Write an Equation Given the Slope and a Point

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CONCEPT 1

Write an Equation Given the Slope and a Point

Here you'll be given the slope of a line and a point on the line and you'll learn to write the equation of the line.

Suppose that you sent out a text message to all of your friends, asking them what information was needed to write the equation of a line. One of your friends responded that all you need is the slope of the line and a point on the line. Do you think that your friend was correct? If so, does it matter what point you have, and how could you use this information to come up with the equation? In this Concept, you'll get answers to these questions so that you can judge the merits of your friend's advice.

Guidance

Previously, you learned how to graph solutions to two-variable equations in slope-intercept form. This Concept focuses on how to write an equation for a graphed line when given the slope and a point. There are two things you will need from the graph to write the equation in slope-intercept form:

1. The $y-$intercept of the graph
2. The slope of the line

Having these two pieces of information will allow you to make the appropriate substitutions in the slope-intercept formula. Recall the following:

Slope-intercept form: $y = (slope)x + (y - intercept)$ or $y = mx + b$

Example A

Write the equation for a line with a slope of 4 and a $y-$intercept of (0, –3).

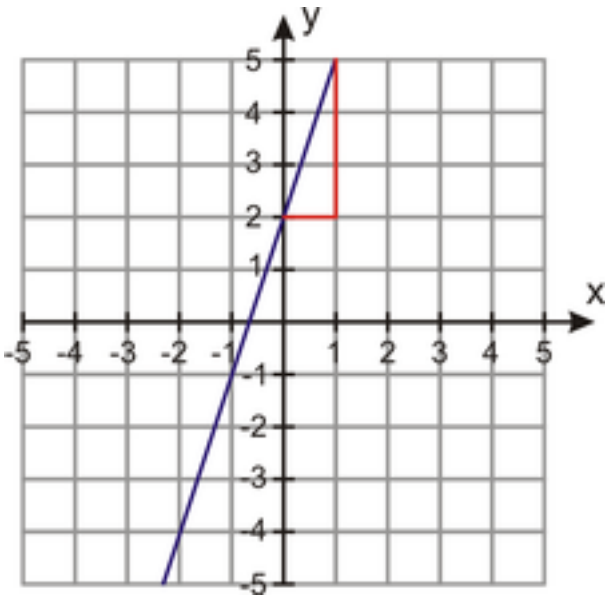
Solution: Slope-intercept form requires two things: the slope and $y-$intercept. To write the equation, you substitute the values into the formula.

$$y = (slope)x + (y - intercept)$$
$$y = 4x + (-3)$$
$$y = 4x - 3$$

You can also use a graphed line to determine the slope and $y-$intercept.

Example B

Use the graph below to write an equation in slope-intercept form.



Solution:

The $y-$intercept is (0, 2). Using the slope triangle, you can determine the slope is $\frac{rise}{run} = \frac{-3}{-1} = \frac{3}{1}$. Substituting the value 2 for b and the value 3 for m, the equation for this line is $y = 3x + 2$.

Writing an Equation Given the Slope and a Point

You will not always be given the $y-$intercept, but sometimes you will be given any point on the line. When asked to write the equation given a graph, it may be difficult to determine the $y-$intercept. Perhaps the $y-$intercept is rational instead of an integer. Maybe all you have is the slope and an ordered pair. You can use this information to write the equation in slope-intercept form. To do so, you will need to follow several steps.

Step 1: Begin by writing the formula for slope-intercept form: $y = mx + b$.

Step 2: Substitute the given slope for m.

Step 3: Use the ordered pair you are given (x, y) and substitute these values for the variables x and y in the equation.

Step 4: Solve for b (the $y-$intercept of the graph).

Step 5: Rewrite the original equation in Step 1, substituting the slope for m and the $y-$intercept for b.

Example C

Write an equation for a line with a slope of 4 that contains the ordered pair (–1, 5).

Solution:

Step 1: Begin by writing the formula for slope-intercept form.

$$y = mx + b$$

Step 2: Substitute the given slope for m.

$$y = 4x + b$$

Step 3: Use the ordered pair you are given, (–1, 5), and substitute these values for the variables x and y in the equation.

$$5 = (4)(-1) + b$$

Step 4: Solve for b (the $y-$intercept of the graph).

$$\begin{aligned} 5 &= -4 + b \\ 5 + 4 &= -4 + 4 + b \\ 9 &= b \end{aligned}$$

Step 5: Rewrite $y = mx + b$, substituting the slope for m and the $y-$intercept for b.

$$y = 4x + 9$$

Vocabulary

Slope: The ***slope*** of a line is the vertical change, Δy, divided by the horizontal change, Δx. The ***slope*** of a line measures its steepness (either negative or positive). The formula for slope is:

$\text{slope} = \frac{\Delta y}{\Delta x} = \frac{\text{rise}}{\text{run}}$

Slope-intercept form: The ***slope-intercept form of an equation*** is: $y = (slope)x + (y-\text{intercept})$ or $y = (m)x + b$, where $m = slope$ and $b = y-\text{intercept}$.

Zero slope: A line with ***zero slope*** is a line without any steepness, or a horizontal line.

Undefined slope: An ***undefined slope*** cannot be computed. Vertical lines have undefined slopes.

Guided Practice

Write the equation for a line with a slope of –3 containing the point (3, –5).

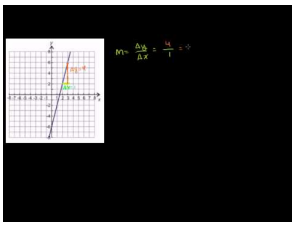
Solution:

Using the five-steps from above:

$$\begin{aligned} y &= (slope)x + (y - intercept) \\ y &= -3x + b \\ -5 &= -3(3) + b \\ -5 &= -9 + b \\ 4 &= b \\ y &= -3x + 4 \end{aligned}$$

Practice

Sample explanations for some of the practice exercises below are available by viewing the following video. Note that there is not always a match between the number of the practice exercise in the video and the number of the practice exercise listed in the following exercise set. However, the practice exercise is the same in both. CK-12 Basic Algebra:Linear Equations inSlope-InterceptForm (14:58)



MEDIA

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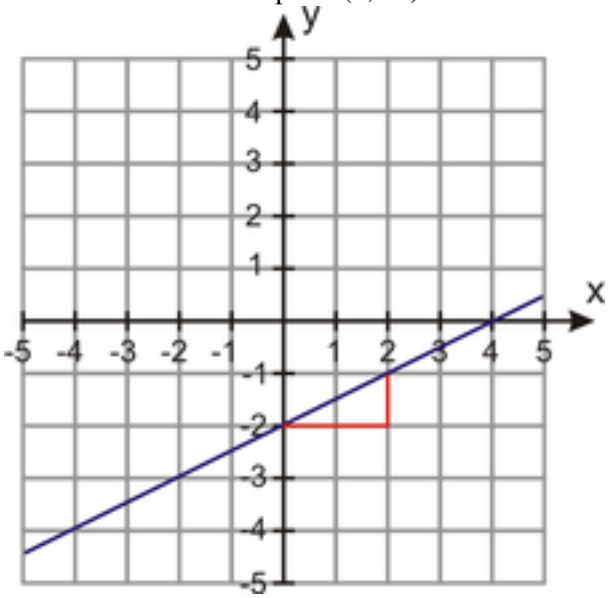
1. What is the formula for slope-intercept form? What do the variables m and b represent?
2. What are the five steps needed to determine the equation of a line given the slope and a point on the graph (not the $y-$intercept)?

In 3 – 13, find the equation of the line in slope–intercept form.

3. The line has a slope of 7 and a $y-$intercept of –2.
4. The line has a slope of –5 and a $y-$intercept of 6.
5. The line has a slope of -2 and a $y-$intercept of 7.
6. The line has a slope of $\frac{2}{3}$ and a $y-$intercept of $\frac{4}{5}$.
7. The line has a slope of $-\frac{1}{4}$ and contains the point (4, –1).
8. The line has a slope of $\frac{2}{3}$ and contains the point $\left(\frac{1}{2}, 1\right)$.
9. The line has a slope of –1 and contains the point $\left(\frac{4}{5}, 0\right)$.
10. The slope of the line is $-\frac{2}{3}$, and the line contains the point (2, –2).
11. The slope of the line is –3, and the line contains the point (3, –5).
12. 

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