

5.3.39

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Question

Solve the following system of equations:

$$\begin{cases} x + y + z = 6 \\ x + 2z = 7 \\ 3x + y + z = 12 \end{cases}$$

Forming Augmented Matrix

$$\left(\begin{array}{ccc|c} 1 & 1 & 1 & 6 \\ 1 & 0 & 2 & 7 \\ 3 & 1 & 1 & 12 \end{array} \right)$$

Row Operations 1

$$\left(\begin{array}{ccc|c} 1 & 1 & 1 & 6 \\ 1 & 0 & 2 & 7 \\ 3 & 1 & 1 & 12 \end{array} \right) \xrightarrow{R_2 \rightarrow R_2 - R_1} \left(\begin{array}{ccc|c} 1 & 1 & 1 & 6 \\ 0 & -1 & 1 & 1 \\ 3 & 1 & 1 & 12 \end{array} \right)$$

Row Operations 2

$$\left(\begin{array}{ccc|c} 1 & 1 & 1 & 6 \\ 0 & -1 & 1 & 1 \\ 3 & 1 & 1 & 12 \end{array} \right) \xrightarrow{R_3 \rightarrow R_3 - 3R_1} \left(\begin{array}{ccc|c} 1 & 1 & 1 & 6 \\ 0 & -1 & 1 & 1 \\ 0 & -2 & -2 & -6 \end{array} \right)$$

Row Operations 3

$$\left(\begin{array}{ccc|c} 1 & 1 & 1 & 6 \\ 0 & -1 & 1 & 1 \\ 0 & -2 & -2 & -6 \end{array} \right) \xrightarrow{R_3 \rightarrow R_3 - 2R_2} \left(\begin{array}{ccc|c} 1 & 1 & 1 & 6 \\ 0 & -1 & 1 & 1 \\ 0 & 0 & -4 & -8 \end{array} \right)$$

Solution

Back Substitution From the third row:

$$-4z = -8 \implies z = 2$$

From the second row:

$$-y + z = 1 \implies -y + 2 = 1 \implies y = 1$$

From the first row:

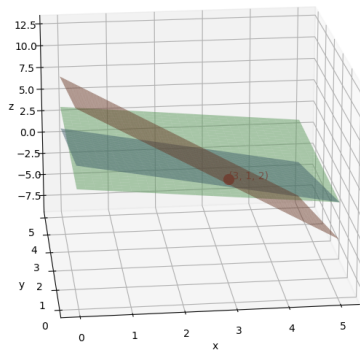
$$x + y + z = 6 \implies x + 1 + 2 = 6 \implies x = 3$$

Solution

The solution of the given system of linear equations is:

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

Intersection of Three Planes



For Codes, refer to the URL below:

<https://github.com/Aditya-Mishra11005/ee1030-2025/tree/temp/ee25btech11005/matgeo/5.3.39/Codes>