

# Assignment 8

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## 1 Question

Obtain the inverse of following matrix using elementary operations

$$\begin{array}{ccc} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{array}$$

## 2 Solution

We know that

$$AA^{-1} = I$$

therefore,

$$\begin{array}{ccc} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{array} \quad \begin{array}{l} \\ \\ \\ \end{array} \quad \begin{array}{ccc} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{array}$$
$$\begin{array}{ccc} 1 & 2 & 3 \\ 0 & 1 & 2 \\ 0 & -5 & -8 \end{array} \quad \begin{array}{l} \\ \\ \\ \end{array} \quad \begin{array}{ccc} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & -3 & 1 \end{array}$$
$$\begin{array}{ccc} 1 & 0 & -1 \\ 0 & 1 & 2 \\ 0 & 0 & 2 \end{array} \quad \begin{array}{l} \\ \\ \\ \end{array} \quad \begin{array}{ccc} -2 & 1 & 0 \\ 1 & 0 & 0 \\ 5 & -3 & 1 \end{array}$$
$$\begin{array}{ccc} 1 & 0 & -1 \\ 1 & 1 & 2 \\ 0 & 0 & 1 \end{array} \quad \begin{array}{l} \\ \\ \\ \end{array} \quad \begin{array}{ccc} -2 & 1 & 0 \\ 1 & 0 & 0 \\ \frac{5}{2} & \frac{-3}{2} & \frac{1}{1} \end{array}$$

$$\begin{array}{l}
R_2 \rightarrow R_2 - 2R_3, R_1 \rightarrow R_1 + R_3 \\
\begin{array}{ccc} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{array} A^{-1} = \begin{array}{ccc} \frac{1}{2} & \frac{-1}{2} & \frac{1}{2} \\ -4 & 3 & -1 \\ \frac{5}{2} & \frac{-3}{2} & \frac{1}{2} \end{array} \\
\Rightarrow IA^{-1} = A^{-1} = \begin{array}{ccc} \frac{1}{2} & \frac{-1}{2} & \frac{1}{2} \\ -4 & 3 & -1 \\ \frac{5}{2} & \frac{-3}{2} & \frac{1}{2} \end{array}
\end{array}$$

Thus,

$$A^{-1} = \begin{array}{ccc} \frac{1}{2} & \frac{-1}{2} & \frac{1}{2} \\ -4 & 3 & -1 \\ \frac{5}{2} & \frac{-3}{2} & \frac{1}{2} \end{array}$$