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Question:

The inverse of the matrix $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ is

Solution:

Let

$$\mathbf{A} = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \quad (1)$$

The augmented matrix is

$$(\mathbf{A} \mid \mathbf{I}) \Rightarrow \left(\begin{array}{cc|cc} 1 & 2 & 1 & 0 \\ 3 & 4 & 0 & 1 \end{array} \right) \xrightarrow{R_2 \rightarrow R_2 - 3R_1} \left(\begin{array}{cc|cc} 1 & 2 & 1 & 0 \\ 0 & -2 & -3 & 1 \end{array} \right) \quad (2)$$

$$\xrightarrow{R_1 \rightarrow R_1 + R_2} \left(\begin{array}{cc|cc} 1 & 0 & -2 & 1 \\ 0 & -2 & -3 & 1 \end{array} \right) \quad (3)$$

$$\xrightarrow{R_2 \rightarrow \frac{-1}{2} \times R_2} \left(\begin{array}{cc|cc} 1 & 0 & -2 & 1 \\ 0 & 1 & \frac{3}{2} & \frac{-1}{2} \end{array} \right) \quad (4)$$

As the left block of the Augmented matrix is \mathbf{I} the right block is \mathbf{A}^{-1} .

$$\mathbf{A}^{-1} = \begin{pmatrix} -2 & 1 \\ \frac{3}{2} & \frac{-1}{2} \end{pmatrix} \quad (5)$$