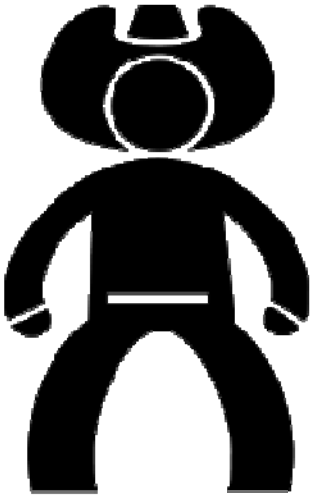
Name _____ Date _____

## Linear Equations as a Matrix Equation - Step-by-Step Lesson

Solve using augmented matrices.

$x + y = -3$

$x = -5$



**Explanation:**

To solve using augmented matrices, follow these three steps:

Step 1: Write the augmented matrix.

Step 2: Use elementary row operations to transform the left part of the augmented matrix into the identity matrix.

Step 3: State the solution.

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Use elementary row operations to transform the left part of the augmented matrix into the identity matrix. Since both equations are in standard form, you can write the numbers in an augmented matrix.

$1x + 1y = -3$

$1x + 0y = -5$ $\longrightarrow$ $\begin{bmatrix} 1 & 1 & -3 \\ 1 & 0 & -5 \end{bmatrix}$

There are three elementary row operations:

Swap any two rows
Multiply any row by a non-zero number
Add a multiple of any row to any other row

Name _____ Date _____

Use these three operations to make the part of the matrix to the left of the dashed line look like the identity matrix:

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

Start with the augmented matrix from step 1.

$$\begin{bmatrix} 1 & 1 & -3 \\ 1 & 0 & -5 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & -3 \\ 0 & -1 & -2 \end{bmatrix}$$ add $^{-}R_1$ to $R_2$

$$\begin{bmatrix} 1 & 1 & -3 \\ 0 & 1 & 2 \end{bmatrix}$$ Multiply $R_2$ to $^{-}1$

$$\begin{bmatrix} 1 & 0 & -5 \\ 0 & 1 & 2 \end{bmatrix}$$ add $^{-}R_2$ to $R_1$

The left part is now the identity matrix, so no more row operation need to be performed.

The solution is the last column of the new matrix.

$$\begin{bmatrix} 1 & 0 & -5 \\ 0 & 1 & 2 \end{bmatrix}$$

The solution is (-5 , 2)