Gauss Elimination Method.

Q1 Solve the equation by Gauss Elimination Method

$$x - y + 2z = 3$$
$$x + 2y + 3z = 5$$
$$3x - 4y - 5z = -13$$

Ans

$$AX = B$$

$$\begin{bmatrix} 1 & -1 & 2 \\ 1 & 2 & 3 \\ 3 & -4 & -5 \end{bmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{bmatrix} 3 \\ 5 \\ -13 \end{bmatrix}$$

$$A : B$$

$$\left[\begin{array}{ccc:c} 1 & -1 & 2 & 3 \\ 1 & 2 & 3 & 5 \\ 3 & -4 & -5 & -13 \end{array}\right]$$

$$R_2 \rightarrow R_2 - R_1, \quad R_3 \rightarrow R_3 - 3R_1$$

$$\left[\begin{array}{ccc:c} 1 & -1 & 2 & 3 \\ 0 & 3 & 1 & 2 \\ 0 & -1 & -11 & -22 \end{array}\right]$$

$$R_3 \rightarrow 3R_3 + R_2$$

$$\left[\begin{array}{ccc:c} 1 & -1 & 2 & 3 \\ 0 & 3 & 1 & 2 \\ 0 & 0 & -32 & -64 \end{array}\right]$$

$$x - y + 2z = 3 \quad \text{— (1)}$$
$$3y + z = 2 \quad \text{— (2)}$$
$$-32z = -64 \quad \text{— (3)}$$

Page No.
Date

Solving ③

$z = 2$

putting z in ②

$$y = 0$$

putting z, y in ①

$$x = -1$$

$\therefore x = -1, y = 0, z = 2$

Q2 Solve the system of eqn using Gauss Elimination Method

$$\begin{bmatrix} 2x + y + z = 10 \\ 3x + 2y + 3z = 18 \\ x + 4y + 9z = 16 \end{bmatrix}$$

$$AX = B$$

$$\begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{bmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{bmatrix} 10 \\ 18 \\ 16 \end{bmatrix}$$

$[A:B]$

$$\begin{bmatrix} 2 & 1 & 1 & : & 10 \\ 3 & 2 & 3 & : & 18 \\ 1 & 4 & 9 & : & 16 \end{bmatrix}$$

$R_3 \leftrightarrow R_1$, $R_2 \leftrightarrow R_3$

$$\begin{bmatrix} 1 & 4 & 9 & : & 16 \\ 2 & 1 & 1 & : & 10 \\ 3 & 2 & 3 & : & 18 \end{bmatrix}$$

$R_2 \rightarrow R_2 - 2R_1$, $R_3 \rightarrow R_3 - 3R_1$

$$\begin{bmatrix} 1 & 4 & 9 & : & 16 \\ 0 & -7 & -17 & : & -26 \\ 0 & -10 & -24 & : & 30 \end{bmatrix}$$

$R_3 \rightarrow 7R_3 - 10R_2$

$$\left[\begin{array}{ccc:c} 1 & 4 & 9 & 16 \\ 0 & -7 & -17 & -26 \\ 0 & 0 & 2 & 10 \end{array}\right]$$

$$\begin{aligned} x + 4y + 9z &= 16 \quad -① \\ -7y - 17z &= -26 \quad -② \\ 2z &= 10 \quad -③ \end{aligned}$$

Solving ③ $z = 5$

putting z in ② $y = -9$

putting z, y in ① $x = 7$.

$\therefore x = 7, y = -9, z = 5$

Q. Solve the equation using Gauss Elimination

A

$$\begin{bmatrix} 4x - 5y = -6 \\ 2x - 2y = 1 \end{bmatrix}$$

$$\left[\begin{array}{cc:c} 4 & -5 & -6 \\ 2 & -2 & 1 \end{array}\right]$$

$R_2 \leftrightarrow R_1$

$$\left[\begin{array}{cc:c} 2 & -2 & 1 \\ 4 & -5 & -6 \end{array}\right]$$

$R_2 \rightarrow R_2 - 2R_1$

$$\left[\begin{array}{cc:c} 2 & -2 & 1 \\ 0 & -1 & -8 \end{array}\right]$$

$$2x - 2y = 1 \quad -(1)$$
$$-y = -8 \quad -(2)$$

putting $y = 8$ in (1)

$$\boxed{\begin{aligned} x &= 8.5 \\ y &= 8 \end{aligned}}$$