# MATRICES

## INVERSE OF A MATRIX BY ELEMENTARY OPERATIONS

### Inverse of a Matrix using Elementary Operations

Consider matrix equation C=AB ……….(I)

If an elementary row operation is applied on matrix C, and the same elementary row operation is applied on the pre-factor A on the right side of the equation (I), then the new equation obtained is still valid.

So, to find $A^{-1}$ we start with the equation A=IA and apply a sequence of row operations to get I=BA, so that B is the inverse of A.

### Inverse of a Matrix using Elementary Row Operations

Working Rule to find $A^{-1}$ using elementary row operations:

**Step 1:** Write A=IA.

**Step 2:** Perform a sequence of elementary row operations successively on A on L.H.S. and on the pre-factor I on R.H.S. till we get I=BA.

Thus, $B=A^{-1}$

**Ex:1** Find the inverse of a matrix $\begin{bmatrix} 2 & -6 \\ 1 & -2 \end{bmatrix}$ using elementary row operations.

**Sol.** Let $A=\begin{bmatrix} 2 & -6 \\ 1 & -2 \end{bmatrix}$

Now, A = IA

$$\Rightarrow \begin{bmatrix} 2 & -6 \\ 1 & -2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} A$$

$$\Rightarrow \begin{bmatrix} 1 & -2 \\ 2 & -6 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} A \qquad \left(\text{ApplyingR } R_1 \leftrightarrow R_2\right)$$

$$\Rightarrow \begin{bmatrix} 1 & -2 \\ 0 & -2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 1 & -2 \end{bmatrix} A \qquad (\text{Applying } R_2 \to R_2 - 2R_1)$$

$$\Rightarrow \begin{bmatrix} 1 & -2 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -\frac{1}{2} & 1 \end{bmatrix} A \qquad \left(\text{Applying } R_2 \to \frac{-1}{2} R_2\right)$$

$$\Rightarrow \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} -1 & 3 \\ -\frac{1}{2} & 1 \end{bmatrix} A \qquad \left(\text{Applying } R_1 \to R_1 + 2R_2\right)$$

$$\therefore \quad A^{-1} = \begin{bmatrix} -1 & 3 \\ -\frac{1}{2} & 1 \end{bmatrix}$$