Teacher Notes

Activity 4

Solving Systems of Equations: The Method of Substitution

Objective

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

Applicable TI InterActive! Functions

- Solve — solve(*equation, variable*)
- Define — *function_name* := *function*

Problem

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

Pre-Activity

Solve the system $\begin{matrix} 3x + y = 5 \\ 4x - y = 2 \end{matrix}$ by using the substitution method and verify graphically.

1. Let eq1 be $3x + y = 5$ and eq2 be $4x - y = 2$.

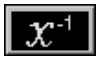
2. Using paper and pencil, have the students solve eq1 for y in terms of x. Then have them substitute this expression in eq2 for y and solve for x. And finally, have students substitute the x-value into eq1 and solve for y.

3. Students should open a new TI InterActive! document, select Math box  and define **eq1: = 3x + y = 5**. In the next math box, define **eq2: = 4x − y = 2**. In the next math box, select **Math▶Algebra▶Solve** and type **eq1,y)** to solve eq1 for y. Have students compare this answer to their written work. Students should define y to be the expression for y.

4. Students should use the **solve** command again to solve eq2 for x. Have them compare this answer to their written answer. In the next math box, students should define x to be the result that they obtained when they solved for x.

5. Using the next math box, students should type **y** to have the value of *y* for the solution to this system of equations. Have the students compare this answer to their written answer.
6. This solution should be the (*x*,*y*) point of intersection in the graph of two lines. Students should type **3x + y** and **4x – y** in math boxes to verify their solutions.

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  and choose a 2x2 matrix.
2. Enter the coefficients as shown below.
3. Select Inverse  from the Math Palette and multiply the inverse of the coefficient matrix by a 2x1 matrix of the constants.

$$\begin{bmatrix} 3 & 1 \\ 4 & -1 \end{bmatrix}^{-1} * \begin{bmatrix} 5 \\ 2 \end{bmatrix}$$

Exploration

3. z: = - 3x+2y+6
4. $y := \frac{11x - 23}{5}$
5. x: = 3
6. y: = 2
7. z: = 1
8. 6
9. 5
10. 9
11. The solution to this system is {3, 2, 1}. The answers to questions 8-10 verify the solution to this system since the left side of each equation has the same value as the corresponding right sides when $x = 3$, $y = 2$, and $z = 1$.

Additional Exercises

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

Process	**Solution**
$z := 2x + 5y + 8$	$x := 4$
$y := \frac{-(7x + 44)}{24}$	$y := -3$
$x := 4$	$z := 1$

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

Process	**Solution**
$x := 2y + 3z - 1$	$x := -2$
$y := \frac{-(11z + 5)}{7}$	$y := 4$
$z := -3$	$z := -3$

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

Process	**Solution**
$y := -3x - 5z - 2$	$x := -1$
$z := \frac{-(x + 1)}{9}$	$y := 1$
$x := -1$	$z := 0$

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

Process	**Solution**
$y := 6z - 5$	$x := 6$
$x := \frac{3(14z - 15)}{4}$	$y := -2$
$z := \frac{1}{2}$	$z := \frac{1}{2}$

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

Process	**Solution**
$z = \frac{x + 2(2y - 5)}{2}$	$x: = \frac{334}{25}$
$y = \frac{5x - 26}{10}$	$y: = \frac{102}{25}$
$x = \frac{334}{25}$	$z: = \frac{246}{25}$

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

Process	**Solution**
$z = -x + y + 12$	$x: = 0$
$y = \frac{-2(2x + 21)}{3}$	$y: = -14$
$x = 0$	$z: = -2$