

# 4.3.17

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**Question** A plane passes through the points  $(2, 0, 0)$ ,  $(0, 3, 0)$  and  $(0, 0, 4)$ . The equation of the plane is \_\_\_\_\_

**Solution** Given details

$$\mathbf{A} = \begin{pmatrix} 2 \\ 0 \\ 0 \end{pmatrix} \quad \mathbf{B} = \begin{pmatrix} 0 \\ 3 \\ 0 \end{pmatrix} \quad \mathbf{C} = \begin{pmatrix} 0 \\ 0 \\ 4 \end{pmatrix} \quad (1)$$

The points for plane for 3 given points is:

$$\mathbf{n}^T \mathbf{x} = c \quad (2)$$

to find  $\mathbf{n}$  by performing Gaussian elimination on the augmented matrix:

$$(\mathbf{A} \quad \mathbf{B} \quad \mathbf{C})^T \mathbf{n} = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \quad (3)$$

$$\begin{pmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 4 \end{pmatrix} \mathbf{n} = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \quad (4)$$

$$\left( \begin{array}{ccc|c} 2 & 0 & 0 & 1 \\ 0 & 3 & 0 & 1 \\ 0 & 0 & 4 & 1 \end{array} \right) \xrightarrow[R_3 \leftarrow R_3/4]{R_1 \leftarrow R_1/2, R_2 \leftarrow R_2/3} \left( \begin{array}{ccc|c} 1 & 0 & 0 & \frac{1}{2} \\ 0 & 1 & 0 & \frac{1}{3} \\ 0 & 0 & 1 & \frac{1}{4} \end{array} \right) \quad (5)$$

This gives the solution:

$$\mathbf{n}_1 = \frac{1}{2} \quad \mathbf{n}_2 = \frac{1}{3} \quad \mathbf{n}_3 = \frac{1}{4} \quad (6)$$

Therefore the equation of plane is:

$$\frac{1}{2}x + \frac{1}{3}y + \frac{1}{4}z = 1 \quad (7)$$

$$6x + 4y + 3z = 12 \quad (8)$$

$$(6 \quad 4 \quad 3)\mathbf{x} = 12 \quad (9)$$

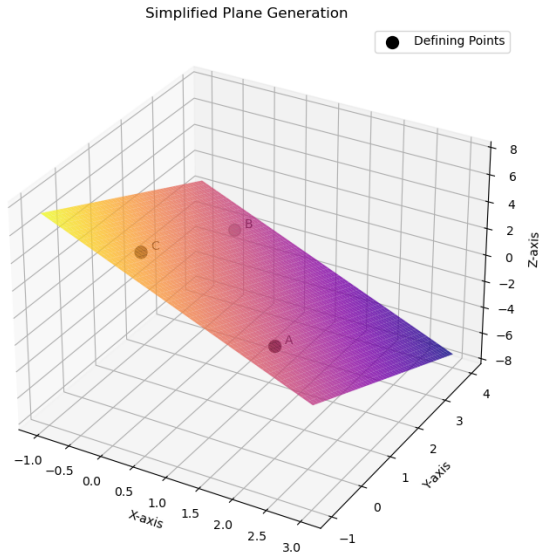


Fig. 0. plane