

ASSIGNMENT 4

A.Tejasri

Download all python codes from

<https://github.com/tejasri3657/Assignment-4/blob/main/Assignment-4.py>

and latex-tikz codes from

<https://github.com/tejasri3657/Assignment-4/blob/main/main.tex>

1 QUESTION No 2.39

Find the equation of the plane through the intersection of the planes $(3 \ -1 \ 2)\mathbf{x} = 4$ and $(1 \ 1 \ 1)\mathbf{x} = -2$ and the point $\begin{pmatrix} 2 \\ 2 \\ 1 \end{pmatrix}$.

2 SOLUTION

Given,

$$(3 \ -1 \ 2)\mathbf{x} = 4 \quad (2.0.1)$$

$$(1 \ 1 \ 1)\mathbf{x} = -2 \quad (2.0.2)$$

$$\mathbf{A} = \begin{pmatrix} 2 \\ 2 \\ 1 \end{pmatrix} \quad (2.0.3)$$

Equation can be written as,

$$\mathbf{n}_1^T \mathbf{x} = c_1 \quad (2.0.4)$$

$$\mathbf{n}_2^T \mathbf{x} = c_2 \quad (2.0.5)$$

Where,

$$\mathbf{n}_1 = \begin{pmatrix} 3 \\ -1 \\ 2 \end{pmatrix}, \mathbf{n}_2 = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \quad (2.0.6)$$

$$c_1 = 4, c_2 = -2 \quad (2.0.7)$$

Required equation of the plane containing (2.0.4) and (2.0.5) is,

$$\mathbf{n}_1^T \mathbf{x} + \lambda \mathbf{n}_2^T \mathbf{x} = c_1 + \lambda c_2 \quad (2.0.8)$$

$$\Rightarrow (\mathbf{n}_1^T + \lambda \mathbf{n}_2^T) \mathbf{x} = c_1 + \lambda c_2 \quad (2.0.9)$$

By substituting the intersection of the plane of the point (2.0.3).so,

$$\lambda = \frac{(c_1 - \mathbf{A}\mathbf{n}_1^T)}{(\mathbf{A}\mathbf{n}_2^T - c_2)} \quad (2.0.10)$$

$$\lambda = \frac{4 - \begin{pmatrix} 2 \\ 2 \\ 1 \end{pmatrix} \begin{pmatrix} 3 & -1 & 2 \end{pmatrix}}{\begin{pmatrix} 2 \\ 2 \\ 1 \end{pmatrix} \begin{pmatrix} 1 & 1 & 1 \end{pmatrix} + 2} \quad (2.0.11)$$

$$\Rightarrow \lambda = \frac{-2}{7} \quad (2.0.12)$$

\therefore By substituting $\lambda, n_1, n_2, c_1, c_2$ values in (2.0.9) we get required plane equation as,

$$(19 \ -9 \ 12)\mathbf{x} = 32 \quad (2.0.13)$$

Plot of the plane :

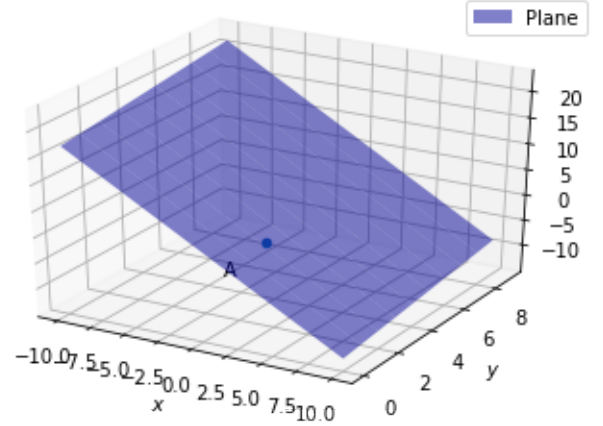


Fig. 2.1: Plot of the plane