

## Module 5: Solving Linear Equations

### Topic 3 Content: Using the Elimination Method to Solve Systems of Linear Equations

#### Introduction



**Today's Lesson**

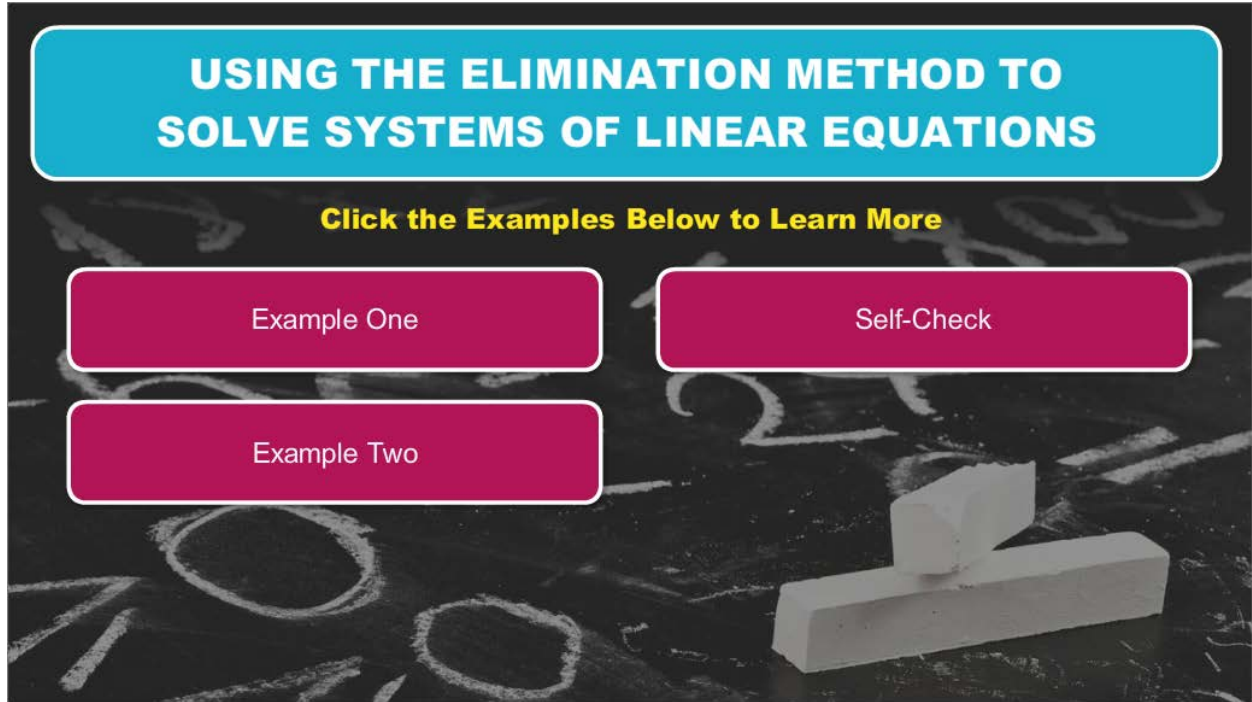
- You will learn how to use the elimination method to solve a system of linear equations.

Hello and welcome! I'm so glad you could join me for this lesson in Algebra I. In this lesson, you will learn how to use the elimination method to solve a system of linear equations.

## Module 5: Solving Linear Equations

### Topic 3 Content: Using the Elimination Method to Solve Systems of Linear Equations

#### Using the Elimination Method to Solve Systems of Linear Equations



**USING THE ELIMINATION METHOD TO SOLVE SYSTEMS OF LINEAR EQUATIONS**

Click the Examples Below to Learn More

Example One

Self-Check

Example Two

Click the examples below to learn more.

- Example One
- Example Two
- Self-Check

## Module 5: Solving Linear Equations

### Topic 3 Content: Using the Elimination Method to Solve Systems of Linear Equations

#### Example 1

Use the elimination method to solve the system of linear equations below.

$$\begin{cases} 3x + y = 4 \\ 2x - y = 21 \end{cases}$$

$$\begin{cases} 3x + y = 4 \\ 2x - y = 21 \end{cases}$$

$$\begin{array}{r} 3x + y = 4 \\ + 2x - y = 21 \\ \hline 5x = 25 \end{array}$$

When using the elimination method to solve a system of linear equations, the goal is to combine the equations in a manner that will eliminate a pair of variables. Like most problems in math, there is more than one way to arrive at the solution. In the case of the elimination method, you can use multiplication, addition, or subtraction to find the solution.

Consider the given system of equations. Notice that the first equation includes a  $y$ -term and the second equation includes a  $-y$ -term. If you add the equations, you will be able to eliminate the  $y$ -terms.

Combine the equations by adding each pair of like terms separately.

$$3x + 2x = 5x$$

$$y + (-y) = 0. \text{ So the } y\text{-terms have been eliminated.}$$

$$4 + 21 = 25$$

## Module 5: Solving Linear Equations

### Topic 3 Content: Using the Elimination Method to Solve Systems of Linear Equations

#### Example 1 (continued)

Use the elimination method to solve the system of linear equations below.

$$\begin{cases} 3x + y = 4 \\ 2x - y = 21 \end{cases}$$

$$5x = 25$$

The resulting equation only consists of one variable,  $x$ .

$$\begin{array}{r} 5x = 25 \\ \hline 5 \quad 5 \end{array}$$

Divide each term by 5 to solve for  $x$ . The solution is  $x = 5$ .

$$x = 5$$

$$x = 5$$

Now that you know the value of  $x$ , substitute it into either equation to find  $y$ .

$$2x - y = 21$$

You can use the second equation, for example. Substitute 5 for  $x$  and solve for  $y$ .

$$2(5) - y = 21$$

$$10 - y = 21$$

$2 \cdot 5 = 10$ . Bring down the subtraction sign and  $y$ , along with the equals sign and 21.

$$10 - y = 21$$

Subtract 10 from each side to begin isolating  $y$ .

$$\begin{array}{r} 10 - y = 21 \\ -10 \quad -10 \\ \hline -y = 11 \end{array}$$

$10 - 10 = 0$ . So these terms are cancelled out. Bring down the subtraction sign,  $y$ , and the equals sign.

$$21 - 10 = 11.$$

## Module 5: Solving Linear Equations

### Topic 3 Content: Using the Elimination Method to Solve Systems of Linear Equations

#### Example 1 (continued)

Use the elimination method to solve the system of linear equations below.

$$\begin{cases} 3x + y = 4 \\ 2x - y = 21 \end{cases}$$

$$\begin{array}{r} -y = 11 \\ \hline -1 \quad -1 \end{array}$$

$$y = -11$$

The last step is to divide term side by  $-1$ . The result is  $y = -11$ .

$$\begin{cases} 3x + y = 4 \\ 2x - y = 21 \end{cases}$$

$$x = 5 \text{ and } y = -11$$

$$(5, -11)$$

The solution to the system of linear equations is  $x = 5$  and  $y = -11$ . You can represent the solution as the ordered pair  $(5, -11)$ .

## Module 5: Solving Linear Equations

### Topic 3 Content: Using the Elimination Method to Solve Systems of Linear Equations

#### Example 2 (continued)

### Example 2

Solve the following system by using the elimination method:  $\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$

$$\begin{array}{r} 6x - 2y = -16 \\ -2(3x - 5y = -4) \\ \hline 6x - 2y = -16 \\ -6x + 10y = 8 \end{array}$$

The goal of the elimination method is to eliminate a pair of  $x$ -terms or a pair of  $y$ -terms. You can use addition, subtraction, or multiplication to achieve this goal.

Solve the system below by using the elimination method.

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

$$6x - 2y = -16$$

$$-2(3x - 5y = -4)$$

$$6x - 2y = -16$$

$$-6x + 10y = 8$$

Remember that the goal of the elimination method is to eliminate a pair of  $x$ -terms or a pair of  $y$ -terms. You can use addition, subtraction, or multiplication to achieve this goal.

Consider the given system of equations. There are no terms that can be eliminated by simply adding the equations. You can, however, eliminate a pair of variables by multiplying one of the equations by a constant term and then adding the equations. For example, multiplying the second equation by  $-2$  and then adding the equations will allow you to eliminate the  $x$ -terms.

The first equation is unchanged. Multiply each term in the second equation by  $-2$ .

$$-2 \cdot 3x = -6x$$

$$-2 \cdot -5y = 10y$$

$$-2 \cdot -4 = 8$$

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### Topic 3 Content: Using the Elimination Method to Solve Systems of Linear Equations

#### Example 2 (continued)

### Example 2

Solve the following system by using the elimination method:  $\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$

$$\begin{array}{r} 6x - 2y = -16 \\ -2(3x - 5y = -4) \\ \hline 6x - 2y = -16 \\ + \quad -6x + 10y = 8 \\ \hline \end{array}$$

After adding the equations the result is...

$12x + 8y = 8$

$8y = -8$

$8y = 24$

Solve the system below by using the elimination method.

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

Now add the equations.

$$6x - 2y = -16$$

$$-2(3x - 5y = -4)$$

$$6x - 2y = -16$$

$$+ \quad -6x + 10y = 8$$

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After adding the equations, the result is...

A)  $12x + 8y = 8$

B)  $8y = -8$

C)  $8y = 24$

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### Topic 3 Content: Using the Elimination Method to Solve Systems of Linear Equations

#### Example 2 (continued)

### Example 2

Solve the following system by using the elimination method:  $\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$

$$\begin{array}{r} 6x - 2y = -16 \\ -2(3x - 5y = -4) \\ \hline 6x - 2y = -16 \\ + \quad -6x + 10y = 8 \\ \hline 8y = -8 \end{array}$$

The resulting equation is  $8y = -8$ .

8y = -8

Next

Solve the system below by using the elimination method.

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

The resulting equation is  $8y = -8$ .

$$6x - 2y = -16$$

$$-2(3x - 5y = -4)$$

$$6x - 2y = -16$$

$$+ \quad -6x + 10y = 8$$

---

$$8y = -8$$



## Module 5: Solving Linear Equations

### Topic 3 Content: Using the Elimination Method to Solve Systems of Linear Equations

#### Example 2 (continued)

**Example 2**

Solve the following system by using the elimination method:  $\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$

$8y = -8$

Now, solve the equation for  $y$ .

$y = -1$       $y = 8$       $y = 1$

Solve the system below by using the elimination method.

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

$$8y = -8$$

Now, solve the resulting equation for  $y$ .

- A)  $y = -1$
- B)  $y = 8$
- C)  $y = 1$

## Module 5: Solving Linear Equations

### Topic 3 Content: Using the Elimination Method to Solve Systems of Linear Equations

#### Example 2 (continued)

**Example 2**

Solve the following system by using the elimination method:  $\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$

$$\frac{8y}{8} = \frac{-8}{8}$$
$$y = -1$$

The resulting equation is  $y = -1$ .

$y = -1$

Solve the system below by using the elimination method.

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

$$\frac{8y}{8} = \frac{-8}{8}$$

The resulting equation is  $y = -1$ .

$$y = -1$$

## Module 5: Solving Linear Equations

### Topic 3 Content: Using the Elimination Method to Solve Systems of Linear Equations

#### Example 2 (continued)

**Example 2**

Solve the following system by using the elimination method:  $\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

$y = -1$ . What is the value of  $x$ ?

$x = 3$         $x = -1$         $x = -3$

Solve the system below by using the elimination method.

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

$$y = -1$$

Now that you know that  $y = -1$ , substitute the value into one of the two original equations and solve for  $x$ .

What is the value of  $x$ ?

- A)  $x = 3$
- B)  $x = -1$
- C)  $x = -3$

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#### Example 2 (continued)

### Example 2

Solve the following system by using the elimination method:  $\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

Substituting  $-1$  for  $y$  in either equation will result in the same solution,  $-3$ .

$x = -3$   
View Work  
Next

Solve the system below by using the elimination method.

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

Substituting  $-1$  for  $y$  in either equation, will result in the same solution,  $-3$ .

## Module 5: Solving Linear Equations

### Topic 3 Content: Using the Elimination Method to Solve Systems of Linear Equations

#### Example 2 (continued)

### Example 2

Solve the following system by using the elimination method:  $\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$

$6x - 2y = -16$	$3x - 5y = -4$
$6x - 2(-1) = -16$	$3x - 5(-1) = -4$
$6x + 2 = -16$	$3x + 5 = -4$
$\begin{array}{r} -2 \quad -2 \\ \hline 6x = -18 \\ \hline 6 \quad 6 \\ \hline x = -3 \end{array}$	$\begin{array}{r} -5 \quad -5 \\ \hline 3x = -9 \\ \hline 3 \quad 3 \\ \hline x = -3 \end{array}$

Next

Solve the system below by using the elimination method.

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

$$6x - 2y = -16$$

$$3x - 5y = -4$$

$$6x - 2(-1) = -16$$

$$3x - 5(-1) = -4$$

$$6x + 2 = -16$$

$$3x + 5 = -4$$

$$\begin{array}{r} 6x + 2 = -16 \\ \hline -2 \quad -2 \\ \hline 6x = -18 \\ \hline 6 \quad 6 \\ \hline x = -3 \end{array}$$

$$\begin{array}{r} 3x + 5 = -4 \\ \hline -5 \quad -5 \\ \hline 3x = -9 \\ \hline 3 \quad 3 \\ \hline x = -3 \end{array}$$

$$x = -3$$

$$x = -3$$

## Module 5: Solving Linear Equations

### Topic 3 Content: Using the Elimination Method to Solve Systems of Linear Equations

#### Example 2 (continued)

### Example 2

Solve the following system by using the elimination method:  $\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

$$x = -3 \quad y = -1$$

Which of the following ordered pairs correctly represents the solution?

$(-3, -3)$

$(-1, -3)$

$(-3, -1)$

Solve the system below by using the elimination method.

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

The solution to the system of linear equations is  $x = -3$  and  $y = -1$ .

$$x = -3 \quad y = -1$$

Which of the following ordered pairs correctly represents the solution?

A)  $(-3, -3)$

B)  $(-1, -3)$

C)  $(-3, -1)$

## Module 5: Solving Linear Equations

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#### Example 2 (continued)

**Example 2**

Solve the following system by using the elimination method:  $\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

$x = -3$        $y = -1$

The ordered pair is in the form  $(x, y)$ . The ordered pair  $(-3, -1)$  correctly represents the solution, because  $x = -3$  and  $y = -1$ .

$(-3, -1)$

Menu

Solve the system below by using the elimination method.

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

$$\begin{cases} 6x - 2y = -16 \\ 3x - 5y = -4 \end{cases}$$

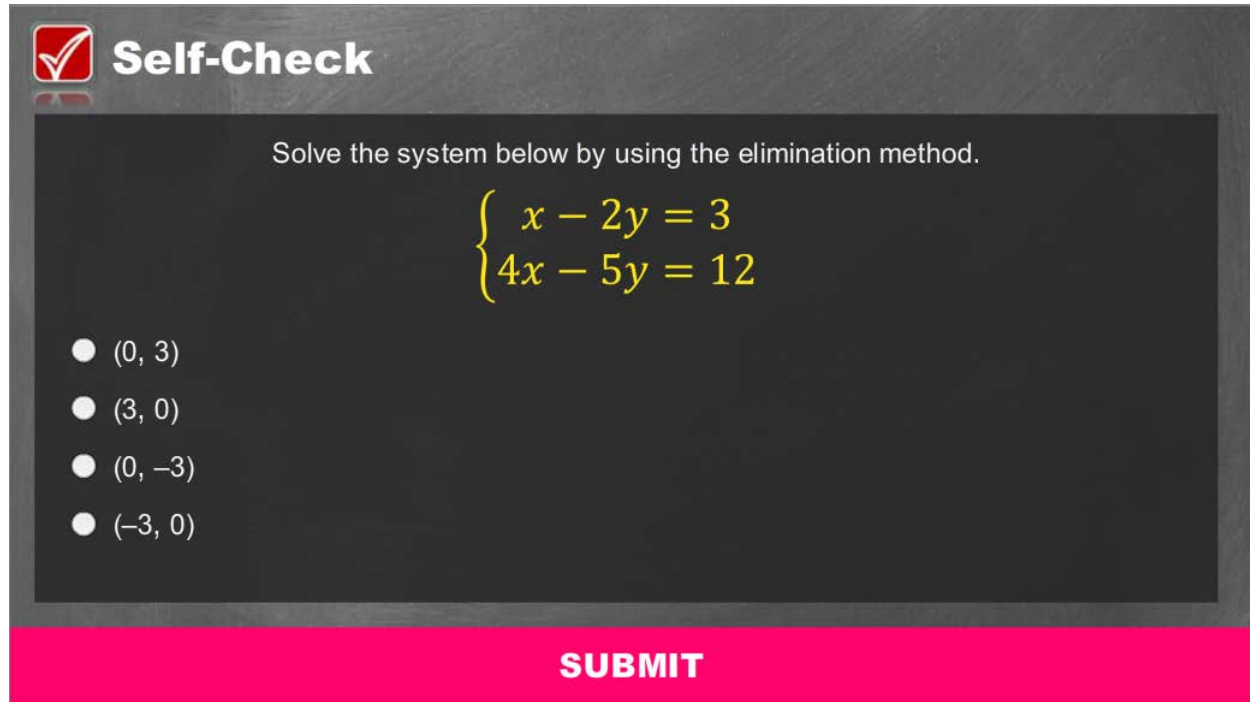
The ordered pair is in the form  $(x, y)$ . The ordered pair  $(-3, -1)$  correctly represents the solution, because  $x = -3$  and  $y = -1$ .

$$x = -3 \quad y = -1$$

## Module 5: Solving Linear Equations

### Topic 3 Content: Using the Elimination Method to Solve Systems of Linear Equations

#### Self-Check



**Self-Check**

Solve the system below by using the elimination method.

$$\begin{cases} x - 2y = 3 \\ 4x - 5y = 12 \end{cases}$$

- (0, 3)
- (3, 0)
- (0, -3)
- (-3, 0)

**SUBMIT**

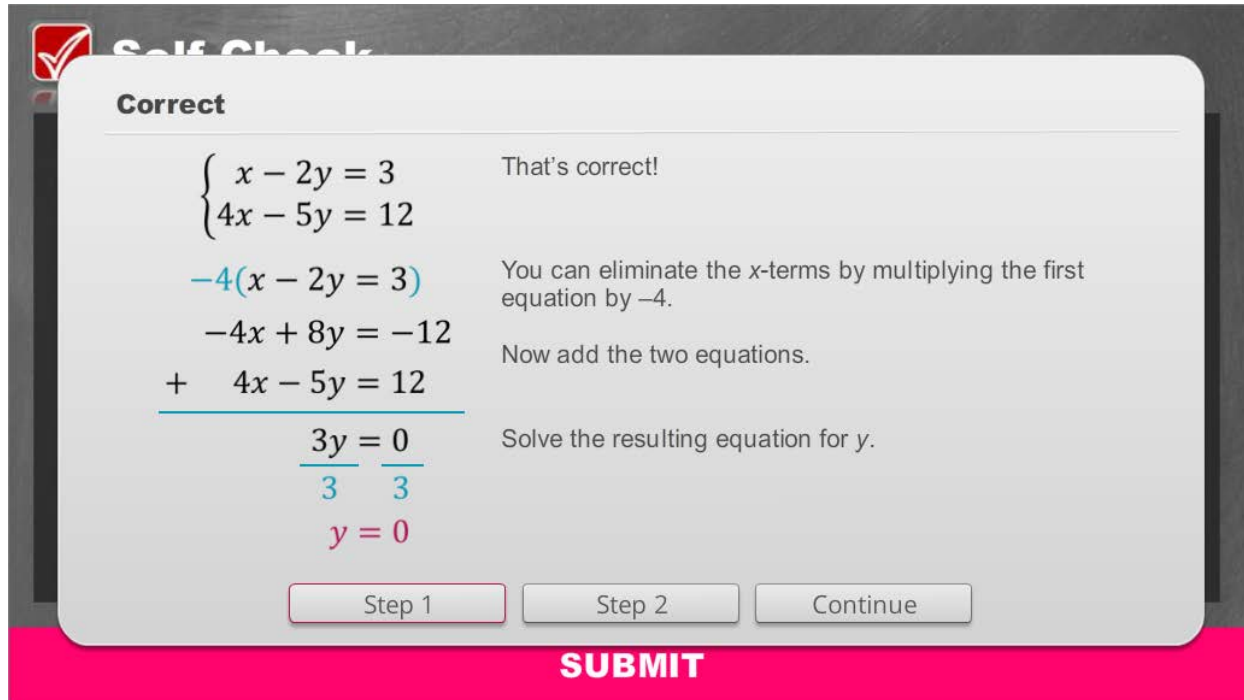
Solve the problem in the image above to check your understanding of the content.



## Module 5: Solving Linear Equations

### Topic 3 Content: Using the Elimination Method to Solve Systems of Linear Equations

#### Self-Check: Answer



**Correct**

$$\begin{cases} x - 2y = 3 \\ 4x - 5y = 12 \end{cases}$$

That's correct!

$$\begin{array}{r} -4(x - 2y = 3) \\ -4x + 8y = -12 \\ + \quad 4x - 5y = 12 \\ \hline \quad \quad 3y = 0 \\ \quad \quad \underline{3} \quad \underline{3} \\ \quad \quad y = 0 \end{array}$$

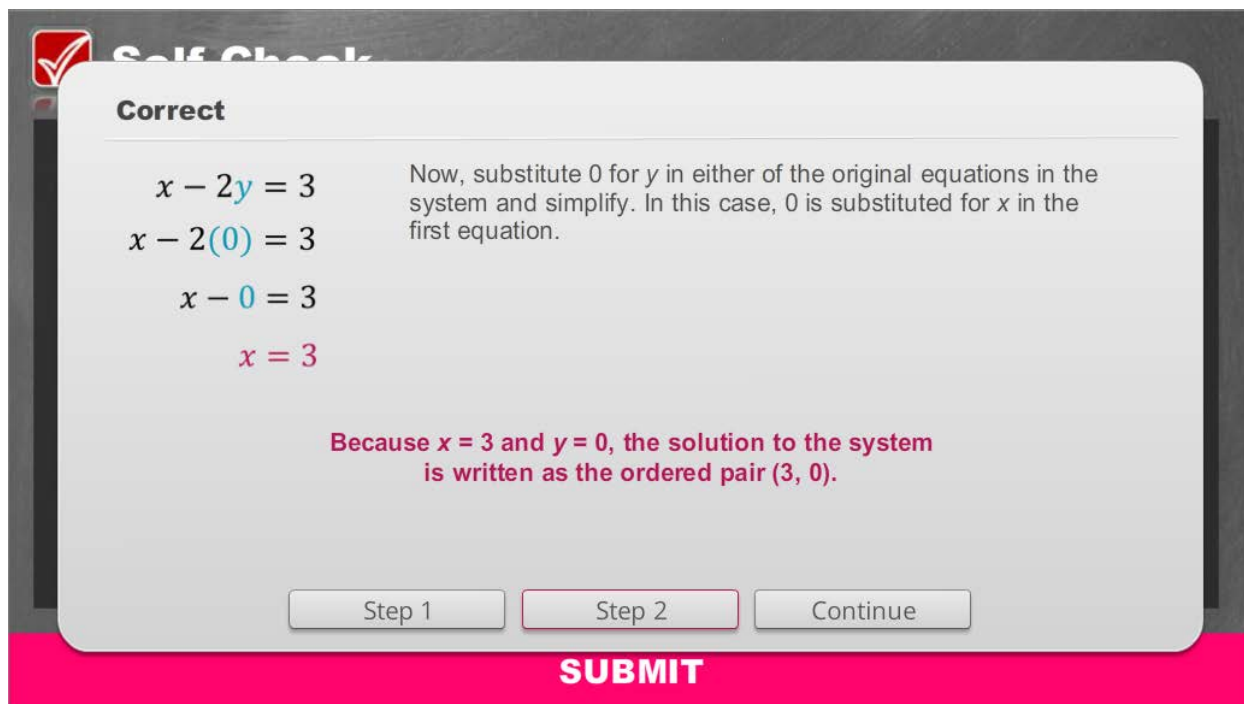
You can eliminate the  $x$ -terms by multiplying the first equation by  $-4$ .

Now add the two equations.

Solve the resulting equation for  $y$ .

Step 1 Step 2 Continue

**SUBMIT**



**Correct**

$$\begin{aligned} x - 2y &= 3 \\ x - 2(0) &= 3 \\ x - 0 &= 3 \\ x &= 3 \end{aligned}$$

Now, substitute 0 for  $y$  in either of the original equations in the system and simplify. In this case, 0 is substituted for  $x$  in the first equation.

Because  $x = 3$  and  $y = 0$ , the solution to the system is written as the ordered pair  $(3, 0)$ .

Step 1 Step 2 Continue

**SUBMIT**

For your reference, the images above shows the correct solution to the self-check problem.

## Module 5: Solving Linear Equations

### Topic 3 Content: Using the Elimination Method to Solve Systems of Linear Equations

#### Conclusion



The image shows a digital interface for a lesson conclusion. On the left, a white sidebar with a pink header titled "Today's Lesson" contains a checkmark and the text "Applied the elimination method to solve a system of linear equations". Below this are two pink buttons: "Exit Lesson" and "Restart Lesson". On the right, a cartoon illustration of a young woman with dark curly hair and a pink top is set against a blue background with faint mathematical symbols.

You have reached the conclusion of this lesson, where you learned how to use the elimination method to solve a system of linear equations.