ASSIGNMENT-3

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Download all python codes from

https://github.com/ThurpuNaveena/ASSIGNMENT-3/tree/main/CODES

and latex-tikz codes from

https://github.com/ThurpuNaveena/ASSIGNMENT-3/tree/main

1 QUESTION No-2.36 (a) (Linear forms)

Find the equation of the planes that passes through three points $\begin{pmatrix}1\\1\\-1\end{pmatrix},\begin{pmatrix}6\\4\\-5\end{pmatrix},\begin{pmatrix}-4\\-2\\3\end{pmatrix}$

2 Solution

$$\mathbf{R}=\begin{pmatrix}1\\1\\-1\end{pmatrix},\mathbf{S}=\begin{pmatrix}6\\4\\-5\end{pmatrix}\text{and}\mathbf{T}=\begin{pmatrix}-4\\-2\\3\end{pmatrix} \tag{2.0.1}$$

If the equation of the plane is given by

$$\mathbf{n}^T\mathbf{x}=1 \tag{2.0.2}$$

$$\begin{pmatrix}1&1&-1\\6&4&-5\\-4&-2&3\end{pmatrix}\mathbf{n}=\begin{pmatrix}1\\1\\1\end{pmatrix} \tag{2.0.3}$$

Row reducing the augmented matrix,

$$\begin{pmatrix}1&1&-1&1\\6&4&-5&1\\-4&-2&3&1\end{pmatrix}\xleftrightarrow{R_2\to R_2-6R_1}\begin{pmatrix}1&1&-1&1\\0&-2&1&-5\\-4&-2&3&1\end{pmatrix} \tag{2.0.4}$$

$$\xleftrightarrow{R_3\to R_3+4R_1}\begin{pmatrix}1&1&-1&1\\0&-2&1&-5\\0&2&-1&5\end{pmatrix} \tag{2.0.5}$$

$$\xleftrightarrow{R_2\to\frac{-R_2}{3}}\begin{pmatrix}1&1&-1&1\\0&1&\frac{-1}{2}&\frac{5}{2}\\0&2&-1&5\end{pmatrix} \tag{2.0.6}$$

$$\xleftrightarrow{R_1\to R_1-R_2}\begin{pmatrix}1&0&\frac{-1}{2}&\frac{-3}{2}\\0&1&\frac{-1}{2}&\frac{5}{2}\\0&2&-1&5\end{pmatrix} \tag{2.0.7}$$

$$\xleftrightarrow{R_3\to R_3-2R_2}\begin{pmatrix}1&0&\frac{-1}{2}&\frac{-3}{2}\\0&1&\frac{-1}{2}&\frac{5}{2}\\0&0&0&0\end{pmatrix} \tag{2.0.8}$$

$$\begin{pmatrix}1&0&-0.5&-1.5\\0&1&-0.5&2.5\\0&0&0&0\end{pmatrix} \tag{2.0.9}$$

$$\implies \mathbf{n}=1\begin{pmatrix}-1.5\\2.5\\0\end{pmatrix} \tag{2.0.10}$$

Thus, the equation of the plane passing through the given point is

$$\begin{pmatrix}-1.5&2.5&0\end{pmatrix}\mathbf{x}=1 \tag{2.0.11}$$

$$\mathbf{n}^T\mathbf{R}=\mathbf{n}^T\mathbf{S}=\mathbf{n}^T\mathbf{T}=1 \tag{2.0.12}$$

plot of the plane

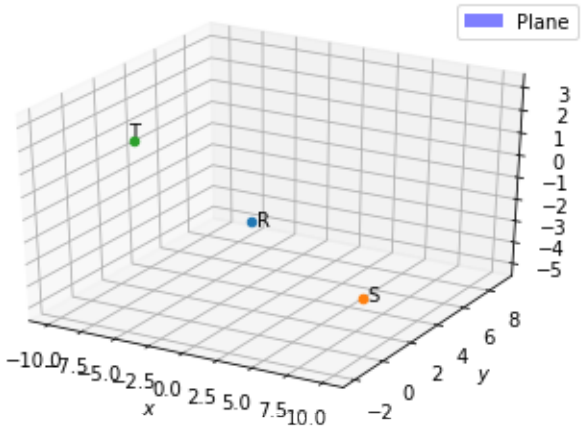

Fig. 2.1: plot of the plane