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Solution of Simultaneous Linear Equations Ex 8.1 Q1(i)

We have,

$$5x + 7y = -2$$
$$4x + 6y = -3$$

The above system of equations can be written in the matrix form as

$$\begin{bmatrix} 5 & 7 \\ 4 & 6 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -2 \\ -3 \end{bmatrix}$$

or $\quad A X = B$

where $A = \begin{bmatrix} 5 & 7 \\ 4 & 6 \end{bmatrix}$ $X = \begin{bmatrix} x \\ y \end{bmatrix}$ and $B = \begin{bmatrix} -2 \\ -3 \end{bmatrix}$

Now, $\quad |A| = 30 - 28 = +2 \neq 0$

So the above system has a unique solution, given by

$$X = A^{-1}B$$

Let C_{ij} be the co-factor of a_{ij} in A, then

$$C_{11} = 6$$
$$C_{12} = -4$$
$$C_{21} = -7$$
$$C_{22} = 5$$

Also,

$$\text{adj } A = \begin{bmatrix} 6 & -4 \\ -7 & 5 \end{bmatrix}^T = \begin{bmatrix} 6 & -7 \\ -4 & 5 \end{bmatrix}$$

$$\therefore\ A^{-1} = \frac{1}{|A|}\text{adj } A = \frac{1}{+2}\begin{bmatrix} 6 & -7 \\ -4 & 5 \end{bmatrix}$$

$$\therefore \quad X = A^{-1}B$$

$$\Rightarrow \begin{bmatrix} x \\ y \end{bmatrix} = \frac{+1}{2}\begin{bmatrix} 6 & -7 \\ -4 & 5 \end{bmatrix}\begin{bmatrix} -2 \\ -3 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} x \\ y \end{bmatrix} = \frac{+1}{2}\begin{bmatrix} -12 & +21 \\ 8 & -15 \end{bmatrix} = \begin{bmatrix} \frac{9}{2} \\ \frac{-7}{2} \end{bmatrix}$$

Hence, $x = \frac{9}{2}, y = \frac{-7}{2}$

Solution of Simultaneous Linear Equations Ex 8.1 Q1(ii)

The above system can be written in matrix form as

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

or $\quad AX = B$

Where,

$$A = \begin{bmatrix} 5 & 2 \\ 3 & 2 \end{bmatrix}, \quad X = \begin{bmatrix} x \\ y \end{bmatrix}, \quad B = \begin{bmatrix} 3 \\ 5 \end{bmatrix}$$

Now, $\quad |A| = 10 - 6 = 4 \neq 0$

So the above system has a unique solution, given by

$$X = A^{-1}B$$

Let C_{ij} be the co-factor of a_{ij} in A, then

$$C_{11} = 2$$
$$C_{12} = -3$$
$$C_{21} = -2$$
$$C_{22} = 5$$

Also,

$$\text{Adj}\,A = \begin{bmatrix} 2 & -3 \\ -2 & 5 \end{bmatrix}^T = \begin{bmatrix} 2 & -2 \\ -3 & 5 \end{bmatrix}$$

$$\therefore\ A^{-1} = \frac{1}{|A|}\text{adj}\,A = \frac{1}{4}\begin{bmatrix} 2 & -2 \\ -3 & 5 \end{bmatrix}$$

Now, $\quad X = A^{-1}B$

$$= \frac{1}{4}\begin{bmatrix} 2 & -2 \\ -3 & 5 \end{bmatrix}\begin{bmatrix} 3 \\ 5 \end{bmatrix}$$

$$= \frac{1}{4}\begin{bmatrix} -4 \\ 16 \end{bmatrix}$$

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

Hence, $x = -1$

$y = 4$

Solution of Simultaneous Linear Equations Ex 8.1 Q1(iii)

The above system can be written in matrix form as:

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

or $\quad AX = B$

Where,

$$A = \begin{bmatrix} 3 & 4 \\ 1 & -1 \end{bmatrix}, \quad X = \begin{bmatrix} x \\ y \end{bmatrix}, \quad B = \begin{bmatrix} 5 \\ -3 \end{bmatrix}$$

Now, $\quad |A| = -7 \neq 0$

So the above system has a unique solution, given by

$$X = A^{-1}B$$

Let C_{ij} be the co-factor of a_{ij} in A, then

$$C_{11} = -1$$
$$C_{12} = -1$$
$$C_{21} = -4$$
$$C_{22} = 3$$

Now,

$$\text{Adj}\,A = \begin{bmatrix} -1 & -1 \\ -4 & 3 \end{bmatrix}^T = \begin{bmatrix} -1 & -4 \\ -1 & 3 \end{bmatrix}$$

$$\therefore \; A^{-1} = \frac{1}{|A|}\text{adj}\,A = \frac{1}{-7}\begin{bmatrix} -1 & -4 \\ -1 & 3 \end{bmatrix}$$

Now, $\quad X = A^{-1}B$

$$\Rightarrow \begin{bmatrix} x \\ y \end{bmatrix} = \frac{-1}{7}\begin{bmatrix} -1 & -4 \\ -1 & 3 \end{bmatrix}\begin{bmatrix} 5 \\ -3 \end{bmatrix}$$

$$= \frac{-1}{7}\begin{bmatrix} 7 \\ -14 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -1 \\ 2 \end{bmatrix}$$

Hence, $x = -1$

$y = 2$

Solution of Simultaneous Linear Equations Ex 8.1 Q1(iv)

The above system can be written in matrix form as:

$$\begin{bmatrix} 3 & 1 \\ 3 & -1 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 19 \\ 23 \end{bmatrix}$$

or $\quad A X = B$

Where,

$$A = \begin{bmatrix} 3 & 1 \\ 3 & -1 \end{bmatrix}, \quad X = \begin{bmatrix} x \\ y \end{bmatrix}, \quad B = \begin{bmatrix} 19 \\ 23 \end{bmatrix}$$

Now, $\quad |A| = -6 \neq 0$

So, the above system has a unique solution, given by

$$X = A^{-1}B$$

Let C_{ij} be the co-factor of a_{ij} in A, then

$$C_{11} = -1$$
$$C_{12} = -3$$
$$C_{21} = -1$$
$$C_{22} = 3$$

Now,

$$\text{Adj}\,A = \begin{bmatrix} -1 & -3 \\ -1 & 3 \end{bmatrix}^T = \begin{bmatrix} -1 & -1 \\ -3 & 3 \end{bmatrix}$$

$$A^{-1} = \frac{1}{|A|}\,\text{adj}\,A = \frac{1}{-6}\begin{bmatrix} -1 & -1 \\ -3 & 3 \end{bmatrix}$$

Now, $\quad X = A^{-1}B$

$$\Rightarrow \begin{bmatrix} x \\ y \end{bmatrix} = \frac{-1}{6}\begin{bmatrix} -1 & -1 \\ -3 & 3 \end{bmatrix}\begin{bmatrix} 19 \\ 23 \end{bmatrix}$$

$$= \frac{-1}{6}\begin{bmatrix} -19 & -23 \\ -57 & +69 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 7 \\ -2 \end{bmatrix}$$

Hence, $x = 7$

$y = -2$

Solution of Simultaneous Linear Equations Ex 8.1 Q1(v)

The above system can be written in matrix form as:

$$\begin{bmatrix} 3 & 7 \\ 1 & 2 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ -1 \end{bmatrix}$$

or $\quad AX = B$

where $A = \begin{bmatrix} 3 & 7 \\ 1 & 2 \end{bmatrix}$, $X = \begin{bmatrix} x \\ y \end{bmatrix}$ and $B = \begin{bmatrix} 4 \\ -1 \end{bmatrix}$

Now,

$$|A| = -1 \neq 0$$

So the above system has a unique solution, given by

$$X = A^{-1}B$$

Now, let C_{ij} be the co-factor of a_{ij} in A

$C_{11} = 2$

$C_{12} = -1$

$C_{21} = -7$

$C_{22} = 3$

$$\text{Adj } A = \begin{bmatrix} 2 & -1 \\ -7 & 3 \end{bmatrix}^T = \begin{bmatrix} 2 & -7 \\ -1 & 3 \end{bmatrix}$$

$$\therefore A^{-1} = \frac{1}{|A|}.\text{adj } A = \frac{1}{(-1)}\begin{bmatrix} 2 & -7 \\ -1 & 3 \end{bmatrix}$$

Now, $\quad X = A^{-1}B$

$$\Rightarrow \begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{-1}\begin{bmatrix} 2 & -7 \\ -1 & 3 \end{bmatrix}\begin{bmatrix} 4 \\ -1 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{-1}\begin{bmatrix} 15 \\ -7 \end{bmatrix} = \begin{bmatrix} -15 \\ 7 \end{bmatrix}$$

Hence, $x = -15$

$y = 7$

Solution of Simultaneous Linear Equations Ex 8.1 Q1(vi)

The given system can be written in matrix form as:

$$\begin{bmatrix} 3 & 1 \\ 5 & 3 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 7 \\ 12 \end{bmatrix}$$

or $\quad AX = B$

Where,

$$A = \begin{bmatrix} 3 & 1 \\ 5 & 3 \end{bmatrix}, X = \begin{bmatrix} x \\ y \end{bmatrix}, B = \begin{bmatrix} 7 \\ 12 \end{bmatrix}$$

Since, $|A| = 4 \neq 0$, the above system has a unique solution, given by

$$X = A^{-1}B$$

Let C_{ij} be the co-factor of a_{ij} in A

$C_{11} = 3$

$C_{12} = -5$

$C_{21} = -1$

$C_{22} = 3$

$$\text{adj}\, A = \begin{bmatrix} 3 & -5 \\ -1 & 3 \end{bmatrix}^T = \begin{bmatrix} 3 & -1 \\ -5 & 3 \end{bmatrix}$$

$$\therefore\ A^{-1} = \frac{1}{|A|}\text{adj}\, A = \frac{1}{4}\begin{bmatrix} 3 & -1 \\ -5 & 3 \end{bmatrix}$$

Now, $\quad X = A^{-1}B$

$$\Rightarrow \begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{4}\begin{bmatrix} 3 & -1 \\ -5 & 3 \end{bmatrix}\begin{bmatrix} 7 \\ 12 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{4}\begin{bmatrix} 9 \\ 1 \end{bmatrix} = \begin{bmatrix} \frac{9}{4} \\ \frac{1}{4} \end{bmatrix}$$

Hence, $x = \frac{9}{4}$

$y = \frac{1}{4}$

*********** END **********