

## Using Linear Combinations to Solve a Linear System

**Learning Goal:**

To solve a system of equations algebraically using linear combinations (elimination).

**Solving Systems of Equations**

- 1) Use \_\_\_\_\_ to get an approximate answer or if the lines are easy to graph, i.e. slope-intercept form.
- 2) Use \_\_\_\_\_ if one variable can be easily replaced by its value or an expression that includes the other variable, i.e.  $y =$  or  $x =$ .
- 3) Use \_\_\_\_\_ when it is easy to eliminate a variable by \_\_\_\_\_ or \_\_\_\_\_ the system of equations.

**Solving a System of Equations Using Linear Combinations**

1. \_\_\_\_\_ so common terms (like  $x$  and  $y$ ) line up.
2. \_\_\_\_\_. The coefficients should be equal, but with opposite signs.
  - a. Does one of the variables have the same coefficient in both equations?
  - b. Can you multiply one or both equations by a number so one of the variables will have the same coefficient in both equations? Hint: find the LCM (least common multiple).
3. \_\_\_\_\_ to eliminate one of the variables.
4. \_\_\_\_\_.
5. Plug the solution into one of the equations to \_\_\_\_\_.
6. \_\_\_\_\_ your solution \_\_\_\_\_.

**Solving a System by Adding Equations****Steps:**

- Eliminate  $y$  by adding the system of equations.
- Solve for  $x$ .
- Replace the value of  $x$  in one of the equations to solve for  $y$ .

**Example 1**

$$2x + 5y = 17$$

$$6x - 5y = -9$$

Let's Practice:

$$\begin{array}{r} 2x + 3y = 11 \\ -2x + 9y = 1 \end{array}$$

What if the 2<sup>nd</sup> equation was  $2x - 9y = -1$ ? How would you solve it?

### Solving a System by Multiplying One Equation

#### Steps:

- Stack the equations so common terms line up.
- Multiply the 2<sup>nd</sup> equation by -3 so the coefficients of  $y$  are equal but with opposite signs.
- Eliminate  $y$  by adding the system of equations.
- Solve for  $x$ .
- Replace the value of  $x$  in one of the equations to solve for  $y$ .

#### Example 2

$$\begin{array}{r} 15y = 2x - 32 \\ -7x + 5y = -17 \end{array}$$

Let's Practice:

$$\begin{array}{r} 6x + 3y = -6 \\ -2x + 5y = 14 \end{array}$$

## Solving a System by Multiplying Both Equations

### Steps:

- Multiply the 1<sup>st</sup> equation by 3 and the 2<sup>nd</sup> equation by -2 so the coefficients of the same variable are the equal but with opposite signs.
- Eliminate  $y$  by adding the system of equations.
- Solve for  $x$ .
- Replace the value of  $x$  in one of the equations to solve for  $y$ .

### Example 3

$$3x + 2y = 1$$

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

### Let's Practice:

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

$$3x + 2y = 11$$

*If you ELIMINATE both variables and you are left with a TRUE statement, then the system of equations has INFINITE SOLUTIONS. A FALSE statement means there is NO SOLUTION.*