Class-XII Ex 3.4. Matrix. 15-07-2020

Q.6. $\begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix}$

Soln. Let $A = \begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix}$. We know that $A = IA$

$\therefore \begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} A \Rightarrow \begin{bmatrix} 1 & 3 \\ 2 & 5 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} A \; [\because R_2 \leftrightarrow R_1]$

$\Rightarrow \begin{bmatrix} 1 & 3 \\ 0 & -1 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 1 & -2 \end{bmatrix} A \; [\because R_2 \to R_2 - 2R_1]$

$\Rightarrow \begin{bmatrix} 1 & 3 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -1 & 2 \end{bmatrix} A \; [\because R_2 \to (-1)R_2]$.

$\Rightarrow \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 3 & -5 \\ -1 & 2 \end{bmatrix} A \; [\because R_1 \to R_1 - 3R_2]$

$\therefore A^{-1} = \begin{bmatrix} 3 & -5 \\ -1 & 2 \end{bmatrix} \; [\because AA^{-1} = I]$

Q.7. $\begin{bmatrix} 3 & 1 \\ 5 & 2 \end{bmatrix}$

Soln. Let $\begin{bmatrix} 3 & 1 \\ 5 & 2 \end{bmatrix}$. We know that $A = IA$

$\therefore \begin{bmatrix} 3 & 1 \\ 5 & 2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} A \Rightarrow \begin{bmatrix} 1 & \frac{1}{3} \\ 5 & 2 \end{bmatrix} \begin{bmatrix} \frac{1}{3} & 0 \\ 0 & 1 \end{bmatrix} A \; [\because R_1 \to \frac{1}{3} R_1$

$\Rightarrow \begin{bmatrix} 1 & \frac{1}{3} \\ 0 & \frac{1}{3} \end{bmatrix} = \begin{bmatrix} \frac{1}{3} & 0 \\ -\frac{5}{3} & 1 \end{bmatrix} A \; [\because R_2 \to R_2 - 5R_1]$

$\Rightarrow \begin{bmatrix} 1 & \frac{1}{3} \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} \frac{1}{3} & 0 \\ -5 & 3 \end{bmatrix} A \; [\because R_2 \to 3R_2]$.

$\Rightarrow \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 2 & -1 \\ -5 & 3 \end{bmatrix} A \; [\because R_1 \to R_1 - \frac{1}{3} R_2]$

$\therefore A^{-1} = \begin{bmatrix} 2 & -1 \\ -5 & 3 \end{bmatrix} \; [\because AA^{-1} = 1]$

Ans.

Q.8. $\begin{bmatrix} 4 & 5 \\ 3 & 4 \end{bmatrix}$

Soln: Let $A = \begin{bmatrix} 4 & 5 \\ 3 & 4 \end{bmatrix}$. We know that $A = IA$

$\therefore \begin{bmatrix} 4 & 5 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} A \Rightarrow \begin{bmatrix} 1 & \frac{5}{4} \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} \frac{1}{4} & 0 \\ 0 & 1 \end{bmatrix} A$ $[\because R_1 \to \frac{1}{4} R_1]$

$\Rightarrow \begin{bmatrix} 1 & \frac{5}{4} \\ 0 & \frac{1}{4} \end{bmatrix} = \begin{bmatrix} \frac{1}{4} & 0 \\ -\frac{3}{4} & 1 \end{bmatrix} A$ $[\because R_2 \to R_2 - 3R_1]$

$\Rightarrow \begin{bmatrix} 1 & \frac{5}{4} \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} \frac{1}{4} & 0 \\ -3 & 4 \end{bmatrix} A$ $[\because R_2 \to 4R_2]$

$\Rightarrow \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 4 & -5 \\ -3 & 4 \end{bmatrix} A$ $[\because R_1 \to R_1 - \frac{5}{4} R_2$

Hence, $A^{-1} = \begin{bmatrix} 4 & -5 \\ -3 & 4 \end{bmatrix}$ $[\because \cancel{R_1 \to R_1 - \frac{5}{4}R_2}$ $\because AA^{-1} = I]$

Q.9. $\begin{bmatrix} 3 & 10 \\ 2 & 7 \end{bmatrix}$

Soln: Let $A = \begin{bmatrix} 3 & 10 \\ 2 & 7 \end{bmatrix}$. We know that $A = IA$

$\therefore \begin{bmatrix} 3 & 10 \\ 2 & 7 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} A \Rightarrow \begin{bmatrix} 1 & \frac{10}{3} \\ 2 & 7 \end{bmatrix} = \begin{bmatrix} \frac{1}{3} & 0 \\ 0 & 1 \end{bmatrix} A$ $[\because R_1 \to \frac{1}{3} R_1]$

$\Rightarrow \begin{bmatrix} 1 & \frac{10}{3} \\ 0 & \frac{1}{3} \end{bmatrix} = \begin{bmatrix} \frac{1}{3} & 0 \\ -\frac{2}{3} & 1 \end{bmatrix} A$ $[\because R_2 \to R_2 - 2R_1]$

$\Rightarrow \begin{bmatrix} 1 & \frac{10}{3} \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} \frac{1}{3} & 0 \\ -2 & 3 \end{bmatrix} A$ $[\because R_2 \to 3R_2]$

$\Rightarrow \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 7 & -10 \\ -2 & 3 \end{bmatrix} A$ $[\because R_1 \to R_1 - \frac{10}{3} R_2]$

$\therefore A^{-1} = \begin{bmatrix} 7 & -10 \\ -2 & 3 \end{bmatrix}$ $[\because AA^{-1} = I]$

Q.10. $\begin{bmatrix} 3 & -1 \\ -4 & 2 \end{bmatrix}$

Soln: Let $A = \begin{bmatrix} 3 & -1 \\ -4 & 2 \end{bmatrix}$. We know that $A = IA$

$\therefore \begin{bmatrix} 3 & -1 \\ -4 & 2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} A \Rightarrow \begin{bmatrix} 1 & -\frac{1}{3} \\ -4 & 2 \end{bmatrix} = \begin{bmatrix} \frac{1}{3} & 0 \\ 0 & 1 \end{bmatrix} A$ $[\because R_1 \to \frac{1}{3} R_1]$

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$\Rightarrow \begin{bmatrix} 1 & -\frac{1}{3} \\ 0 & \frac{2}{3} \end{bmatrix} = \begin{bmatrix} \frac{1}{3} & 0 \\ \frac{4}{3} & 1 \end{bmatrix} A \quad [\because R_2 \to R_2 + 4R_1]$

$\Rightarrow \begin{bmatrix} 0 & \frac{2}{3} \\ 1 & -\frac{1}{3} \end{bmatrix} = \begin{bmatrix} \frac{1}{3} & 0 \\ 2 & \frac{3}{2} \end{bmatrix} A \quad [\because R_2 \to \frac{3}{2} R_2]$

$\Rightarrow \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & \frac{1}{2} \\ 2 & \frac{3}{2} \end{bmatrix} A \quad [\because R_1 \to R_1 + \frac{1}{3} R_2]$

$\therefore A^{-1} = \begin{bmatrix} 1 & \frac{1}{2} \\ 2 & \frac{3}{2} \end{bmatrix} \quad [\because AA^{-1} = I]$

Q.11. $\begin{bmatrix} 2 & -6 \\ 1 & -2 \end{bmatrix}$

Soln: Let $A = \begin{bmatrix} 2 & -6 \\ 1 & -2 \end{bmatrix}$. We know that $A = IA$

$\therefore \begin{bmatrix} 2 & -6 \\ 1 & -2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} A \Rightarrow \begin{bmatrix} 1 & -2 \\ 2 & -6 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} A \quad [\because R_1 \leftrightarrow R_2]$

$\Rightarrow \begin{bmatrix} 1 & -2 \\ 0 & -2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 1 & -2 \end{bmatrix} A \quad [\because R_2 \to R_2 - 2R_1]$

$\Rightarrow \begin{bmatrix} 1 & -2 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -\frac{1}{2} & 1 \end{bmatrix} A \quad [\because R_2 \to (-\frac{1}{2}) R_2]$

$\Rightarrow \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} -1 & 3 \\ -\frac{1}{2} & 1 \end{bmatrix} A \quad [\because R_1 \to R_1 + 2R_2]$

$\therefore A^{-1} = \begin{bmatrix} -1 & 3 \\ -\frac{1}{2} & 1 \end{bmatrix} \quad [\because AA^{-1} = I]$

Q.12. $\begin{bmatrix} 6 & -3 \\ -2 & 1 \end{bmatrix}$

Soln: Let $A = \begin{bmatrix} 6 & -3 \\ -2 & 1 \end{bmatrix}$. We know that $A = IA$]

$\therefore \begin{bmatrix} 6 & -3 \\ -2 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} A \Rightarrow \begin{bmatrix} 1 & -\frac{1}{2} \\ -2 & 1 \end{bmatrix} = \begin{bmatrix} \frac{1}{6} & 0 \\ 0 & 1 \end{bmatrix} A \quad [\because R_1 \to \frac{1}{6} R_1]$

$\Rightarrow \begin{bmatrix} 1 & -\frac{1}{2} \\ 0 & 0 \end{bmatrix} = \begin{bmatrix} \frac{1}{6} & 0 \\ \frac{1}{3} & 1 \end{bmatrix} A \quad [\because R_2 \to R_2 + 2R_1]$

[∵ All the elements are zero in the second row of the matrix on the L.H.S. ∴ A^{-1} does not exist.]

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Q.13. $\begin{bmatrix} 2 & -3 \\ -1 & 2 \end{bmatrix}$

Soln: Let $A = \begin{bmatrix} 2 & -3 \\ -1 & 2 \end{bmatrix}$. We know that $A = IA$]

$\therefore \begin{bmatrix} 2 & -3 \\ -1 & 2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} A \Rightarrow \begin{bmatrix} 1 & -\frac{3}{2} \\ -1 & 2 \end{bmatrix} = \begin{bmatrix} \frac{1}{2} & 0 \\ 0 & 1 \end{bmatrix}$ [$\because R_1 \to \frac{1}{2}R_1$]

$\Rightarrow \begin{bmatrix} 1 & -\frac{3}{2} \\ 0 & \frac{1}{2} \end{bmatrix} = \begin{bmatrix} \frac{1}{2} & 0 \\ \frac{1}{2} & 1 \end{bmatrix} A$ [$\because R_2 \to R_2 + R_1$]

$\Rightarrow \begin{bmatrix} 1 & -\frac{3}{2} \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} \frac{1}{2} & 0 \\ 1 & 2 \end{bmatrix} A$ [$\because R_2 \to 2R_2$]

$\Rightarrow \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix} A$ [$\because R_1 \to R_1 + \frac{3}{2}R_2$]

$\therefore A^{-1} = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$ [$\because AA^{-1} = I$]

Q.14. $\begin{bmatrix} 2 & 1 \\ 4 & 2 \end{bmatrix}$

Soln Let $A = \begin{bmatrix} 2 & 1 \\ 4 & 2 \end{bmatrix}$. We know that $A = IA$]

$\therefore \begin{bmatrix} 2 & 1 \\ 4 & 2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} A \Rightarrow \begin{bmatrix} 1 & \frac{1}{2} \\ 4 & 2 \end{bmatrix} = \begin{bmatrix} \frac{1}{2} & 0 \\ 0 & 1 \end{bmatrix} A$ [$\because R_1 \to \frac{1}{2}R_1$]

$\Rightarrow \begin{bmatrix} 1 & \frac{1}{2} \\ 0 & 0 \end{bmatrix} = \begin{bmatrix} \frac{1}{2} & 0 \\ -2 & 1 \end{bmatrix} A$ [$\because R_2 \to R_2 - 4R_1$]

[$\because$ All the elements are zero in the second row of the matrix on the L.H.S. $\therefore A^{-1}$ does not exist.]