

# Module 8: Graphing Linear Equations

## Topic 3 Content: Graphing Transformations of the Parent Function

### Introduction



**Today's Lesson**

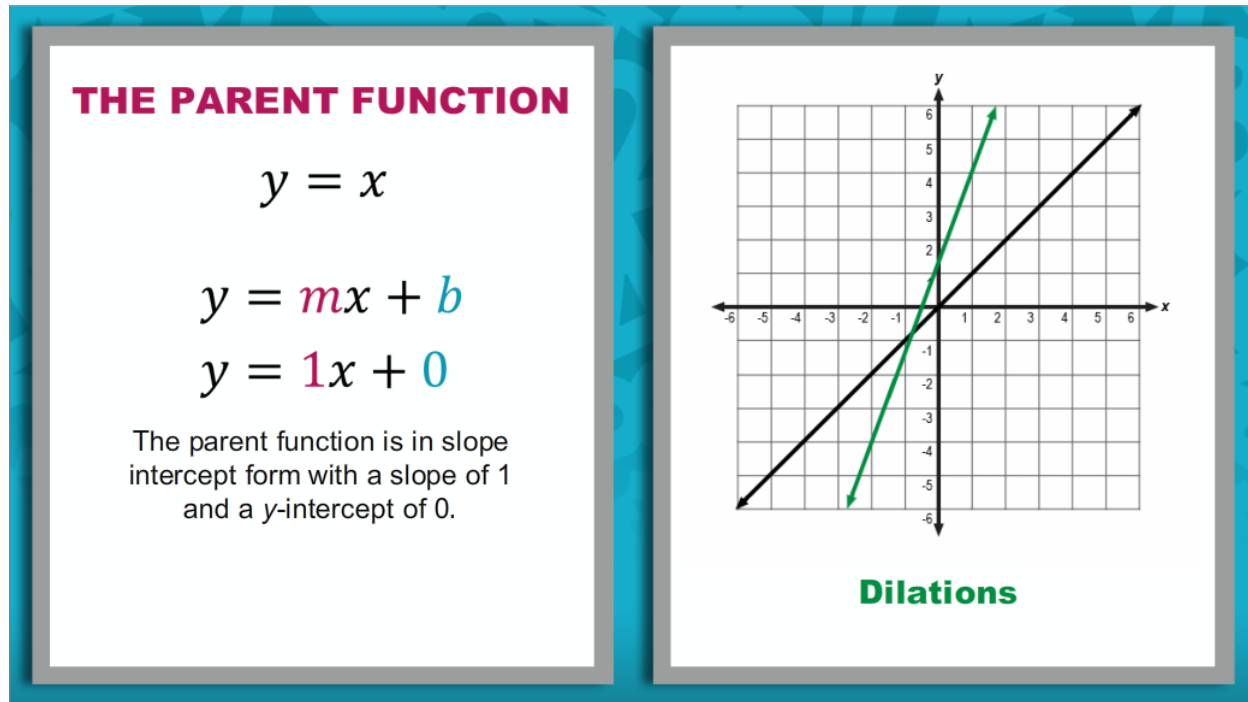
- You will learn how to graph a line by performing transformations to the parent function  $y = x$ .

Hi there! I'm so glad you could join me for this lesson in Algebra I. In this lesson, you will learn how to graph a line by performing transformations to the parent function  $y = x$ .

## Module 8: Graphing Linear Equations

### Topic 3 Content: Graphing Transformations of the Parent Function

#### The Parent Function



Notice that the parent function  $y = x$  is in slope-intercept form; the slope is 1 and the  $y$ -intercept is 0. Other members of the family of graphs of linear functions can be created by transforming the parent function.

The transformations you will explore in this topic are:

- translations;
- reflections;
- and dilations.

**Module 8: Graphing Linear Equations**  
**Topic 3 Content: Graphing Transformations of the Parent Function**

**Graphing Transformations of the Parent Function**

**GRAPHING TRANSFORMATIONS  
OF THE PARENT FUNCTION**

**Click the Examples Below to Learn More**

Translations

Applying Multiple Transformations

Reflections

Self-Check

Dilations

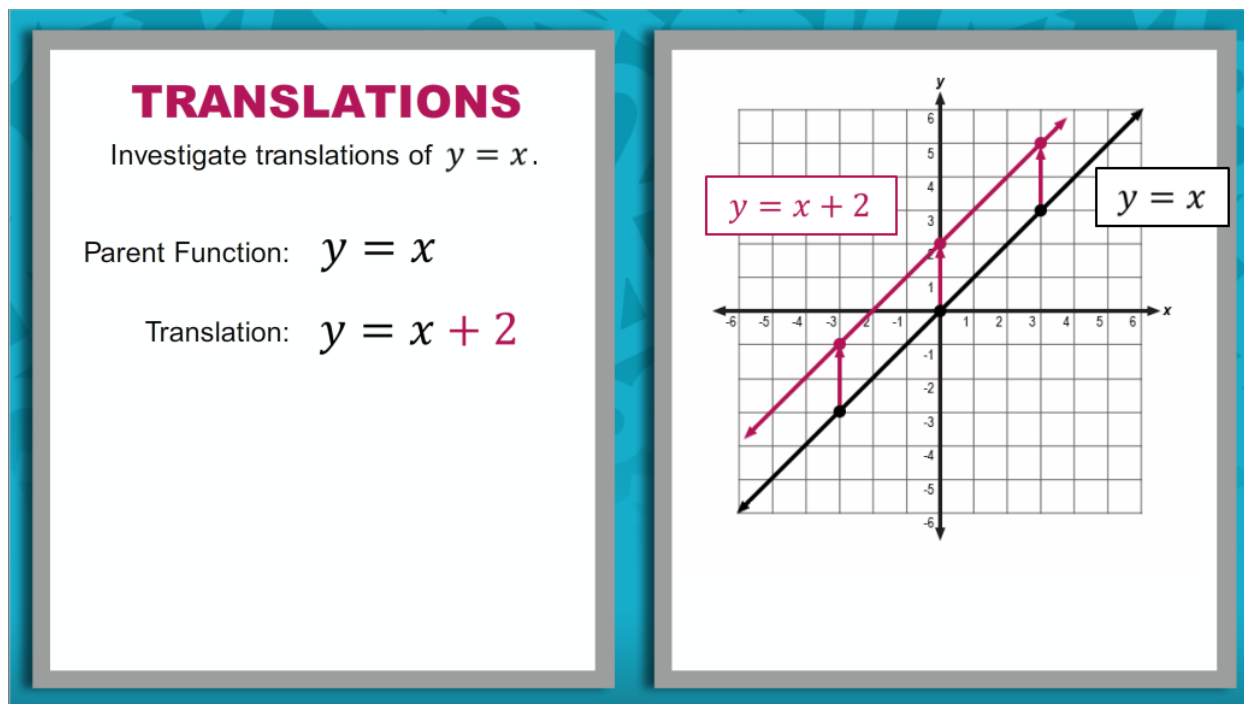
Click the examples below to learn more.

- Translations
- Reflections
- Dilations
- Applying Multiple Transformations
- Self-Check

## Module 8: Graphing Linear Equations

### Topic 3 Content: Graphing Transformations of the Parent Function

#### Example 1: Translations



Investigate translations of  $y = x$ .

Adding a value to the parent function results in the graph of  $y = x$  moving up.

Subtracting a value results in the graph moving down.

Consider the linear equation  $y = x + 2$ .

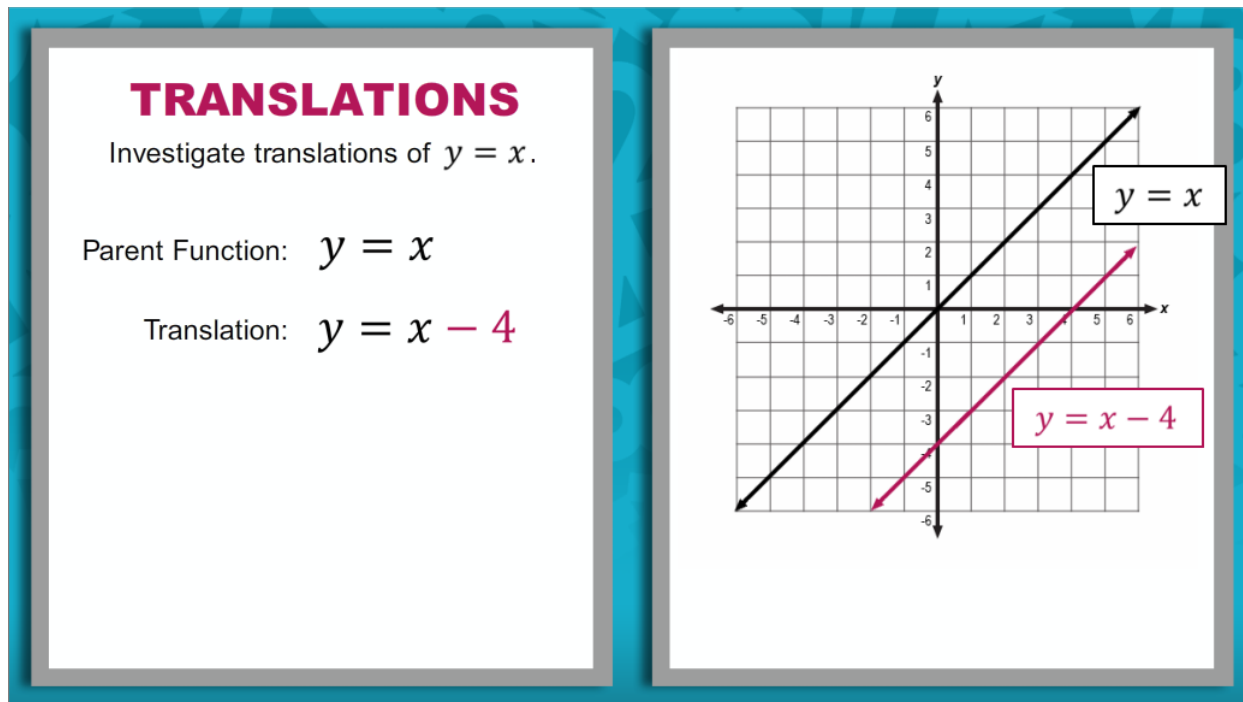
The value, 2, was added to the right side of the equation. As a result, the parent function was shifted two units up.

More specifically, each point on the line  $y = x$  was shifted two units up.

## Module 8: Graphing Linear Equations

### Topic 3 Content: Graphing Transformations of the Parent Function

#### Example 1: Translations (continued)



Investigate translations of  $y = x$ .

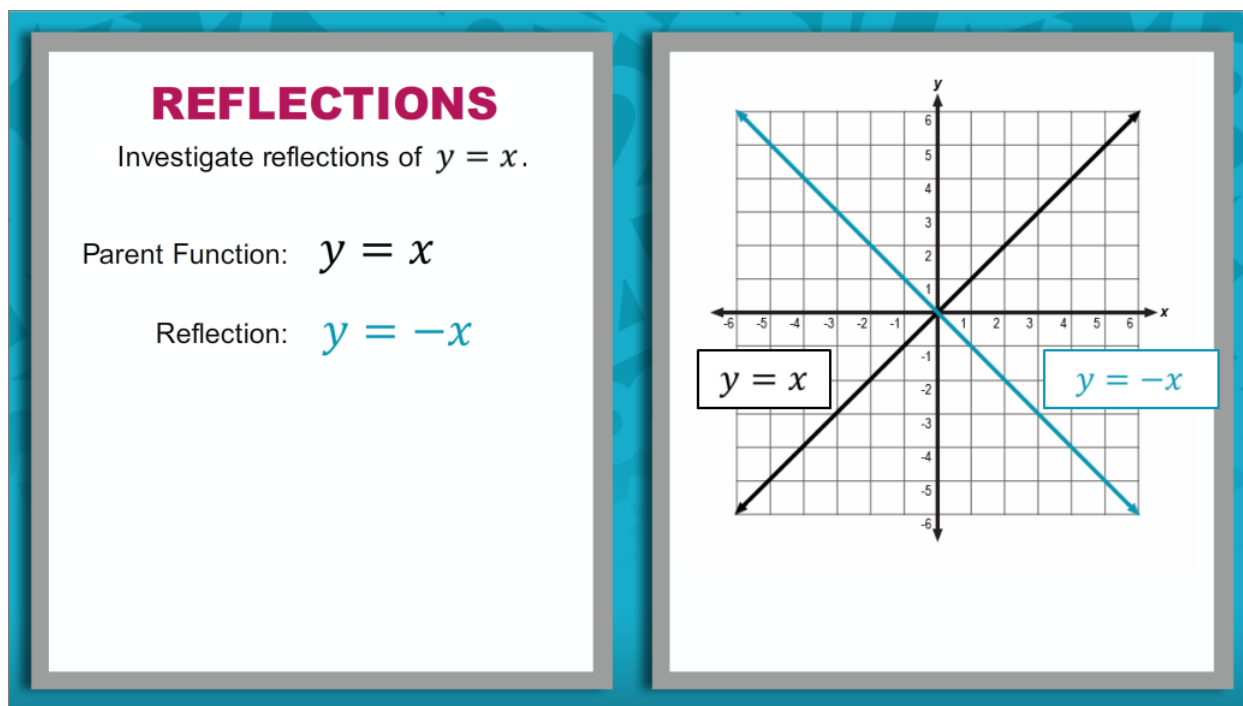
Now consider the linear equation  $y = x - 4$ .

Four was subtracted from the right side of the equation. As a result, the parent function was shifted four units down.

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### Topic 3 Content: Graphing Transformations of the Parent Function

#### Example 2: Reflections



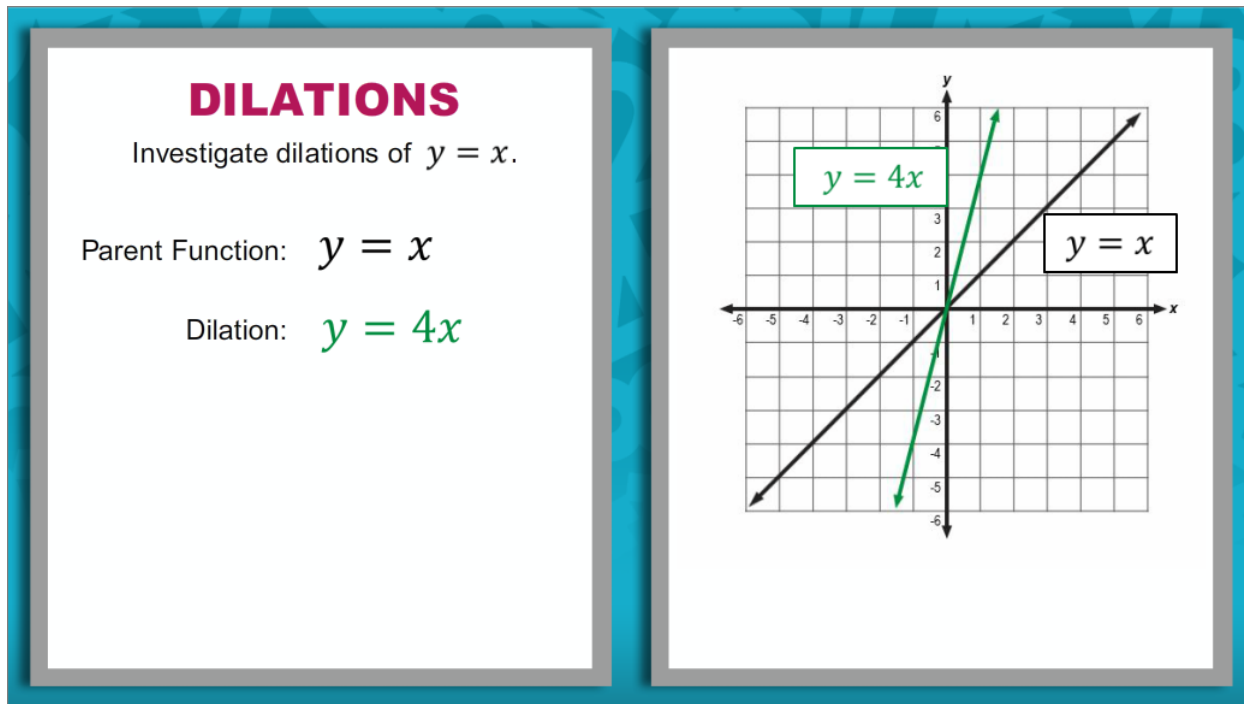
Investigate reflections of  $y = x$ .

Changing the value of the slope of the parent function to a negative value results in the graph of  $y = x$  reflecting over the  $x$ -axis. You can think of it as the graph of  $y = x$  flipped over the  $x$ -axis.

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### Topic 3 Content: Graphing Transformations of the Parent Function

#### Example 3: Dilations



Investigate dilations of  $y = x$ .

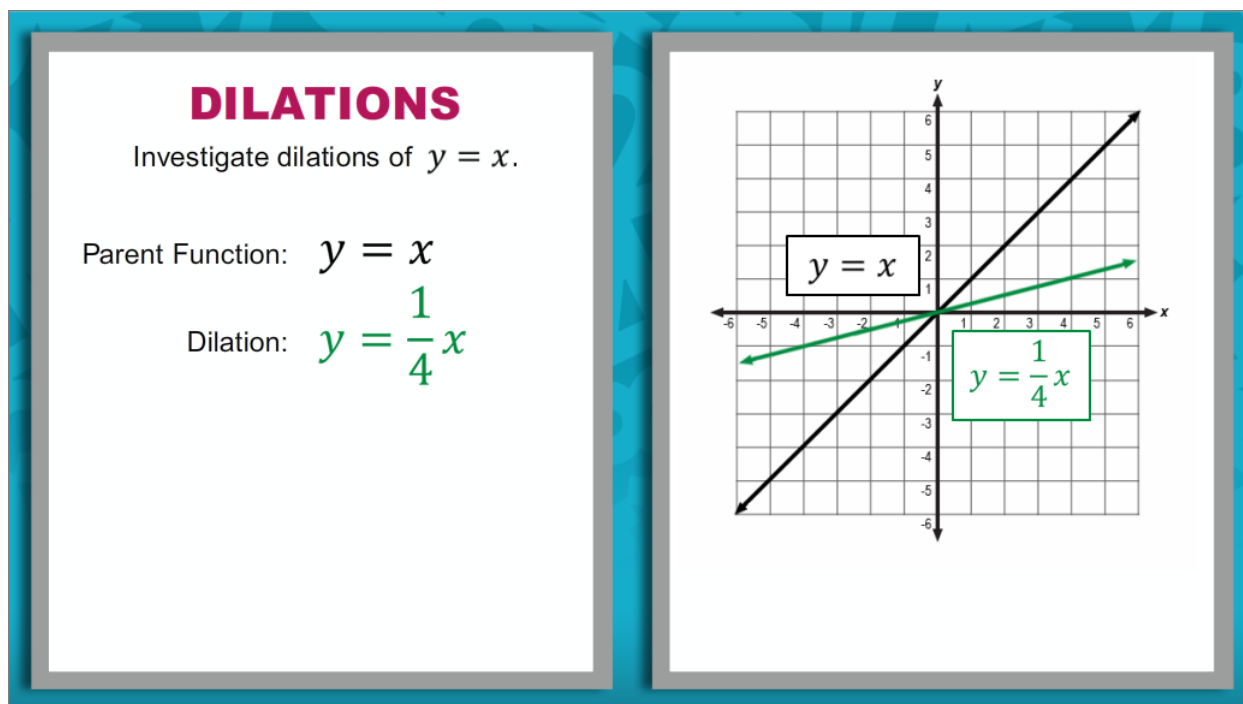
A dilation can be described as a stretch or a compression.

Increasing the value of the slope of the parent function results in the graph of  $y = x$  stretching away from the  $x$ -axis. The line becomes steeper as the value of the slope increases. In this example, the graph of the parent function was stretched by a factor of 4.

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### Topic 3 Content: Graphing Transformations of the Parent Function

#### Example 3: Dilations (continued)



Investigate dilations of  $y = x$ .

Decreasing the slope of the parent function to a positive fractional value, or in other words a value greater than 0 but less than 1, results in a compression of the graph of  $y = x$ . The line becomes less steep as the slope decreases. It moves closer to the  $x$ -axis.

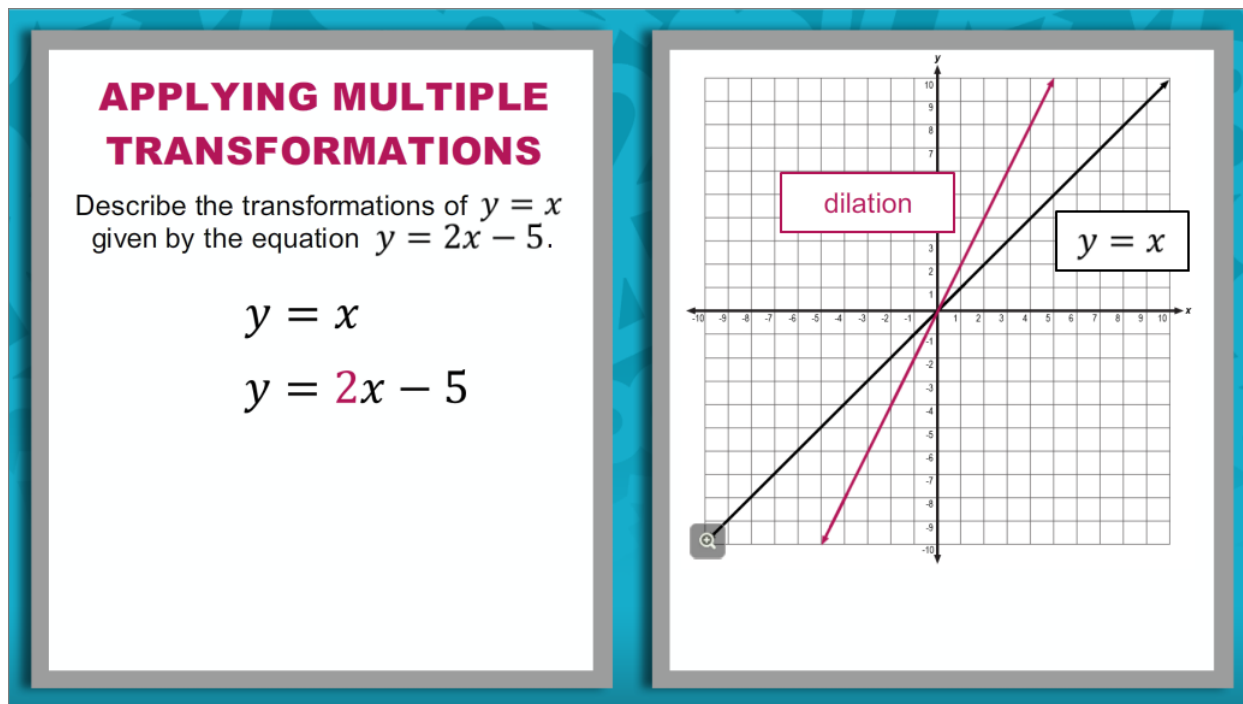
In this example, the graph of the parent function was compressed by a factor of  $\frac{1}{4}$ .



## Module 8: Graphing Linear Equations

### Topic 3 Content: Graphing Transformations of the Parent Function

#### Example 4: Applying Multiple Transformations



Describe the transformations of  $y = x$  given by the equation  $y = 2x - 5$ .

It is possible to apply more than one transformation to the parent function.

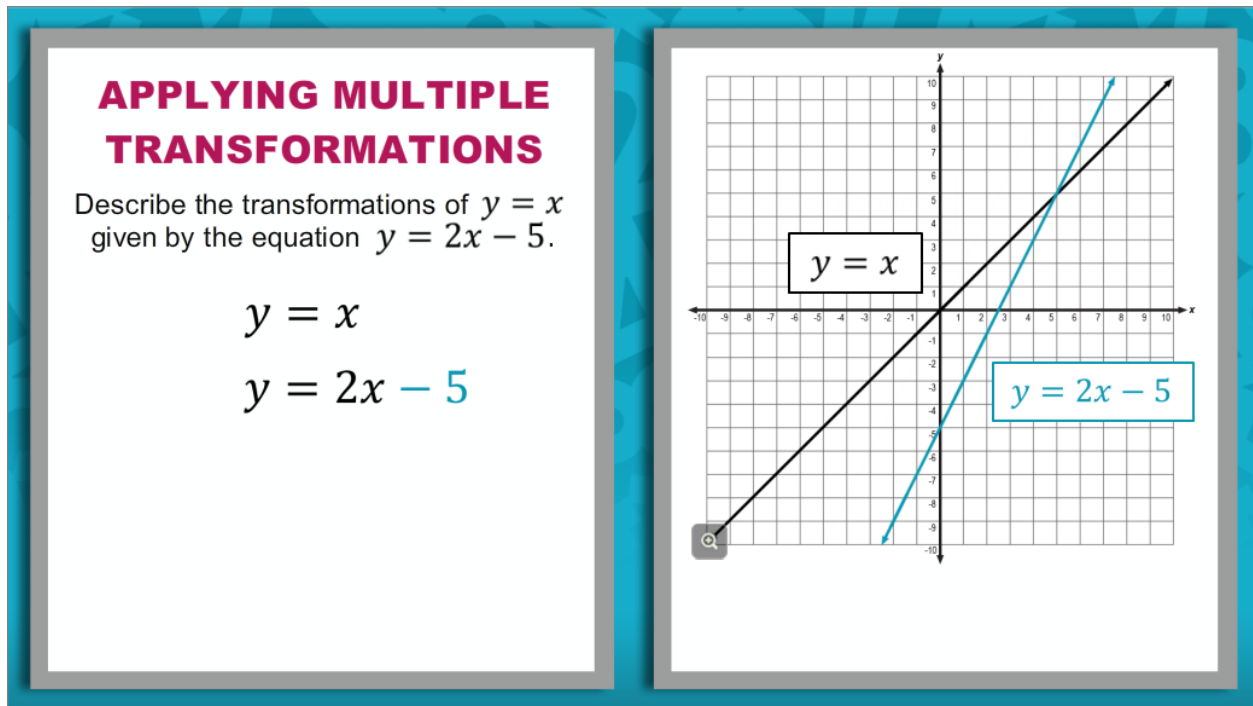
Consider the linear equation  $y = 2x - 5$ . Notice that the slope of the given equation is 2. So you can conclude that a dilation has occurred.

Because 2 is a positive whole number, you can further conclude that the graph of the parent function was stretched by a factor of 2.

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### Topic 3 Content: Graphing Transformations of the Parent Function

#### Example 4: Applying Multiple Transformations (continued)



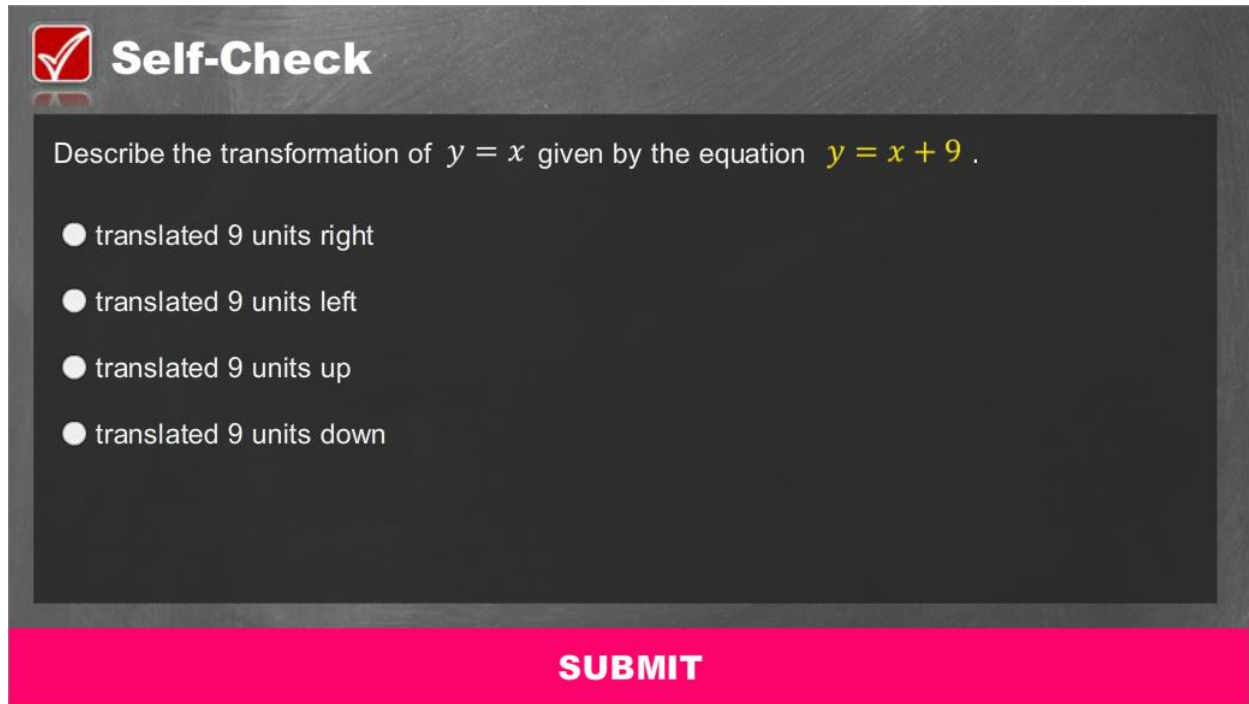
Describe the transformations of  $y = x$  given by the equation  $y = 2x - 5$ .

As well as being stretched by a factor of 2, the value 5 was subtracted from the parent function. Therefore, the graph was translated 5 units down.

The graph of  $y = 2x - 5$  stretches the parent function by a factor of 2 and translates the graph 5 units down.

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Self-Check 1

A digital interface for a self-check question. It features a dark grey background with a red checkmark icon and the text "Self-Check" in white. Below this, a question asks to describe the transformation of  $y = x$  given by the equation  $y = x + 9$ . Four radio button options are listed: translated 9 units right, translated 9 units left, translated 9 units up, and translated 9 units down. At the bottom, there is a prominent pink button labeled "SUBMIT" in white capital letters.

**Self-Check**

Describe the transformation of  $y = x$  given by the equation  $y = x + 9$ .

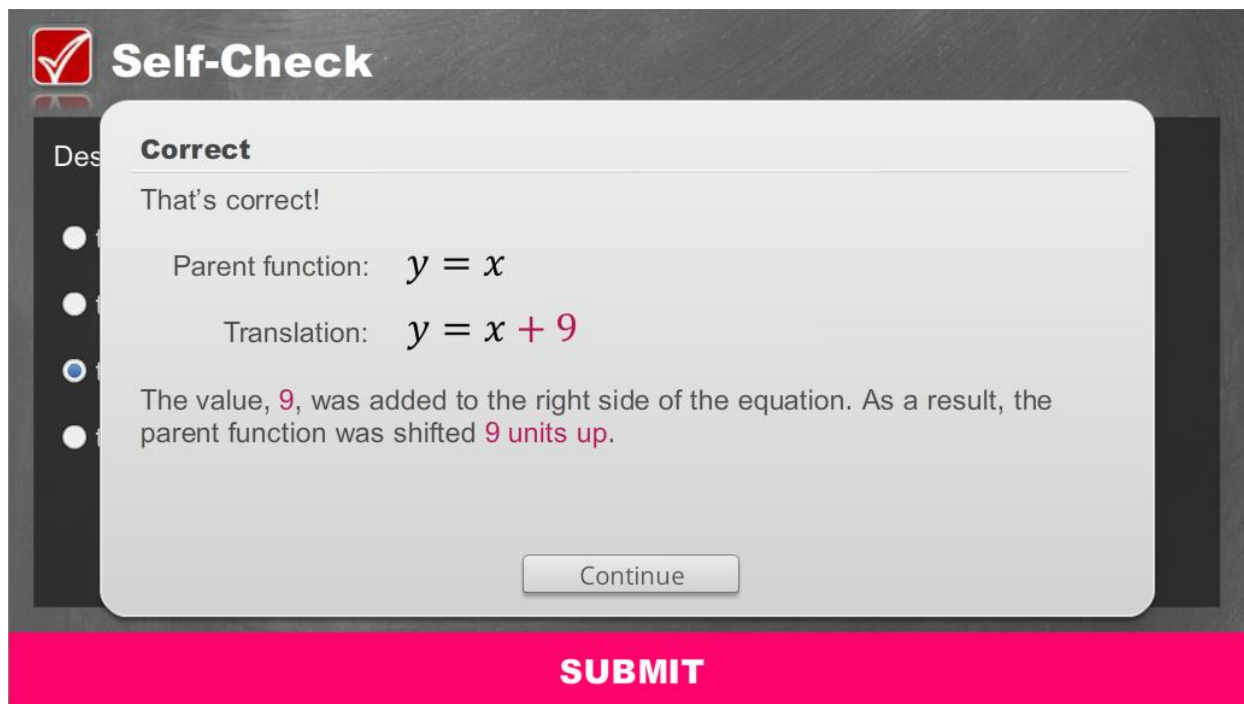
- translated 9 units right
- translated 9 units left
- translated 9 units up
- translated 9 units down

**SUBMIT**

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

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**Topic 3 Content: Graphing Transformations of the Parent Function**

**Self-Check 1: Answer**



The image shows a digital interface for a self-check. At the top left, there is a red checkmark icon and the text "Self-Check". Below this, on the left side, is a vertical list of four circular indicators, with the third one from the top being filled with blue, indicating the current question. The main content area is a light gray rounded rectangle with the following text:

**Correct**

That's correct!

Parent function:  $y = x$

Translation:  $y = x + 9$


The value, **9**, was added to the right side of the equation. As a result, the parent function was shifted **9 units up**.

At the bottom of this gray box is a "Continue" button. Below the gray box is a large red bar with the word "SUBMIT" in white capital letters.

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

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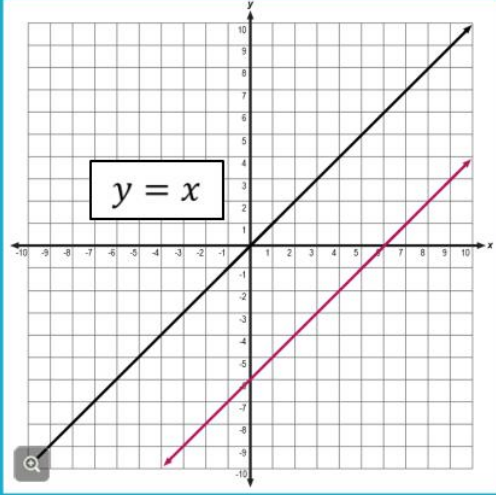
**Self-Check 2**

 **Self-Check**

Describe the transformation of  $y = x$  given by the graph to the right.

- translated 4 units up
- translated 4 units down
- translated 6 units up
- translated 6 units down

**Graph**



**SUBMIT**

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

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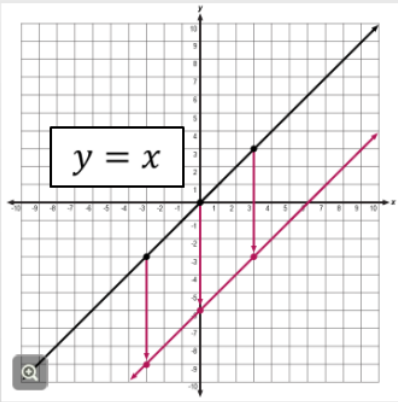
**Self-Check 2: Answer**

**Self-Check** **Graph**

**Correct**

That's correct!

Each point of the graph  $y = x$  was shifted **6 units down**.




Continue

**SUBMIT**

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

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**Self-Check 3**

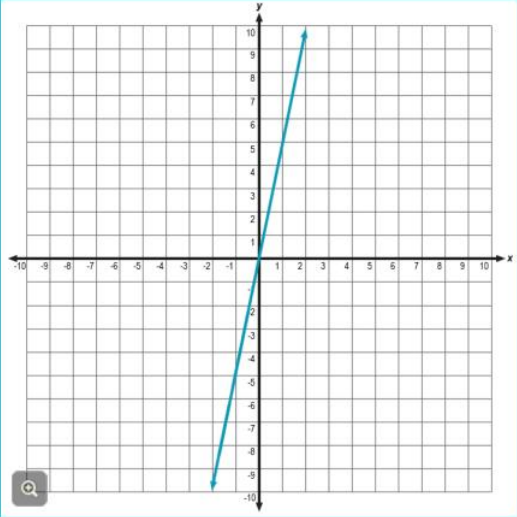
 **Self-Check**

Which graph shows a reflection of the parent function  $y = x$  ?

- Graph A
- Graph B
- Graph C

**SUBMIT**

**Graph A**



[CLICK HERE](#) to view additional options.

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

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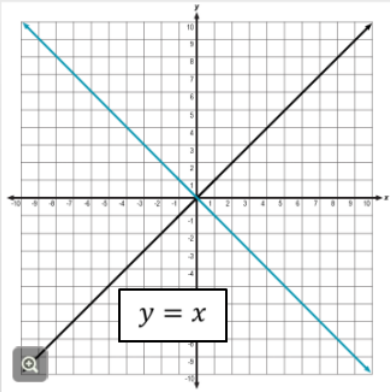
**Self-Check 3: Answer**

**Self Check** **Graph A**

**Correct**

That's correct! The correct answer is Graph B.

Graph B shows the parent function reflected, or "flipped," over the  $x$ -axis.



[Continue](#)

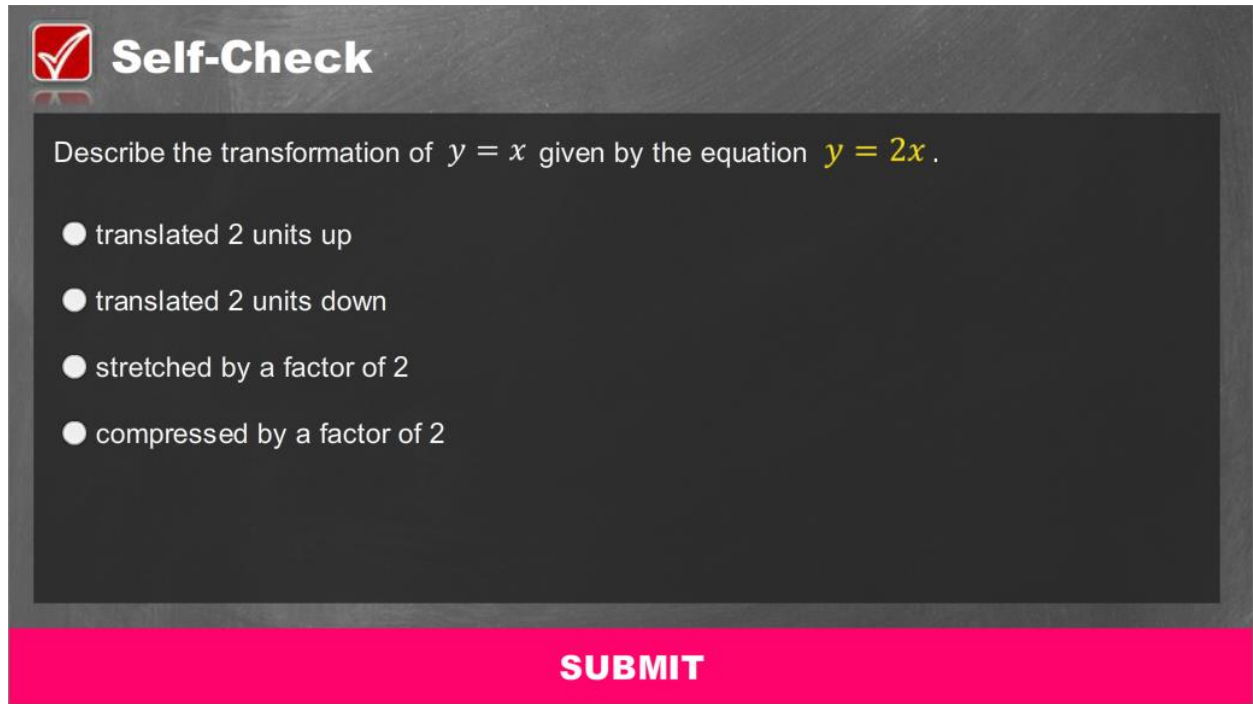
**SUBMIT** [CLICK HERE to view additional options.](#)

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



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**Self-Check 4**

A digital interface for a self-check exercise. It features a dark grey background with a red checkmark icon and the text "Self-Check" in white. Below this, a question asks to describe the transformation of  $y = x$  given by the equation  $y = 2x$ . Four radio button options are listed: translated 2 units up, translated 2 units down, stretched by a factor of 2, and compressed by a factor of 2. At the bottom, there is a bright pink button labeled "SUBMIT" in white capital letters.

**Self-Check**

Describe the transformation of  $y = x$  given by the equation  $y = 2x$ .

- translated 2 units up
- translated 2 units down
- stretched by a factor of 2
- compressed by a factor of 2

**SUBMIT**

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

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**Self-Check 4: Answer**

The image shows a digital interface for a self-check. At the top left, there is a red checkmark icon and the text "Self-Check". Below this, a white box contains the word "Correct" in bold. Underneath, it says "That's correct!". Then, it lists "Parent function:  $y = x$ " and "Translation:  $y = 2x$ ". A paragraph follows: "The slope of the parent function was increased by a factor of 2. Because the factor is a positive whole number, you can conclude that the graph was stretched by a factor of 2." At the bottom of the white box is a "Continue" button. Below the white box is a large red bar with the word "SUBMIT" in white capital letters.

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

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**Self-Check 5**

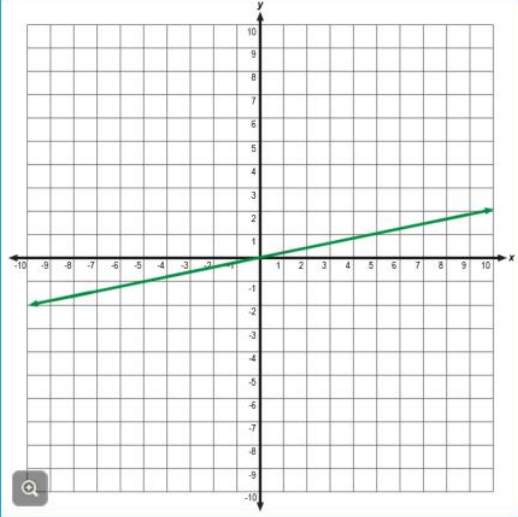
 **Self-Check**

Which graph shows a compression of the parent function  $y = x$ ?

- Graph A
- Graph B
- Graph C

**SUBMIT**

**Graph A**



[CLICK HERE](#) to view additional options.

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

## Module 8: Graphing Linear Equations

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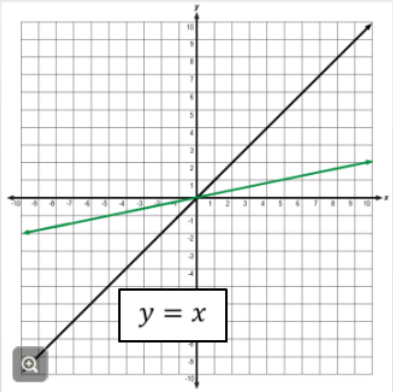
#### Self-Check 5: Answer

**Self Check** **Graph A**

**Incorrect**

That's correct! The correct answer is Graph A.

Graph A shows a compression of the parent function  $y = x$ . The line is less steep than the graph of the parent function.



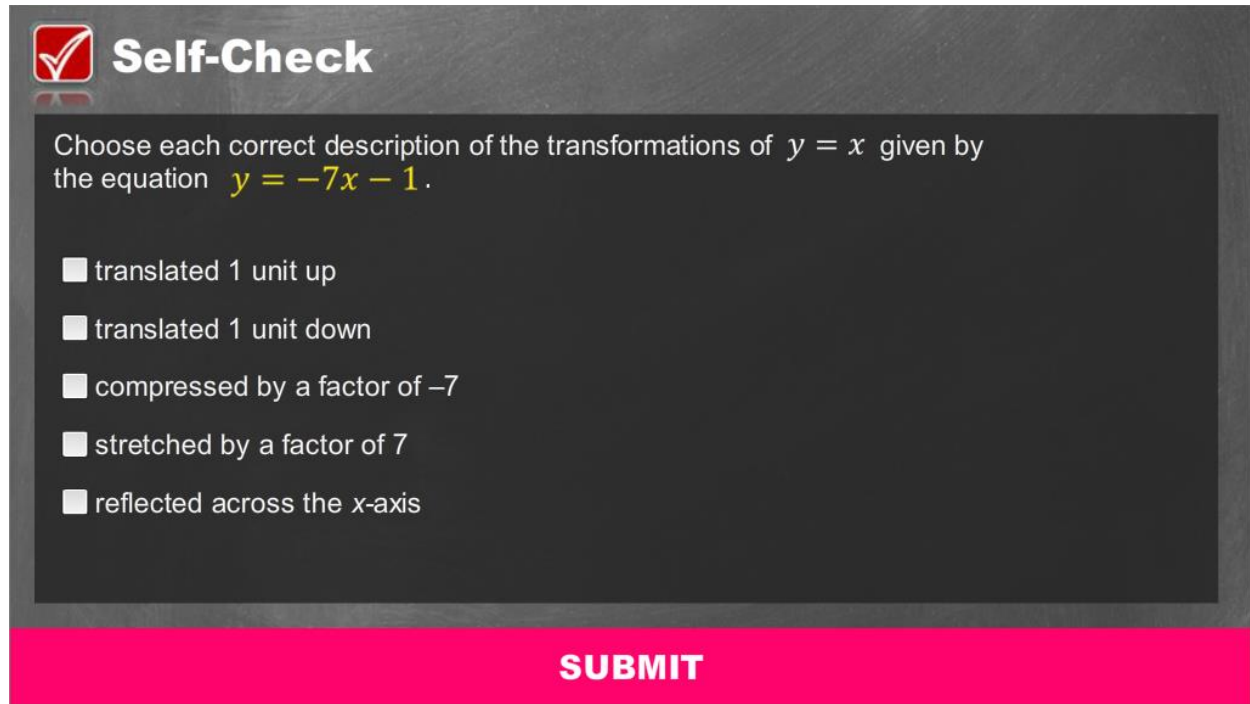
[CLICK HERE to view additional options.](#)

**SUBMIT**

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

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**Self-Check 6**

The image shows a digital interface for a self-check exercise. At the top left, there is a red checkmark icon followed by the text "Self-Check". Below this, the question asks to choose correct descriptions of the transformations of  $y = x$  given by the equation  $y = -7x - 1$ . There are five multiple-choice options, each with an unchecked checkbox. At the bottom of the interface is a prominent pink button labeled "SUBMIT".

**Self-Check**

Choose each correct description of the transformations of  $y = x$  given by the equation  $y = -7x - 1$ .

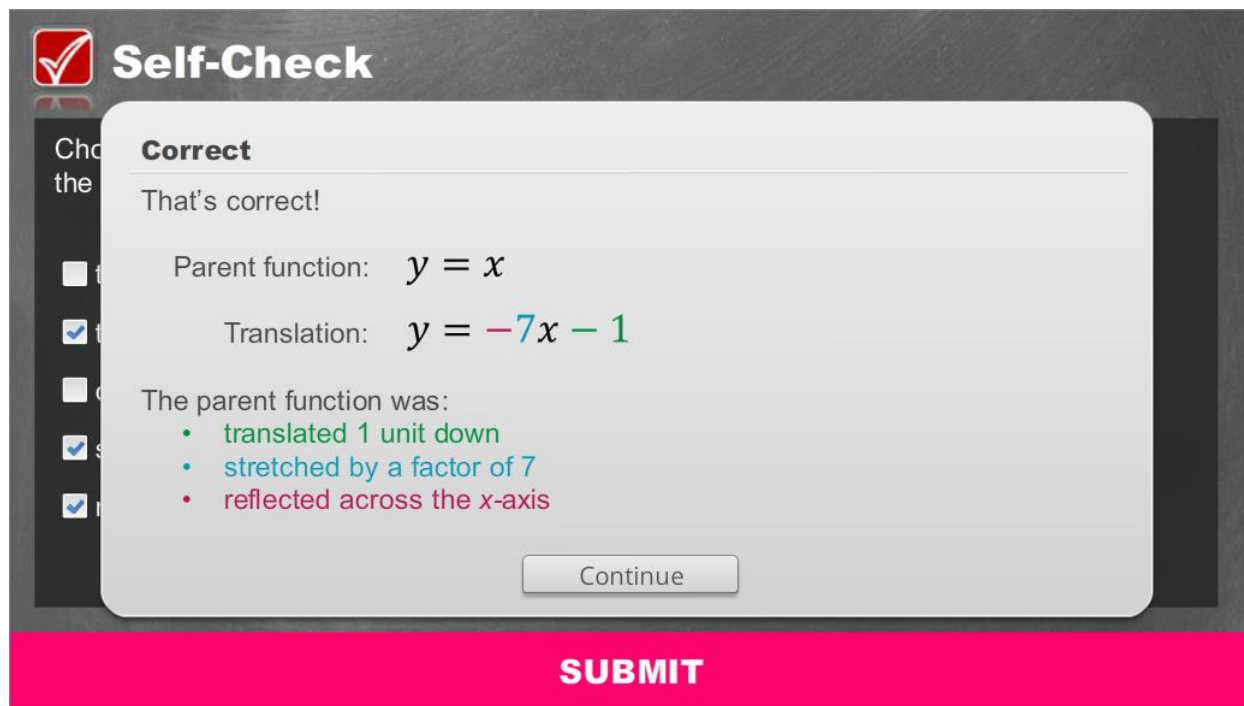
- translated 1 unit up
- translated 1 unit down
- compressed by a factor of  $-7$
- stretched by a factor of 7
- reflected across the  $x$ -axis

**SUBMIT**

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

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**Self-Check 6: Answer**



**Self-Check**

**Correct**

That's correct!

Parent function:  $y = x$

Translation:  $y = -7x - 1$

The parent function was:

- translated 1 unit down
- stretched by a factor of 7
- reflected across the x-axis

Continue

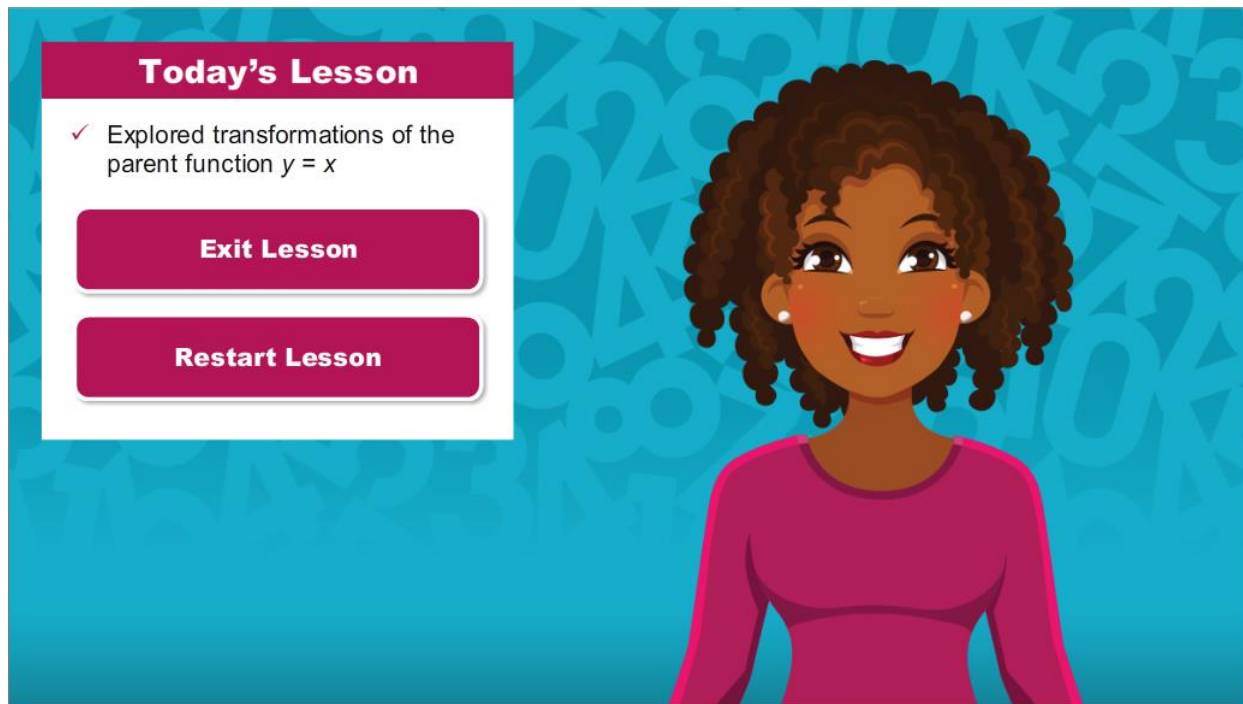
**SUBMIT**

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

## Module 8: Graphing Linear Equations

### Topic 3 Content: Graphing Transformations of the Parent Function

#### Conclusion



You have reached the conclusion of this lesson where you explored transformations of the parent function  $y = x$ .