Find A^{-1} if $A = \begin{bmatrix} 5 & 3 \\ 1 & 1 \end{bmatrix}$ and verify that $AA^{-1} = A^{-1}A = I$ (4)

$|A| = \begin{vmatrix} 5 & 3 \\ 1 & 1 \end{vmatrix} = 5 - 3 = 2 \quad |A| \neq 0$, $\therefore$ A^{-1} find.

$$A^{-1} = \frac{1}{|A|} \operatorname{adj} A = \frac{1}{2}\begin{bmatrix} 1 & -3 \\ -1 & 5 \end{bmatrix} = \begin{bmatrix} \frac{1}{2} & \frac{-3}{2} \\ \frac{-1}{2} & \frac{5}{2} \end{bmatrix}$$

Now,

$$AA^{-1} = \begin{bmatrix} 5 & 3 \\ 1 & 1 \end{bmatrix}\begin{bmatrix} \frac{1}{2} & \frac{-3}{2} \\ \frac{-1}{2} & \frac{5}{2} \end{bmatrix} = \begin{bmatrix} \frac{5}{2} - \frac{3}{2} & \frac{-15}{2} + \frac{15}{2} \\ \frac{1}{2} - \frac{1}{2} & \frac{-3}{2} + \frac{5}{2} \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$A^{-1}A = \begin{bmatrix} \frac{1}{2} & \frac{-3}{2} \\ \frac{-1}{2} & \frac{5}{2} \end{bmatrix}\begin{bmatrix} 5 & 3 \\ 1 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

System of linear Equations. $3x_1 - x_2 = 1$

$x_1 + x_2 \quad 3$

Matrix Inversion Method $AX = B \Rightarrow X = A^{-1}B$

Matrix form of system $\underset{A}{\begin{bmatrix} 3 & -1 \\ 1 & 1 \end{bmatrix}} \underset{X}{\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}} \quad \underset{B}{\begin{bmatrix} 1 \\ 3 \end{bmatrix}}$

$AX = B$

$|A| = \begin{vmatrix} 3 & -1 \\ 1 & 1 \end{vmatrix} = 3 + 1 = 4$, $\operatorname{adj} A = \begin{bmatrix} 1 & 1 \\ -1 & 3 \end{bmatrix}$

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

$$X = A^{-1}B \Rightarrow \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} \frac{1}{4} & \frac{1}{4} \\ \frac{-1}{4} & \frac{3}{4} \end{bmatrix}\begin{bmatrix} 1 \\ 3 \end{bmatrix} = \begin{bmatrix} \frac{1}{4} + \frac{3}{4} \\ \frac{-1}{4} + \frac{9}{4} \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$

$x_1 = 1, \; x_2 = 2$

Property of inverse $(AB)^{-1} = B^{-1}A^{-1}$

$\cancel{x_1 + 2}$