Name: _____ Date: _____

Solving Linear Systems by Elimination
Algebra 1

In the previous lesson, we learned how to algebraically solve a system of equations by substitution. There is another common method for solving linear systems algebraically – **elimination**. This method relies on the two important properties of equality shown below:

PROPERTIES OF EQUALITY

If a, b, c and d are any real numbers then:

1. If $a = b$ and $c = d$ then $a + c = b + d$. Equals added to equals form equals.

2. If $a = b$ then $c \cdot a = c \cdot b$. Equals multiplied by equals form equals.

***Exercise* #1:** Which of the following equations is *not* equivalent to $2x + 3y = 7$?

(1) $4x + 6y = 14$ (3) $-2x - 3y = -7$

(2) $2x + 3y + 3 = 10$ (4) $6x + 3y = 14$

***Exercise* #2:** Solve the following system of equations using elimination. Check your answer by using **STORE** on your graphing calculator.

$$3x + 2y = 8$$
$$2x - 2y = 12$$

***Exercise* #3:** Solve the following system of equations using elimination. Check your answer by using **STORE** on your graphing calculator.

$$x + y = 6$$
$$-x + y = 8$$

In *Exercises* #2 and #3, the elimination occurred by simply adding the two equations together because one term in the second equation was the **additive inverse** of a term in the first equation. When this isn't the case, manipulation of the equations must happen using the multiplication property of equality.

Exercise #3: Consider the system given to the right:

$$\begin{aligned} -2x + 3y &= -6 \\ x + y &= 8 \end{aligned}$$

(a) Write all numbers you could multiply the second equation by in order to produce an **additive inverse** with a term in the first equation.

(b) Write an equation equivalent to the second equation by multiplying it by one of the choices from part (a).

(c) Solve the system of equations now by adding the equation you wrote in part (b) to the first equation. Check your answers in the **original system** by using **STORE** on your calculator.

Exercise #4: Solve and check the following system of equations. Check your answers using **STORE**.

$$\begin{aligned} 9d + 6e &= 18 \\ 5d - 3e &= -28 \end{aligned}$$

Sometimes we will need to multiply *each* equation by a different constant in order to produce additive inverses for one of the variables.

Exercise #5: Solve each system below by elimination. Check your answers using **STORE**.

(a) $\begin{aligned} 3x + 4y &= 2 \\ 2x + 7y &= -3 \end{aligned}$

(b) $\begin{aligned} 5a - 2b &= -7 \\ 3a + 5b &= -29 \end{aligned}$

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Solving Linear Systems by Elimination
Algebra 1 Homework

Skills

1. Which of the following is a solution to the system of equations given to the right?

$$x - 4y = 16$$
$$-x + y = -1$$

(1) $(4, -3)$ (3) $(-4, -5)$

(2) $(2, 1)$ (4) $(-6, -3)$

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2. Which is the *x*-coordinate for the solution of the system of equations shown to the right?

$$3x + 2y = 6$$
$$x + 2y = -2$$

(1) 1 (3) –3

(2) 2 (4) 4

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3. If the lines whose equations are given to the right were graphed, which of the following would represent their intersection point?

$$3x + 2y = 4$$
$$3x - y = -20$$

(1) $(2, -1)$ (3) $(-4, 8)$

(2) $(2, -5)$ (4) $(-4, -8)$

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For problems 4 and 5, solve each system of equations using elimination. Check your answers in the original system by using **STORE** on your calculator.

4. $2x - y = 3$
$x + y = 3$

5. $-x - 6y = -28$
$x - 2y = -4$

For problems 6 through 9, solve each system of equations using elimination. Check your answers in the original system by using **STORE** on your calculator.

6. $4x - 3y = 11$
$5x + y = 9$

7. $2c + 5d = 18$
$3c - d = -7$

8. $5a - 2b = 20$
$2a + 3b = 27$

9. $3x + 5y = 7$
$2x + 4y = 6$

Reasoning

10. Bane believes that the following system of equations has no solution. Is Bane correct? Justify using the Elimination Method.

$$2x - 3y = 7$$
$$-2x + 3y = 5$$