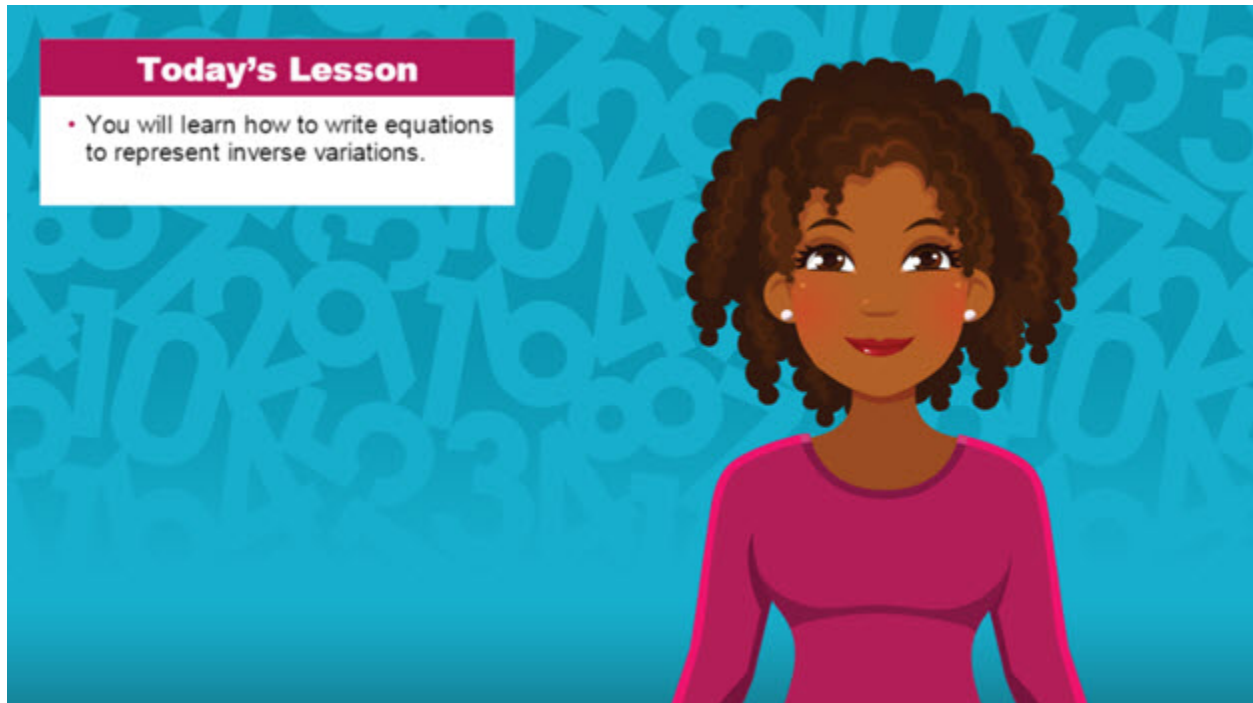


# Module 11: Direct and Inverse Variation

## Topic 3 Content: Writing Inverse Variation Equations Notes

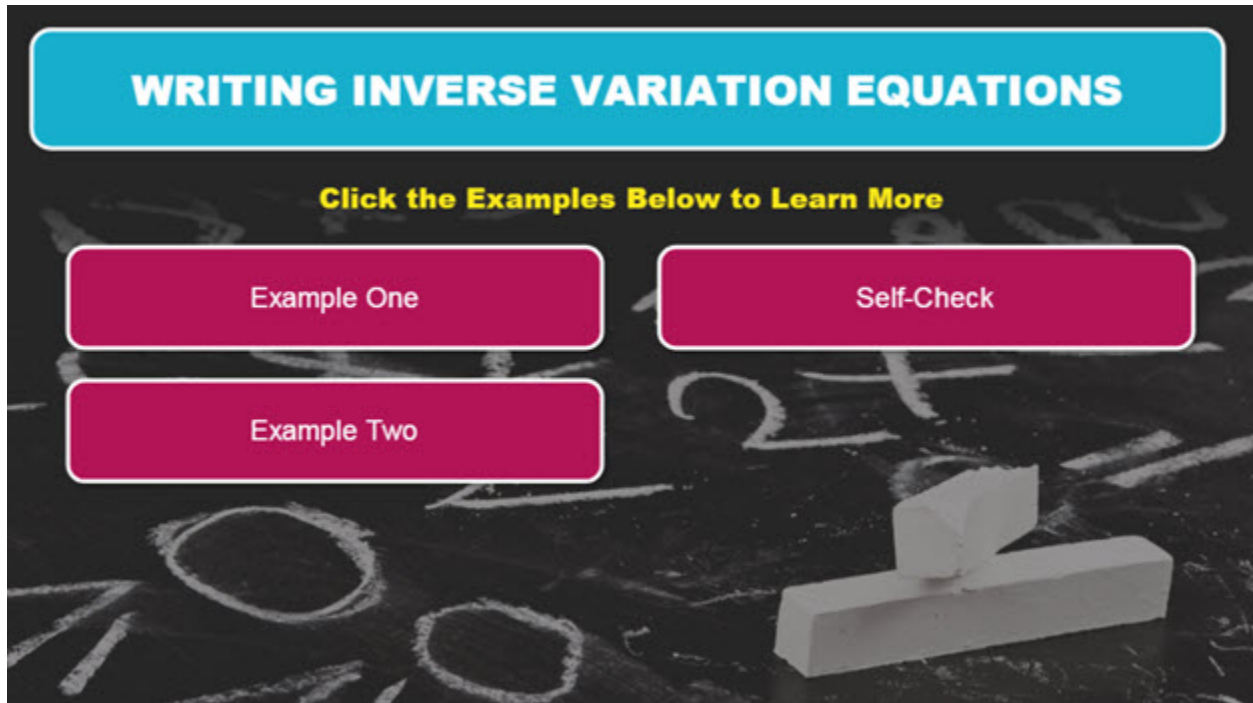
### Introduction



Hi there! I'm so glad you could join me for this lesson in Algebra I. In this lesson, you will learn how to write equations to represent inverse variations.

**Module 11: Direct and Inverse Variation**  
**Topic 3 Content: Writing Inverse Variation Equations Notes**

Introduction



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

Click the examples below to learn more.

- Example One
- Example Two
- Self-Check

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**Example One**

**EXAMPLE 1**

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

- $y$  is inversely proportional to  $x$
- $y = 12$  when  $x = 5$

*$k = \text{independent variable} \cdot \text{dependent variable}$*

$y$  is inversely proportional to  $x$ .

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

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

- $y$  is inversely proportional to  $x$
- $y = 12$  when  $x = 5$

In an inverse variation, the constant of proportionality, is the product of the dependent variable and the independent variable. The value is represented by the variable,  $k$ .

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

The statement “ $y$  is inversely proportional to  $x$ ” can be modeled by the equation  $y = \frac{k}{x}$ .

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Example One (continued)

**EXAMPLE 1**

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

- $y$  is inversely proportional to  $x$
- $y = 12$  when  $x = 5$

$$k = xy$$

In this example,  $y = 12$ , when  $x = 5$ . Therefore,  $k$  is equal to...

60   40   80   20

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

- $y$  is inversely proportional to  $x$
- $y = 12$  when  $x = 5$

$$k = xy$$

In this example,  $y = 12$ , when  $x = 5$ . Therefore,  $k$  is equal to...

- A) 60
- B) 40
- C) 80
- D) 20

**Module 11: Direct and Inverse Variation**  
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Example One (continued)

**EXAMPLE 1**

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

- $y$  is inversely proportional to  $x$
- $y = 12$  when  $x = 5$

$$\begin{aligned}k &= xy \\ &= 5 \cdot 12 \\ &= 60\end{aligned}$$

$k$  is equal to 60.

**60** **Next**

$$\begin{aligned}k &= xy \\ &= 5 \cdot 12 \\ &= 60\end{aligned}$$

$k$  is equal to 60.

**Module 11: Direct and Inverse Variation**  
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Example One (continued)

**EXAMPLE 1**

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

- $y$  is inversely proportional to  $x$
- $y = 12$  when  $x = 5$

$$k = 60$$
$$y = \frac{k}{x}$$
$$y = \frac{60}{x}$$

Menu

Now that you know that  $k = 60$ , you have the information needed to write the equation.

Substitute 60 for  $k$ . The equation to model this inverse variation is  $y = \frac{60}{x}$ .

## Module 11: Direct and Inverse Variation

### Topic 3 Content: Writing Inverse Variation Equations Notes

#### Example 2

### EXAMPLE 2

The president of the senior class of a local high school plans to organize a class trip. The cost per person,  $C$ , varies inversely with the number of students,  $n$ , who go on the trip.

If 55 students go on the trip, the cost per person is \$85. If 100 students go on the trip, what is the cost per person?

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

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

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

*The president of the senior class of a local high school plans to organize a class trip. The cost per person,  $C$ , varies inversely with the number of students,  $n$ , who go on the trip.*

*If 55 students go on the trip, the cost per person is \$85.*

*If 100 students go on the trip, what is the cost per person?*

In the given situation, the cost per person,  $C$ , varies inversely with the number of students,  $n$ , who go on the trip. Therefore, the situation is an inverse variation.

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

**Step 1:** Find  $k$

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

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

**Module 11: Direct and Inverse Variation**  
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Example 2 (continued)

**EXAMPLE 2**

The president of the senior class of a local high school plans to organize a class trip. The cost per person,  $C$ , varies inversely with the number of students,  $n$ , who go on the trip.

If 55 students go on the trip, the cost per person is \$85. If 100 students go on the trip, what is the cost per person?

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

*independent variable* =

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

**the number of students,  $n$**       **the cost per person,  $C$**

*The president of the senior class of a local high school plans to organize a class trip. The cost per person,  $C$ , varies inversely with the number of students,  $n$ , who go on the trip.*

*If 55 students go on the trip, the cost per person is \$85.*

*If 100 students go on the trip, what is the cost per person?*

**Step 1: Find  $k$**

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

- A) the number of students,  $n$
- B) the cost per person,  $C$



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Example 2 (continued)

**EXAMPLE 2**

The president of the senior class of a local high school plans to organize a class trip. The cost per person,  $C$ , varies inversely with the number of students,  $n$ , who go on the trip.

If 55 students go on the trip, the cost per person is \$85. If 100 students go on the trip, what is the cost per person?

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

*independent variable = the number of students*

The independent variable is the number of students,  $n$ .

**the number of students,  $n$**  **Next**

The independent variable is *the number of students,  $n$* .

**Module 11: Direct and Inverse Variation**  
**Topic 3 Content: Writing Inverse Variation Equations Notes**

Example 2 (continued)

**EXAMPLE 2**

The president of the senior class of a local high school plans to organize a class trip. The cost per person,  $C$ , varies inversely with the number of students,  $n$ , who go on the trip.

If 55 students go on the trip, the cost per person is \$85. If 100 students go on the trip, what is the cost per person?

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

*dependent variable* =

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

the number of students,  $n$       the cost per person,  $C$

*The president of the senior class of a local high school plans to organize a class trip. The cost per person,  $C$ , varies inversely with the number of students,  $n$ , who go on the trip.*

*If 55 students go on the trip, the cost per person is \$85.*

*If 100 students go on the trip, what is the cost per person?*

**Step 1:** Find  $k$

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

- A) the number of students,  $n$
- B) the cost per person,  $C$

**Module 11: Direct and Inverse Variation**  
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Example 2 (continued)

**EXAMPLE 2**

The president of the senior class of a local high school plans to organize a class trip. The cost per person,  $C$ , varies inversely with the number of students,  $n$ , who go on the trip.

If 55 students go on the trip, the cost per person is \$85. If 100 students go on the trip, what is the cost per person?

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

*dependent variable = the cost per person*

The dependent variable is the cost per person,  $C$ .

the cost per person,  $C$       Next

The dependent variable is [the cost per person,  \$C\$](#) .

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Example 2 (continued)

**EXAMPLE 2**

The president of the senior class of a local high school plans to organize a class trip. The cost per person,  $C$ , varies inversely with the number of students,  $n$ , who go on the trip.

If 55 students go on the trip, the cost per person is \$85. If 100 students go on the trip, what is the cost per person?

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

*independent variable = the number of students*  
*dependent variable = the cost per person*

The cost per person depends on the number of students. Therefore, the independent variable is the number of students,  $n$ , and the dependent variable is the cost per person,  $C$ .

**Next**

The cost per person depends on the number of students. Therefore,

- the independent variable is the number of students,  $n$ ; and
- the dependent variable is the cost per person,  $C$ .

**Module 11: Direct and Inverse Variation**  
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Example 2 (continued)

**EXAMPLE 2**

The president of the senior class of a local high school plans to organize a class trip. The cost per person,  $C$ , varies inversely with the number of students,  $n$ , who go on the trip.

If 55 students go on the trip, the cost per person is \$85. If 100 students go on the trip, what is the cost per person?

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

$k = \text{the number of students} \cdot \text{the cost per person}$

If 55 students decide to go on the trip, the cost per person is \$85. Therefore,  $k$  equals...

5400     4675     1.55

**Step 1:** Find  $k$

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

$$k = \text{the number of students} \cdot \text{the cost per person}$$

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

If 55 students decide to go on the trip, the cost per person is \$85. Therefore,  $k$  equals...

- A) 5400
- B) 4675
- C) 1.55

**Module 11: Direct and Inverse Variation**  
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Example 2 (continued)

**EXAMPLE 2**

The president of the senior class of a local high school plans to organize a class trip. The cost per person,  $C$ , varies inversely with the number of students,  $n$ , who go on the trip.

If 55 students go on the trip, the cost per person is \$85. If 100 students go on the trip, what is the cost per person?

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

$$\begin{aligned}k &= \text{the number of students} \cdot \text{the cost per person} \\ &= 55 \cdot 85 \\ &= 4675\end{aligned}$$

$k$  equals 4,675.

**4675**

$$\begin{aligned}k &= \text{the number of students} \cdot \text{the cost per person} \\ &= 55 \cdot 85 \\ &= 4675\end{aligned}$$

$k$  equals 4675.

**Module 11: Direct and Inverse Variation**  
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Example 2 (continued)

**EXAMPLE 2**

The president of the senior class of a local high school plans to organize a class trip. The cost per person,  $C$ , varies inversely with the number of students,  $n$ , who go on the trip.

If 55 students go on the trip, the cost per person is \$85. If 100 students go on the trip, what is the cost per person?

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

$k = 4675$

Choose the equation that models the inverse variation.

$C = \frac{1}{4675}n$        $C = 4675n$        $C = \frac{4675}{n}$

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

Now that you have found that  $k = 4675$ , you can write an equation to represent the inverse variation.

Choose the equation that models the inverse variation.

- A)  $C = \frac{1}{4675}n$
- B)  $C = 4675n$
- C)  $C = \frac{4675}{n}$

**Module 11: Direct and Inverse Variation**  
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Example 2 (continued)

**EXAMPLE 2**

The president of the senior class of a local high school plans to organize a class trip. The cost per person,  $C$ , varies inversely with the number of students,  $n$ , who go on the trip.

If 55 students go on the trip, the cost per person is \$85. If 100 students go on the trip, what is the cost per person?

$$k = 4675 \qquad C = \frac{k}{n}$$
$$C = \frac{4675}{n}$$

The equation that models the inverse variation is...

$$C = \frac{4675}{n}$$

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

$$k = 4675 \qquad C = \frac{k}{n}$$
$$C = \frac{4675}{n}$$



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Example 2 (continued)

**EXAMPLE 2**

The president of the senior class of a local high school plans to organize a class trip. The cost per person,  $C$ , varies inversely with the number of students,  $n$ , who go on the trip.

If 55 students go on the trip, the cost per person is \$85. If 100 students go on the trip, what is the cost per person?

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

$$C = \frac{4675}{100}$$

Choose the correct response.

\$100     \$4.86     \$46.75

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

$$C = \frac{4675}{n}$$

$$C = \frac{4675}{100}$$

In the equation  $C = \frac{4675}{n}$ ,  $C$  represents the cost per person and  $n$  represents the number of students.

Substitute 100 for  $n$ . Then, evaluate the expression on the right side of the equation.

Choose the correct response.

- A) \$100
- B) \$4.68
- C) \$46.75

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Example 2 (continued)

**EXAMPLE 2**

The president of the senior class of a local high school plans to organize a class trip. The cost per person,  $C$ , varies inversely with the number of students,  $n$ , who go on the trip.

If 55 students go on the trip, the cost per person is \$85. If 100 students go on the trip, what is the cost per person?

$$C = \frac{4675}{100}$$
$$= 46.75$$

If 100 students go on the trip, each student will pay \$46.75.

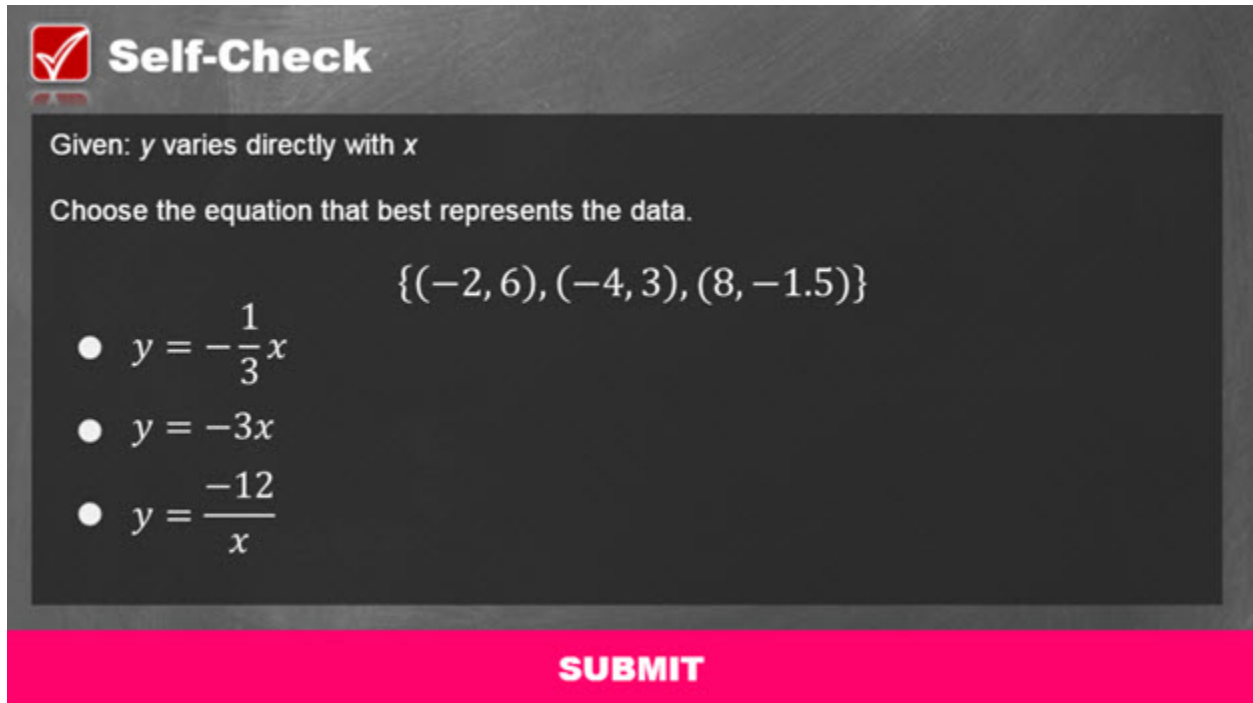
**\$46.75**      **Menu**

$$C = \frac{4675}{100}$$
$$= 46.75$$

If 100 students go on the trip, each student will pay \$46.75.

**Module 11: Direct and Inverse Variation**  
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Self-Check 1



**Self-Check**

Given:  $y$  varies directly with  $x$

Choose the equation that best represents the data.

$\{(-2, 6), (-4, 3), (8, -1.5)\}$

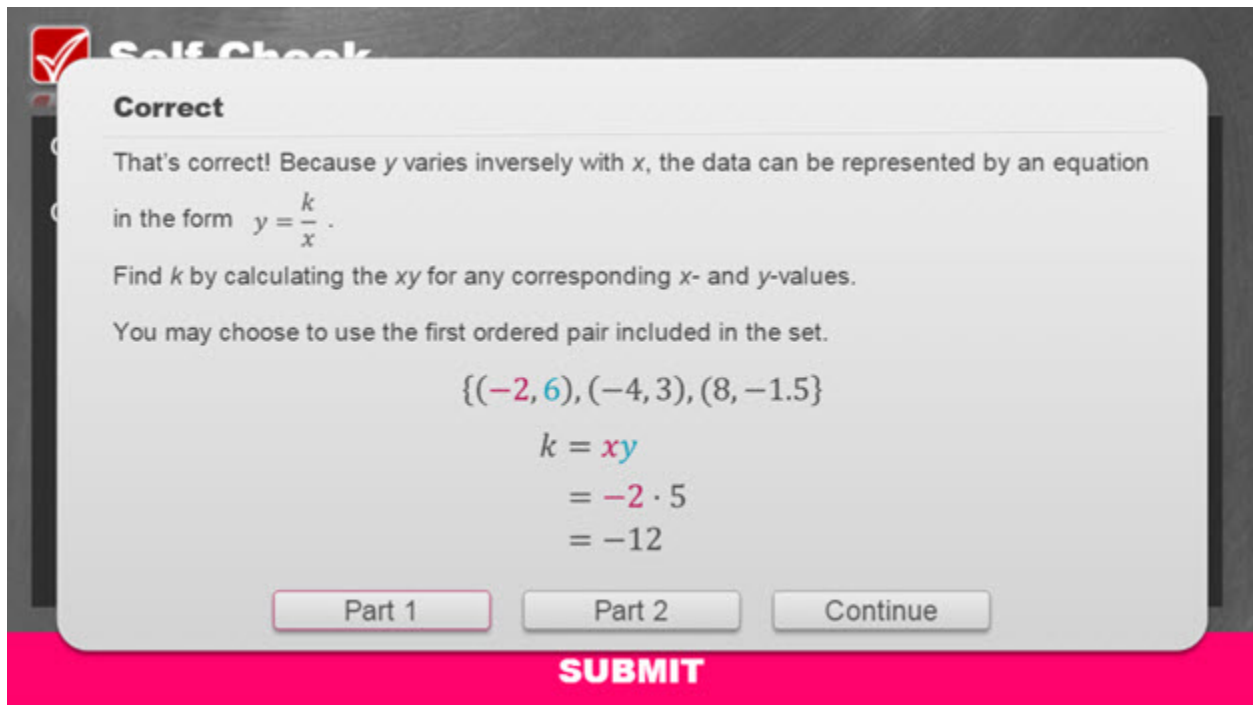
- $y = -\frac{1}{3}x$
- $y = -3x$
- $y = \frac{-12}{x}$

**SUBMIT**

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

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**Self-Check 1: Answer**



**Correct**

That's correct! Because  $y$  varies inversely with  $x$ , the data can be represented by an equation in the form  $y = \frac{k}{x}$ .

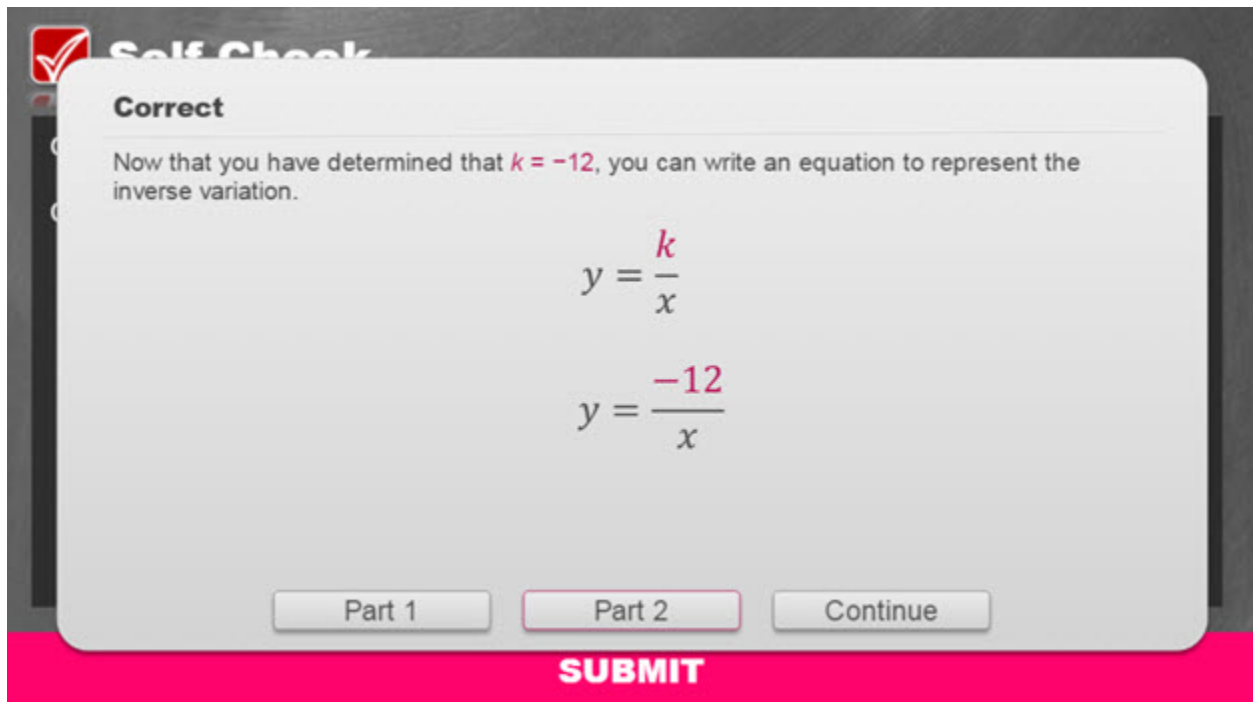
Find  $k$  by calculating the  $xy$  for any corresponding  $x$ - and  $y$ -values.

You may choose to use the first ordered pair included in the set.

$$\{(-2, 6), (-4, 3), (8, -1.5)\}$$
$$k = xy$$
$$= -2 \cdot 6$$
$$= -12$$

Part 1    Part 2    Continue

**SUBMIT**



**Correct**

Now that you have determined that  $k = -12$ , you can write an equation to represent the inverse variation.

$$y = \frac{k}{x}$$
$$y = \frac{-12}{x}$$

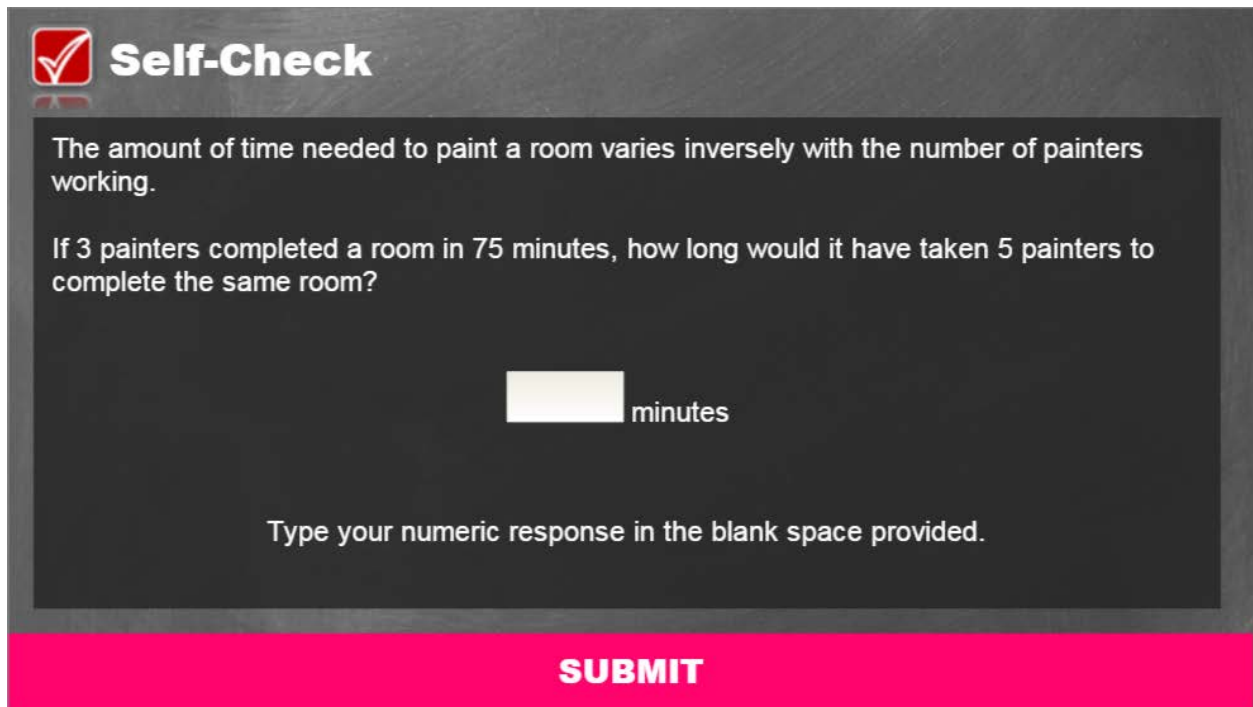
Part 1    Part 2    Continue

**SUBMIT**

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

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Self-Check 2



**Self-Check**

The amount of time needed to paint a room varies inversely with the number of painters working.

If 3 painters completed a room in 75 minutes, how long would it have taken 5 painters to complete the same room?

minutes

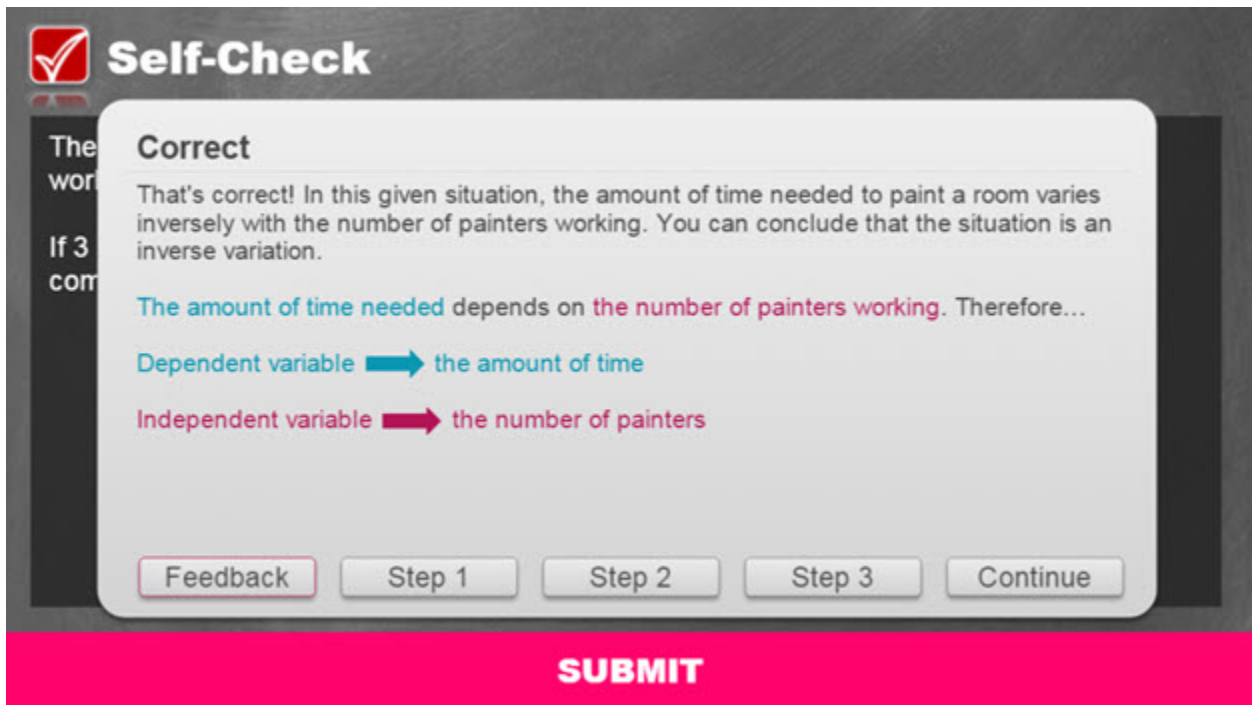
Type your numeric response in the blank space provided.

**SUBMIT**

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

**Module 11: Direct and Inverse Variation**  
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Self-Check 2: Answer



**Self-Check**

**Correct**

That's correct! In this given situation, the amount of time needed to paint a room varies inversely with the number of painters working. You can conclude that the situation is an inverse variation.

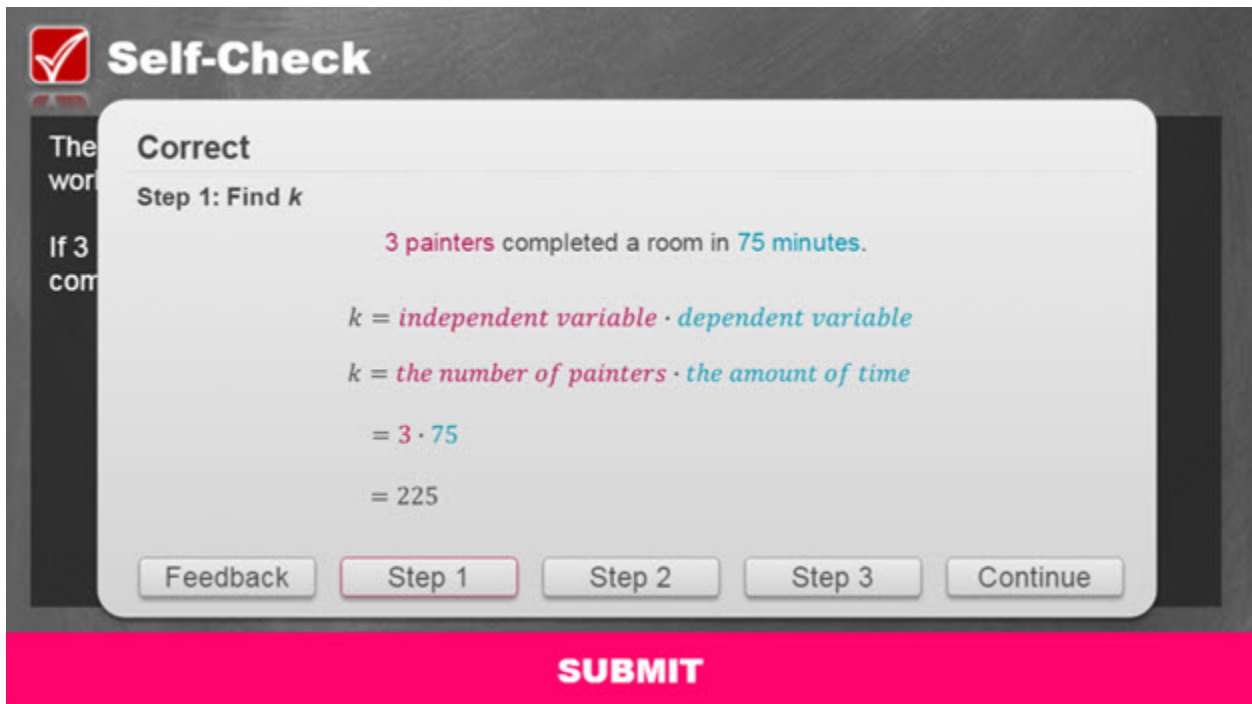
The amount of time needed depends on the number of painters working. Therefore...

Dependent variable → the amount of time

Independent variable → the number of painters

Feedback Step 1 Step 2 Step 3 Continue

**SUBMIT**



**Self-Check**

**Correct**

Step 1: Find  $k$

3 painters completed a room in 75 minutes.

$$k = \text{independent variable} \cdot \text{dependent variable}$$
$$k = \text{the number of painters} \cdot \text{the amount of time}$$
$$= 3 \cdot 75$$
$$= 225$$

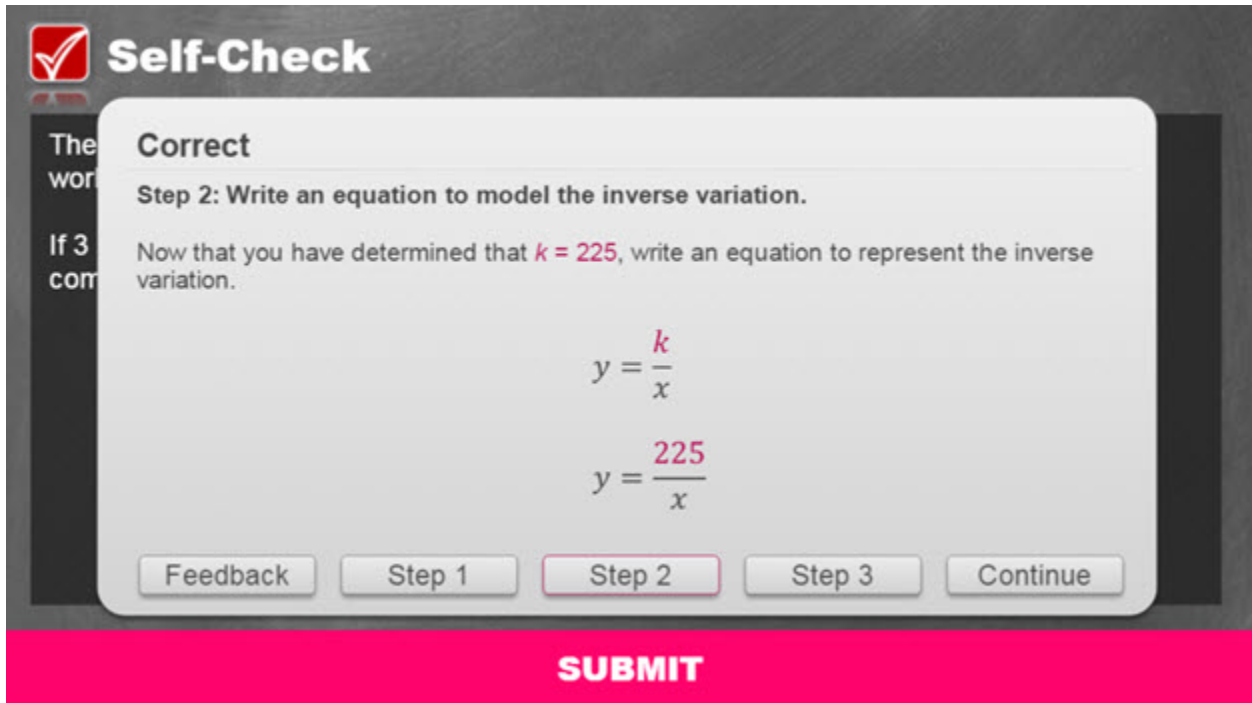
Feedback Step 1 Step 2 Step 3 Continue

**SUBMIT**

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

**Module 11: Direct and Inverse Variation**  
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Self-Check 2: Answer (continued)



**Self-Check**

**Correct**

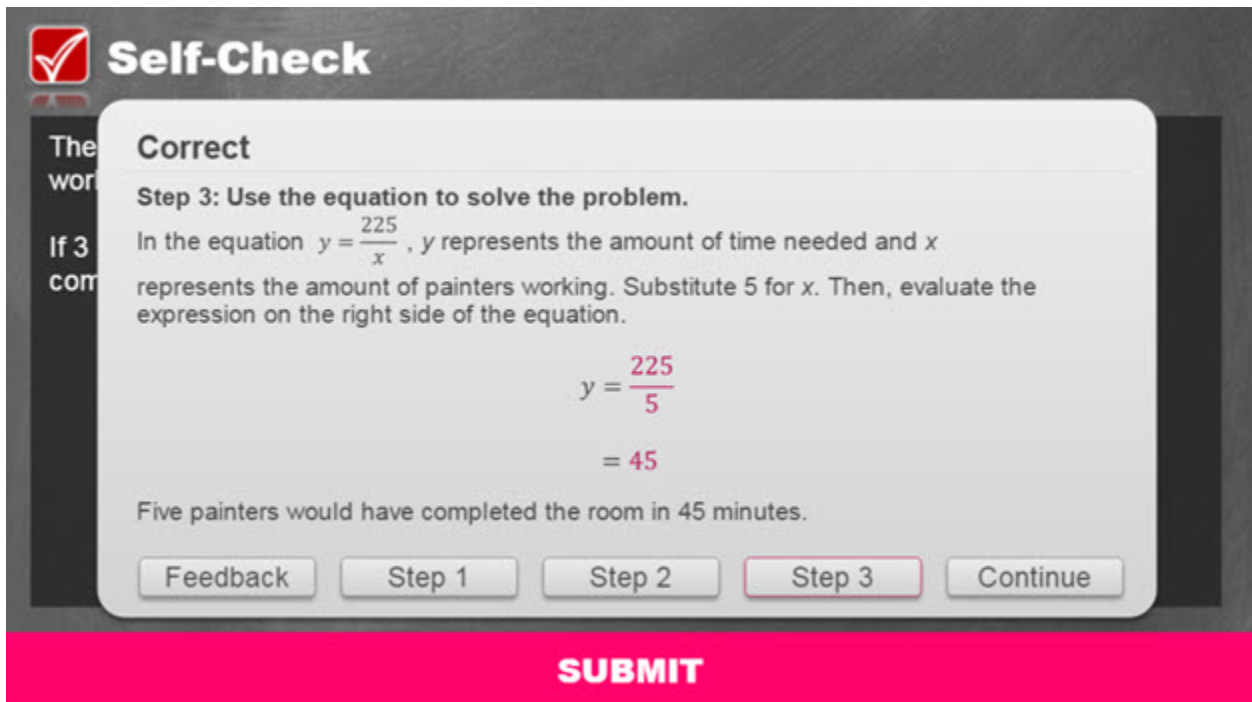
**Step 2: Write an equation to model the inverse variation.**

Now that you have determined that  $k = 225$ , write an equation to represent the inverse variation.

$$y = \frac{k}{x}$$
$$y = \frac{225}{x}$$

Feedback Step 1 Step 2 Step 3 Continue

**SUBMIT**



**Self-Check**

**Correct**

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

In the equation  $y = \frac{225}{x}$ ,  $y$  represents the amount of time needed and  $x$  represents the amount of painters working. Substitute 5 for  $x$ . Then, evaluate the expression on the right side of the equation.

$$y = \frac{225}{5}$$
$$= 45$$

Five painters would have completed the room in 45 minutes.

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**  
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**Conclusion**



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