Inverse of a Matrix Using Elementary Transformations

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October 4, 2025

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:

$$[A|I] = \begin{pmatrix} 2 & 3 & 1 & 0 \\ 1 & 4 & 0 & 1 \end{pmatrix}.$$

Step 1:

$$R_1 \to \frac{1}{2}R_1$$

$$\begin{pmatrix} 1 & 3/2 & 1/2 & 0 \\ 1 & 4 & 0 & 1 \end{pmatrix}.$$

Step 2:

$$R_2 \to R_2 - R_1$$

$$\begin{pmatrix} 1 & 3/2 & 1/2 & 0 \\ 0 & 5/2 & -1/2 & 1 \end{pmatrix}.$$

Step 3:

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

$$\begin{pmatrix} 1 & 3/2 & 1/2 & 0 \\ 0 & 1 & -1/5 & 2/5 \end{pmatrix}.$$

Step 4:

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

$$\begin{pmatrix} 1 & 0 & 4/5 & -3/5 \\ 0 & 1 & -1/5 & 2/5 \end{pmatrix}.$$

Hence, the inverse of A is

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