

## Finding the Inverse of a Matrix - Step-by-Step Lesson

### Lesson 1 Matrix Problem:

Find the inverse of the following matrix.

$$\begin{pmatrix} 1 & 0 & 4 \\ 1 & 1 & 6 \\ -3 & 0 & -10 \end{pmatrix}$$



### Explanation:

Step 1) First we will see what is being asked.

$$\left( \begin{array}{ccc|ccc} 1 & 0 & 4 & 1 & 0 & 0 \\ 1 & 1 & 6 & 0 & 1 & 0 \\ -3 & 0 & -10 & 0 & 0 & 1 \end{array} \right) \xrightarrow[\text{R}_3 + 3\text{R}_1]{\text{R}_2 - \text{R}_1} \left( \begin{array}{ccc|ccc} 1 & 0 & 4 & 1 & 0 & 0 \\ 0 & 1 & 2 & -1 & 1 & 0 \\ 0 & 0 & 2 & 3 & 0 & 1 \end{array} \right)$$

Step 2)

$$\text{R}_3 \rightarrow \frac{1}{2} \text{R}_3 \left( \begin{array}{ccc|ccc} 1 & 0 & 4 & 1 & 0 & 0 \\ 0 & 1 & 2 & -1 & 1 & 0 \\ 0 & 0 & 1 & \frac{3}{2} & 0 & \frac{1}{2} \end{array} \right) \xrightarrow[\text{R}_2 - 2\text{R}_3]{\text{R}_1 - 4\text{R}_3} \left( \begin{array}{ccc|ccc} 1 & 0 & 0 & -5 & 0 & -2 \\ 0 & 1 & 0 & -4 & 1 & -1 \\ 0 & 0 & 1 & \frac{3}{2} & 0 & \frac{1}{2} \end{array} \right)$$

Step 3) The inverse matrix is just the right hand side of the final argument matrix.

$$A^{-1} = \begin{pmatrix} -5 & 0 & -2 \\ -4 & 1 & -1 \\ \frac{3}{2} & 0 & \frac{1}{2} \end{pmatrix}$$

