

# 4.7.62

EE25BTECH11065 - Yoshita

## Question:

Find the equation of the plane which passes through the point (5, 2, -4) and perpendicular to the line with direction ratios 2, 3, -1.

## Solution:

The plane passes through a known point,

$$\mathbf{A} = \begin{pmatrix} 5 \\ 2 \\ -4 \end{pmatrix}$$

The plane is perpendicular to a line with direction ratios (2, 3, -1).

$$\mathbf{n} = \begin{pmatrix} 2 \\ 3 \\ -1 \end{pmatrix}$$

The equation of a plane is given by the formula

$$\mathbf{n}^T(\mathbf{x} - \mathbf{A}) = 0$$

where  $\mathbf{x}$  is a general point  $[x, y, z]^T$  on the plane.

Substituting the numerical values for our normal vector  $\mathbf{n}$  and point  $\mathbf{A}$ :

$$(2 \quad 3 \quad -1) \left( \begin{pmatrix} x \\ y \\ z \end{pmatrix} - \begin{pmatrix} 5 \\ 2 \\ -4 \end{pmatrix} \right) = 0 \quad (1)$$

$$\Rightarrow (2 \quad 3 \quad -1) \begin{pmatrix} x-5 \\ y-2 \\ z-(-4) \end{pmatrix} = 0 \quad (2)$$

$$\Rightarrow (2 \quad 3 \quad -1) \begin{pmatrix} x-5 \\ y-2 \\ z+4 \end{pmatrix} = 0 \quad (3)$$

$$\Rightarrow 2(x-5) + 3(y-2) - 1(z+4) = 0 \quad (4)$$

$$\Rightarrow 2x - 10 + 3y - 6 - z - 4 = 0 \quad (5)$$

$$\Rightarrow 2x + 3y - z = 20 \quad (6)$$

Thus, the equation of the plane is  $2x + 3y - z = 20$ .

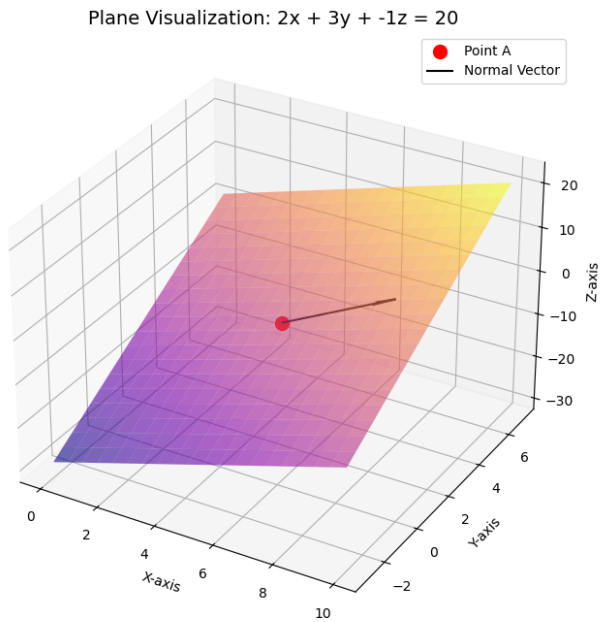


Fig. 0: A plane passing through point A with normal vector n.