \lambda \mathbf{b} = \begin{pmatrix} 2 \\ 3 \\ 4 \end{pmatrix} + \lambda \begin{pmatrix} 3 \\ 6 \\ 2 \end{pmatrix} \tag{0.2}$$

The point on the plane lying on this line can be found out by substituting the parametric point in the equation of the plane and find out the value of $\lambda$.

After solving for $\lambda$ we get $\lambda = -1$. Thus, the point is **B** would be $\begin{pmatrix} -1 \\ -3 \\ 2 \end{pmatrix}$.

Thus, the final distance along the line can be written as;

$$d = \mathbf{A}^T.\mathbf{B} = 7 \tag{0.3}$$

Thus, the distance between the point $(2, 3, 4)$ measured along the line $\frac{x-4}{3} = \frac{y+5}{6} = \frac{z+1}{2}$ from the plane $3x + 2y + 2z + 5 = 0$ is 7