



Solution of Simultaneous Linear Equations Ex 8.2 Q1

$$2x - y + z = 0$$

$$3x + 2y - z = 0$$

$$x + 4y + 3z = 0$$

The system can be written as

$$\begin{bmatrix} 2 & -1 & 1 \\ 3 & 2 & -1 \\ 1 & 4 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$
$$A X = 0$$

$$\begin{aligned} \text{Now } |A| &= 2(10) + 1(10) + 1(10) \\ &= 40 \\ &\neq 0 \end{aligned}$$

Since $|A| \neq 0$, hence $x = y = z = 0$ is the only solution of this homogeneous system.

Solution of Simultaneous Linear Equations Ex 8.2 Q2

$$2x - y + 2z = 0$$

$$5x + 3y - z = 0$$

$$x + 5y - 5z = 0$$

$$\begin{bmatrix} 2 & -1 & 2 \\ 5 & 3 & -1 \\ 1 & 5 & -5 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

$$\text{or } A x = 0$$

$$|A| = 2(-10) + 1(-24) + 2(22)$$

$$= -20 - 24 + 44$$

$$= 0$$

Hence, the system has infinite solutions.

Let $z = k$

$$2x - y = -2k$$

$$5x + 3y = k$$

$$\begin{bmatrix} 2 & -1 \\ 5 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -2k \\ k \end{bmatrix}$$

$$A x = B$$

$$|A| = 6 + 5 = 11 \neq 0 \quad \text{so } A^{-1} \text{ exist}$$

$$\text{Now } \text{adj } A = \begin{bmatrix} 3 & -5 \\ 1 & 2 \end{bmatrix}' = \begin{bmatrix} 3 & 1 \\ -5 & 2 \end{bmatrix}$$

$$x = A^{-1}.B = \frac{1}{|A|} (\text{adj } A) B = \frac{1}{11} \begin{bmatrix} 3 & 1 \\ -5 & 2 \end{bmatrix} \begin{bmatrix} -2k \\ k \end{bmatrix} = \begin{bmatrix} \frac{-5k}{11} \\ \frac{12k}{11} \end{bmatrix}$$

$$\text{Hence, } x = \frac{-5k}{11}, y = \frac{12k}{11}, z = k$$

Solution of Simultaneous Linear Equations Ex 8.2 Q3

$$3x - y + 2z = 0$$

$$4x + 3y + 3z = 0$$

$$5x + 7y + 4z = 0$$

$$|A| = \begin{vmatrix} 3 & -1 & 2 \\ 4 & 3 & 3 \\ 5 & 7 & 4 \end{vmatrix}$$

$$= B(-9) + 1(1) + 2(13) = -27 + 1 + 26 = -27 + 27 \\ = 0$$

Hence, it has infinite solutions.

Let $z = k$

$$3x - y = -2k$$

$$4x + 3y = -3k$$

$$\text{or} \quad \begin{bmatrix} 3 & -1 \\ 4 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -2k \\ -3k \end{bmatrix}$$

$$\text{or} \quad A X = B$$

$|A| = 9 + 4 = 13 \neq 0$ hence A^{-1} exists

$$\text{adj } A = \begin{bmatrix} 3 & -4 \\ 1 & 3 \end{bmatrix} = \begin{bmatrix} 3 & 1 \\ -4 & 3 \end{bmatrix}$$

$$\text{Now } X = A^{-1}B = \frac{1}{|A|}(\text{adj } A)B$$

$$\begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{13} \begin{bmatrix} 3 & 1 \\ -4 & 3 \end{bmatrix} \begin{bmatrix} -2k \\ -3k \end{bmatrix} = \frac{1}{13} \begin{bmatrix} -9k \\ -k \end{bmatrix}$$

$$\text{Hence, } x = \frac{-9k}{13}, y = \frac{-k}{13}, z = k$$

Solution of Simultaneous Linear Equations Ex 8.2 Q4

$$\begin{aligned}x + y - 6z &= 0 \\x - y + 2z &= 0 \\-3x + y + 2z &= 0\end{aligned}$$

$$\begin{aligned}\text{Hence, } |A| &= \begin{vmatrix} 1 & 1 & -6 \\ 1 & -1 & 2 \\ -3 & 1 & 2 \end{vmatrix} \\&= 1(-4) - 1(8) - 6(-2) \\&= -4 - 8 + 12 \\&= 0\end{aligned}$$

Hence, the system has infinite solutions.

$$\begin{aligned}\text{Let } z &= k \\x + y &= 6k \\x - y &= -2k\end{aligned}$$

$$\begin{aligned}\text{or } \begin{bmatrix} 1 & +1 \\ 1 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} &= \begin{bmatrix} 6k \\ -2k \end{bmatrix} \\ \text{or } A X &= B\end{aligned}$$

$|A| = -1 - 1 = -2 \neq 0$ hence A^{-1} exists.

$$\text{adj } A = \begin{bmatrix} -1 & -1 \\ -1 & +1 \end{bmatrix}$$

$$X = A^{-1}B = \frac{1}{|A|}(\text{adj } A)B = \frac{1}{-2} \begin{bmatrix} -1 & -1 \\ -1 & +1 \end{bmatrix} \begin{bmatrix} 6k \\ -2k \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{-2} \begin{bmatrix} -6k + 2k \\ -6k - 2k \end{bmatrix} = \left(\frac{1}{-2} \right) \begin{bmatrix} -4k \\ -8k \end{bmatrix} = \frac{-1}{2} \begin{bmatrix} -4k \\ -8k \end{bmatrix} = \begin{bmatrix} 2k \\ 4k \end{bmatrix}$$

Hence, $x = 2k$, $y = 4k$, $z = k$

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