

Teacher Notes



Activity 3

Solving Systems of Equations: The Method of Elimination

Objective

- ◆ Students will develop an understanding of solving a system of equation using the elimination method.

Applicable TI InterActive! Functions


- ◆ Solve *solve (equation, variable)*
- ◆ Expand *expand (equation)*
- ◆ Define *function_name := function*

Problem

There are several methods that can be used to solve a system of equations. Students will employ the elimination method to solve systems of equations.



Pre-Activity

Solve the system $\begin{matrix} 3x + 4y = -1 \\ 4x - 3y = 7 \end{matrix}$ using the elimination method and verify graphically.

1. Let eq1 be $3x + 4y = -1$ and eq2 be $4x - 3y = 7$.
2. Using paper and pencil, have the students multiply eq1 by 3 and eq2 by 4. Next, have students add the new eq1 and the new eq2. Then have the students solve for x and y .
3. Students should open a new TI InterActive! document. Select Math box  and define eq1: $= 3x + 4y = -1$. In the next math box, define eq2: $= 4x - 3y = 7$.
4. In a math box, multiply eq1 by 3. In the next math box, expand the result by typing **expand (3*eq1)**. (Select **Math►Algebra►Expand**.) Expand will distribute the 3 over $3x + 4y$.
5. In a math box, multiply eq2 by 4 and then expand the result. Expand will distribute the 4 over $4x - 3y$.
6. In a math box, define eq3: $= 3 * eq1 + 4 * eq2$.
7. In a math box, solve eq3 for x by typing **solve (eq3,x)**.

8. In the next math box, define x as this answer.
9. In the next math box, solve eq1 for y by typing **solve (eq1,y)**.

This activity has students solve systems of equations that can't be verified graphically in the xy plane. Solutions to the systems of equations in the student activity can be verified using matrices. To solve the system in the pre-activity using matrices :

1. On the Math Palette, select Matrix .
2. On the Math Palette, choose a 2x2 matrix.
3. Enter the coefficients as shown.
4. Select inverse  and multiply the inverse of the coefficient matrix by a 2x1 matrix of the constants.

$$\begin{bmatrix} 3 & 4 \\ 4 & -3 \end{bmatrix}^{-1} * \begin{bmatrix} -1 \\ 7 \end{bmatrix}$$

Explorations

3. eq4: = eq1 + eq2; $8x + 2y = 26$
4. eq5: = eq1 + 2 * eq3; $y - 9x = -13$
5. eq6: = eq4 - 2 * eq5; $26x = 52$ or eq6: = -0.5 * eq4 + eq5; $-13x = -26$
6. $x = 2$
7. $y = 5$
8. $z = 6$
9. 19
10. 7
11. -16
12. The solution to this system is $\{2, 5, 6\}$. The answers to questions 9 through 11 verify the solution to this system since the left side of each equation has the same value as the corresponding right sides when $x = 2$, $y = 5$, and $z = 6$.

Additional Exercises

1. The process may vary with each student. One process could be:

Process	Solution
$\text{eq4:} = 2 * \text{eq1} - 3 * \text{eq2}; 13y - 4z = -38$	$x: = 7$
$\text{eq5:} = 4 * \text{eq1} - 3 * \text{eq3}; -10y - 11z = -13$	$y: = -2$
$\text{eq6:} = 11 * \text{eq4} - 4 * \text{eq5}; 183y = -366$	$z: = 3$

2. The process may vary with each student. One process could be:

Process	Solution
$\text{eq4:} = -5 * \text{eq1} + \text{eq2}; 33z - 16y = 14$	$x: = -4$
$\text{eq5:} = 3 * \text{eq1} + \text{eq3}; 8y - 6z = 0$	$y: = \frac{1}{2}$
$\text{eq6:} = \text{eq4} + 2 * \text{eq5}; 21z = 14$	$z: = \frac{2}{3}$

3. The process may vary with each student. One process could be:

Process	Solution
$\text{eq4:} = 4 * \text{eq1} - \text{eq2}; 17x + 5y = 13$	$x: = -1$
$\text{eq5:} = 9 * \text{eq1} - \text{eq3}; 41x + 13y = 37$	$y: = 6$
$\text{eq6:} = 13 * \text{eq4} - 5 * \text{eq5}; 16x = -16$	$z: = 2$

4. The process may vary with each student. One process could be:

Process	Solution
$\text{eq4:} = \text{eq1} - 3 * \text{eq3}; 17y + 18z = 14$	$x: = 12$
$\text{eq5:} = \text{eq2} + 2 * \text{eq3}; -4y - 4z = -4$	$y: = 4$
$\text{eq6:} = 4 * \text{eq4} + 17 * \text{eq5}; 4z = -12$	$z: = -3$

5. The process may vary with each student. One process could be:

Process

$$\text{eq4:} = \text{eq1} + \text{eq3}; 7x + y = 19$$

$$\text{eq5:} = 4\text{eq1} + \text{eq2}; 26x + 3y = 42$$

$$\text{eq6:} = 3\text{eq4} + \text{eq5}; 5x = -15$$

Solution

$$x: = -3$$

$$y: = 40$$

$$z: = 54$$

6. The process may vary with each student. One process could be:

Process

$$\text{eq4:} = \text{eq1} - 3\text{eq2}; 8y - x = -7$$

$$\text{eq5:} = 6\text{eq1} + \text{eq3}; 15x - 16y = 42$$

$$\text{eq6:} = 15\text{eq4} + \text{eq5}; 104x = -65$$

Solution

$$x: = 2$$

$$y: = -\frac{5}{8}$$

$$z: = -\frac{7}{8}$$