Name: _____   Date: _____

Student Exploration: Standard Form of a Line

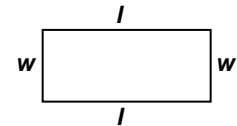**Vocabulary:** slope, slope-intercept form, standard form, *x*-intercept, *y*-intercept

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

1. The rectangle to the right has a length of *l* and a width of *w*.

   A. Write a formula for the perimeter of the rectangle, *P*, in terms

      of *l* and *w*.   *P* = _____

   B. What is the perimeter if the length is 6 feet and the width is 4 feet? _____

2. Suppose a rectangle with unknown length and width has a perimeter of exactly 100 feet.

   Write an equation that describes this.   100 = _____

Gizmo Warm-up

The formula you wrote for the perimeter of a rectangle is
an example of a linear equation written in **standard form**
($Ax + By = C$). You can explore the graph of an equation in
standard form with the *Standard Form of a Line* Gizmo.

Ax + By = C

3x + 2y = 1   ■

A ———————╂——— 3.0
B ———————╂——— 2.0
C ———————╂——— 1.0

1. Drag the **A** slider to change the value of *A*. (You can also change the value by clicking in the
   text field, typing in a new value, and hitting **Enter**.)

   A. What changes about the graph? _____

      The measure of the steepness of a line is its **slope**.

   B. What stays the same about the graph? _____

      The *y*-coordinate where a graph intersects the *y*-axis is the **y-intercept**.

2. Drag the **B** slider to change the value of *B*.

   A. What changes about the graph? _____

   B. What stays the same about the graph? _____

      The *x*-coordinate where a graph intersects the *x*-axis is the **x-intercept**.

Activity A:	Get the Gizmo ready:	$Ax + By = C$
The equation $Ax + By = C$	• Be sure **Show slope** and **Show intercepts** are turned off.	$2x - y = 4$

1. In the Gizmo, set **A** to 2.0, **B** to –1.0, and **C** to 4.0 to graph the equation $2x - y = 4$.

x	y
–2	
–1	
0	
1	
2	

   A. Write $2x - y = 4$ in **slope-intercept form** ($y = mx + b$).

   _____

   B. Substitute the *x*-values shown in the table to the right into the equation to find several points on the line. Click on the **TABLE** tab in the Gizmo to check your work.
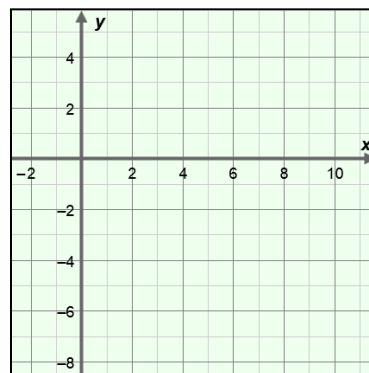
   C. Plot the points on the grid to the right and draw the line.

   D. Use your graph to find the *x*-intercept. _____

   E. Use your graph to find the *y*-intercept. _____

   F. How can you use the table find the *x*- and *y*-intercepts?

   _____

   _____

   G. Once you've converted $2x - y = 4$ to slope-intercept form, what two pieces of

   information about the graph are easy to find? _____

2. The standard form of a linear equation is $Ax + By = C$.

   A. Write $Ax + By = C$ in slope-intercept form. _____

   B. How can you find the slope of the line $Ax + By = C$? _____

   Select the **CONTROLS** tab. Test your answer on a variety of lines in the Gizmo. Turn on **Show slope** to check the slope of each line.

   C. How can you find the *y*-intercept of the line $Ax + By = C$? _____

   Test your answer on a variety of lines in the Gizmo. Turn on **Show intercepts** to check the *y*-intercept of each line.

(Activity A continued on next page)

Activity A (continued from previous page)

3. Turn off **Show slope** and **Show intercepts**.

   A. Substitute 0 for x in $2x - 3y = 6$ and solve for y. What are the coordinates of the point you found? What is the y-coordinate of this point called?

   (_____ , _____) _____

   B. Substitute 0 for y in $2x - 3y = 6$ and solve for x. What are the coordinates of the point you found? What is the x-coordinate of this point called?

   (_____ , _____) _____

   C. Graph the points you found on the grid to the right. Connect the points to graph the equation $2x - 3y = 6$. In the Gizmo, set **A** to 2.0, **B** to –3.0, and **C** to 6.0, and turn on **Show intercepts** to check your graph.
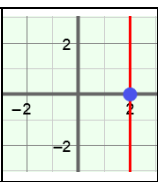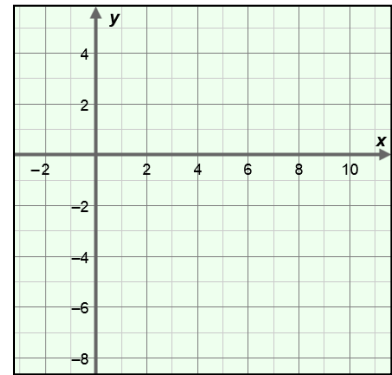
   D. Substitute 0 for y in $Ax + By = C$ and solve for x. How can you find the x-intercept of

   the line $Ax + By = C$? _____

4. Solve the following problems. Show your work in the space below each problem. Then check your answers in the Gizmo.

   A. Find the slope, x-intercept, and y-intercept for the line with equation $5x + 2y = -6$.

   B. A line has an x-intercept of 4 and a y-intercept of 3. Find the slope and equation in standard form of this line.

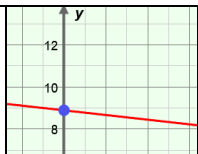| Activity B: **Horizontal and vertical lines**	<u>Get the Gizmo ready</u>: • Select the **CONTROLS** tab. • Turn off **Show slope** and **Show intercepts**.	

1. In the Gizmo, set **A** to 2.0, **B** to 3.0, and **C** to 6.0 to graph the equation $2x + 3y = 6$. Slowly drag the **A** slider until the line is perfectly horizontal.

   A. What value of A creates a horizontal line? _____

   B. Find the slope, y-intercept, and equation of your horizontal line. Check your answers in the Gizmo by turning on **Show slope** and **Show intercepts**.

   slope: _____   y-intercept: _____   equation: _____

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

   D. Vary **B** and **C**. How does each variable affect the location of the y-intercept?

   _____

   _____

   E. Write the general equation of a horizontal line in standard form. _____

2. Turn off **Show slope** and **Show intercepts**. Then graph $x + y = 3$. Slowly drag the **B** slider until the line is perfectly vertical.

   A. What value of B creates a vertical line? _____

   B. Find the slope, x-intercept, and equation of the line. Check your answers in the Gizmo by turning on **Show slope** and **Show intercepts**.

   slope: _____   x-intercept: _____   equation: _____

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

   D. Vary **A** and **C**. How does each variable affect the location of the x-intercept?

   _____

   _____

   E. In the Gizmo, graph a variety of vertical lines. Write the equations of 3 of your lines.

   _____   _____   _____

   F. Write the general equation of a vertical line in standard form. _____

Activity C:	Get the Gizmo ready:	
Using ***Ax + By = C***	• Click on the **CONTROLS** tab. • Turn off **Show slope** and **Show intercepts**.	

1. Jason has some $1 bills and $5 bills in his wallet.

   A. If Jason has seven $1 bills, how much money does he have in $1 bills? _____

   B. If he has *x* $1 bills, how much money does he have in $1 bills? _____

   C. If he has four $5 bills, how much money does he have in $5 bills? _____

   D. If he has *y* $5 bills, how much money does he have in $5 bills? _____

   E. If he has *x* $1 bills and *y* $5 bills, how much money does he have? _____

2. Jason counts the $1 bills and $5 bills in his wallet, and finds that he has $46 total. You can write an equation in standard form to describe this situation. In your equation, let *x* represent the number of $1 bills and let *y* represent the number of $5 bills.

   A. What values will you use for *A*, *B*, and *C* in the equation *Ax + By = C*?

   $A =$ _____ $B =$ _____ $C =$ _____

   Explain. _____

   _____

   B. What is the equation in standard form? _____

   C. In the Gizmo, enter the values of **A**, **B**, and **C** in the text boxes next to the sliders. On the **TABLE** tab, set **MIN** to 0.00, **MAX** to 46.00, and **STEP** to 1.00.

   Look for *x*-values that have an integer value for *y*. Write these solutions as ordered pairs below.

   _____

   _____

   D. Can Jason have zero $1 bills in his wallet? _____   Explain. _____

   _____

   _____

(Activity C continued on next page)

Activity C (continued from previous page)

3. Jason added more bills to his wallet. The amount in his wallet increased from $46 to $53.

    A. What you need to change in the standard form equation? _____

       Explain. _____

       _____

    B. What is the new equation in standard form? _____

    C. Explain what bills Jason could have added to his wallet. _____

       _____

       _____

4. Farmer John needs to build a fence to surround his goat pen. The perimeter of the pen is 55 feet. The fencing he plans to buy is sold in 3-foot and 8-foot sections.

    A. You can write an equation in standard form to model this situation. What will x and y represent in the equation?

       $x = $ _____ $y = $ _____

    B. Write an equation in standard form to model this situation. _____

    C. In the Gizmo, enter the values of **A**, **B**, and **C** in the text boxes next to the sliders and hit **Enter**. On the **TABLE** tab, set **MIN** to 0.00, **MAX** to 55.00, and **STEP** to 1.00.

       Farmer John wants exactly 55 feet of fence without having to cut any sections. What do you need to look for in the Gizmo table to find solutions that satisfy this condition?

       _____

    D. What are the possible solutions that satisfy this? _____

       _____

    E. Plug the solutions into your original equation to check your answers. Show your work in the space below.