

## Solve More Linear Systems By Elimination

**Starter Problem 1: Solve the linear system with elimination:**

$$-1(4x - 9y) = -21(-1)$$

$$4x = -3y - 9 \rightarrow 4x + 3y = -9$$

$$\begin{array}{r} -4x + 9y = 21 \\ + 4x + 3y = -9 \\ \hline 12y = 12 \\ y = 1 \end{array}$$

$$4x = -3(1) - 9$$

$$4x = -3 - 9$$

$$4x = -12$$

$$x = -3$$

$$\boxed{(-3, 1)}$$

**Starter Problem 2:**

$$5x + 2y = 16$$

$$3x - 4y = 20$$

Would it be possible to use elimination to solve the system above using elimination?

Only if we multiply the top eqn by 2

What would you have to do in order to use elimination? Mult. top eqn by 2

Solve the system:  $2(5x + 2y) = 16 \cdot 2$

$$\begin{array}{r} 10x + 4y = 32 \\ + 3x - 4y = 20 \\ \hline 13x = 52 \\ x = 4 \end{array}$$

$$5(4) + 2y = 16$$

$$20 + 2y = 16$$

$$2y = -4$$

$$y = -2$$

$$\boxed{(4, -2)}$$

**Steps to solve linear systems by ELIMINATION:**

**GOAL – to have either the  $x$  or the  $y$  terms with the same number but opposite signs!**

- 1) Identify the variable to eliminate: Which would be easiest to get to the same number but opposite signs?
- 2) If we need to change the numeric portion, multiply one (or both) equations by the an appropriate numbers – **remember the goal is opposite signs**
- 3) Add the 2 equations together to eliminate one set of variables.
- 4) Solve for the remaining variable.
- 5) Substitute this value into one of the original equations to find the eliminated variable.
- 6) **Check the solution and write as a set of ordered pairs  $(x, y)$ .**

EXAMPLES:

<p>1. <math>2(3x-2y)=3 \cdot 2</math>  <math>-4x+4y=4</math></p> $\begin{array}{r} 6x - 4y = 6 \\ -4x + 4y = 4 \\ \hline 2x = 10 \\ x = 5 \end{array}$ <p><math>-4(5) + 4y = 4</math>  <math>-20 + 4y = 4</math>  <math>4y = 24</math> <math>y = 6</math> <span style="border: 1px solid black; padding: 2px;"><math>(5, 6)</math></span></p>	<p>2. <math>-2(4x-3y)=8(-2)</math>  <math>3(5x-2y)=-11(3)</math></p> $\begin{array}{r} -8x + 6y = -16 \\ 15x - 6y = -33 \\ \hline 7x = -49 \\ x = -7 \end{array}$ <p><math>4(-7) - 3y = 8</math>  <math>-28 - 3y = 8</math>  <math>-3y = 36</math> <math>y = -12</math></p> <span style="border: 1px solid black; padding: 5px; display: inline-block;"><math>(-7, -12)</math></span>
<p>3. <math>-5(7x-6y)=-1(-5)</math>  <math>7(5x-4y)=1(7)</math></p> $\begin{array}{r} -35x + 30y = 5 \\ + 35x - 28y = 7 \\ \hline 2y = 12 \\ y = 6 \end{array}$ <p><math>5x - 4(6) = 1</math>  <math>5x - 24 = 1</math>  <math>5x = 25</math>  <math>x = 5</math></p> <span style="border: 1px solid black; padding: 5px; display: inline-block;"><math>(5, 6)</math></span>	<p>4. <math>-2(x+3y)=8(-2)</math>  <math>2x+6y=10</math></p> $\begin{array}{r} -2x - 6y = -16 \\ + 2x + 6y = 10 \\ \hline 0 = -6 \end{array}$ <p>No Solution</p>
<p>5. <math>2(-x+2y)=5(2)</math>  <math>2x-4y=-10</math></p> <p style="text-align: center; font-size: 1.5em;">Infinite Solutions</p> $\begin{array}{r} -2x + 4y = 10 \\ + 2x - 4y = -10 \\ \hline 0 = 0 \end{array}$ <p style="font-size: 1.5em;">↙ Switch</p>	

Homework – Use ELIMINATION to solve each linear system on a separate sheet of paper!

- 1.)  $10x - 9y = 46$   $(19, 16)$   
 $-2x + 3y = 10$
- 2.)  $2x + 7y = 9$   $(1, 1)$   
 $x + y = 2$
- 3.)  $8x - 5y = 11$   $7x + 3y = -12$   
 $4x - 3y = 5$   $2x + 5y = 38$   
 $(-6, 10)$
- 4.)  $-16x + 2y = -2$   $-9x + 6y = 18$   
 $8x - y = 1$   $6x - 4y = -12$   
 $\emptyset$