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Linear Equations as a Matrix Equation - Guided Lesson Explanation:

Explanation#1

Before solving, we must write a system of equations. Let x = the cost of a cold drink of coffee shop, and let y = the cost of a cold coffee of coffee shop

5x + 6y = $50
x = $5

Now use augmented matrices to solve the system of equations.

Since both equations are in standard form, you can write the numbers in an augmented matrix.

$$\begin{array}{l} 5x + 6y = \$50 \\ 0x + 1y = \$5 \end{array} \longrightarrow \begin{bmatrix} 5 & 6 & 50 \\ 1 & 0 & 5 \end{bmatrix}$$

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

There are three elementary row operation:

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

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

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

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Start with the augmented matrix from step 1.

$$\begin{bmatrix} 1 & 0 & 5 \\ 5 & 6 & 50 \end{bmatrix}$$ swap R_1 with R_2

$$\begin{bmatrix} 1 & 0 & 5 \\ 0 & 6 & 25 \end{bmatrix}$$ add $^{-}5R_1$ to R_2

$$\begin{bmatrix} 1 & 0 & 5 \\ 0 & 1 & 25/6 \end{bmatrix}$$ multiply R_2 by 1/6

The solution is (5, 25/6)

Rationale: Check by plugging the solution into the equations.

5(5) + 6(25/6) = 50

25 + 25 = 50 and 5 = 5

Explanation#2

Before solving, we must write a system of equations. Let x = the cost of a cold drink of jacket, and let y = the cost of a pullover of coffee shop.

4x + 7y = \$430
x = \$20

Now use augmented matrices to solve the system of equations.

Since both equations are in standard form, you can write the numbers in an augmented matrix.

4x + 7y = \$430
1x + 0y = \$20

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

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

There are three elementary row operation:

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

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.

$$\begin{bmatrix} 4 & 7 & 430 \\ 1 & 0 & 20 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 0 & 20 \\ 4 & 7 & 430 \end{bmatrix}$$ swap R_1 with R_2

$$\begin{bmatrix} 1 & 0 & 20 \\ 0 & 7 & 350 \end{bmatrix}$$ add $^-4R_1$ to R_2

$$\begin{bmatrix} 1 & 0 & 20 \\ 0 & 1 & 50 \end{bmatrix}$$ multiply R_2 to 1/7

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.

$$\begin{bmatrix} 1 & 0 & 20 \\ 0 & 1 & 50 \end{bmatrix}$$

The solution is (20, 50)

Explanation#3

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

Use augmented matrices to solve the system of equations:

x + y = -2

x = -1

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Since both equations are in standard form, you can write the numbers in an augmented matrix.

1x + 1y = -2 $\longrightarrow$ $\begin{bmatrix} 1 & 1 & -2 \\ 1 & 0 & -1 \end{bmatrix}$

1x + 0y = -1

We have use elementary row operations to transform the left part of the augmented matrix into the identity matrix.

There are three elementary row operation:

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

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

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

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

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

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

The solution is (-1, -1)