

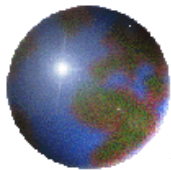
Quiz 1

Solve the following systems of linear equations by Gaussian elimination method:

$$2x - 2y + 3z = 2$$

$$x + 2y - z = 3$$

$$3x - y + 2z = 1$$



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SOLUTION

(i) $2x - 2y + 3z = 2$, $x + 2y - z = 3$, $3x - y + 2z = 1$

The given system equations is $2x - 2y + 3z = 2$ -----(1)

$$x + 2y - z = 3 \quad \text{-----(2)}$$

$$3x - y + 2z = 1 \quad \text{-----(3)}$$

The augmented matrix of the above system is $[A | B] = \left[\begin{array}{ccc|c} 2 & -2 & 3 & 2 \\ 1 & 2 & -1 & 3 \\ 3 & -1 & 2 & 1 \end{array} \right]$

Transforming augmented matrix to echelon form we get

$$\left[\begin{array}{ccc|c} 2 & -2 & 3 & 2 \\ 1 & 2 & -1 & 3 \\ 3 & -1 & 2 & 1 \end{array} \right] \xrightarrow{R_1 \leftrightarrow R_2} \left[\begin{array}{ccc|c} 1 & 2 & -1 & 3 \\ 2 & -2 & 3 & 2 \\ 3 & -1 & 2 & 1 \end{array} \right] \xrightarrow{\begin{array}{l} R_2 \rightarrow R_2 - 2R_1 \\ R_3 \rightarrow R_3 - 3R_1 \end{array}} \left[\begin{array}{ccc|c} 1 & 2 & -1 & 3 \\ 0 & -6 & 5 & -4 \\ 0 & -7 & 5 & -8 \end{array} \right]$$

$$\xrightarrow{R_3 \rightarrow R_3 - R_2} \left[\begin{array}{ccc|c} 1 & 2 & -1 & 3 \\ 0 & -6 & 5 & -4 \\ 0 & -1 & 0 & -4 \end{array} \right]$$

The given system of equations using this row - echelon form reduces to

$$x + 2y - z = 3 \quad \text{-----(4)}$$

$$-6y + 5z = -4 \quad \text{-----(5)}$$

$$-y = -4 \quad \text{-----(6)}$$

$$\Rightarrow y = 4$$

Substituting $y = 4$ in equation (5) we get

$$-6 \times 4 + 5z = -4 \quad \Rightarrow \quad 5z = -4 + 24 = 20$$

$$z = \frac{20}{5} = 4$$

Substituting $y = 4$ and $z = 4$ in equation (1) we get

$$x + 2 \times 4 - 4 = 3 \quad \Rightarrow \quad x + 8 - 4 = 3 \quad \Rightarrow \quad x = 3 - 4 = -1$$

∴ The required solutions of the system is $x = -1$, $y = 4$, $z = 4$