

4.7.50

EE25BTECH11052 - Shriyansh Kalpesh Chawda

Question:

Find the vector equation of the line passing through $(1, 2, 3)$ and perpendicular to the $\mathbf{r} \cdot (\hat{i} + 2\hat{j} - 5\hat{k}) + 9 = 0$.

Solution

The plane is given by

$$\mathbf{r} \cdot (1, 2, -5) + 9 = 0 \quad (0.1)$$

so the plane's normal vector is

$$\mathbf{n} = \begin{pmatrix} 1 \\ 2 \\ -5 \end{pmatrix}. \quad (0.2)$$

The required line is perpendicular to the plane, so its direction vector lies in the row space. Thus, the line direction vector can be chosen as

$$\mathbf{d} = \mathbf{n} = \begin{pmatrix} 1 \\ 2 \\ -5 \end{pmatrix}. \quad (0.3)$$

Using the point

$$\mathbf{a} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}, \quad (0.4)$$

the vector equation of the line is

$$\mathbf{r} = \mathbf{a} + t\mathbf{d} \quad (0.5)$$

$$\mathbf{r} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} + t \begin{pmatrix} 1 \\ 2 \\ -5 \end{pmatrix}, \quad t \in \mathbb{R}. \quad (0.6)$$

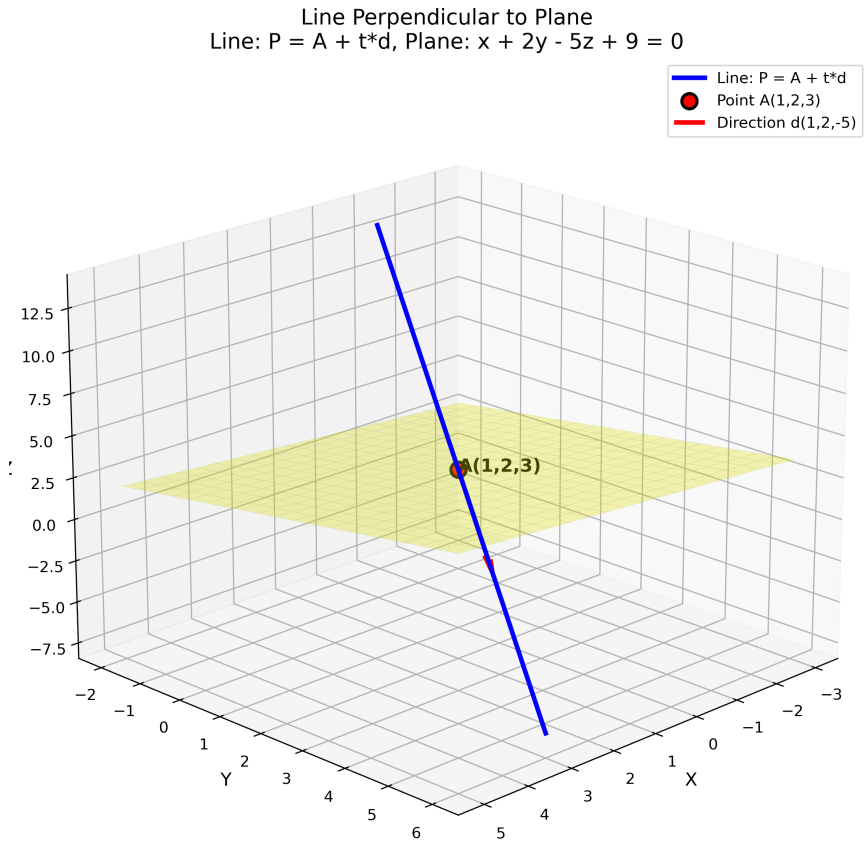


Fig. 0.1