Name: _____ Date: _____

The Elimination Method (And a Super Fancy Calculator Trick)

Do Now: Two cell phone plans offer differing text packages. The two plans are outlined below:

Plan A: $5.00 per month charge along with a charge of $0.03 per text.

Plan B: No per month charge, but a charge of $0.10 per text.

Is there a certain number of texts, when the two plans cost the same amount? Determine your answer by setting up a system of equations that model the two plans.

Plan A: $y = .03x + 5$

Plan B: $y = .10x$ (x = per text)

$y = .03x + 5$

$y = .10x$

$.10x = .03x + 5$

$-.03x \quad -.03x$

$.07x = 5$

$\frac{.07x}{.07} = \frac{5}{.07}$

$x \approx 71$ 71.4

There is one final way that we will solve systems of equations, but before we discuss that, let's confirm the below system solution algebraically.

***Exercise* #1:** Consider the system shown to the right and its solution (1, 5) ✓

$$4x + 2y = 14$$
$$x - y = -4$$

(a) Show that $x = 1$ and $y = 5$ is a solution to the system of equations.

$4x + 2y = 14$

$4(1) + 2(5) = 14$

$4 + 10 = 14$

$14 = 14$ ✓

$x - y = -4$

$(1) - (5) = -4$

$-4 = -4$ ✓

(b) Find the sum of the two equations. Is the point (1, 5) a solution to this new equation? Justify your yes/no response.

$4x + 2y = 14$

$+ \quad x - y = -4$

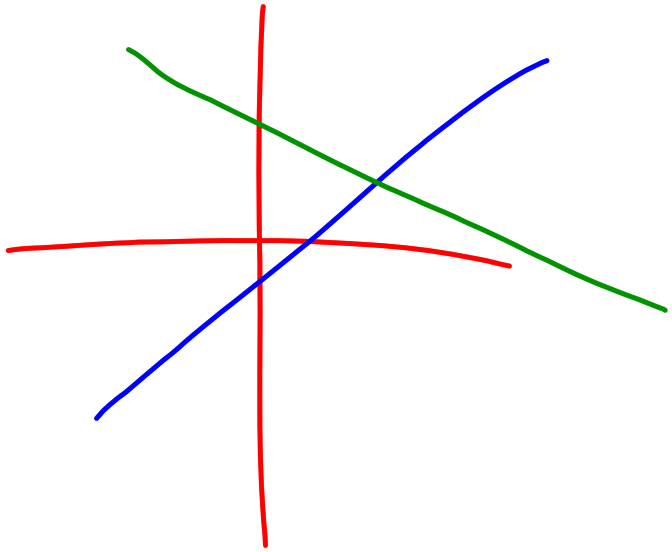
$5x + y = 10$

$5x + y = 10$

$5(1) + 5 = 10$

$5 + 5 = 10$

$10 = 10$ ✓



So, what we see is that a solution to a system of equations remains a solution to that system under a variety of conditions.

SOLUTIONS TO SYSTEMS REMAIN SOLUTIONS IF

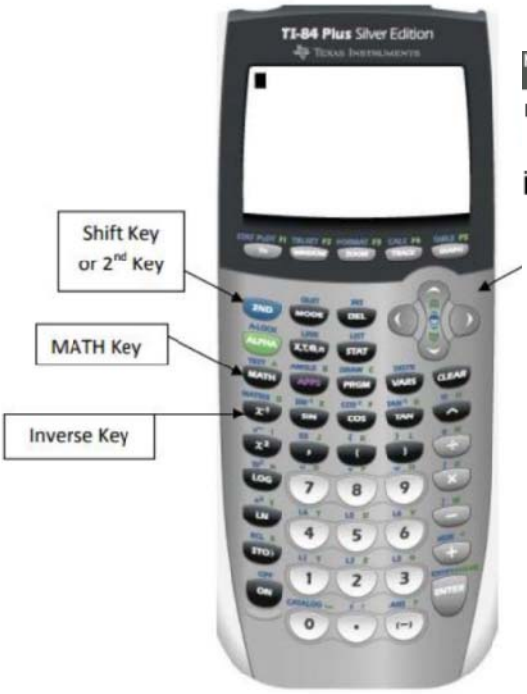
1. Properties of equality are used to rewrite either of the equations.
2. The equations are added or subtracted or any rewrite is added or subtracted.

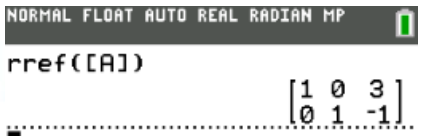
Let's play some more with these ideas, but with a new calculator trick.

***Exercise* #2:** Consider the system shown to the right:

$$4x - 3y = -15$$
$$3x + 2y = 7$$

We are going to use the graphing calculator to find a solution to this system.





$x = 3$

$y = -1$

Step 1: To access the matrix features of your calculator, you need to press the shift key and then the inverse key. This will show the matrix menu of the calculator, which looks like:

*If this feature has been used before, then the dimensions of the matrices entered will appear next to the matrix letter name.

Step 2: Press the right arrow key twice so that EDIT is highlighted.

Step 3: Select a matrix by using the down arrow until the desired matrix is highlighted. (Here we will use matrix [A], so we do not need to use the arrows). Press ENTER to edit the matrix.

Step 4: Enter the number of rows of your matrix, then press ENTER. Enter the number of columns of your matrix, then press ENTER. Here we are using a 2 X 3 Matrix. These are the dimensions of the matrix.

Step 5: When the matrix values are entered, they are entered by rows. Enter the values in (making sure that the x and y values are lined up in your system. THIS IS VERY IMPORTANT.

Step 6: Now that the matrix is entered into the calculator, the reduced row-echelon form of our matrix is needed. To have the calculator complete this operation, use the matrix menu by pressing shift then the inverse key. Press the right arrow key once until MATH is highlighted. Arrow down until rref(is highlighted. Your screen should look like:

Press ENTER. Your screen should look like:

Now go back into the matrix feature by pressing shift and then the inverse key. Arrow down to highlight your matrix, if necessary, and press ENTER. Now you are back to the main screen. Close the parentheses around your matrix. Your screen should look like:

NOW YOU TRY! Find the x and y values that solve each of the following systems using your graphing calculator.

1.

$$8x - 6y = 30$$

$$9x + 6y = 21$$

x =

y =

2.

$$2x + 4y = 2$$

$$6x + 3y = -3$$

x =

y =

3.

$$3x + 2y = 20$$

$$x - y = -5$$

x =

y =

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HOMEWORK!

1. The point $(4,-2)$ is a solution to the system of equations $\begin{matrix} 2x+y=6 \\ x+5y=-6 \end{matrix}$. Which of the following equations would it *not* be a solution to?

   (1) $3x+6y=0$ (3) $2x+2y=12$

   (2) $2x+10y=-12$ (4) $x-4y=12$

2. Which of the following points is a solution to the system?

   $\begin{matrix} x-2y=-11 \\ 5x+2y=29 \end{matrix}$

   (1) $(4,1)$ (3) $(-3,9)$

   (2) $(5,2)$ (4) $(3,7)$

☺ In the next lesson, we will reinforce solving systems using the **Method of Elimination**. This last question reinforces why and how the method works.

3. Consider the system of equation: $\begin{matrix} x+4y=13 \\ 3x+2y=19 \end{matrix}$

   (a) Multiply both sides of the second equation by -2. What equation results?

   (b) Add the equation from (a) to the first equation. What happens? What can you now solve for?

   (c) Now that you know the value of x, how can you find the value of y? Find it.

   (d) What could you have multiplied both sides of the first equation by to **eliminate** the x instead of the y?