Solving Systems Algebraically

Example 1: Solve the system $\begin{matrix} y = 6x - 11 \\ -2x - 3y = -7 \end{matrix}$ using the substitution method.

$y = 6x - 11$
$-2x - 3y = -7$

The first equation is already solved for the variable *y*. Substitute $6x - 11$ into the second equation for *y*.

$-2x - 3(6x - 11) = -7$
$-2x - 18x + 33 = -7$
$-20x + 33 = -7$
$-20x = -40$
$x = 2$

Simplify the equation and solve for *x*.

$y = 6x - 11$
$y = 6(2) - 11$
$y = 12 - 11$
$y = 1$

Substitute the value you found for *x* into the first equation to solve for *y*.

(2, 1)

Write your answer as an ordered pair.

Example 2: Solve the system $\begin{matrix} -4x - 2y = -12 \\ 4x + 8y = -24 \end{matrix}$ using the elimination method.

$-4x - 2y = -12$
$4x + 8y = -24$

-4*x* and 4*x* are inverses of one another. If you were to add them the sum would be 0.

$-4x - 2y = -12$
$+\ 4x + 8y = -24$
$6y = -36$

Adding the two equations will eliminate the *x* terms and you can solve for *y*.

$\frac{6y}{6} = \frac{-36}{6}$
$y = -6$

Solve for *y*.

$$-4x-2y=-12$$

Substitute your value for *y* into either equation and solve for *x*.

$$-4x-2(-6)=-12$$
$$-4x+12=-12$$
$$-4x+12-12=-12-12$$
$$-4x=-24$$
$$\frac{-4x}{-4}=\frac{-24}{-4}$$
$$x=6$$

$(6,-6)$

Write the solution as an ordered pair.

Example 3: Solve the system $\begin{matrix}3x-2y=2\\5x-5y=10\end{matrix}$ using the elimination method.

$$3x-2y=2$$
$$5x-5y=10$$

There are no additive inverses, so you will need to multiply one or both equations by a number to create an additive inverse.

$$-5(3x-2y)=-5(2)$$
$$2(5x-5y)=2(10)$$

Multiply the first equation by -5 and the second equation by 2.

$$-15x+10y=-10$$
$$10x-10y=20$$

$$\begin{array}{r} -15x+10y=-10\\ +\ 10x-10y=20\\ \hline -5x\qquad\quad =10\end{array}$$

Adding the two equations will eliminate the *y* terms and you can solve for *x*.

$$-5x=10$$
$$\frac{-5x}{-5}=\frac{10}{-5}$$
$$x=-2$$

Solve for *x*.

$$3x-2y=2$$
$$3(-2)-2y=2$$
$$-6-2y=2$$
$$-6+6-2y=2+6$$
$$-2y=8$$
$$\frac{-2y}{-2}=\frac{8}{-2}$$
$$y=-4$$

Substitute your value for *x* into either equation and solve for *y*.

$(-2,-4)$

Write the solution as an ordered pair.