

Module 9: Writing Linear Equations

Topic 3 Content: Writing the Equation of a Line Perpendicular to a Given Line

Introduction



Today's Lesson

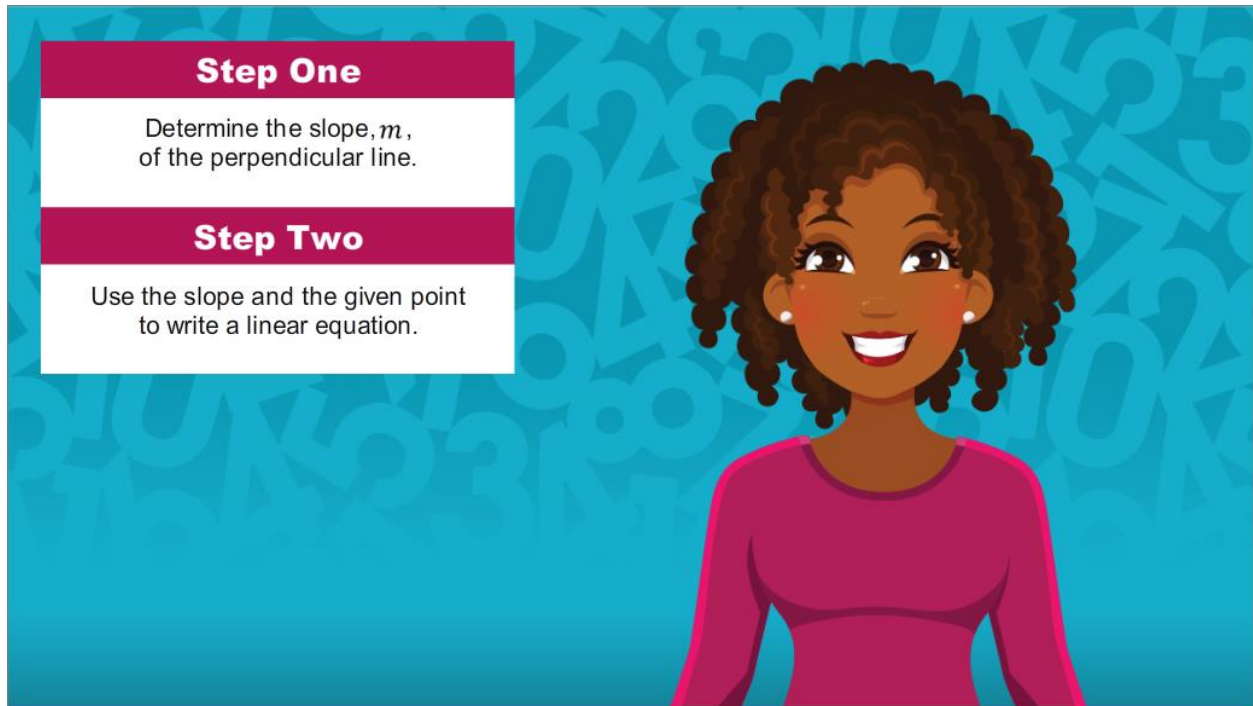
- You will learn how to write the equation of a line that is perpendicular to a given line and passes through a given point.

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 the equation of a line that is perpendicular to a given line and passes through a given point.

Module 9: Writing Linear Equations

Topic 3 Content: Writing the Equation of a Line Perpendicular to a Given Line

Anticipatory Set



Step One

Determine the slope, m , of the perpendicular line.

Step Two

Use the slope and the given point to write a linear equation.

Use the following steps to guide you in the process of writing the equation of a line that is perpendicular to a given line and passes through a given point.

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

Step 2: Use the slope and the given point to write a linear equation.

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

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Topic 3 Content: Writing the Equation of a Line Perpendicular to a Given Line

Writing the Equation of a Line Perpendicular to a Given Line

WRITING THE EQUATION OF A LINE PERPENDICULAR TO A GIVEN LINE

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 9: Writing Linear Equations

Topic 3 Content: Writing the Equation of a Line Perpendicular to a Given Line

Example 1

EXAMPLE 1

Write an equation in slope-intercept form of the line that passes through the point $(0, 5)$ and is perpendicular to line p .

STEP ONE

Determine the slope, m , of the perpendicular line.

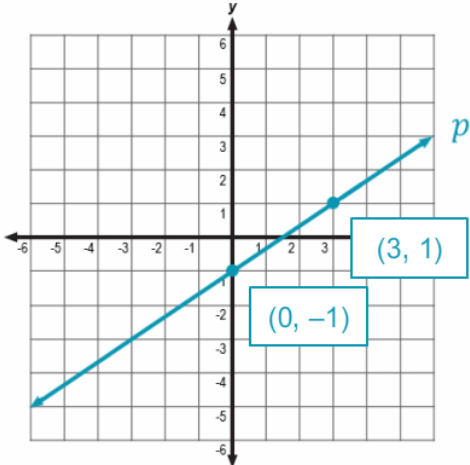
The slope of line p is...

A) $-\frac{3}{2}$

B) $-\frac{2}{3}$

C) $\frac{2}{3}$

D) $\frac{3}{2}$



Write an equation in slope-intercept form of the line that passes through the point $(0, 5)$ and is perpendicular to line p .

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

Recall that perpendicular lines have opposite reciprocal slopes. You must find the slope of line p in order to determine the slope of the line perpendicular to line p .

Begin by locating two points on line p with integral coordinates. You can choose the points $(0, -1)$ and $(3, 1)$.

The slope of line p is ...

- A) $-\frac{3}{2}$
- B) $-\frac{2}{3}$
- C) $\frac{2}{3}$
- D) $\frac{3}{2}$

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Topic 3 Content: Writing the Equation of a Line Perpendicular to a Given Line

Example 1 (continued)

EXAMPLE 1

Write an equation in slope-intercept form of the line that passes through the point $(0, 5)$ and is perpendicular to line p .

STEP ONE

Determine the slope, m , of the perpendicular line.

$$m = \frac{\text{change in } y - \text{values}}{\text{change in } x - \text{values}}$$
$$= \frac{\text{vertical change}}{\text{horizontal change}} = \frac{2}{3}$$

The slope of the line is $\frac{2}{3}$.

$\frac{2}{3}$

Next

Write an equation in slope-intercept form of the line that passes through the point $(0, 5)$ and is perpendicular to line p .

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

$$m = \frac{\text{change in } y - \text{values}}{\text{change in } x - \text{values}} = \frac{\text{vertical change}}{\text{horizontal change}} = \frac{2}{3}$$

The slope of the line is $\frac{2}{3}$.

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Topic 3 Content: Writing the Equation of a Line Perpendicular to a Given Line

Example 1 (continued)

EXAMPLE 1

Write an equation in slope-intercept form of the line that passes through the point $(0, 5)$ and is perpendicular to line p .

STEP ONE

Determine the slope, m , of the perpendicular line.

The slope of line p is $\frac{2}{3}$.

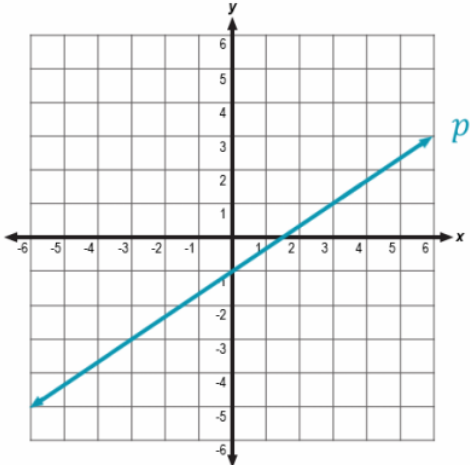
What is the slope of a line perpendicular to line p ?

A) $-\frac{3}{2}$

B) $-\frac{2}{3}$

C) $\frac{2}{3}$

D) $\frac{3}{2}$



Write an equation in slope-intercept form of the line that passes through the point $(0, 5)$ and is perpendicular to line p .

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

Now that you know the slope of line p is $\frac{2}{3}$, you can find the slope of a line perpendicular to line p .

Recall that perpendicular lines have opposite reciprocal slopes.

What is the slope of a line perpendicular to line p ?

- A) $-\frac{3}{2}$
- B) $-\frac{2}{3}$
- C) $\frac{2}{3}$
- D) $\frac{3}{2}$

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Topic 3 Content: Writing the Equation of a Line Perpendicular to a Given Line

Example 1 (continued)

EXAMPLE 1

Write an equation in slope-intercept form of the line that passes through the point $(0, 5)$ and is perpendicular to line p .

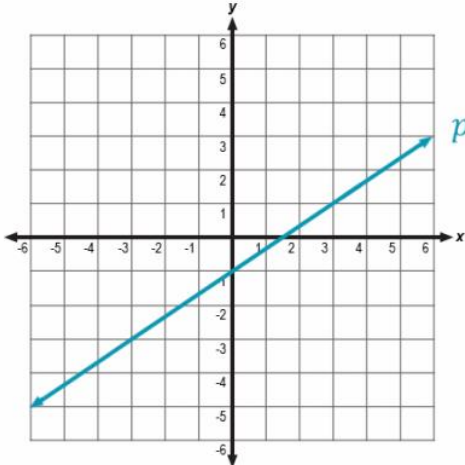
STEP ONE

Determine the slope, m , of the perpendicular line.

$\frac{2}{3}$ and $-\frac{3}{2}$ are opposite reciprocals.

Therefore, the slope of the line perpendicular to line p is $-\frac{3}{2}$.

$-\frac{3}{2}$



Next

Write an equation in slope-intercept form of the line that passes through the point $(0, 5)$ and is perpendicular to line p .

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

$\frac{2}{3}$ and $-\frac{3}{2}$ are opposite reciprocals.

Therefore, the slope of a line perpendicular to line p is $-\frac{3}{2}$.

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Topic 3 Content: Writing the Equation of a Line Perpendicular to a Given Line

Example 1 (continued)

<p>EXAMPLE 1</p> <p>Write an equation in slope-intercept form of the line that passes through the point (0, 5) and is perpendicular to line p.</p> <p>STEP ONE</p> <p>Determine the slope, m, of the perpendicular line.</p> <p>STEP TWO</p> <p>Use the slope and the given point to write a linear equation.</p> $y = mx + b$ $m = -\frac{3}{2} \quad b = 5$	<p>Which of the following equations represents a line that passes through the point (0, 5) and is perpendicular to line p?</p> <p>$y = -\frac{3}{5}x + 2$</p> <p>$y = -\frac{3}{2}x + 5$</p> <p>$y = -5x - \frac{3}{2}$</p>
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Write an equation in slope-intercept form of the line that passes through the point (0, 5) and is perpendicular to line p .

Step 2: Use the slope and the given point to write a linear equation.

$$y = mx + b$$
$$m = -\frac{3}{2} \quad b = 5$$

In this example, you are asked to write an equation in the form $y = mx + b$. Now that Step 1 is complete, you know that the slope, m , is $-\frac{3}{2}$.

The given point (0, 5) is the y -intercept of the perpendicular line. So you can conclude that $b = 5$. You have enough information to write the equation of the perpendicular line.

Which of the following equations represents the line that passes through (0, 5) and is perpendicular to line p ?

- A) $y = -\frac{3}{5}x + 2$
- B) $y = -\frac{3}{2}x + 5$
- C) $y = 5x - \frac{3}{2}$

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Topic 3 Content: Writing the Equation of a Line Perpendicular to a Given Line

Example 1 (continued)

EXAMPLE 1

Write an equation in slope-intercept form of the line that passes through the point $(0, 5)$ and is perpendicular to line p .

STEP ONE

Determine the slope, m , of the perpendicular line.

STEP TWO

Use the slope and the given point to write a linear equation.

$$y = mx + b$$

$$m = -\frac{3}{2} \quad b = 5$$

After substituting $-\frac{3}{2}$ for m and 5 for b ,
you find that $y = -\frac{3}{2}x + 5$.

$$y = -\frac{3}{2}x + 5$$

Next

Write an equation in slope-intercept form of the line that passes through the point $(0, 5)$ and is perpendicular to line p .

Step 2: Use the slope and the given point to write a linear equation.

$$y = mx + b$$

$$m = -\frac{3}{2} \quad b = 5$$

After substituting $-\frac{3}{2}$ for m and 5 for b , you find that $y = -\frac{3}{2}x + 5$.

Module 9: Writing Linear Equations

Topic 3 Content: Writing the Equation of a Line Perpendicular to a Given Line

Example 1 (continued)

EXAMPLE 1

Write an equation in slope-intercept form of the line that passes through the point $(0, 5)$ and is perpendicular to line p .

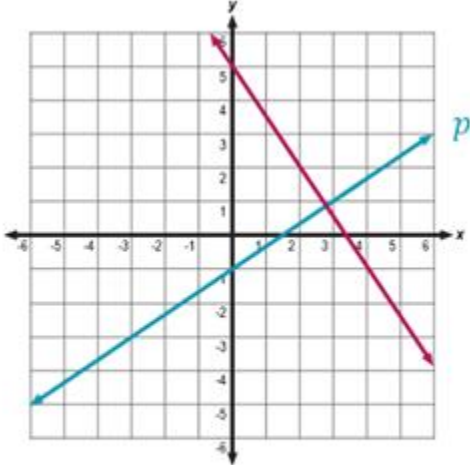
STEP ONE

Determine the slope, m , of the perpendicular line.

STEP TWO

Use the slope and the given point to write a linear equation.

$$y = mx + b$$
$$y = -\frac{3}{2}x + 5$$



Menu

Write an equation in slope-intercept form of the line that passes through the point $(0, 5)$ and is perpendicular to line p .

Step 2: Use the slope and the given point to write a linear equation.

$$y = mx + b$$
$$y = -\frac{3}{2}x + 5$$

Your work is complete. You have written the equation of a line that passes through $(0, 5)$ and is perpendicular to line p .

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Topic 3 Content: Writing the Equation of a Line Perpendicular to a Given Line

Example 2

EXAMPLE 2

Write an equation in slope-intercept form of the line that passes through the point (8, 13) and is perpendicular to the line $4x + 5y = 10$.

STEP ONE

Determine the slope, m , of the perpendicular line.

Standard Form: $Ax + By = C$

Slope-Intercept Form: $y = mx + b$

What is the slope of a line perpendicular to $4x + 5y = 10$?

$\frac{5}{4}$ $-\frac{5}{4}$ $\frac{4}{5}$ $-\frac{4}{5}$

Write an equation in slope-intercept form of the line that passes through the point (8, 13) and is perpendicular to the line $4x + 5y = 10$.

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

Standard form: $Ax + By = C$

Slope-intercept form: $y = mx + b$

Recall that when given a linear equation in standard form, you can determine the slope by representing the equation in slope-intercept form. Keep in mind that perpendicular lines have opposite reciprocal slopes.

What is the slope of a line perpendicular to $4x + 5y = 10$?

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

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Example 2 (continued)

EXAMPLE 2

Write an equation in slope-intercept form of the line that passes through the point (8, 13) and is perpendicular to the line $4x + 5y = 10$.

STEP ONE

Determine the slope, m , of the perpendicular line.

Standard Form: $Ax + By = C$

Slope-Intercept Form: $y = mx + b$

The slope of a line perpendicular to $4x + 5y = 10$ is $\frac{5}{4}$.

$\frac{5}{4}$ [View Work](#) [Next](#)

Write an equation in slope-intercept form of the line that passes through the point (8, 13) and is perpendicular to the line $4x + 5y = 10$.

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

Standard form: $Ax + By = C$
Slope-intercept form: $y = mx + b$

The slope of a line perpendicular to $4x + 5y = 10$ is $\frac{5}{4}$.

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Topic 3 Content: Writing the Equation of a Line Perpendicular to a Given Line

Example 2 (continued)

EXAMPLE 2

Write an equation in slope-intercept form of the line that passes through the point (8, 13) and is perpendicular to the line $4x + 5y = 10$.

$$\begin{array}{r} 4x + 5y = 10 \\ -4x \quad -4x \\ \hline 5y = -4x + 10 \\ \frac{5y}{5} = \frac{-4x}{5} + \frac{10}{5} \\ y = -\frac{4}{5}x + 2 \end{array}$$

Begin by finding the slope of the line represented by the equation $4x + 5y = 10$.

Subtract $4x$ from both sides of the equation.

Divide each term by 5.

The slope of the given line is $-\frac{4}{5}$.

Because perpendicular lines have opposite reciprocal slopes, the slope of a line perpendicular to the given line is $\frac{5}{4}$.

Next

Write an equation in slope-intercept form of the line that passes through the point (8, 13) and is perpendicular to the line $4x + 5y = 10$.

Begin by finding the slope of the line represented by the equation $4x + 5y = 10$.

$$\begin{array}{r} 4x + 5y = 10 \\ -4x \quad -4x \\ \hline 5y = -4x + 10 \\ \frac{5y}{5} = \frac{-4x}{5} + \frac{10}{5} \\ y = -\frac{4}{5}x + 2 \end{array}$$

Subtract $4x$ from both sides of the equation.

Divide each term by 5.

The slope of the given line is $-\frac{4}{5}$.

Because perpendicular lines have opposite reciprocal slopes, the slope of a line perpendicular to the given line is $\frac{5}{4}$.

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Example 2 (continued)

EXAMPLE 2

Write an equation in slope-intercept form of the line that passes through the point (8, 13) and is perpendicular to the line $4x + 5y = 10$.

STEP TWO

Use the slope and the given point to write a linear equation.

$$y = mx + b$$
$$m = \frac{5}{4} \quad (x, y) = (8, 13)$$

Which of the following represents a line with a slope of $\frac{5}{4}$ that passes through the point (8, 13)?

$y = \frac{5}{4}x$

$y = \frac{5}{4}x + 3$

$y = -\frac{5}{4}x + 8$

$y = \frac{5}{4}x + 13$

Write an equation in slope-intercept form of the line that passes through the point (8, 13) and is perpendicular to the line $4x + 5y = 10$.

Step 2: Use the slope and the given point to write a linear equation.

$$y = mx + b$$
$$m = \frac{5}{4} \quad (x, y) = (8, 13)$$

In this example, you are asked to write an equation in the form $y = mx + b$. Now that Step 1 is complete, you know that the slope, m , is $\frac{5}{4}$.

To find b , substitute $\frac{5}{4}$ for m and the coordinates of the given point (8, 13) for x and y . Then, solve for b .

Which of the following represents a line with a slope of $\frac{5}{4}$ that passes through the point (8, 13)?

- A) $y = \frac{5}{4}x$
- B) $y = \frac{5}{4}x + 3$
- C) $y = -\frac{5}{4}x + 8$
- D) $y = \frac{5}{4}x + 13$

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Example 2 (continued)

EXAMPLE 2

Write an equation in slope-intercept form of the line that passes through the point (8, 13) and is perpendicular to the line $4x + 5y = 10$.

STEP TWO

Use the slope and the given point to write a linear equation.

$$y = mx + b$$
$$m = \frac{5}{4} \quad (x, y) = (8, 13)$$

The following equation represents a line with a slope of $\frac{5}{4}$ that passes through the point (8, 13).

$y = \frac{5}{4}x + 3$

View Work

Menu

Write an equation in slope-intercept form of the line that passes through the point (8, 13) and is perpendicular to the line $4x + 5y = 10$.

Step 2: Use the slope and the given point to write a linear equation.

$$y = mx + b$$
$$m = \frac{5}{4} \quad (x, y) = (8, 13)$$

The following equation represents a line with a slope of $\frac{5}{4}$ that passes through the point (8, 13).

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Example 2 (continued)

EXAMPLE 2

Write an equation in slope-intercept form of the line that passes through the point (8, 13) and is perpendicular to the line $4x + 5y = 10$.

$y = mx + b$ $13 = \frac{5}{4}(8) + b$ $13 = 10 + b$ $\begin{array}{r} -10 \quad -10 \\ \hline 3 = b \end{array}$	<p>In this example, $m = \frac{5}{4}$ and $(x, y) = (8, 13)$.</p> <p>Begin by substituting $\frac{5}{4}$ for m, 8 for x, and 13 for y.</p> <p>Then, solve for b. Start by finding the product of $\frac{5}{4}$ and 8.</p> <p>Next, subtract 10 from both sides of the equation.</p>
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Now that you know that $m = \frac{5}{4}$ and $b = 3$, you can write the equation of the line in slope-intercept form: $y = mx + b$.

$$y = \frac{5}{4}x + 3$$

Menu

Write an equation in slope-intercept form of the line that passes through the point (8, 13) and is perpendicular to the line $4x + 5y = 10$.

$y = mx + b$ $13 = \frac{5}{4}(8) + b$ $13 = 10 + b$ $\begin{array}{r} -10 \quad -10 \\ \hline 3 = b \end{array}$	<p>In this example, $m = \frac{5}{4}$ and $(x, y) = (8, 13)$.</p> <p>Begin by substituting $\frac{5}{4}$ for m, 8 for x, and 13 for y.</p> <p>Then, solve for b. Start by finding the product of $\frac{5}{4}$ and 8.</p> <p>Next, subtract 10 from both sides of the equation.</p>
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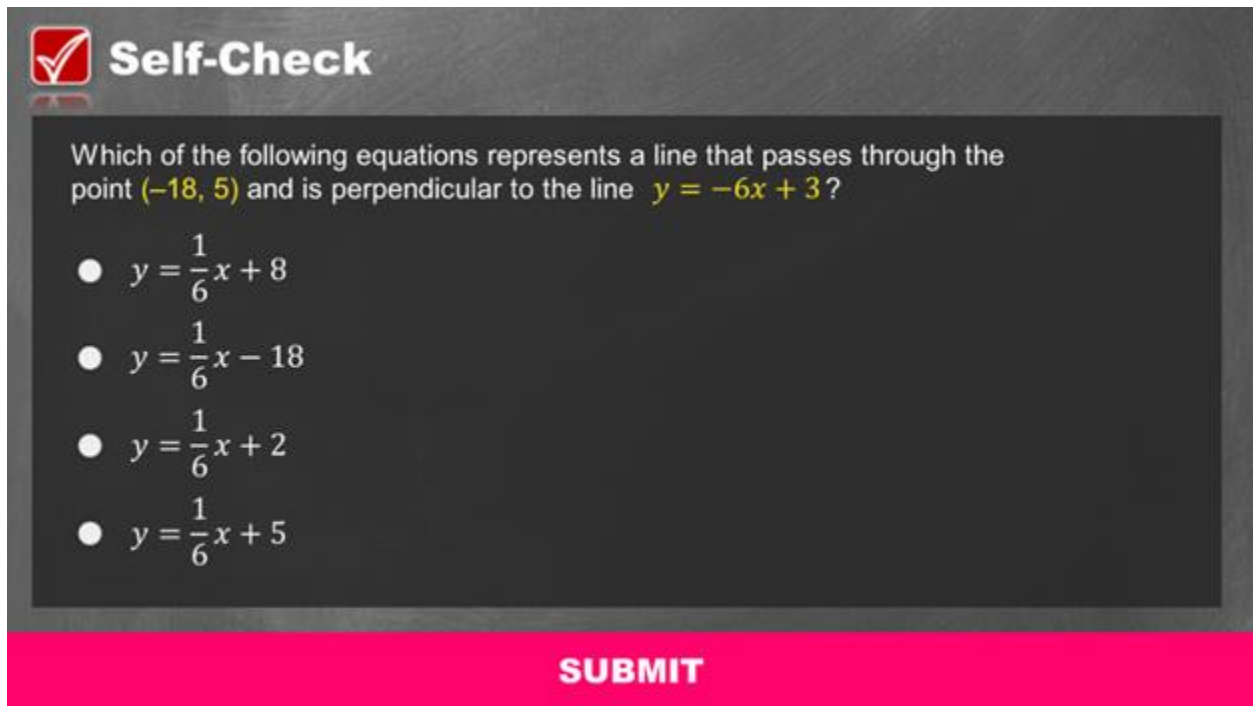
Now that you know that $m = \frac{5}{4}$ and $b = 3$, you can write the equation of the line in slope-intercept form: $y = mx + b$.

$$y = \frac{5}{4}x + 3$$

Module 9: Writing Linear Equations

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Self-Check



Self-Check

Which of the following equations represents a line that passes through the point $(-18, 5)$ and is perpendicular to the line $y = -6x + 3$?

- $y = \frac{1}{6}x + 8$
- $y = \frac{1}{6}x - 18$
- $y = \frac{1}{6}x + 2$
- $y = \frac{1}{6}x + 5$

SUBMIT

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

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Topic 3 Content: Writing the Equation of a Line Perpendicular to a Given Line

Self-Check: Answer

Correct

That's correct!

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

The slope of the line represented by the equation $y = -6x + 3$ is -6 .

Because perpendicular lines have opposite reciprocal slopes, the slope of a line perpendicular to the given line is $\frac{1}{6}$.

Step 2: Use the slope and the given point to write a linear equation.

In this example, $m = \frac{1}{6}$ and $(x, y) = (-18, 5)$. $y = mx + b$

Begin by substituting $\frac{1}{6}$ for m , -18 for x , and 5 for y . $5 = \frac{1}{6}(-18) + b$

Part 1 Part 2 Continue

SUBMIT

Correct

$5 = \frac{1}{6}(-18) + b$ Then, solve for b . Start by finding the product of $\frac{1}{6}$ and -18 .

$5 = -3 + b$ Next add 3 to both sides of the equation.

$+3 \quad +3$

$8 = b$

Now that you know that $m = \frac{1}{6}$ and $b = 8$, you can write the equation of the line in slope-intercept form.

$y = mx + b$

$y = \frac{1}{6}x + 8$

Part 1 Part 2 Continue

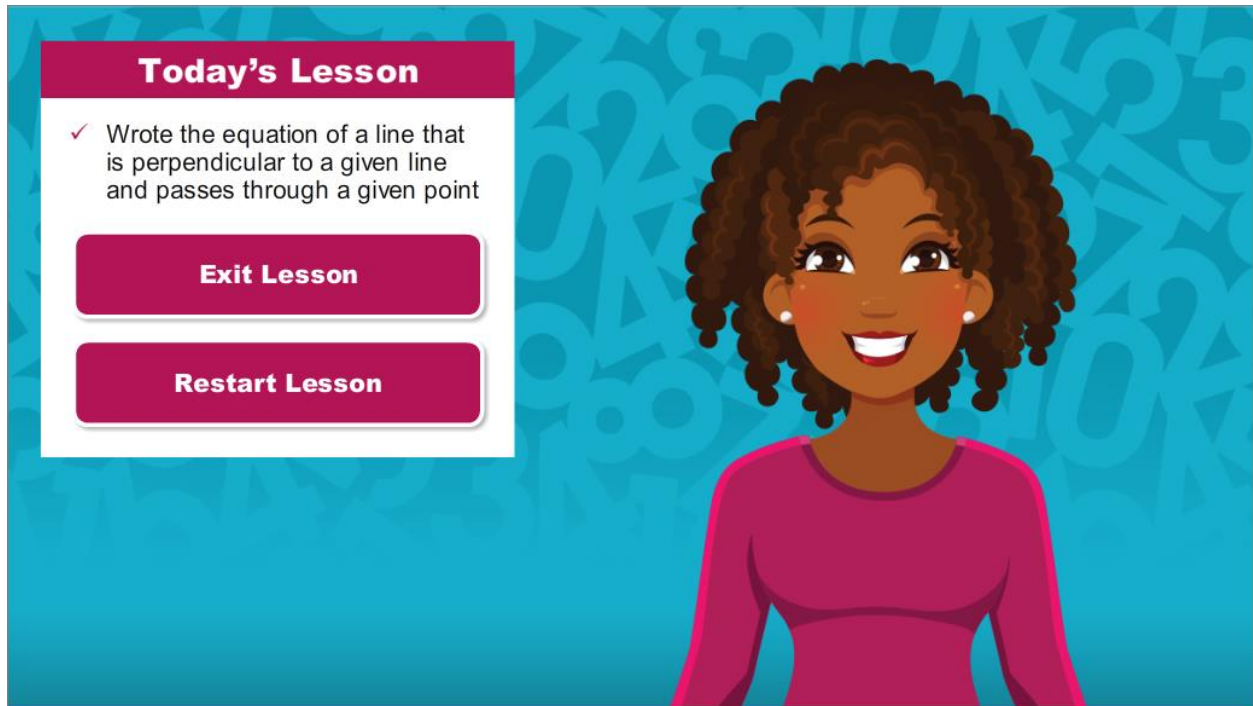
SUBMIT

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

Module 9: Writing Linear Equations

Topic 3 Content: Writing the Equation of a Line Perpendicular to a Given Line

Conclusion



The image shows a digital lesson conclusion screen. On the right side, there is a cartoon illustration of a young woman with dark skin, curly hair, and a pink long-sleeved shirt, smiling. The background is a teal color with a pattern of faint, light blue mathematical symbols like pi, infinity, and numbers. On the left side, there is a white rectangular box with a pink header that says "Today's Lesson". Below the header, there is a checkmark icon followed by the text: "Wrote the equation of a line that is perpendicular to a given line and passes through a given point". At the bottom of this box are two pink buttons with white text: "Exit Lesson" and "Restart Lesson".

You have reached the conclusion of this lesson where you learned how to write the equation of a line that is perpendicular to a given line and passes through a given point.