

Module 9: Writing Linear Equations

Topic 2 Content: Writing the Equation of a Line in Point-Slope Form

Introduction



Today's Lesson

- You will learn how to write a linear equation in point-slope form.

Hello and welcome! I'm so glad you could join me for this lesson in Algebra I, where you will learn how to write a linear equation in point-slope form.

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Anticipatory Set



Step One

Determine the slope, m , of the line.

Step Two

Write the equation of the line in the form $y - y_1 = m(x - x_1)$ by substituting the slope, m , and the coordinates of a given point for x_1 and y_1 .

Use the following steps to guide you in the process of writing the equation of a line in point-slope form, when given two points on the line or when given the slope of the line and a point on the line.

Step 1: Determine the slope, m , of the line.

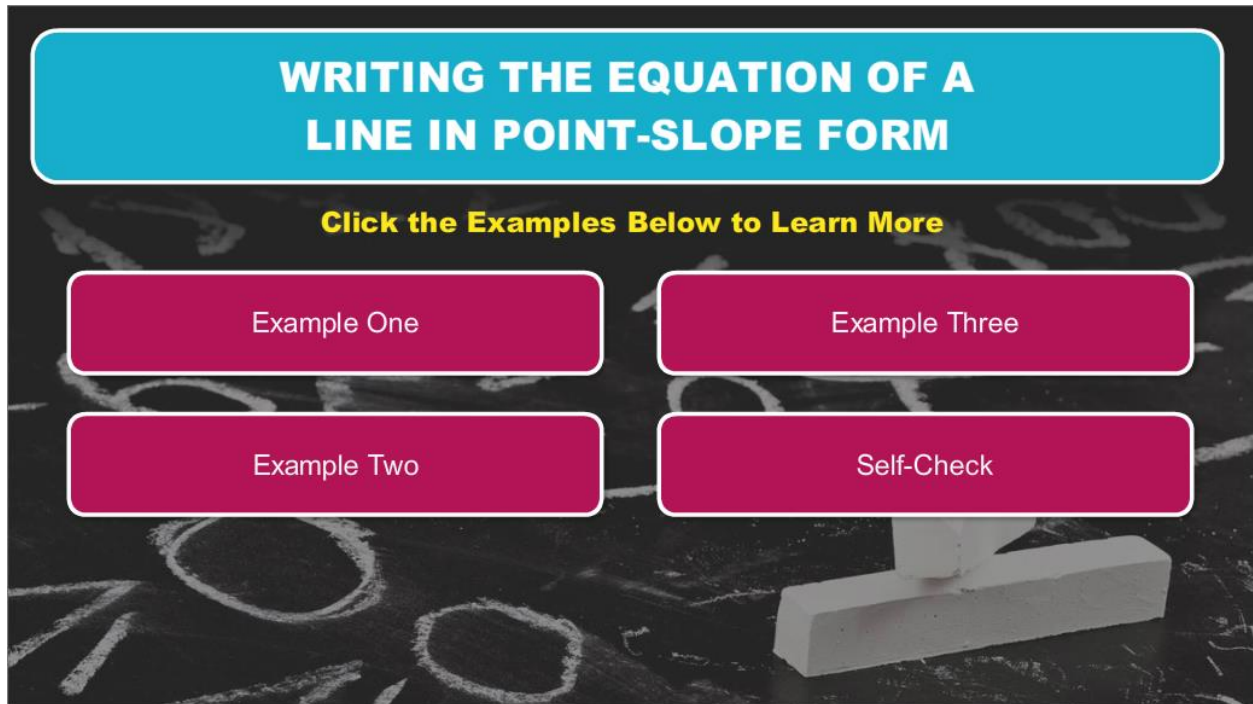
Step 2: Write the equation of the line in the form $y - y_1 = m(x - x_1)$ by substituting the slope, m , and the coordinates of a given point for x_1 and y_1 .

Keep these steps in mind as you work through the following examples.

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Writing the Equation of a Line in Point-Slope Form



The graphic features a dark background with faint chalkboard-style drawings of circles and lines. At the top, a blue rounded rectangle contains the title "WRITING THE EQUATION OF A LINE IN POINT-SLOPE FORM" in white, bold, uppercase letters. Below this, a yellow text prompt reads "Click the Examples Below to Learn More". Underneath the prompt are four magenta rounded rectangles arranged in a 2x2 grid. The top-left button is labeled "Example One", the top-right "Example Three", the bottom-left "Example Two", and the bottom-right "Self-Check". In the bottom right corner of the graphic, there is a 3D white object that looks like a piece of chalk or a small stand.

Click the examples below to learn more.

- Example One
- Example Two
- Example Three
- Self-Check

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Topic 2 Content: Writing the Equation of a Line in Point-Slope Form

Example 1

EXAMPLE 1

Write an equation in point-slope form of the line that has a slope of -3 and passes through the point $(5, -4)$.

STEP ONE

Determine the slope, m , of the line.

$m = -3$

Write an equation in point-slope form of the line that has a slope of -3 and passes through the point $(5, -4)$.

Step 1: Determine the slope, m , of the line.

The first step to writing the equation of a line in point-slope form is to determine the slope of the line. For this example, you know that the slope of the line is -3 .

$$m = -3$$

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Example 1 (continued)

EXAMPLE 1

Write an equation in point-slope form of the line that has a slope of -3 and passes through the point $(5, -4)$.

STEP TWO

Write the equation of the line in the form $y - y_1 = m(x - x_1)$ by substituting the slope, m , and the coordinates of a given point for x_1 and y_1 .

$$m = -3 \quad (x_1, y_1) = (5, -4)$$

$$y - y_1 = m(x - x_1)$$

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

Write an equation in point-slope form of the line that has a slope of -3 and passes through the point $(5, -4)$.

Step 2: Write the equation of the line in the form $y - y_1 = m(x - x_1)$ by substituting the slope for m , and the coordinates of a given point for x_1 and y_1 .

In this example, $m = -3$ and the given point is located at $(5, -4)$.

$$m = -3 \quad (x_1, x_2) = (5, -4)$$

Substitute -4 for y_1 , -3 for m , and 5 for x_1 .

$$y - y_1 = m(x - x_1)$$

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

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Example 1 (continued)

EXAMPLE 1

Write an equation in point-slope form of the line that has a slope of -3 and passes through the point $(5, -4)$.

STEP TWO

Write the equation of the line in the form $y - y_1 = m(x - x_1)$ by substituting the slope, m , and the coordinates of a given point for x_1 and y_1 .

$$m = -3 \quad (x_1, y_1) = (5, -4)$$

$$y - y_1 = m(x - x_1)$$

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

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

Write an equation in point-slope form of the line that has a slope of -3 and passes through the point $(5, -4)$.

Next, simplify the left side of the equation.

$$y - y_1 = m(x - x_1)$$

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

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

The result is an equation in point-slope form that has a slope of -3 and passes through the point $(5, -4)$:

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

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Example 2

EXAMPLE 2

Write an equation in point-slope form of the line that passes through the point (3, 6) and has a slope of 2.

STEP ONE

Determine the slope, m , of the line.

$m = ?$

Which of the following completes the expression above?

6 3 2

Write an equation in point-slope form of the line that passes through the point (3, 6) and has a slope of 2.

Step 1: Determine the slope, m , of the line.

$$m = ?$$

- A) 6
- B) 3
- C) 2

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Example 2 (continued)

EXAMPLE 2

Write an equation in point-slope form of the line that passes through the point (3, 6) and has a slope of 2.

STEP ONE

Determine the slope, m , of the line.

$$m = 2$$

In this example the slope of the line is 2. Therefore, $m = 2$.

2

Next

Write an equation in point-slope form of the line that passes through the point (3, 6) and has a slope of 2.

Step 1: Determine the slope, m , of the line.

$$m = 2$$

In this example the slope of the line is 2. Therefore, $m = 2$.

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Example 2 (continued)

EXAMPLE 2

Write an equation in point-slope form of the line that passes through the point (3, 6) and has a slope of 2.

STEP TWO

Write the equation of the line in the form $y - y_1 = m(x - x_1)$ by substituting the slope, m , and the coordinates of a given point for x_1 and y_1 .

$$m = 2 \quad (x_1, y_1) = (3, 6)$$
$$y - y_1 = m(x - x_1)$$
$$y - \square = \square(x - \square)$$

Substitute the appropriate values above and click submit.

Submit

Write an equation in point-slope form of the line that passes through the point (3, 6) and has a slope of 2.

Step 2: Write the equation of the line in the form $y - y_1 = m(x - x_1)$ by substituting the slope for m , and the coordinates of a given point for x_1 and y_1 .

In this example, $m = 2$ and the given point is located at (3, 6).

$$m = 2 \quad (x_1, y_1) = (3, 6)$$

$$y - y_1 = m(x - x_1)$$

$$y - ? = ?(x - ?)$$

Substitute the appropriate values above and click submit.

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Example 2 (continued)

EXAMPLE 2

Write an equation in point-slope form of the line that passes through the point (3, 6) and has a slope of 2.

After substituting 2 for m , 3 for x_1 , and 6 for y_1 , the result is $y - 6 = 2(x - 3)$.

$$m = 2 \quad (x_1, y_1) = (3, 6)$$

$$y - y_1 = m(x - x_1)$$

$$y - 6 = 2(x - 3)$$

Menu

Write an equation in point-slope form of the line that passes through the point (3, 6) and has a slope of 2.

After substituting 2 for m , 3 for x_1 , and 6 for y_1 , the result is $y - 6 = 2(x - 3)$.

$$m = 2 \quad (x_1, y_1) = (3, 6)$$

$$y - y_1 = m(x - x_1)$$

$$y - 6 = 2(x - 3)$$

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Example 3

EXAMPLE 3

Write an equation in point-slope form of the line that passes through the points $(-5, -6)$ and $(15, 2)$.

STEP ONE

Determine the slope, m , of the line.

$$\text{slope} = m = \frac{y_2 - y_1}{x_2 - x_1}$$

Let $(x_1, y_1) = (-5, -6)$ and $(x_2, y_2) = (15, 2)$. The slope of the line is...

$-\frac{2}{5}$ $\frac{1}{13}$ $\frac{2}{5}$

Write an equation in slope-intercept form of the line that passes through the points $(-5, -6)$ and $(15, 2)$.

Step 1: Determine the slope, m , of the line.

$$\text{slope} = m = \frac{y_2 - y_1}{x_2 - x_1}$$

Recall that the slope formula can be used to find the slope of a line that passes through two given points.

Let $(x_1, y_1) = (-5, -6)$ and $(x_2, y_2) = (15, 2)$. The slope of the line is...

- A) $-\frac{2}{5}$
- B) $\frac{1}{13}$
- C) $\frac{2}{5}$

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Example 3 (continued)

EXAMPLE 3

Write an equation in point-slope form of the line that passes through the points $(-5, -6)$ and $(15, 2)$.

STEP ONE

Determine the slope, m , of the line.

$$\text{slope} = m = \frac{y_2 - y_1}{x_2 - x_1}$$

The slope of the line is $\frac{2}{5}$.

$\frac{2}{5}$

View Work

Next

Write an equation in slope-intercept form of the line that passes through the points $(-5, -6)$ and $(15, 2)$.

Step 1: Determine the slope, m , of the line.

$$\text{slope} = m = \frac{y_2 - y_1}{x_2 - x_1}$$

The slope of the line is $\frac{2}{5}$.

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Example 3 (continued)

EXAMPLE 3

Write an equation in point-slope form of the line that passes through the points $(-5, -6)$ and $(15, 2)$.

Let $(x_1, y_1) = (-5, -6)$ and $(x_2, y_2) = (15, 2)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{2 - (-6)}{15 - (-5)} \quad \text{Substitute the appropriate values.}$$

$$= \frac{8}{20} \quad \text{Simplify the expression.}$$

$$= \frac{2}{5} \quad \text{The slope is } \frac{2}{5}.$$

Next

Write an equation in slope-intercept form of the line that passes through the points $(-5, -6)$ and $(15, 2)$.

Let $(x_1, y_1) = (-5, -6)$ and $(x_2, y_2) = (15, 2)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Substitute the appropriate values.

$$= \frac{2 - (-6)}{15 - (-5)}$$

$$= \frac{8}{20}$$

Simplify the expression.

$$= \frac{2}{5}$$

The slope of the line is $\frac{2}{5}$.

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Example 3 (continued)

EXAMPLE 3

Write an equation in point-slope form of the line that passes through the points $(-5, -6)$ and $(15, 2)$.

STEP TWO

Write the equation of the line in the form $y - y_1 = m(x - x_1)$ by substituting the slope, m , and the coordinates of a given point for x_1 and y_1 .

$$m = \frac{2}{5}$$

$$(x_1, y_1) = (-5, -6) \text{ and } (x_1, y_1) = (15, 2)$$

Write an equation in slope-intercept form of the line that passes through the points $(-5, -6)$ and $(15, 2)$.

Step 2: Write the equation of the line in the form $y - y_1 = m(x - x_1)$ by substituting the slope for m , and the coordinates of a given point for x_1 and y_1 .

$$m = \frac{2}{5}$$

$$(x_1, y_1) = (-5, -6) \text{ and } (x_1, y_1) = (15, 2)$$

By using the slope formula in Step 1, you found that $m = \frac{2}{5}$. You can choose to substitute the coordinates of either point for x_1 and y_1 , since both of the given points lie on the line.

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Example 3 (continued)

EXAMPLE 3

Write an equation in point-slope form of the line that passes through the points $(-5, -6)$ and $(15, 2)$.

$$m = \frac{2}{5} \quad (x_1, y_1) = (-5, -6)$$

$$y - y_1 = m(x - x_1)$$

$$y - (-6) = \frac{2}{5}(x - (-5))$$

$$y + 6 = \frac{2}{5}(x + 5)$$

$$m = \frac{2}{5} \quad (x_1, y_1) = (15, 2)$$

$$y - y_1 = m(x - x_1)$$

$$y - 2 = \frac{2}{5}(x - 15)$$

Write an equation in slope-intercept form of the line that passes through the points $(-5, -6)$ and $(15, 2)$.

If you choose to substitute the coordinates of the point $(-5, -6)$, the result is the equation $y + 6 = \frac{2}{5}(x + 5)$.

If you choose to substitute the coordinates of the point $(15, 2)$, the result is the equation $y - 2 = \frac{2}{5}(x - 15)$.

$$m = \frac{2}{5} \quad (x_1, y_1) = (-5, -6)$$

$$y - y_1 = m(x - x_1)$$

$$y - (-6) = \frac{2}{5}(x - (-5))$$

$$y + 6 = \frac{2}{5}(x + 5)$$

$$m = \frac{2}{5} \quad (x_1, y_1) = (15, 2)$$

$$y - y_1 = m(x - x_1)$$

$$y - 2 = \frac{2}{5}(x - 15)$$

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Example 3 (continued)

EXAMPLE 3

Write an equation in point-slope form of the line that passes through the points $(-5, -6)$ and $(15, 2)$.

OPTION 1
Used the point $(-5, -6)$.

[View Work](#)

OPTION 2
Used the point $(15, 2)$.

[View Work](#)

Write an equation in slope-intercept form of the line that passes through the points $(-5, -6)$ and $(15, 2)$.

It is important to mention that although the equations appear to represent different lines, by writing the equations in slope-intercept form you can easily determine that the equations are equivalent.

Option 1: Used the point $(-5, -6)$.

Option 2: Used the point $(15, 2)$.

[View Work](#)

[View Work](#)

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Example 3 (continued)

EXAMPLE 3

Write an equation in point-slope form of the line that passes through the points $(-5, -6)$ and $(15, 2)$.

OPTION 1

Used the point $(-5, -6)$.

$$y + 6 = \frac{2}{5}(x + 5)$$

$$y + 6 = \frac{2}{5}x + 2 \quad \text{Distributive Property.}$$

$$\begin{array}{r} -6 \qquad -6 \\ \hline y = \frac{2}{5}x - 4 \end{array} \quad \text{Subtract 6 from each side.}$$

OPTION 2

Used the point $(15, 2)$.

View Work

Write an equation in slope-intercept form of the line that passes through the points $(-5, -6)$ and $(15, 2)$.

Option 1: Used the point $(-5, -6)$.

Option 2: Used the point $(15, 2)$.

$$y + 6 = \frac{2}{5}(x + 5)$$

View Work

$$y + 6 = \frac{2}{5}x + 2 \quad \text{Distributive property}$$

$$\begin{array}{r} -6 \qquad -6 \\ \hline y = \frac{2}{5}x - 4 \end{array} \quad \text{Subtract 6 from each side.}$$

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Example 3 (continued)

EXAMPLE 3

Write an equation in point-slope form of the line that passes through the points $(-5, -6)$ and $(15, 2)$.

OPTION 1

Used the point $(-5, -6)$.

$$y + 6 = \frac{2}{5}(x + 5)$$

$$y + 6 = \frac{2}{5}x + 2 \quad \text{Distributive Property.}$$

$$\begin{array}{r} -6 \qquad -6 \\ \hline y = \frac{2}{5}x - 4 \end{array} \quad \text{Subtract 6 from each side.}$$

OPTION 2

Used the point $(15, 2)$.

$$y - 2 = \frac{2}{5}(x - 15)$$

$$y - 2 = \frac{2}{5}x - 6 \quad \text{Distributive Property.}$$

$$\begin{array}{r} +2 \qquad +2 \\ \hline y = \frac{2}{5}x - 4 \end{array} \quad \text{Add 2 to each side.}$$

[Menu](#)

Write an equation in slope-intercept form of the line that passes through the points $(-5, -6)$ and $(15, 2)$.

Option 1: Used the point $(-5, -6)$.

Option 2: Used the point $(15, 2)$.

$$y + 6 = \frac{2}{5}(x + 5)$$

$$y + 6 = \frac{2}{5}x + 2 \quad \text{Distributive property}$$

$$\begin{array}{r} -6 \qquad -6 \\ \hline y = \frac{2}{5}x - 4 \end{array} \quad \text{Subtract 6 from each side.}$$

$$y - 2 = \frac{2}{5}(x - 15)$$

$$y - 2 = \frac{2}{5}x - 6 \quad \text{Distributive property}$$

$$\begin{array}{r} +2 \qquad +2 \\ \hline y = \frac{2}{5}x - 4 \end{array} \quad \text{Add 2 to each side.}$$

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Self-Check 1



Self-Check

Which of the following equations represents a line that passes through the point $(-8, 7)$ and has a slope of $-\frac{1}{4}$?

- ☐ $y - 7 = -\frac{1}{4}(x + 8)$
- ☐ $y + 8 = -\frac{1}{4}(x - 7)$
- ☐ $y - 7 = -\frac{1}{4}(x - 8)$

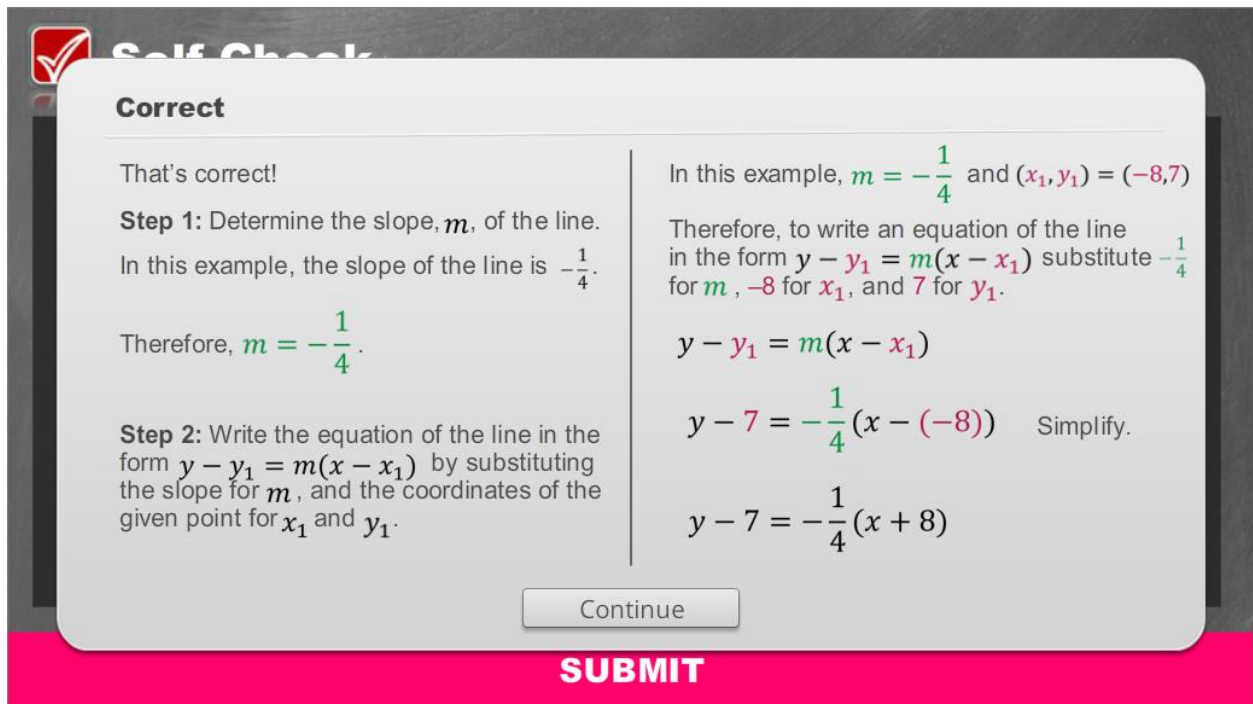
SUBMIT

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!

Step 1: Determine the slope, m , of the line.
In this example, the slope of the line is $-\frac{1}{4}$.

Therefore, $m = -\frac{1}{4}$.

Step 2: Write the equation of the line in the form $y - y_1 = m(x - x_1)$ by substituting the slope for m , and the coordinates of the given point for x_1 and y_1 .

In this example, $m = -\frac{1}{4}$ and $(x_1, y_1) = (-8, 7)$

Therefore, to write an equation of the line in the form $y - y_1 = m(x - x_1)$ substitute $-\frac{1}{4}$ for m , -8 for x_1 , and 7 for y_1 .

$$y - y_1 = m(x - x_1)$$
$$y - 7 = -\frac{1}{4}(x - (-8)) \quad \text{Simplify.}$$
$$y - 7 = -\frac{1}{4}(x + 8)$$

Continue

SUBMIT

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

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Self-Check 2

 **Self-Check**

Choose **each** equation that represents the line that passes through the points (2, -11) and (-1, 7).

- ☐ $y + 11 = -6(x + 2)$
- ☐ $y - 7 = -6(x - 1)$
- ☐ $y + 11 = -6(x - 2)$
- ☐ $y - 7 = -6(x + 1)$

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

Correct

That's correct! **Step 1:** Determine the slope, m , of the line.

Let $(x_1, y_1) = (2, -11)$ and $(x_2, y_2) = (-1, 7)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{7 - (-11)}{-1 - 2}$$

Substitute the appropriate values.

$$= \frac{18}{-3}$$

Simplify the expression.

$$= -6$$

The slope of the line is -6 .

SUBMIT

 Self Check

Correct

Step 2: Write the equation of the line in the form $y - y_1 = m(x - x_1)$ by substituting the slope for m , and the coordinates of a given point for x_1 and y_1 .

By using the slope formula in Step 1, you found that $m = -6$. Since both of the given points lie on the line, you can choose either point to substitute for x_1 and y_1 .

Option 1: Use the point $(2, -11)$.	Option 2: Use the point $(-1, 7)$.
$y - y_1 = -6(x - x_1)$	$y - y_1 = -6(x - x_1)$
$y - (-11) = -6(x - 2)$	$y - 7 = -6(x - (-1))$
$y + 11 = -6(x - 2)$	$y - 7 = -6(x + 1)$

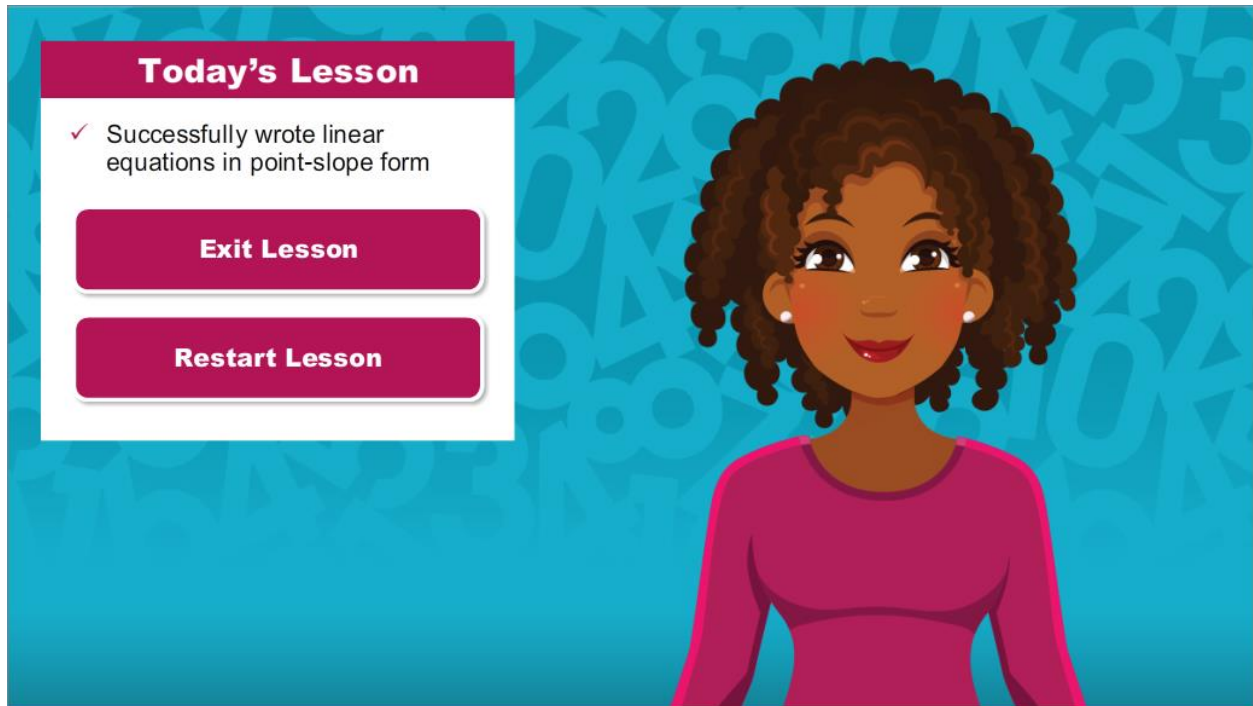
SUBMIT

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

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Conclusion



You have reached the conclusion of this lesson where you learned how to write a linear equation in point-slope form.