

## Lesson 3: Solving Systems of Equations by Elimination

At this point in Chapter 4, you have learned how to solve a system of equations using two different methods. The final method you will become familiar with is the elimination method.



*"If equals be added to equals, the wholes are equal."  
- Euclid, c. 300 BCE*

**Exercise #1:** Consider the equation  $4 + 5 = 9$ . Is it true?

Now, multiply the equation by 3. Is the resulting equation true?

The resulting equation is true because the properties of equality always hold true for algebra. Any real number that you choose to multiply the equation by, the equation will always remain true.

**Exercise #2:** Create two equations that are true. Use the blank spaces below to choose numbers you would like to use.

$$\underline{\quad\quad} + \underline{\quad\quad} = \underline{\quad\quad}$$

$$\underline{\quad\quad} + \underline{\quad\quad} = \underline{\quad\quad}$$

Add the equations together. Is the resulting equation true?

The resulting equation is true because, once again, the properties of equality in algebra are preserved. Any two equations that are true, when added together, will result in a true equation.

**Exercise #3:** Let's take a look at a system of linear equations.

$$2x + 3y = 12$$

$$3x - 3y = 3$$

Since we have two variables in each equation, we are unable to solve for an exact value of either variable. In order to solve for one variable, the other variable must be eliminated.

As you saw in Exercise #2, we are able to add equations together and the resulting equation remains true.

Add the given system of equations together. What do you notice about the resulting equation?

Now, solve the equation for  $x$ .

Use the value you found for  $x$ , and substitute it into either original equation to find the value of  $y$ .

**Exercise #4:** Solve each system of equations using the elimination method.

a) 
$$\begin{aligned} 2x + 7y &= 4 \\ -2x - y &= 8 \end{aligned}$$

b) 
$$\begin{aligned} 5x - 3y &= 12 \\ 2x + 3y &= -33 \end{aligned}$$

**Exercise #5:** In this exercise, you will need to eliminate a variable by multiplying one (or both) of the equations by a constant. Remember from Exercise #1, when an equation is multiplied by a constant the resulting equation will always remain true.

Solve the following systems of equations using the elimination method.

a)  $3x + 6y = 24$   
 $4x - 3y = 10$

b)  $-7x + 2y = 54$   
 $5x - 8y = -32$

c)  $9x - 4y = 52$   
 $3x - 4y = 28$

d)  $2x + 3y = 6$   
 $3x + 2y = 4$

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**Lesson 3 Extra Practice**

EP1. Solve the following systems of equations using the elimination method.

a) 
$$\begin{aligned} -6x + 5y &= 1 \\ 6x + 4y &= -10 \end{aligned}$$

b) 
$$\begin{aligned} x - y &= 11 \\ 2x + y &= 19 \end{aligned}$$

c) 
$$\begin{aligned} -2x - 9y &= -25 \\ -4x - 9y &= -23 \end{aligned}$$

d) 
$$\begin{aligned} 5x + y &= 9 \\ 10x - 7y &= -18 \end{aligned}$$

e) 
$$\begin{aligned} 8x + 14y &= 4 \\ -6x - 7y &= -10 \end{aligned}$$

f) 
$$\begin{aligned} 3x - 2y &= 2 \\ 5x - 5y &= 10 \end{aligned}$$

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