ALGEBRA II ACTIVITY 10: SOLVING SYSTEMS USING MATRICES—THE LONG WAY AND THE SHORT WAY

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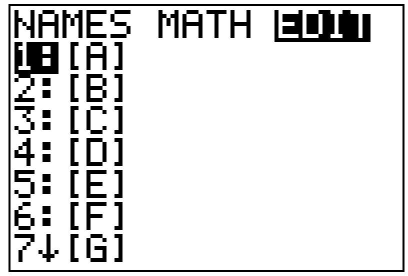
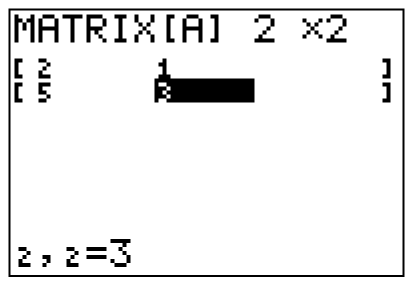
ACTIVITY OVERVIEW:
In this activity we will
- Enter coefficients and constants from a system of equations into matrices
- Use row operations to solve the system using the row reduction method
- Use an inverse matrix to solve the system quickly



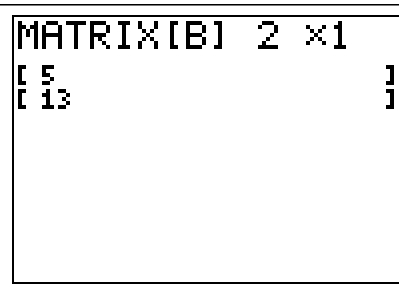
Consider the system of equations:
$2x + y = 5$
$5x + 3y = 13$

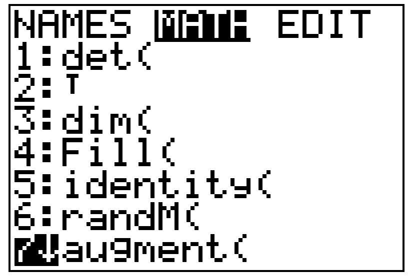
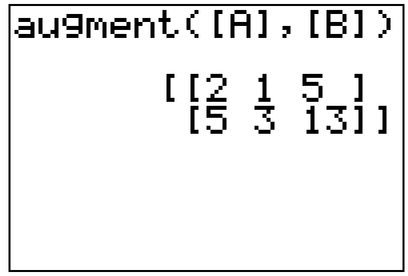
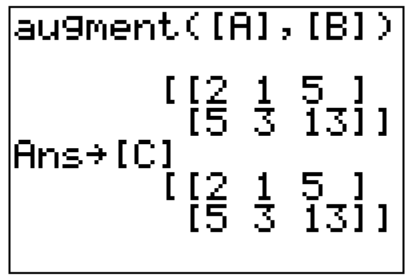
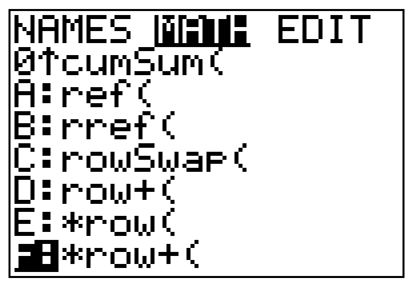
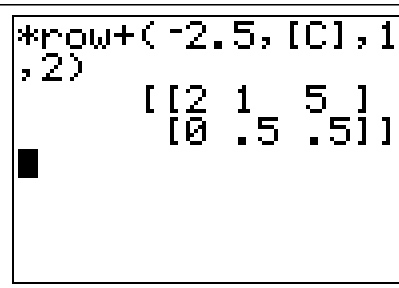
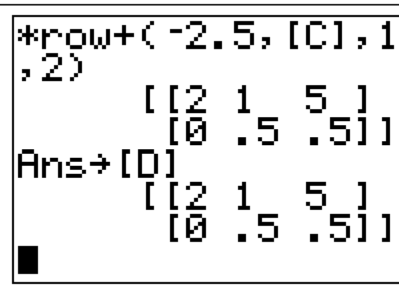
Since the equations are in standard form the coefficients can be entered into a matrix. Press [2nd][x^{-1}] to access the **MATRIX** menu. Right arrow to **EDIT** and select **2: [A]**. Define Matrix A as a 2 row by 2 column matrix by typing over the dimensions in the top line. Press [ENTER] to see this screen.

Type in the coefficients of *x* in the first column and *y* in the second column as shown.



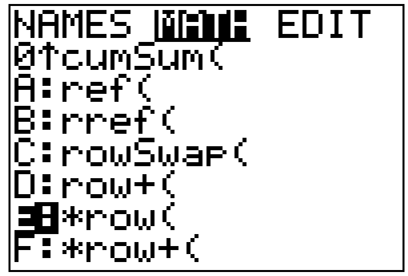
Next enter the constants into Matrix B. Press [2nd][x^{-1}] to access the **MATRIX** menu. Right arrow to **EDIT** and select **2: [B]**. Enter the dimensions and the constants as shown.



Matrices A and B will be used later in the activity. To use the row reduction method, augment matrices A and B into Matrix C. Press [2nd][MODE] to return to the home screen. Press [2nd][x^{-1}] to access the **MATRIX** menu. Right arrow to **MATH** and select **7: augment(**.	
This will paste the command **augment(** onto the home screen. Press [2nd][x^{-1}] to access the **MATRIX** menu. Select **1:[A]**. Press [2nd][x^{-1}] to access the **MATRIX** menu. Select **2:[B]**. Press [ENTER].	
Store the result in Matrix C. Press [STO▸] [2nd][x^{-1}] and select **3:[C]**. Press [ENTER].	
The next step to solve the system would be to eliminate *x* by multiplying the first equation by -2.5 and adding it to the second equation. This can be done using row operations. Press [2nd][x^{-1}] to access the **MATRIX** menu. Right arrow to **MATH** and select **F: *row+(**. (This command multiplies a row and adds it to another row.)	
Press [(-)][2][.][5][,][2nd][x^{-1}][3][,][1][,][2][)]. This enters the command shown, which means: "multiply by -2.5 Matrix C's first row, and add the result in the second row." Press [ENTER]. This will NOT replace Matrix C.	
Store the result in Matrix D. Press [STO▸] [2nd][x^{-1}] and select **4:[D]**. Press [ENTER].	

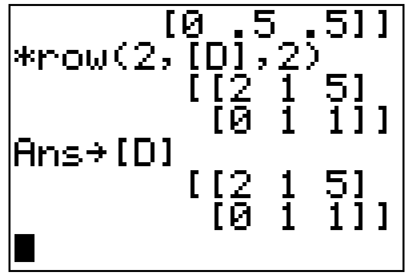
The goal is to get the coefficient of *y* to be 1. To do this requires doubling the second row. Press [2nd][x^{-1}] to access the **MATRIX** menu. Right arrow to **MATH** and select **E: *row(**.

(This command multiplies a row.)



Press [2][,][2nd][x^{-1}][4][,][2][)]. This enters the command as shown at the top of the screen shown. The command means: "multiply by 2 Matrix D's second row." Press [ENTER]. This does NOT replace Matrix D.

Store the result in Matrix D (replace it) by pressing [STO▸][2nd][x^{-1}][4] [ENTER].

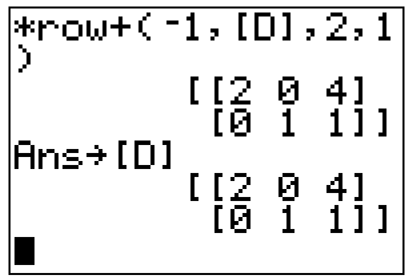


The next step to solve the system would be to eliminate *y* by multiplying the second equation by -1 and adding it to the first equation. This can also be done using row operations.

Press [2nd][x^{-1}] to access the **MATRIX** menu. Right arrow to **MATH** and select **F: *row+(**.

Enter the command as shown, which means: "multiply by -1 Matrix D's second row and add it to the first row."

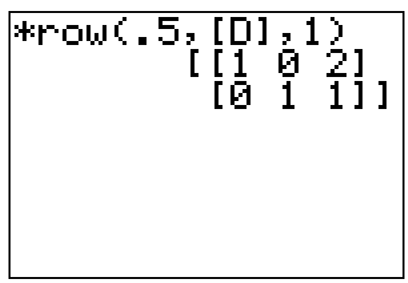
Store the result in Matrix D.



The goal here is to get the coefficient of *x* to be 1. To do this requires halving the first row. Press [2nd][x^{-1}] to access the **MATRIX** menu. Right arrow to **MATH** and select **E: *row(**.

Enter the command as shown, which means: "multiply by 0.5 Matrix D's first row."

The resulting matrix is in reduced row-echelon form. The last column indicates the solution to the system is the coordinate pair (2,1).



Once students understand the row reduction method, they may wish to know the quick method for using matrices to solve systems. Recall that Matrix A contains the coefficients of x and y and Matrix B contains the constants.

Press [2nd][x^{-1}][1] to bring Matrix A to the home screen. Press [x^{-1}] to instruct the calculator to takes its inverse. Multiply the Matrix B by pressing [×][2nd][x^{-1}][2][ENTER]. The resulting matrix contains the solution.