



Name: _____

Date: _____

Student Exploration: Point-Slope Form of a Line

Vocabulary: point-slope equation, slope, slope-intercept equation, y-intercept

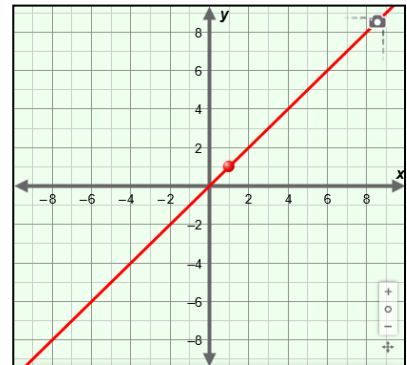
Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

1. After five days in her new job, Karen has \$800 in her bank account. If she is adding exactly \$50 to her account each day, when will her balance reach \$1000? Explain.

2. How much was in Karen’s account five days ago, just before she started the job? Explain.

Gizmo Warm-up

There are many ways to define a line. One way is to state the coordinates of a point on the line – such as (5 days, \$800) – and the rate of change of the line – such as \$50/day – which is also called the **slope**. You can explore how lines are graphed in this way with the *Point-Slope Form of a Line* Gizmo.



To begin, check that m , x_1 , and y_1 are set to 1.0. (To quickly set a slider to a specific value, type the value into the text box to the right of the slider and press **Enter** or **Return** on your keyboard.)

1. The slope of the line is given by the variable m . Slowly drag the m slider to the right. How does this change the line? _____

2. Set m to 2.0. Turn on the **Show triangle** checkbox. The triangle shows how much the y-coordinate of the line changes (the rise) for a given change in the x-coordinate (the run). The ratio “rise over run” is the slope of the line.

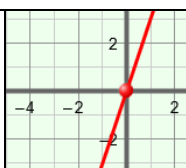
What is the rise? _____ What is the run? _____ What is the slope? _____

3. Turn off **Show triangle**. Drag the red point on the line to different locations on the grid.

A. How do the point’s coordinates relate to x_1 and y_1 ? _____

B. Does the slope change when the position of the point is changed? _____



Activity A: The point-slope equation	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> • Be sure Show slope-intercept form and Show triangle are turned off. • Set m to 3.0, x_1 to 0.0, and y_1 to 0.0. 	
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1. The **point-slope form** of a linear equation is $y - y_1 = m(x - x_1)$. This form is most helpful when you know the slope of a line (m) and a point on the line with coordinates (x_1, y_1) . First, you will work with a situation in which the point is at the origin, so (x_1, y_1) is $(0, 0)$.

A. What is the point-slope equation for this line? _____

B. Select the **TABLE** tab. For each value of x , how do you calculate the value of y ?

2. On the **CONTROLS** tab, set y_1 to 2.0. Notice how the position of the line changed.

A. What are the coordinates of (x_1, y_1) , the point shown on the line now? _____

B. What is the point-slope equation for this line? _____

C. The point where the line crosses the y -axis is called the **y -intercept**. Turn on **Show slope-intercept form**. In the **slope-intercept form**, the line is described by the slope m and the y -intercept b : $y = mx + b$.

How does the slope-intercept form compare to the point-slope form? _____

D. When $x_1 = 0$, how does the value of y_1 compare to b ? _____

3. Select the **TABLE** tab. Check that the **STEP** is 1.00.

A. How much does the value of y change each time x increases by 1? _____

B. For each value of x , what is the value of $y - 2$? _____

C. Recall that the slope of the line is equal to “rise over run,” or the change in the y -value divided by the change in the x -value:

$$m = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x}$$

How does the value “ $y - 2$ ” relate to the equation for slope? _____

(Activity A continued on next page)



Activity A (continued from previous page)

4. On the **CONTROLS** tab, set m to -2.0 , x_1 to 1.0 , and y_1 to 6.0 .

A. What are the coordinates of the designated point on the line? _____

B. What is the point-slope equation of this line? _____

C. In the space to the right, solve this equation for y . Then state the equation of the line in slope-intercept form, and its y -intercept.

slope-intercept form: _____ y -intercept: _____

D. Select the **TABLE** tab. How does y change if x increases by 1? _____

E. How does “ $x - 1$ ” relate to the equation for slope: $m = \frac{\text{change in } y}{\text{change in } x}$?

F. How does “ $y - 7$ ” relate to the slope? _____

5. Algebra connection: Consider the general point-slope form of a line: $y - y_1 = m(x - x_1)$.

A. What part of the formula represents the change in y ? _____

B. What part of the formula represents the change in x ? _____

C. Describe the point-slope form by filling in the blanks: The change in _____ is equal to the _____ multiplied by the change in _____.

D. Rearrange the equation to solve for the slope, m . $m =$ _____

Is this equivalent to the equation for slope given in question 4F above? _____

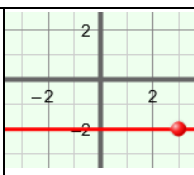
Explain. _____

E. Rearrange the equation to solve for y . $y =$ _____

F. Challenge: Compare your equation to the slope-intercept form of a line. What is the value of the y -intercept (b) in terms of m , x_1 , and y_1 ? $b =$ _____

6. Describe what you know about the line described by the equation $y - 3 = -2(x + 4)$.



Activity B: Horizontal and vertical lines	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> • Turn on Show slope-intercept form. • Turn off Show triangle. 	
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1. Set m to 0.0 to create a horizontal line. Then set x_1 to 3.0 and y_1 to -2.0 .

A. Write the slope, point, and point-slope equation of the line below.

slope: _____ point: _____ equation: _____

B. Select the **TABLE** tab. What do all the points on this line have in common?

C. Drag the point around to graph more horizontal lines. What is the general equation of a horizontal line? _____

D. What is the equation of the horizontal line that contains the point $(-8, 7)$? _____

Explain. _____

2. Select the **CONTROLS** tab. Set x_1 to 3.0 and y_1 to -2.0 . Carefully drag the line until it is perfectly vertical. (When the line is perfectly vertical, the slope is undefined.)

A. Write the slope, point, and equation of your line below.

slope: _____ point: _____ equation: _____

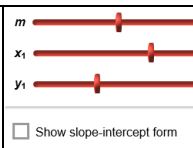
B. What do all the points on this line have in common? _____

C. Drag the point around to graph more vertical lines. What is the general equation of a vertical line? _____

D. What is the equation of the vertical line that contains the point $(-4, -5)$? _____

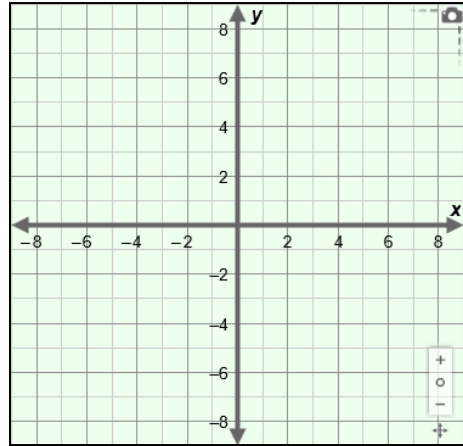
Explain. _____



<p>Activity C:</p> <p>Using $y - y_1 = m(x + x_1)$</p>	<p><u>Get the Gizmo ready:</u></p> <ul style="list-style-type: none"> Turn off Show slope-intercept form and Show triangle. 	
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1. Graph the line $y + 5 = -0.5(x - 2)$ on the grid to the right.

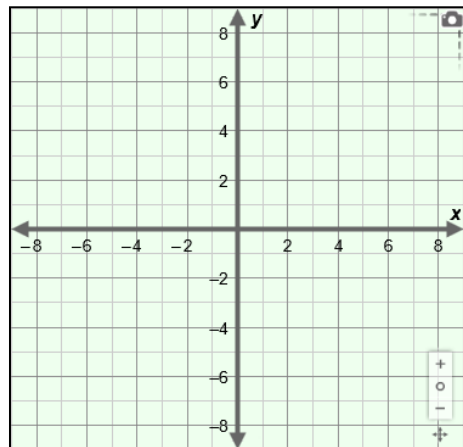
- What is the slope of this line? _____
- What point lies on this line? _____
- What is the y-intercept? _____
- Write the equation of the line in slope-intercept form. Check your answer using the Gizmo.



2. Turn off **Show slope-intercept form**. A line has a slope of -2.5 and contains the point $(-5, 7)$.

- Write the equation of the line in point-slope form.

- What is the y-intercept of the line? _____
- Write the equation in slope-intercept form. Check your answer using the Gizmo.



D. Graph the line in the grid to the right.

3. A line contains the points $(1, 2)$ and $(5, -4)$.

- Find the slope of the line. Show your work.

$$m = \underline{\hspace{2cm}}$$

- Write *two* point-slope equations of the line.

- Graph the line and check it with the Gizmo.

