Guided Practice 2.2.1

Example 1

Solve the following system by substitution.

$$\begin{cases} x + y = 2 \\ x - y = 0 \end{cases}$$

1. Solve one of the equations for one of the variables in terms of the other variable.

   It doesn't matter which equation you choose, nor does it matter which variable you solve for.

   Let's solve $x + y = 2$ for the variable y.

   Isolate y by subtracting x from both sides.

   $$\begin{array}{r} x + y = 2 \\ \underline{-x \qquad\quad -x} \\ y = 2 - x \end{array}$$

   Now we know that y is equal to $2 - x$.

2. Substitute, or replace $2 - x$ into the other equation, $x - y = 0$.

   It helps to place parentheses around the expression you are substituting.

$x - y = 0$	Second equation of the system
$x - (2 - x) = 0$	Substitute $(2 - x)$ for y.

3. Solve the equation for the second variable.

$x-(2-x)=0$	
$x-2+x=0$	Distribute the negative over $(2-x)$.
$2x-2=0$	Simplify.
$2x=2$	Add 2 to both sides.
$x=1$	Divide both sides by 2.

4. Substitute the found value, $(x=1)$, into either of the original equations to find the value of the other variable.

$x+y=2$	First equation of the system
$(1)+y=2$	Substitute 1 for x.
$1+y=2$	Simplify.
$y=1$	Subtract 1 from both sides.

The solution to the system of equations is (1, 1).
If graphed, the lines would cross at (1, 1).

Example 2

Solve the following system by elimination.

$$\begin{cases} 2x-3y=-11 \\ x+3y=11 \end{cases}$$

1. Add the two equations if the coefficients of one of the variables are opposites of each other.

   $3y$ and $-3y$ are opposites, so the equations can be added.

   Add downward, combining like terms only.

   $$\begin{array}{r} 2x-3y=-11 \\ \underline{x\ +3y=\ \ \ 11} \\ 3x+0\ =\ \ \ \ 0 \end{array}$$

   Simplify.

   $3x = 0$

2. Solve the equation for the second variable.

   $3x = 0$

   $x = 0$ Divide both sides by 3.

3. Substitute the found value, $x = 0$, into either of the original equations to find the value of the other variable.

   $2x - 3y = -11$ First equation of the system

   $2(0) - 3y = -11$ Substitute 0 for x.

   $-3y = -11$ Simplify.

   $y = \dfrac{11}{3}$ Divide both sides by –3.

4. The solution to the system of equations is $\left(0, \frac{11}{3}\right)$.

   If graphed, the lines would cross at $\left(0, \frac{11}{3}\right)$.

Example 3

Solve the following system by multiplication.

$$\begin{cases} x - 3y = 5 \\ -2x + 6y = 4 \end{cases}$$

1. Multiply each term of the equation by the same number.

   The variable x has a coefficient of 1 in the first equation and a coefficient of –2 in the second equation.

   Multiply the first equation by 2.

$x - 3y = 5$	Original equation
$2(x - 3y = 5)$	Multiply the equation by 2.
$2x - 6y = 10$	

2. Add or subtract the two equations to eliminate one of the variables.

$$\begin{array}{r} 2x - 6y = 10 \\ +(-2x + 6y = 4) \\ \hline 0 + 0 = 14 \end{array}$$

3. Simplify.

   $0 + 0 = 14$

   $0 = 14$ This is NOT a true statement.

4. The system $\begin{cases} x - 3y = 5 \\ -2x + 6y = 4 \end{cases}$ does not have a solution. There are no points that will make both equations true. ✓