Name: _____ Date: _____

SOLVING SYSTEMS BY ELIMINATION
N-GEN MATH® 8

We've now seen how to solve systems of equations **graphically** and by **substitution**. Sometimes systems occur where all of the variables are on the same side of the equation. In this case, a method known as **elimination** is often the easiest way to solve them.

***Exercise* #1:** Two numbers, x and y, have the property that their sum is 21 and their positive difference is 9. Let x be the larger number.

(a) Model this situation with a system of equations.

(b) Show that $x = 15$ and $y = 6$ is a solution to this system.

To solve the system in *Exercise* #1(a) graphically or by substitution is possible, but it would take rearranging one or both of the equations into different forms. But we can use another **property of equality** to make solving this system easy.

ADDITION PROPERTY OF EQUALITY

Equals added to equals are equal. In equation form, if $a = b$ and $c = d$ are both true equations then $a + c = b + d$ will also be a true equation.

Before we use the **addition property of equality** let's review combining like terms.

***Exercise* #2:** Simplify each expression below by combining like terms.

(a) $4x + 3y + 2x + 7y$ (b) $x + 4y + 3x - y$ (c) $5x + 3y - x - 3y$

***Exercise* #3:** Consider the system shown below (look familiar?).

$$x + y = 21$$
$$x - y = 9$$

(a) Use the addition property of equality to add these two equations together. Simplify the left-hand side.

(b) Solve the resulting equation in (a) for x.

(c) Use your value of x, to find the value of y.

These types of equations can be very easy to solve using elimination when there is a variable whose **additive opposites** show up in the two equations.

***Exercise* #4:** Consider the system shown to the right.

$$2x + 3y = 16$$
$$5x - 3y = 19$$

(a) When added together, which variable will be eliminated? Why?

(b) Solve the system by adding the equations and eliminating one of the two variables.

Of course, if opposites are not present in our system it becomes more difficult. But we can always use the **multiplication property of equality** to produce those opposites.

***Exercise* #5:** Consider the system shown to the right.

$$2x + y = 20$$
$$3x - 2y = -12$$

(a) What could we multiply both sides of the first equation by in order to produce an opposite pair? What would this new equation become? Show.

(b) Use the equation in (a) along with the second equation as a new system. Solve by elimination.

(c) Show that this solution is a solution to the original system.

***Exercise* #6:** Solve the system of equations below using elimination.

$$-3x + 5y = -14$$
$$x + 6y = 20$$

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SOLVING SYSTEMS BY ELIMINATION
N-GEN MATH® 8 HOMEWORK

FLUENCY

1. Consider the system shown to the right. Answer the following questions.

$$2x + 5y = 13$$
$$3x - 5y = 7$$

(a) Show that the values $x = 4$ and $y = 1$ are the solution to the system by substituting into both equations and showing they are true.

(b) Add these equations together to eliminate *y*. Then finish solving the system.

2. In each of the systems below, the two equations contain **additive opposites**. Add the equations together to eliminate that variable. Then finish solving the systems.

(a) $x + y = 22$
$x - y = 4$

(b) $x + 4y = 28$
$-x + y = 12$

(c) $5x - 2y = 46$
$-2x + 2y = -16$

(d) $3x - 4y = 30$
$-3x + 2y = -24$

3. Solve each system by first multiplying one of the two equations by an integer to produce additive opposite pairs.

(a) $3x + y = 27$

$2x - 2y = 10$

(b) $-4x + 3y = 26$

$x + 2y = -1$

(c) $2m + 5n = 42$

$m + 2n = 19$

(d) $4a + 5b = 3$

$-2a - b = 3$

4. Consider the system shown to the right.

$4g - h = 24$

$-2g + 3h = -2$

(a) Solve the system by first multiplying both sides of the first equation by 3.

(b) Solve the system by first multiplying both sides of the second equation by 2.