

# Inverse of a Matrix Using Elementary Transformations

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## Question

Find the inverse of the matrix

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

using elementary transformations.

## Solution

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

We write the augmented matrix of  $A$  with the identity matrix:

$$[A|I] = \left( \begin{array}{cc|cc} 2 & 3 & 1 & 0 \\ 1 & 4 & 0 & 1 \end{array} \right).$$

**Step 1:**

$$R_1 \rightarrow \frac{1}{2}R_1$$
$$\left( \begin{array}{cc|cc} 1 & 3/2 & 1/2 & 0 \\ 1 & 4 & 0 & 1 \end{array} \right).$$

**Step 2:**

$$R_2 \rightarrow R_2 - R_1$$
$$\left( \begin{array}{cc|cc} 1 & 3/2 & 1/2 & 0 \\ 0 & 5/2 & -1/2 & 1 \end{array} \right).$$

**Step 3:**

$$R_2 \rightarrow \frac{2}{5}R_2$$

$$\left( \begin{array}{cc|cc} 1 & 3/2 & 1/2 & 0 \\ 0 & 1 & -1/5 & 2/5 \end{array} \right).$$

**Step 4:**

$$R_1 \rightarrow R_1 - \frac{3}{2}R_2$$

$$\left( \begin{array}{cc|cc} 1 & 0 & 4/5 & -3/5 \\ 0 & 1 & -1/5 & 2/5 \end{array} \right).$$

Hence, the inverse of  $A$  is

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