

# Assignment 4

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Download all the python codes from

<https://github.com/cmaspi/EE3900/tree/main/Assignment-4/code>

latex-tikz codes from

<https://github.com/cmaspi/EE3900/blob/main/Assignment-4/main.tex>

The equation of plane is given by

$$\mathbf{n}^T \mathbf{x} = c \quad (2.0.9)$$

$$\mathbf{n}^T \mathbf{a} = 2 + 4 = 6 \quad (2.0.10)$$

$$\begin{pmatrix} 0 & -1 & 3 \end{pmatrix}^T \mathbf{x} = 6 \quad (2.0.11)$$

A plot for the planes is given below

## 1 PROBLEM

(Matrix Q 2.40) Find the equation of the plane passing through the line of intersection of the planes

$$\begin{pmatrix} 1 & 1 & 1 \end{pmatrix} \mathbf{x} = 1 \text{ and} \quad (1.0.1)$$

$$\begin{pmatrix} 2 & 3 & -1 \end{pmatrix} \mathbf{x} = -4 \quad (1.0.2)$$

and parallel to x-axis

## 2 SOLUTION

The equations of planes are

$$\mathbf{n}_1^T \mathbf{x} = 1 \quad (2.0.1)$$

$$\mathbf{n}_2^T \mathbf{x} = -4 \quad (2.0.2)$$

where

$$\mathbf{n}_1 = \begin{pmatrix} 1 & 1 & 1 \end{pmatrix}^T \quad (2.0.3)$$

$$\mathbf{n}_2 = \begin{pmatrix} 2 & 3 & -1 \end{pmatrix}^T \quad (2.0.4)$$

The line of intersection of the given planes will have a slope parallel to  $\mathbf{n}_1 \times \mathbf{n}_2$ . Further we have to find a plane which contains this line and is parallel to x-axis.

Let

$$\mathbf{n}_3 = \begin{pmatrix} 1 & 0 & 0 \end{pmatrix}^T \quad (2.0.5)$$

Assume a vector  $\mathbf{a}$  lies on both the planes, this means that it lies on the intersecting line and on the required plane. The normal vector of the desired plane is perpendicular to  $\mathbf{n}_1 \times \mathbf{n}_1$  and x-axis.

$$\mathbf{n} = \mathbf{n}_3 \times (\mathbf{n}_1 \times \mathbf{n}_2) \quad (2.0.6)$$

$$\mathbf{n} = \mathbf{n}_1 (\mathbf{n}_3^T \mathbf{n}_2) - \mathbf{n}_2 (\mathbf{n}_3^T \mathbf{n}_1) \quad (2.0.7)$$

$$\mathbf{n} = 2\mathbf{n}_1 - \mathbf{n}_2 \quad (2.0.8)$$

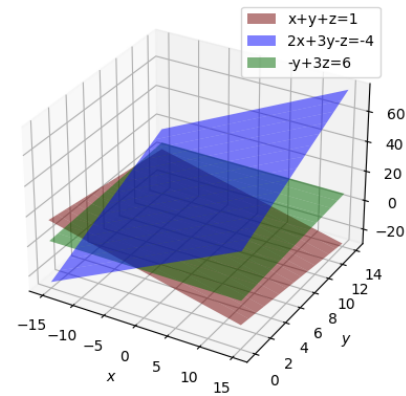


Fig. 0: Plot of the planes