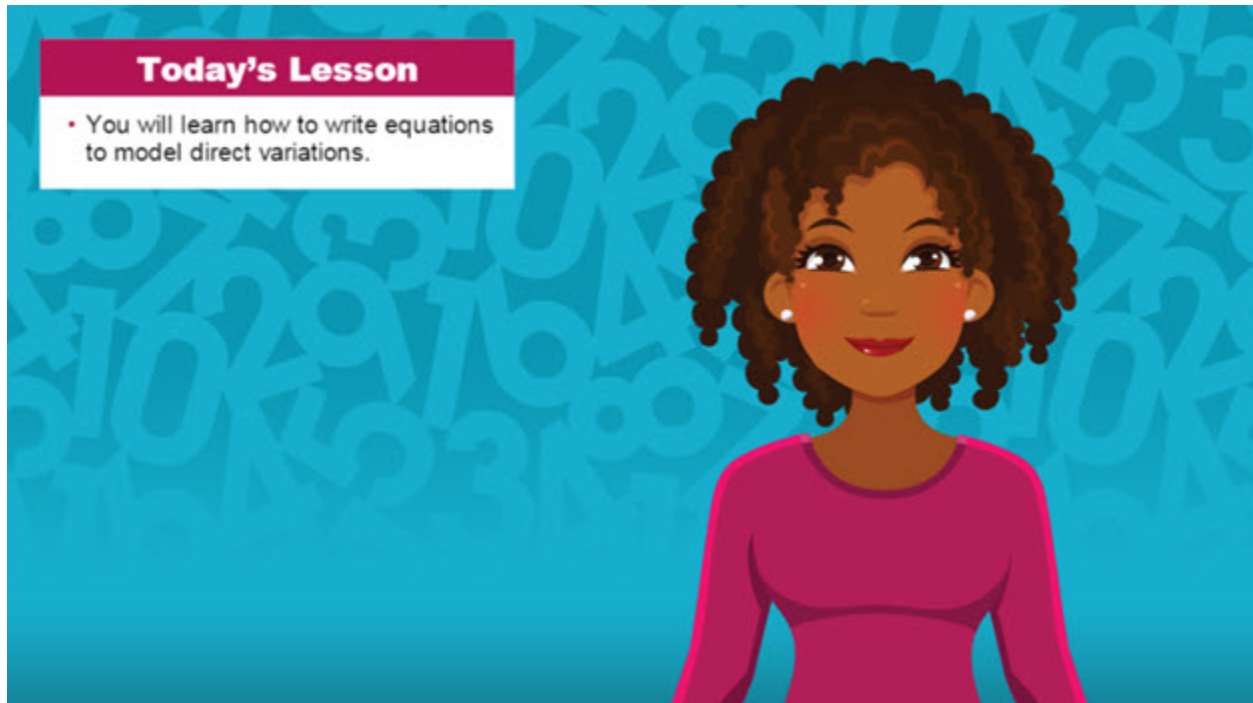


# Module 11: Direct and Inverse Variation

## Topic 2 Content: Writing Direct Variation Equations Notes

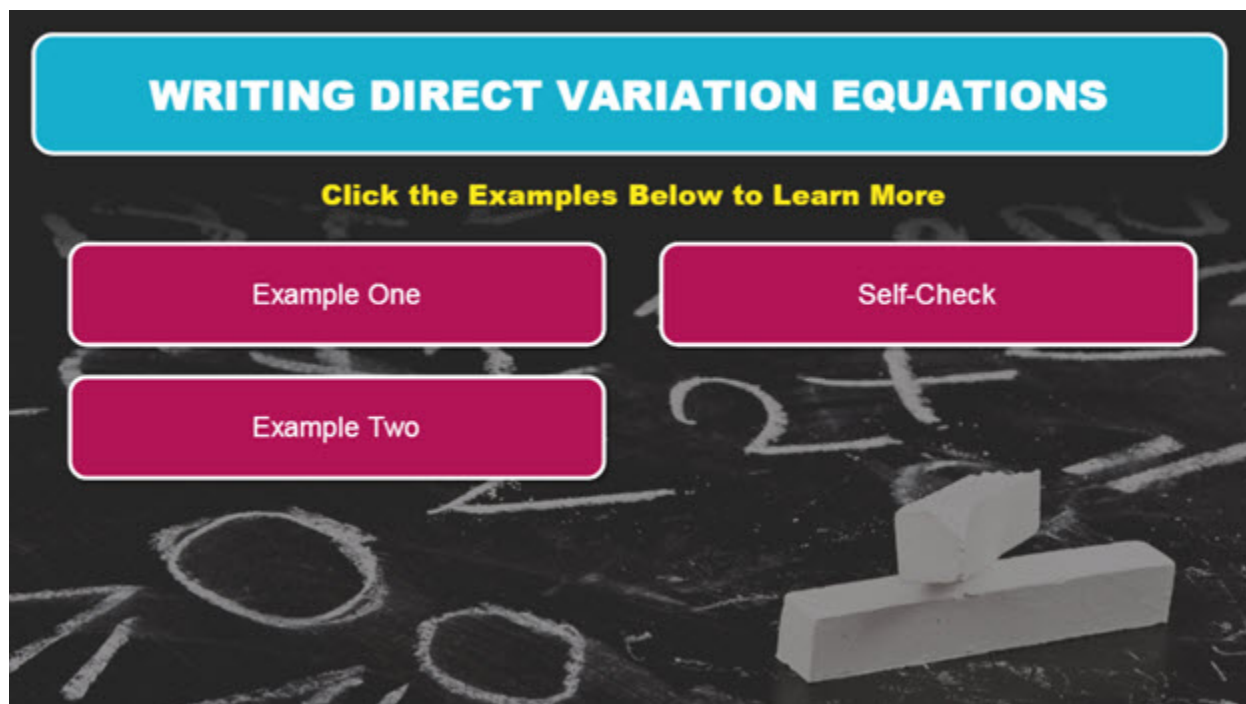
### Introduction



Hello and welcome! I'm so glad to have you here for this lesson in Algebra I, where you will learn how to write equations to model direct variations.

**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

**Writing Direct Variation Equations**



The graphic features a dark background with faint chalkboard-style numbers and symbols. At the top, a light blue rounded rectangle contains the text "WRITING DIRECT VARIATION EQUATIONS" in white. Below this, a yellow text prompt reads "Click the Examples Below to Learn More". Three pink rounded rectangles are arranged in two rows: "Example One" and "Self-Check" in the top row, and "Example Two" in the bottom row. In the bottom right corner, there is a 3D rendering of a white rectangular block with a smaller white cube on top of it.

Click the examples below to learn more.

- Example One
- Example Two
- Self-Check

## Module 11: Direct and Inverse Variation

### Topic 2 Content: Writing Direct Variation Equations Notes

#### Example One

**EXAMPLE 1**

Given the information below, write an equation to model the relationship between  $x$  and  $y$ .

- $y$  is directly proportional to  $x$
- $y = 3$  when  $x = 18$

$$k = \frac{\text{dependent variable}}{\text{independent variable}}$$

$y$  is directly proportional to  $x$

$$y = kx$$

Given the information below, write an equation to model the relationship between  $x$  and  $y$ .

- $y$  is directly proportional to  $x$
- $y = 3$  when  $x = 18$

In a direct variation, the constant of proportionality is a ratio of the dependent variable to the independent variable. The value is represented by the variable,  $k$ .

$$k = \frac{\text{dependent variable}}{\text{independent variable}}$$

The statement “ $y$  is directly proportional to  $x$ ” can be modeled by the equation  $y = kx$ .

**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

**Example One (continued)**

**EXAMPLE 1**

Given the information below, write an equation to model the relationship between  $x$  and  $y$ .

- $y$  is directly proportional to  $x$
- $y = 3$  when  $x = 18$

$$k = \frac{y}{x}$$

In this example,  $y = 3$  when  $x = 18$ . Therefore,  $k$  is equal to...

$\frac{1}{6}$      $\frac{1}{3}$     6    3

Given the information below, write an equation to model the relationship between  $x$  and  $y$ .

- $y$  is directly proportional to  $x$
- $y = 3$  when  $x = 18$

$$k = \frac{y}{x}$$

To write a direct variation equation to model the given situation, begin by finding  $k$ . Remember,  $k$  is a ratio of the dependent variable,  $y$ , to the independent variable,  $x$ .

In this example,  $y = 3$ , when  $x = 18$ . Therefore,  $k$  is equal to...

- A)  $\frac{1}{6}$
- B)  $\frac{1}{3}$
- C) 6
- D) 3

**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

Example One (continued)

**EXAMPLE 1**

Given the information below, write an equation to model the relationship between  $x$  and  $y$ .

- $y$  is directly proportional to  $x$
- $y = 3$  when  $x = 18$

$$k = \frac{1}{6}$$

In this example,  $k$  is equal to  $\frac{1}{6}$ .

$$k = \frac{1}{6}$$

In this example,  $k$  is equal to  $\frac{1}{6}$ .

**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

Example One (continued)

**EXAMPLE 1**

Given the information below, write an equation to model the relationship between  $x$  and  $y$ .

- $y$  is directly proportional to  $x$
- $y = 3$  when  $x = 18$

$$\begin{aligned}k &= \frac{y}{x} \\ &= \frac{3}{18} && \text{In this example, } y = 3 \text{ when } x = 18. \\ &= \frac{1}{6}\end{aligned}$$

**Next**

In this example,  $y = 3$ , when  $x = 18$ .

$$\begin{aligned}k &= \frac{y}{x} \\ &= \frac{3}{18} \\ &= \frac{1}{6}\end{aligned}$$

**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

Example One (continued)

**EXAMPLE 1**

Given the information below, write an equation to model the relationship between  $x$  and  $y$ .

- $y$  is directly proportional to  $x$
- $y = 3$  when  $x = 18$

$$k = \frac{1}{6}$$
$$y = kx$$
$$y = \frac{1}{6}x$$

Menu

Given the information below, write an equation to model the relationship between  $x$  and  $y$ .

- $y$  is directly proportional to  $x$
- $y = 3$  when  $x = 18$

$$k = \frac{1}{6}$$
$$y = kx$$
$$y = \frac{1}{6}x$$

Now that you know that  $k = \frac{1}{6}$ , you have the information needed to write the equation.

Substitute  $\frac{1}{6}$  for  $k$ . The equation to model this direct variation is  $y = \frac{1}{6}x$ .

**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

**Example Two**

**EXAMPLE 2**

Your distance from lightning varies directly with the amount of time it takes you to hear thunder. If you hear thunder 5 seconds after you see the lightning, then you are approximately 1 mile from the lightning.

During a recent thunderstorm, Kyle heard thunder 12 seconds after he saw lightning. Approximately, how many miles is Kyle from the lightning?

**Step 1:** Find  $k$ .

**Step 2:** Write an equation to model the direct variation.

**Step 3:** Use the equation to solve the problem.

*Your distance from lightning varies directly with the amount of time it takes you to hear thunder. If you hear thunder 5 seconds after you see the lightning, then you are approximately 1 mile from the lightning.*

*During a recent thunderstorm, Kyle heard thunder 12 seconds after he saw lightning. Approximately, how many miles is Kyle from the lightning?*

In the given situation, your distance from lightning varies directly with the amount of time it takes you to hear thunder. Therefore, the situation is a direct variation.

You can use the following steps to solve a practical problem involving a direct variation:

**Step 1:** Find  $k$ .

**Step 2:** Write an equation to model the direct variation.

**Step 3:** Use the equation to solve the problem.



**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

**Example Two (continued)**

**EXAMPLE 2**

Your distance from lightning varies directly with the amount of time it takes you to hear thunder. If you hear thunder 5 seconds after you see the lightning, then you are approximately 1 mile from the lightning.

During a recent thunderstorm, Kyle heard thunder 12 seconds after he saw lightning. Approximately, how many miles is Kyle from the lightning?

**Step 1: Find  $k$ .**

*independent variable* =

In the given scenario, the independent variable is...

**the amount of time it takes you to hear thunder**      **your distance from the lightning**

*Your distance from lightning varies directly with the amount of time it takes you to hear thunder. If you hear thunder 5 seconds after you see the lightning, then you are approximately 1 mile from the lightning.*

*During a recent thunderstorm, Kyle heard thunder 12 seconds after he saw lightning. Approximately, how many miles is Kyle from the lightning?*

**Step 1: Find  $k$**

In the given scenario, the independent variable is....

- A) the amount of time it takes you to hear thunder
- B) your distance from the lightning

**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

**Example Two (continued)**

**EXAMPLE 2**

Your distance from lightning varies directly with the amount of time it takes you to hear thunder. If you hear thunder 5 seconds after you see the lightning, then you are approximately 1 mile from the lightning.

During a recent thunderstorm, Kyle heard thunder 12 seconds after he saw lightning. Approximately, how many miles is Kyle from the lightning?

**Step 1:** Find  $k$ .

*independent variable = your distance from the lightning*

The independent variable is your distance from lightning.

**your distance from the lightning**      **Next**

The independent variable is *your distance from the lightning*.

**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

**Example Two (continued)**

**EXAMPLE 2**

Your distance from lightning varies directly with the amount of time it takes you to hear thunder. If you hear thunder 5 seconds after you see the lightning, then you are approximately 1 mile from the lightning.

During a recent thunderstorm, Kyle heard thunder 12 seconds after he saw lightning. Approximately, how many miles is Kyle from the lightning?

**Step 1:** Find  $k$ .

*dependent variable* =

In the given scenario, the dependent variable is...

**the amount of time it takes you to hear thunder**      **your distance from the lightning**

*Your distance from lightning varies directly with the amount of time it takes you to hear thunder. If you hear thunder 5 seconds after you see the lightning, then you are approximately 1 mile from the lightning.*

*During a recent thunderstorm, Kyle heard thunder 12 seconds after he saw lightning. Approximately, how many miles is Kyle from the lightning?*

In the given scenario, the dependent variable is....

- A) the amount of time it takes you to hear thunder
- B) your distance from the lightning

**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

Example Two (continued)

**EXAMPLE 2**

Your distance from lightning varies directly with the amount of time it takes you to hear thunder. If you hear thunder 5 seconds after you see the lightning, then you are approximately 1 mile from the lightning.

During a recent thunderstorm, Kyle heard thunder 12 seconds after he saw lightning. Approximately, how many miles is Kyle from the lightning?

**Step 1:** Find  $k$ .

*dependent variable* = *the amount of time it takes you to hear thunder*

The dependent variable is the amount of time it takes you to hear thunder.

the amount of time it  
takes you to hear thunder

Next

The independent variable is [the amount of time it takes you the hear thunder](#).

## Module 11: Direct and Inverse Variation

### Topic 2 Content: Writing Direct Variation Equations Notes

#### Example Two (continued)

### EXAMPLE 2

Your distance from lightning varies directly with the amount of time it takes you to hear thunder. If you hear thunder 5 seconds after you see the lightning, then you are approximately 1 mile from the lightning.

During a recent thunderstorm, Kyle heard thunder 12 seconds after he saw lightning. Approximately, how many miles is Kyle from the lightning?

**Step 1:** Find  $k$ .

*independent variable* = *your distance from the lightning*

*dependent variable* = *the amount of time it takes you to hear thunder*

The amount of time it takes you to hear thunder depends on your distance from the lightning. Therefore, the independent variable is your distance from the lightning, and the dependent variable is the amount of time it takes you to hear thunder.

**Next**

The amount of time it takes you to hear thunder depends on your distance from the lightning. Therefore,

- the independent variable is your distance from the lightning; and
- the dependent variable is the amount of time it takes you to hear thunder.

**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

**Example Two (continued)**

**EXAMPLE 2**

Your distance from lightning varies directly with the amount of time it takes you to hear thunder. If you hear thunder 5 seconds after you see the lightning, then you are approximately 1 mile from the lightning.

During a recent thunderstorm, Kyle heard thunder 12 seconds after he saw lightning. Approximately, how many miles is Kyle from the lightning?

**Step 1: Find  $k$ .**

$$k = \frac{\text{the amount of time it takes you to hear thunder}}{\text{your distance from the lightning}}$$

If you hear thunder 5 seconds after you see the lightning, then you are approximately 1 mile from the lightning. Therefore,  $k$  equals...

5       1        $\frac{1}{5}$         $\frac{1}{4}$

**Step 1: Find  $k$**

$$k = \frac{\text{dependent variable}}{\text{independent variable}} = \frac{\text{the amount of time it takes you to hear thunder}}{\text{your distance from the lightning}}$$

Now that you have identified the dependent and independent variables, you can use the given information to find  $k$ .

If you hear thunder 5 seconds after you see the lightning, then you are approximately 1 mile from the lightning. Therefore,  $k$  equals...

- A) 5
- B) 1
- C)  $\frac{1}{5}$
- D)  $\frac{1}{4}$

**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

Example Two (continued)

**EXAMPLE 2**

Your distance from lightning varies directly with the amount of time it takes you to hear thunder. If you hear thunder 5 seconds after you see the lightning, then you are approximately 1 mile from the lightning.

During a recent thunderstorm, Kyle heard thunder 12 seconds after he saw lightning. Approximately, how many miles is Kyle from the lightning?

**Step 1:** Find  $k$ .

$$k = \frac{\text{the amount of time it takes you to hear thunder}}{\text{your distance from the lightning}} = \frac{5}{1}$$

$k$  equals 5.

**5**

$$k = \frac{\text{the amount of time it takes you to hear thunder}}{\text{your distance from the lightning}} = \frac{5}{1}$$

$k$  equals 5.

**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

**Example Two (continued)**

**EXAMPLE 2**

Your distance from lightning varies directly with the amount of time it takes you to hear thunder. If you hear thunder 5 seconds after you see the lightning, then you are approximately 1 mile from the lightning.

During a recent thunderstorm, Kyle heard thunder 12 seconds after he saw lightning. Approximately, how many miles is Kyle from the lightning?

**Step 2:** Write an equation to model the direct variation.

$$k = 5$$

Choose the equation that models the direct variation.

$x = 5y$       $x = \frac{1}{5}y$       $y = \frac{1}{5}x$       $y = 5x$

**Step 2:** Write an equation to model the direct variation.

Now that you have found  $k$ , you can write an equation to represent the direct variation.

Choose the equation that models the direct variation.

- A)  $x = 5y$
- B)  $x = \frac{1}{5}y$
- C)  $y = \frac{1}{5}x$
- D)  $y = 5x$



**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

Example Two (continued)

**EXAMPLE 2**

Your distance from lightning varies directly with the amount of time it takes you to hear thunder. If you hear thunder 5 seconds after you see the lightning, then you are approximately 1 mile from the lightning.

During a recent thunderstorm, Kyle heard thunder 12 seconds after he saw lightning. Approximately, how many miles is Kyle from the lightning?

$$k = 5 \quad y = kx$$
$$y = 5x$$

The equation that models the direct variation is...

$$k = 5$$

$$y = kx$$

$$y = 5x$$

The equation that models the direct variation is  $y = 5x$ .

**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

**Example Two (continued)**

**EXAMPLE 2**

Your distance from lightning varies directly with the amount of time it takes you to hear thunder. If you hear thunder 5 seconds after you see the lightning, then you are approximately 1 mile from the lightning.

During a recent thunderstorm, Kyle heard thunder 12 seconds after he saw lightning. Approximately, how many miles is Kyle from the lightning?

**Step 3:** Use the equation to solve the problem.

$$y = 5(12)$$

Choose the correct response.

5    2.4    60    4.2

**Step 3:** Use the equation to solve the problem.

$$y = 5x$$

$$y = 5(12)$$

In the equation,  $y$  represents Kyle's distance from the lightning and  $x$  represents the amount of time it takes him to hear thunder. Substitute 12 for  $x$ . Then, evaluate the expression on the right side of the equation to determine Kyle's distance from the lightning. Choose the correct response.

- A) 5
- B) 2.4
- C) 60
- D) 4.2

**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

**Example Two (continued)**

**EXAMPLE 2**

Your distance from lightning varies directly with the amount of time it takes you to hear thunder. If you hear thunder 5 seconds after you see the lightning, then you are approximately 1 mile from the lightning.

During a recent thunderstorm, Kyle heard thunder 12 seconds after he saw lightning. Approximately, how many miles is Kyle from the lightning?

$$y = 5(12)$$
$$= 60$$

If Kyle heard thunder 12 seconds after he saw lightning,  
then he is approximately 60 miles from the lightning.


**60**

$$y = 5(12)$$
$$= 60$$

If Kyle heard thunder 12 seconds after he saw lightning, then he is approximately 60 miles from the lightning.

**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

Self-Check 1

 **Self-Check**

Given:  $y$  varies directly with  $x$

Choose the equation that best represents the data.

- $y = -\frac{1}{3}x$
- $y = -3x$
- $y = \frac{1}{3}x$
- $y = 3x$

**SUBMIT**

$x$	$y$
-8	24
$-\frac{1}{2}$	$\frac{3}{2}$
12	-36
15	-45

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

**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

**Self-Check 1: Answer**

**Correct**

That's correct! Because  $y$  varies directly with  $x$ , the data can be represented by an equation on the form  $y = kx$ .

Find  $k$  by calculating the ratio,  $\frac{y}{x}$ , for any corresponding  $x$ - and  $y$ -values.

You may choose to use the first ordered pair included in the table of values.

$$k = \frac{y}{x}$$
$$= \frac{24}{-8}$$
$$= -3$$

$x$	$y$
-8	24
$-\frac{1}{2}$	$\frac{3}{2}$
12	-36
15	-45

Part 1   Part 2   Continue

**SUBMIT**

**Correct**

Now that you have determined that  $k = -3$ , you can write an equation to represent the direct variation.

$$y = kx$$
$$y = -3x$$

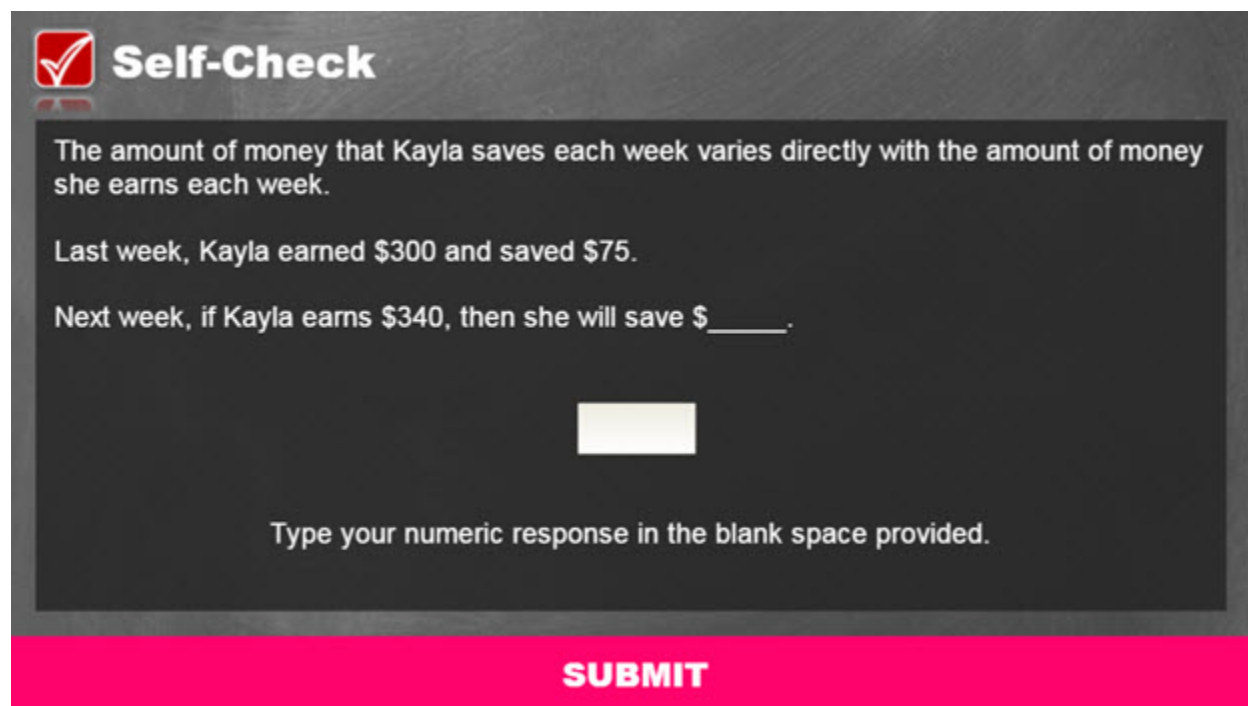
Part 1   Part 2   Continue

**SUBMIT**

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

**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

Self-Check 2



**Self-Check**

The amount of money that Kayla saves each week varies directly with the amount of money she earns each week.

Last week, Kayla earned \$300 and saved \$75.

Next week, if Kayla earns \$340, then she will save \$\_\_\_\_\_.

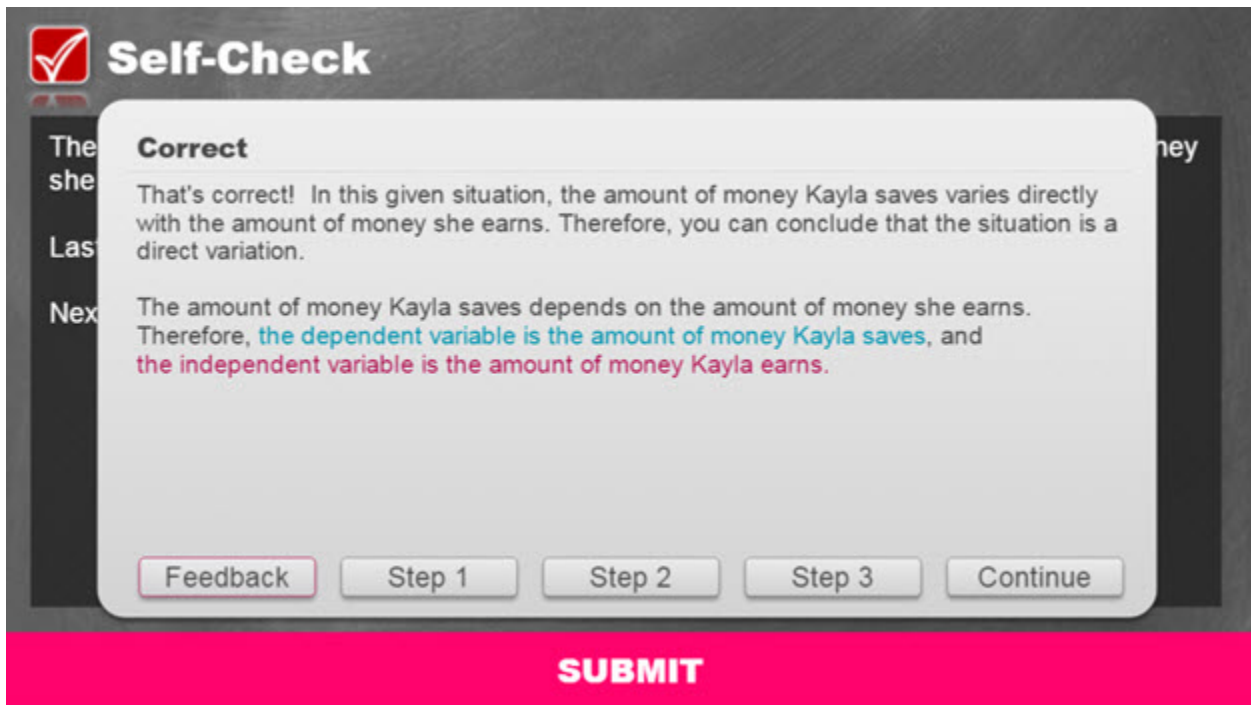
Type your numeric response in the blank space provided.

**SUBMIT**

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

**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

Self-Check 2: Answer



**Self-Check**

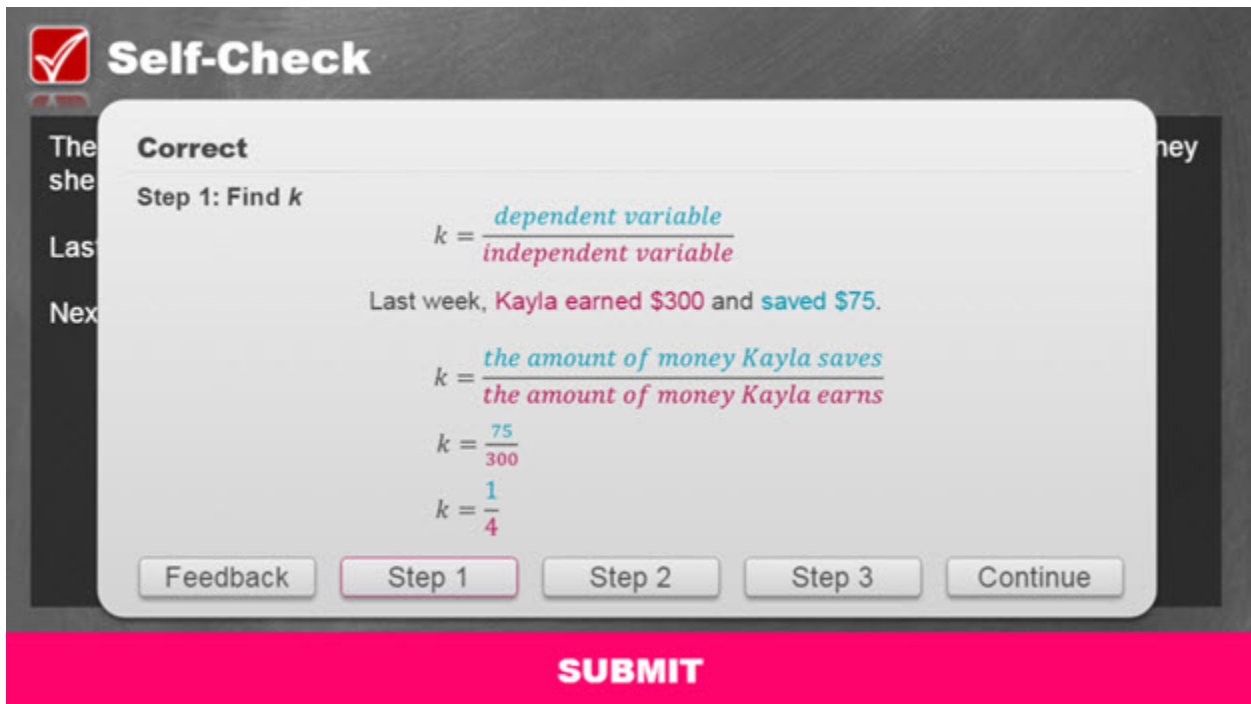
**Correct**

That's correct! In this given situation, the amount of money Kayla saves varies directly with the amount of money she earns. Therefore, you can conclude that the situation is a direct variation.

The amount of money Kayla saves depends on the amount of money she earns. Therefore, **the dependent variable is the amount of money Kayla saves**, and **the independent variable is the amount of money Kayla earns**.

Feedback Step 1 Step 2 Step 3 Continue

**SUBMIT**



**Self-Check**

**Correct**

Step 1: Find  $k$

$$k = \frac{\text{dependent variable}}{\text{independent variable}}$$

Last week, Kayla earned \$300 and saved \$75.

$$k = \frac{\text{the amount of money Kayla saves}}{\text{the amount of money Kayla earns}}$$
$$k = \frac{75}{300}$$
$$k = \frac{1}{4}$$

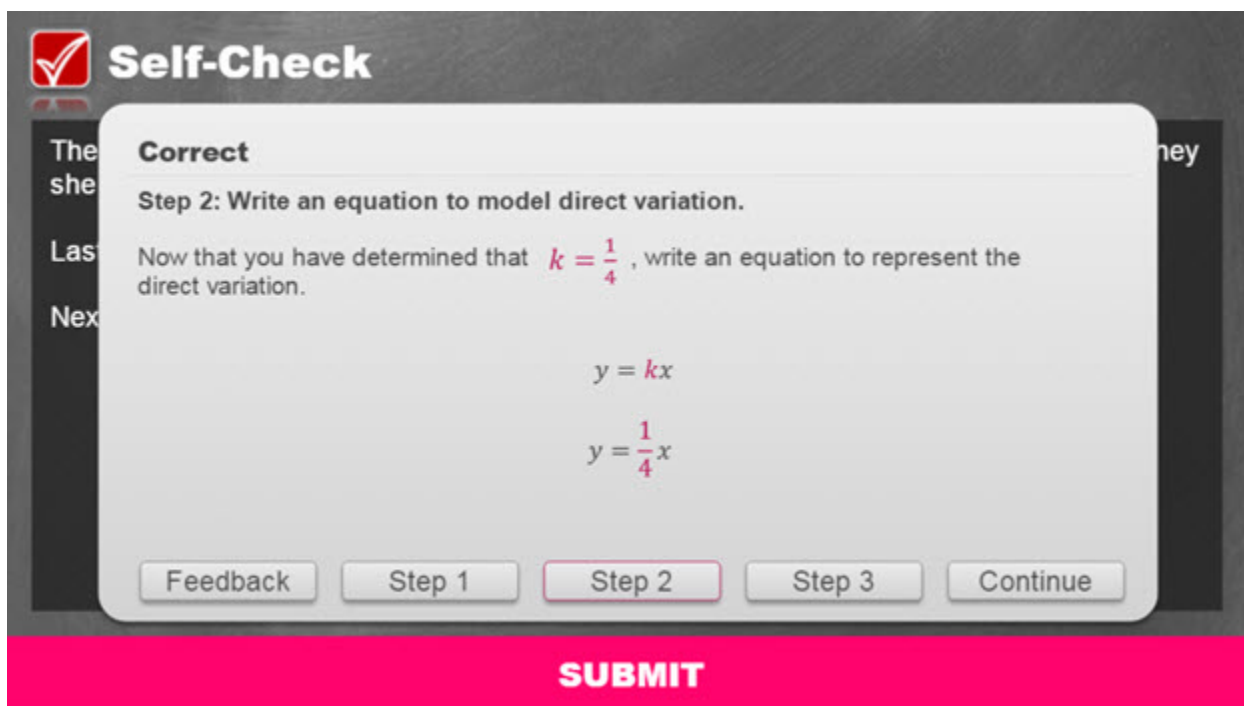
Feedback Step 1 Step 2 Step 3 Continue

**SUBMIT**

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

**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

Self-Check 2: Answer (continued)



**Self-Check**

**Correct**

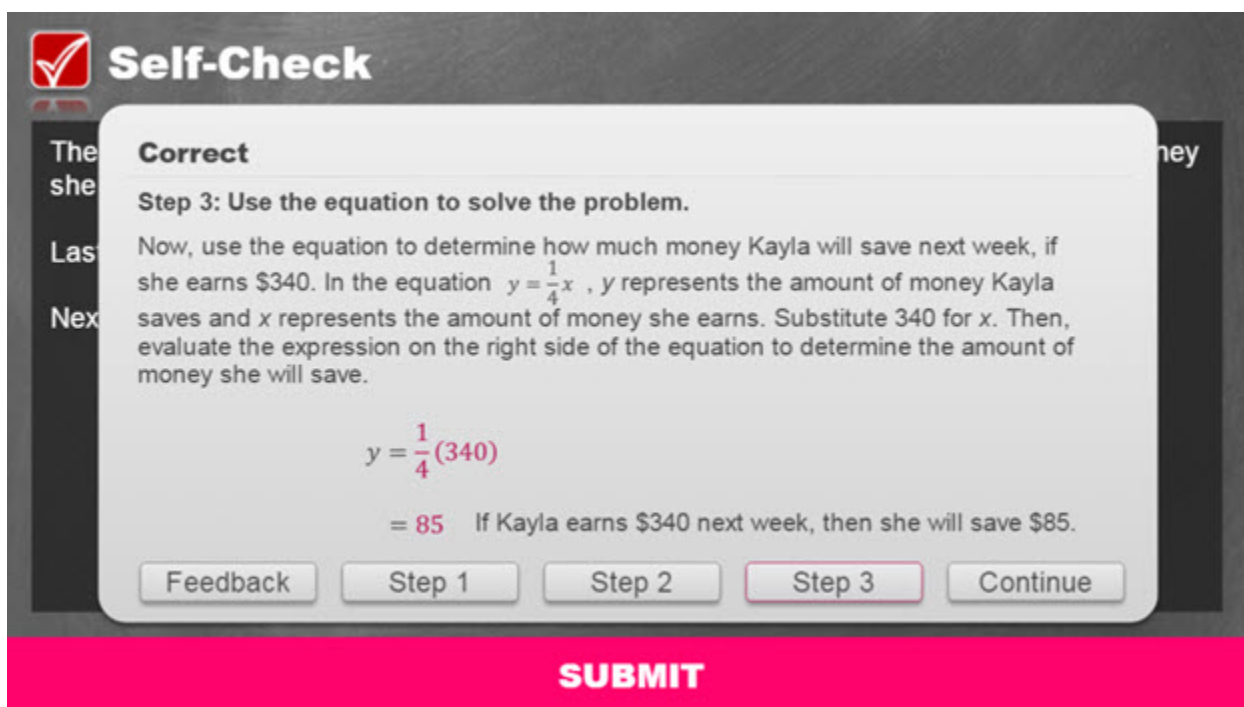
**Step 2: Write an equation to model direct variation.**

Now that you have determined that  $k = \frac{1}{4}$ , write an equation to represent the direct variation.

$$y = kx$$
$$y = \frac{1}{4}x$$

Feedback Step 1 Step 2 Step 3 Continue

**SUBMIT**



**Self-Check**

**Correct**

**Step 3: Use the equation to solve the problem.**

Now, use the equation to determine how much money Kayla will save next week, if she earns \$340. In the equation  $y = \frac{1}{4}x$ ,  $y$  represents the amount of money Kayla saves and  $x$  represents the amount of money she earns. Substitute 340 for  $x$ . Then, evaluate the expression on the right side of the equation to determine the amount of money she will save.

$$y = \frac{1}{4}(340)$$
$$= 85$$

If Kayla earns \$340 next week, then she will save \$85.

Feedback Step 1 Step 2 Step 3 Continue

**SUBMIT**

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



**Module 11: Direct and Inverse Variation**  
**Topic 2 Content: Writing Direct Variation Equations Notes**

**Conclusion**



You have reached the conclusion of this lesson where you learned how to write equations to model direct variations.