Date: 23/11/18

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(Lec no 7,8) Inverse of Matrix :-

- Inverse of matrix using row operation.
- Inverse of matrix exists when determinent of adjoint method is non-zero.

$$A^{-1} = \frac{[A]}{|A|}, \text{ where } |A| \neq 0$$

Example:-

Find inverse of following matrix using row operation.

$$A = \begin{bmatrix} 1 & 0 & 3 \\ 2 & 4 & 1 \\ 1 & 3 & 0 \end{bmatrix}$$

$$\overset{[A]}{\begin{bmatrix} 1 & 0 & 3 \\ 2 & 4 & 1 \\ 1 & 3 & 0 \end{bmatrix}} \overset{[I_3]}{\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}}$$

$$\begin{bmatrix} 1 & 0 & 3 \\ 0 & 4 & -5 \\ 0 & 3 & -3 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ -2 & 1 & 0 \\ -1 & 0 & 1 \end{bmatrix} \quad \begin{matrix} R_2 + (-2)R_1 \\ R_3 + (-1)R_1 \end{matrix}$$

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$$= \begin{bmatrix} 1 & 0 & 3 \\ 0 & 1 & -2 \\ 0 & 3 & -3 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 1 \\ -1 & 0 & 1 \end{bmatrix} \quad R_2 + (-1) R_3$$

$$= \begin{bmatrix} 1 & 0 & 3 \\ 0 & 1 & -2 \\ 0 & 0 & 3 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ -1 & 1 & -1 \\ 2 & -3 & 4 \end{bmatrix} \quad R_3 + (-3) R_1$$

$$= \begin{bmatrix} 1 & 0 & 3 \\ 0 & 1 & -2 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ -1 & 1 & -1 \\ 2/3 & -1 & 4/3 \end{bmatrix} \quad 1/3 \, (R_3)$$

$$= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} -1 & 3 & -4 \\ 1/3 & -1 & 5/3 \\ 2/3 & -1 & 4/3 \end{bmatrix} \quad \begin{matrix} R_1 + (-3) R_3 \\ R_2 + (2) R_3 \end{matrix}$$

$$A^{-1} = \begin{bmatrix} -1 & 3 & -4 \\ 1/3 & -1 & 5/3 \\ 2/3 & -1 & 4/3 \end{bmatrix}$$

For prove:— $\boxed{AA^{-1} = I}$

For Practice:—

i) $B = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$

iii) $D = \begin{bmatrix} 2 & 0 & 1 \\ 3 & 2 & 5 \\ 1 & -1 & 0 \end{bmatrix}$

ii) $C = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 4 \\ 2 & 4 & 7 \end{bmatrix}$

iv) $E = \begin{bmatrix} 1 & 1 & 4 \\ 4 & 3 & 1 \\ 3 & 5 & 3 \end{bmatrix}$