Lesson 11
More Forms of Lines

Outline

Part A
Standard Form

- Graphing an Equation in Standard Form
- Writing an Equation in Standard Form
- Comparing Forms of Linear Equations

Part B
Horizontal and Vertical Lines

- Horizontal Lines
- Vertical Lines

Targeted Review

Vocabulary

- standard form
- horizontal line
- vertical line

Check out **More to Explore** in the Digital Pack to see if there are additional activities for this part of the lesson.

Warm Up

Your student should spend no more than 5 minutes on the Warm Up. This should be a quick review to activate prior knowledge

1) Another way of saying this is to solve for y or write a "y equals" equation.

2) Q: What form of the line did you use to rewrite the equations?

A: *slope-intercept, or* $y = mx + b$

In other books, the definition may allow for A to also be an integer. This is the meaning of standard form of a linear equation for this course.

11A EXPLORE

Part A: Standard Form

Objectives

In this part of the lesson, you will learn about standard form.

By the end of this lesson you will be able to do the following:

- Solve for the x- and y-intercepts from standard form and use the intercepts to create a graph of the line.
- Convert the equation of a line to standard form and determine the slope and intercept formulas found in a linear equation in standard form.

Why?

Until now, you have primarily worked with lines in point-slope and slope-intercept form. It is also important to understand how standard form is used.

Warm Up

Write the equations in slope-intercept form.

1) $5x + 6y = 0$

$6y = -5x$

$y = -\frac{5}{6}x$

2) $2x - y = 4$

$-y = -2x + 4$

$y = 2x - 4$

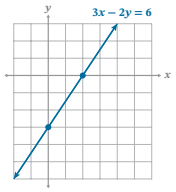
Graphing an Equation in Standard Form

- $Ax + By = C$ is a linear equation in **standard** form.
- For equations in standard form, the following must be true:
  - A must be a **whole** number.
  - B and C must be **whole**.
  - A, B, and C have a **greatest common factor (GCF)** of 1.
- To graph a line from standard form, find the **x- and y-intercepts** because it takes two points to draw a line.
- The x-intercept is always in the form **$(a, 0)$**.
- The y-intercept is always in the form **$(0, b)$**.

EXPLORE 11A

Example 1

Graph the equation of the line: $3x - 2y = 6$



Plan
Solve for the x-intercept.
Solve for the y-intercept.
Write answers as ordered pairs.
Graph the points.
Draw the line through the two points.

Implement

Solve for the x-intercept $(a, 0)$.

$3x - 2y = 6$

$3a - 2(0) = 6$

$3a - 0 = 6$

$3a = 6$

$a = 2$

The x-intercept is 2, and the point is $(2, 0)$.

Solve for the y-intercept $(0, b)$.

$3x - 2y = 6$

$3(0) - 2b = 6$

$0 - 2b = 6$

$-2b = 6$

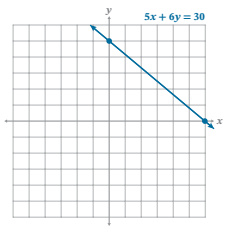
$b = -3$

The y-intercept is $(0, -3)$.

In some instances, you may prefer to use slope-intercept form rather than standard form when graphing. This would especially be true if $C = 0$.

Example 2

Graph the equation of the line: $5x + 6y = 30$



x-intercept

$5a + 6(0) = 30$

$5a = 30$

$a = 6$

$(6, 0)$

y-intercept

$5(0) + 6b = 30$

$6b = 30$

$b = 5$

$(0, 5)$

Example 2

When $C = 0$, your student will need to convert the equation to slope-intercept form because both the x and y-intercept would be $(0, 0)$. Only one point is not enough information to create the graph of a line without using the slope.

Checkpoint

To continue past this checkpoint, students should confidently and correctly answer this problem.

Q: What variable represents the y-intercept? The x-intercept?

A: b; a

Example 3

Convert from $y = mx + b$ to $Ax + By = C$

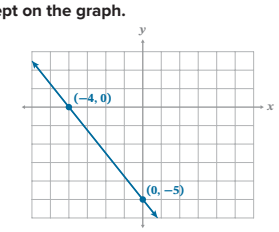
11A EXPLORE

Checkpoint

Graph from standard form. Mark and label your x and y-intercept on the graph.

$5x + 4y = -20$

$5a + 4(0) = -20$	$5(0) + 4b = -20$
$5a = -20$	$4b = -20$
$a = -4$	$b = -5$
$(-4, 0)$	$(0, -5)$



Writing an Equation in Standard Form

- The standard form of a line creates a single solution for each line, which allows different lines to be compared.

Example 3

Convert the equation to standard form: $y = \frac{3}{4}x - 2$

Plan Move both variables to the same side of the equation.
Use the rules to simplify until the equation is in standard form.

Implement	Explain
$y = \frac{3}{4}x - 2$	
$-\frac{3}{4}x \quad -\frac{3}{4}x$	◂ Addition Property of Equality
$-\frac{3}{4}x + y = -2$	
$(-4)\left(-\frac{3}{4}x + y\right) = (-4)(-2)$	◂ Multiplication Property of Equality.
$3x - 4y = 8$	◂ GCF $(3, -4, 8) = 1$, this line is in standard form.

EXPLORE 11A

Example 4

Convert the equation given in point-slope form to standard form: $y - 1 = \frac{3}{5}(x + 4)$

Plan Solve for y.
Move both variables to the same side of the equation.
Simplify the equation to standard form.

Implement	Explain
$y - 1 = \frac{3}{5}(x + 4)$	
$y - 1 = \frac{3}{5}x + \frac{12}{5}$	◂ **Distributive Property**
$y = \frac{3}{5}x + \frac{17}{5}$	◂ **Solve for y**
$-\frac{3}{5}x \quad -\frac{3}{5}x$	◂ Move both variables to the same side of the equation
$-\frac{3}{5}x + y = \frac{17}{5}$	◂ Simplify the equation
$(-5)\left(-\frac{3}{5}x + y\right) = \left(\frac{17}{5}\right)(-5)$	
$3x - 5y = -17$	

Checkpoint

Write the following equation in standard form: $y - 4 = \frac{2}{3}(x - 9)$

$y - 4 = \frac{2}{3}x - 6$

$+4 \qquad +4$

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

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

$(-3)\left(-\frac{2}{3}x + y\right) = (-2)(-3)$

$2x - 3y = 6$

Comparing Forms of Linear Equations

- Knowing the formula for slope and y-intercept can save you from **rewriting** all the equations in the **same** form.

Example 4

Convert from $y - y_1 = m(x - x_1)$ to $Ax + By = C$

Since 3, −5, and −17 do not have a common factor, this line is in standard form.

Checkpoint

To continue past this checkpoint, students should confidently and correctly answer this problem.

Q: What is the first step to convert this equation to standard form?

A: *Distribute*

Q: What set of numbers will A belong to (the leading coefficient or the number next to x)?

A: *Whole Numbers*

Checkpoint

To continue past this checkpoint, students should confidently and correctly answer this problem.

Q: What is the slope from standard form?

A: *The opposite of A over B.*

11A EXPLORE

Example 5

Gary found the following list of equations. However, he needed to know the slope for each line represented on the list.

A)	$Ax + By = C$
B)	$2x + 3y = 6$
C)	$4x - 2y = 7$
D)	$-\frac{2}{3}x + \frac{1}{4}y = \frac{3}{4}$

Find the formula that would help Gary find the slope for each line.

Plan First, y is multiplied by B.
Then Ax is added to y.

A)

Implement	**Explain**
$Ax + By = C$	Given
$By = -Ax + C$	Addition Property of Equality
$\left(\frac{1}{B}\right)By = \left(\frac{1}{B}\right)(-Ax + C)$	Multiplication Property of Equality
$y = -\left(\frac{A}{B}\right)x + \frac{C}{B}$	Distributive Property

This is the general rule, or formula, for finding the slope and y-intercept when given an equation in standard form.

slope: $-\left(\frac{A}{B}\right)$ y-intercept: $\frac{C}{B}$

Use the formula to find the slope for the remaining equations in this example.
First identify A, B, and C.

B) $2x + 3y = 6$

$A = 2 \quad B = 3 \quad C = 6$

slope: $m = -\left(\frac{A}{B}\right) = -\frac{2}{3} = -\frac{2}{3}$

C) $4x - 2y = 7$

$\boldsymbol{A = 4 \quad B = -2 \quad C = 7}$

slope: $\boldsymbol{m = -\left(\frac{A}{B}\right) = -\left(-\frac{4}{2}\right) = 2}$

D) $-\frac{2}{3}x + \frac{1}{4}y = \frac{3}{4}$

$\boldsymbol{A = -\frac{2}{3} \quad B = \frac{1}{4} \quad C = \frac{3}{4}}$

slope: $\boldsymbol{m = -\left(\frac{A}{B}\right) = -\left(\frac{-\frac{2}{3}}{\frac{1}{4}}\right) = \frac{2}{3} \div \frac{1}{4} = \frac{2}{3} \cdot \frac{4}{1} = \frac{8}{3}}$

Checkpoint

Given $5x + 3y = 2$, find the slope and the y-intercept using the formula.

$\boldsymbol{A = 5, B = 3, C = 2}$

$\boldsymbol{m = -\left(\frac{A}{B}\right) = -\left(\frac{5}{3}\right) = -\frac{5}{3}}$

$\boldsymbol{b = \frac{C}{B} = \frac{2}{3}}$

PRACTICE 1 11A

Practice 1

Complete the practice problems on a separate sheet of paper.

Find the x-intercept and y-intercept for each equation. Graph the line on a coordinate plane.

1) $3x - y = 6$ $a = 2$ $(2, 0)$ $b = -6$ $(0, -6)$

2) $x - 3y = 6$ $a = 6$ $(6, 0)$ $b = -2$ $(0, -2)$

Find the x-intercept and y-intercept for each equation.

3) $5x + 2y = 3$

4) $3x - y = -19$

5) $5x - 6y = 72$

6) Jenna planned on making sandwiches for lunch this week. She had \$10 that she planned to spend on sliced turkey or cheese. Turkey is \$10 per pound, and cheese is \$5 per pound. How much would Jenna be able to purchase if she only purchased turkey or only purchased cheese using the equation $10x + 5y = 10$ (x: turkey, y: cheese)? $x = 1$ **pound of turkey** $y = 2$ **pounds of cheese**

Write an equation in standard form. Identify A, B, C.

7) $y - 6 = \frac{2}{7}(x - 7)$

8) $y = -\frac{1}{9}x + 11$

Identify A, B, C in the given equation. Find the slope and y-intercept from standard form.

3) $x - 2y = 4$

4) $8x - 5y = -6$

11) Given the equations, for a, b, and c, find the slope and y-intercept.

12) Which equation has the smallest slope? Explain.

13) Which equations have equal y-intercepts?

Line a: $2x + 3y = 6$	$m = -\frac{2}{3}, b = 2$
Line b: $y = \frac{2}{3}x + 3$	$m = \frac{2}{3}, b = 3$
Line c: $3x + 2y = 6$	$m = -\frac{2}{3}, b = 3$

14) Given the equations, for p, q, and r, find the slope and y-intercept.

15) List the lines in order from greatest to least slope.

Line r, Line p, Line q

Line p: $x - y = P$	$m = -\left(\frac{1}{-1}\right) = 1, b = -P$
Line q: $4x + 7y = Q$	$m = -\frac{4}{7}, b = \frac{Q}{7}$
Line r: $6x - 5y = R$	$m = -\left(\frac{6}{-5}\right) = \frac{6}{5}, b = \frac{R}{-5}$

16) Identify the slope and y-intercept for: $x + Ey = F$

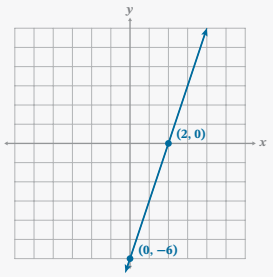
17) What formula do you use to determine the y-intercept from standard form? $b = \frac{C}{B}$

18) What formula do you use to determine the slope from standard form? $m = -\left(\frac{A}{B}\right)$

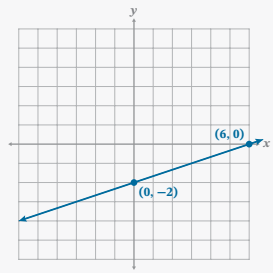
Practice 1

Worked solutions for these problems are located in the Digital Pack.

1)



2)



3) $a = \frac{3}{5}$ $b = \frac{3}{2}$

$\left(\frac{3}{5}, 0\right)$ $\left(0, \frac{3}{2}\right)$

4) $a = -\frac{19}{3}$ $b = 19$

$\left(-\frac{19}{3}, 0\right)$ $(0, 19)$

5) $a = \frac{72}{5}$ $b = -12$

$\left(\frac{72}{5}, 0\right)$ $(0, -12)$

7–8)

Remind your student that A must be a whole number.

7) $2x - 7y = -28$

$A = 2, B = -7, C = -28$

8) $x + 9y = 99$

$A = 1, B = 9, C = 99$

9) $A = 1, B = -2, C = 4$

$m = \frac{1}{2}$

$b = -2$

10) $A = 8, B = -5, C = -6$

$m = \frac{8}{5}$

$b = \frac{6}{5}$

11) Remember to have your student use the formulas from standard form. If they prefer, they can also write every equation in slope-intercept form, but this will be less efficient.

12) Line c has the smallest slope because it is the farthest to the left on the number line.

13) Line b and line c

16) $A = 1, B = E, C = F$

$m = -\left(\frac{A}{B}\right) = -\left(\frac{1}{E}\right) = -\frac{1}{E}$

$b = \frac{C}{B} = \frac{F}{E}$

Even though there are no numbers in this equation, your student can still find the representation for slope and the y-intercept using the formula from this lesson.

Mastery Check

Show What You Know

A) The y-intercept is a given ordered pair. There is no need to solve for it.

B) Part B will help your student understand the remainder of the problem. In Part C, 30 will change to 90 since Austin's budget increases.

C) Q: What does the x-intercept represent?

A: *30 lbs cheese, 0 lbs ham*

Q: What does the y-intercept mean?

A: *0 lbs cheese, 18 lbs ham*

D) Your student may notice that any point under the line will be under budget since the total will be less than \$90. They will learn more about this in Unit 3. Use the following question if you want to discuss being under budget further.

Q: Would the point $(9, 9)$ be a possible combination of ham and cheese?

A: *Yes, because Austin will be under budget. It does not equal exactly \$90.*

Say What You Know

Your student should be able to restate the objectives of the lesson in their own words. If your student is unable to restate the lesson objectives, have them go back and reread the objectives and then explain them.

- Solve for the x- and y-intercepts from standard form and use the intercepts to create a graph of the line.
- Convert the equation of a line to standard form and determine the slope and intercept formulas found in a linear equation in standard form.

11A MASTERY CHECK

Mastery Check

Show What You Know

Austin was making sandwiches for a party. He used the ordered pair (cheese, ham). Austin can purchase 6 pounds of ham with 0 pounds of cheese. Likewise, he can purchase 10 pounds of cheese and 0 pounds of ham, which he determined using $y = -\frac{3}{5}x + 6$.

A) Write the equation $y = -\frac{3}{5}x + 6$ in standard form.

$$y = -\frac{3}{5}x + 6$$

$$\frac{3}{5}x + y = 6$$

$$(5)\left(+\frac{3}{5}x + y\right) = (6)(5)$$

$$3x + 5y = 30$$

B) The numbers in the equation from part A represent dollar amounts.

How much does one pound of cheese cost? **\$3**

How much does one pound of ham cost? **\$5**

What is the total amount of money Austin has to spend? **\$30**

C) Austin decided to increase his budget to \$90 to ensure that everyone would have enough to eat. Write the new equation in standard form and find the intercepts as ordered pairs.

$3x + 5y = 90$

$3a + 5(0) = 90$

$3a = 90$

$(30, 0)$

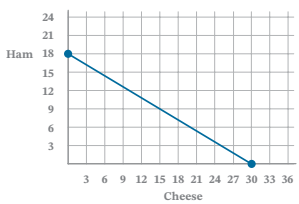
$3(0) + 5b = 90$

$5b = 90$

$b = 18$

$(0, 18)$

D) Graph your equation from Part C.



E) Would Austin be able to purchase 15 pounds of cheese and 9 pounds of ham? 18 pounds of cheese and 9 pounds of ham? Explain your thinking for each purchase.

Yes, Austin can make the purchase of 15 pounds of cheese and 9 pounds of ham because the ordered pair (15, 9) is on the graphed line and is a solution to the equation of the line.

No, Austin cannot make the purchase of 18 pounds of cheese and 9 pounds of ham because the ordered pair (18, 9) is not on the line. If you plug in these numbers to the equation $3(18) + 5(9) = 99$, this is over budget.

Say What You Know

In your own words, talk about what you have learned using the objectives for this part of the lesson and your work on this page.

PRACTICE 2 11A

Practice 2

Complete the practice problems on a separate sheet of paper.

Find the x-intercept and y-intercept. Graph the line on a coordinate plane.

1) $2x - y = 8$

2) $5x + 3y = -15$

Find the x-intercept and y-intercept for each equation.

3) $2x + 5y = 10$

4) $12x - 5y = 30$

5) $3x + 4y = 12$

6) While attending a sporting event, a family was deciding between hot dogs for \$5 and hamburgers for \$8. They had a spending budget of \$40. Using (x: hot dogs, y: hamburgers), find how many hot dogs or hamburgers could be purchased using the equation $5x + 8y = 40$.

Write the equation in standard form. Then identify the slope and y-intercept.

7) $y = \frac{1}{3}(x + 6) - 1$

8) $\frac{x}{2} + \frac{y}{3} = 1$

9) $y - \frac{1}{5} = \frac{3}{7}(x + 1)$

10) $y = \frac{2}{3}\left(x - \frac{1}{2}\right) + 4$

Use the table to compare the equations.

Line a: $y - 1 = -2(x - 1)$	$m = -2, b = 3$
Line b: $2x - y = 2$	$m = 2, b = -2$
Line c: $y = -\frac{4}{3}x + 4$	$m = -\frac{4}{3}, b = 4$
Line d: $4x - 3y = -3$	$m = \frac{4}{3}, b = 1$

11) List the equations from least to greatest y-intercept. **Line b, Line d, Line a, Line c**

12) List the equations from greatest to least slope. **Line b, Line d, Line c, Line a**

Given: $y = -Ex + H$

13) Determine the slope (m) and y-intercept (b). **$m = -E$ and $b = H$**

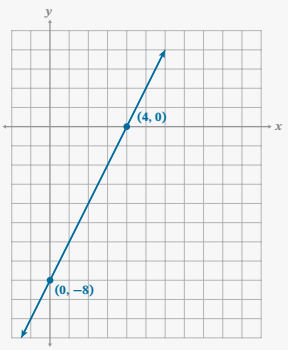
14) Write the equation in standard form. **$Ex + y = H$**

15) Use the results in problems 13 and 14 to identify the value of E and H in $15x + y = 30$, and determine the slope and y-intercept. **$E = 15, H = 30, m = -E = -15, b = H = 30$**

Practice 2

Worked solutions for these problems are located in the Digital Pack.

1)



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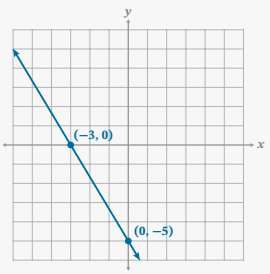


3) $a = 5$ $b = 2$
$(5, 0)$ $(0, 2)$

4) $a = \frac{5}{2}$ $b = -6$
$\left(\frac{5}{2}, 0\right)$ $(0, -6)$

5) $a = 4$ $b = 3$
$(4, 0)$ $(0, 3)$

6) $x = 8$ hot dogs
$y = 5$ hamburgers

7) $x - 3y = -3$
$m = \frac{1}{3}$
$b = 1$

8) $3x + 2y = 6$
$m = -\frac{3}{2}$
$b = 3$

9) $15x - 35y = -22$
$m = \frac{3}{7}$
$b = \frac{22}{35}$

10) $2x - 3y = -11$
$m = \frac{2}{3}$
$b = \frac{11}{3}$

If needed, have your student go back to the Mastery Check and reapply what they have learned to say and show what they know.

Part B: Horizontal and Vertical Lines

Check out **More to Explore** in the Digital Pack to see if there are additional activities for this part of the lesson.

Objectives

In this part of the lesson, you will learn about horizontal and vertical lines.

By the end of this lesson, you will be able to do the following:

- Graph horizontal and vertical lines.
- Find the domain, range, slope, and y-intercept for horizontal and vertical lines.
- Determine the equation of horizontal and vertical lines that pass through a given point.

Why?

Horizontal and vertical lines do not show up often in algebra. However, it is critical to understand their uniqueness when you encounter problems that include them.

Warm Up

Your student should spend no more than 5 minutes on the Warm Up. This should be a quick review to activate prior knowledge

1) Q: What is different about this slope
A: *Zero is in the denominator.*

Q: Can you divide by zero?
A: *No.*

Q: What is the answer when zero is in the denominator?
A: *The slope is undefined.*

Q: What is the rise?
A: *5*

Q: What is the run?
A: *0*

Q: What would this line look like if graphed?
A: *A vertical line.*

You can either have your student graph these points or refer back to Lesson 8, where the four types of slope were given.

2) Q: What is the rise?
A: *0*

Q: What is the run?
A: *13*

Q: What would this look like if graphed?
A: *A horizontal line.*

Some examples of this occurred in Lesson 9 with graphed scenarios.

11B EXPLORE

Part B: Horizontal and Vertical Lines

Warm Up

Use the slope formula to find the slope between two points.

1) $(2, 11)$ and $(2, 6)$

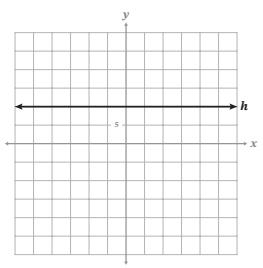
$m = \frac{11-6}{2-2} = \frac{5}{0} =$ **undefined**

2) $(24, 7)$ and $(11, 7)$

$m = \frac{7-7}{24-11} = \frac{0}{13} = 0$

Horizontal Lines

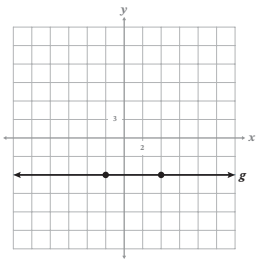
- A horizontal line ($\leftrightarrow$) is a line in which the input (x-values) can be ___$\mathbb{R}$___, and the output (y-value) is equal to the ___**y-intercept**___.
- Because the graph of a horizontal line passes the vertical line test (VLT), it is a ___**function**___.
- The equation for a horizontal line is $y = 0x + b$ or more commonly, ___**$y = b$**___.
- When you see that y equals a number, you should visualize a ___**horizontal**___ line.
- The slope of ___**every**___ horizontal line is ___**zero**___.
- The ___**domain**___ for a linear function is all real numbers.
- Remember to check the ___**scale**___ of each axis when reading a graph.



EXPLORE 11B

Example 1

Write the equation for line g shown in the graph. Name the domain and range.



Plan Find the scale of the coordinate plane.
Determine the slope and y-intercept.
Write the equation in slope-intercept form for this line.
Determine the domain and range.

Implement

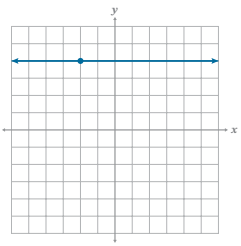
x-axis scale: 2 **slope: $m = 0$** **$y = 0x - 6$**

y-axis scale: 3 **y-intercept: $b = -6$** **$y = -6$**

Domain: $\{\mathbb{R}\}$ This will always be the domain for a horizontal line (and linear functions).
Range: $\{-6\}$ The range will always be a single number since the output remains the same.

Example 2

Write the equation of the horizontal line that passes through the point $(-2, 4)$.



Plan Graph the point on a plane.
Draw a horizontal line through the point.
Write the equation in slope-intercept form.

Implement

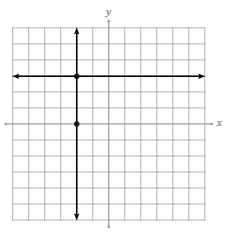
$y = 0x + 4$

$y = 4$

- Notice that the equation is the same as the y-coordinate of **any point** included on the line.
- The **y-coordinate** of the ordered pair will also be the number you use for the **equation** of a horizontal line.

Checkpoint

Given the graph, find the domain and range of the horizontal line. Write the equation of the line.



Domain: $\{\mathbb{R}\}$

Range: $\{3\}$

Equation: $y = 3$

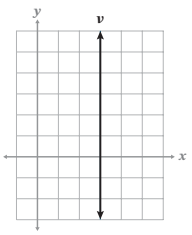
Checkpoint

To continue past this checkpoint, students should confidently and correctly answer this problem.

11B EXPLORE

Vertical Lines

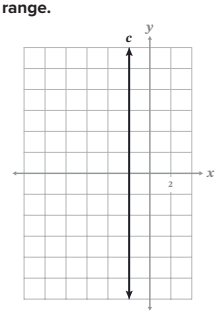
- A vertical line (↕) is a line that has a single ___x-value___, and the ___output___ can be any real number.
- The graph of a vertical line fails the vertical line test (VLT) because there is one ___domain (value)___ and the ___range___ is ___ℝ___.
- Because it fails the vertical line test (VLT), a vertical line is not a ___function___.
- Writing the equation for a vertical line in ___slope-intercept___ form is not possible because $y = mx + b$ becomes $y =$ (undefined)$x +$ (does not exist).
- The equation for a vertical line is ___$x = a$___, where a is the x-intercept.



Example 3

Write the equation for line c shown in the graph. Name the domain and range.

Plan Find the scale of the coordinate plane.
Determine the slope and y-intercept.
Write the slope-intercept form of the equation of the line.
Determine domain and range.



Implement

x-axis scale: 2

y-axis scale: 1

$m =$ **undefined**

$b =$ **does not exsist**

x-intercept: **-2**

The equation for this line: **$x = -2$**

Domain: **$\{-2\}$**

Range: **$\{\mathbb{R}\}$**

EXPLORE 11B

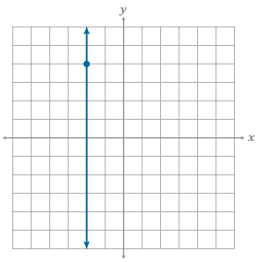
Example 4

Write the equation of the vertical line that passes through the point $(-2, 4)$.

Equation for the line: $x = -2$

Domain: $\{-2\}$

Range: $\{\mathbb{R}\}$



- The equation is the ___*x*-coordinate___ of any point that is on the line.
- Vertical lines do not need to be graphed to find the equation because the formula ___$x = a$___ is known.

☑ Checkpoint

Provide the equation of the vertical line and the horizontal line that passes through the point $(-7, 3)$. Name the slope for each line.

Vertical line:

$x = -7$

m = undefined

Horizontal line:

$y = 3$

$m = 0$

☑ Checkpoint

To continue past this checkpoint, students should confidently and correctly answer this problem.

Q: What is the domain for the vertical line?

A: *−7*

Q: What is the domain for the horizontal line?

A: *all real numbers*

Practice 1

Worked solutions for these problems are located in the Digital Pack.

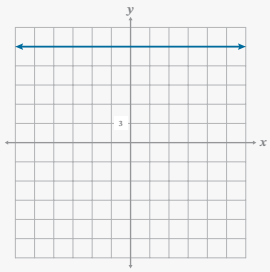
7) Yes, the line is horizontal, which means that the x-value can be any number as long as the y-value is -2.

8) It is horizontal since the slope is zero and all horizontal lines have zero slope.

Q: What is the slope of every horizontal line?

A: *zero*

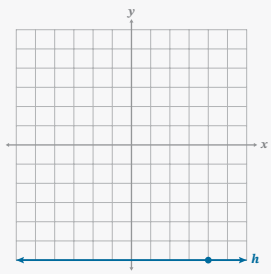
9)



Q: What is the scale of the coordinate plane?

A: *The y-axis is counting by 3, the x-axis is counting by 1.*

10)



Q: Why is the domain all real numbers for a horizontal line?

A: *Because x can be any value.*

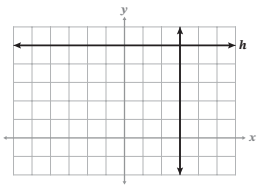
12) Sample:
She mixed up the x and y coordinates. The horizontal line that passes through the point $(-2, -6)$ is $y = -6$.

11B PRACTICE 1

Practice 1

Complete the practice problems on a separate sheet of paper.

Using the graph below, answer the following questions.



1) What is the slope of line h? $m = 0$

2) What is the y-intercept for line h? $b = 5$

3) Write the equation for line h. $y = 5$ or $h(x) = 5$

4) Does line h represent a function? Explain. **Yes, it passes the Vertical Line Test.**

5) Find the slope of line f that passes through the points $(1, -2)$ and $(-5, -2)$. $m = 0$

6) Write the equation of line f. $y = -2$ or $f(x) = -2$

7) Does line f also pass through the point $(10, -2)$? Explain.

8) Is the line horizontal or vertical? Without graphing, explain your reasoning.

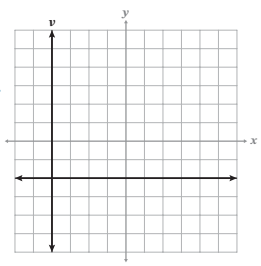
9) Graph the line $y = 15$ on a coordinate plane.

10) Graph the horizontal line passing through the point $(4, -6)$. Find the equation of the horizontal line passing through the point $(4, -6)$. Name the domain and range.
$y = -6$ **Domain:** $\{\mathbb{R}\}$ **Range:** $\{-6\}$

11) Find the domain and range for the horizontal line $y = -9$. **Domain:** $\{\mathbb{R}\}$ **Range:** $\{-9\}$

12) Nicole wrote the equation for the horizontal line that passes through the point $(-2, -6)$ as $y = -2$. Explain her mistake, and provide the correct equation.

Using the graph of line v, answer the following questions:



13) What is the slope of line v? **The slope is undefined.**

14) What is the y-intercept for line v? **The y-intercept does not exist.**

15) Write the equation for line v. $x = -4$

16) Does line v represent a function? Explain. **No, it does not pass the Vertical Line Test.**

PRACTICE 1 11B

17) Find the slope of the line that passes through the points $(-7, 1)$ and $(-7, 13)$. **m = undefined**

18) Write the equation of the line that passes through the points $(-7, 1)$ and $(-7, 13)$. **$x = -7$**

19) Will this line also pass through the point $(1, 1)$? Explain.

20) Is the line horizontal or vertical? Without graphing, explain your reasoning.

21) Graph the line $x = 8$ on a coordinate plane.

22) Graph the vertical line and the horizontal line passing through the point $(3, 1)$.

Find the equation of the vertical line passing through the point $(3, 1)$. Name the domain and range.

23) Find the domain and range for the vertical line $x = -1$. **Domain: $\{-1\}$ Range: $\{\mathbb{R}\}$**

24) Determine if the point $(10, -7)$ is on the line $x = 10$. Why or why not? Name the vertical and horizontal lines going through the given point.

Yes, the x-coordinate is 10, and the equation is $x = 10$.

$x = 10$

$y = -7$

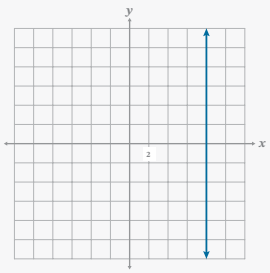
19) Sample:
No, this is a vertical line, so no matter what the y-value is, the x-value will be –7.

20) Vertical, since the slope is undefined and all vertical lines have an undefined slope.

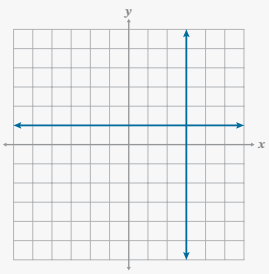
Q: What should you write when you find that the slope has zero in the denominator?

A: *undefined*

21)



22) $x = 3$
Domain: $\{3\}$
Range: $\{\mathbb{R}\}$



Mastery Check

Show What You Know

C) Q: How many points are needed to find the equation of a line?

A: *Either one point and the slope or two points.*

Remind your student to calculate the y-intercept because it does not intersect the coordinate plane through a grid line.

Q: What type of line is side QR?

A: *horizontal*

Q: What is the equation for a horizontal line?

A: $y = b$

Q: What type of line is side PR?

A: *Vertical*

Q: What is the slope of a vertical line?

A: *undefined*

D) Your student can plot this new point on the graph to help picture how the rectangle would change. This question is to help them visualize how changing one point can create many mathematical differences.

Say What You Know

Your student should be able to restate the objectives of the lesson in their own words. If your student is unable to restate the lesson objectives, have them go back and reread the objectives and then explain them.

- Graph horizontal and vertical lines.
- Find the domain, range, slope, and y-intercept for horizontal and vertical lines.
- Determine the equation of horizontal and vertical lines that pass through a given point.

11B MASTERY CHECK

Mastery Check

Show What You Know

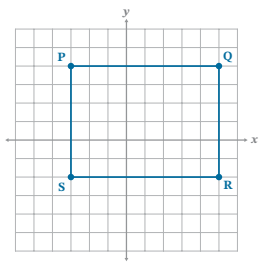
A group of students was given the point $(-5, 1)$. Each student was asked to state a fact about the point.

A) Jeremiah said the horizontal line passing through this point is $x = -5$, and Matthew said the horizontal line passing through this point is $y = 1$. Who is correct? Explain.

Horizontal lines are "$y =$" so Matthew is correct.

B) Graph the ordered pairs and connect the points to form rectangle $PQRS$.

$P\,(-3, 4)$, $Q\,(5, 4)$, $R\,(5, -2)$, $S\,(-3, -2)$



C) Write the equation for each side of rectangle $PQRS$.

$\overleftrightarrow{PQ}$: $y = 4$

$\overleftrightarrow{QR}$: $x = 5$

$\overleftrightarrow{RS}$: $y = 2$

$\overleftrightarrow{PS}$: $x = -3$

D) Jeremiah decided to move point P on the graph to $(-4, -3)$. Without doing any calculations, explain how your equations in part C will change.

Side $\overline{PQ}$ and side $\overline{PS}$ will have a change of slope. $\overline{PQ}$ will no longer be horizontal and $\overline{PS}$ will no longer be vertical

Say What You Know

In your own words, talk about what you have learned using the objectives for this part of the lesson and your work on this page.

Lesson Test

After achieving mastery for Parts A and B of this lesson, your student has the option to take the test. Before taking the test, ask your student these questions:

- Do you know all the new vocabulary words?
- Can you explain the objectives?
- Do you know how to check your work?
- Do you know how to use your Formula Sheet?
- Were you able to complete the practice questions without help?

YES

If your student can answer "yes" to all of these questions, decide if your student is ready to take the Lesson Test.

NOT YET

If your student cannot answer "yes" to all of these questions, consider having your student complete some of these options:

- Rework Practice 1.
- Complete Practice 2.
- Review the videos, Guided Notes, and Examples.

PRACTICE 2 11B

Practice 2

Complete the practice problems on a separate sheet of paper.

1) What is the general equation or formula for a horizontal line given the point (a, b)? $y = b$

2) Find the slope of the line and determine the equation of the line passing through $(-15, 6)$ and $(2, 6)$. $m = 0, y = 6$

3) Graph the line $y = -30$ on a coordinate plane. Remember to scale your graph.

4) Graph the horizontal line and vertical line that goes through the point $(-4, -4)$.

5) What is the equation of the horizontal line through $(-4, -4)$? $y = -4$

6) What is the equation of the vertical line? $x = 5$

7) Find the domain and range of the line $y = 7$. **Domain: $\{\mathbb{R}\}$** **Range: $\{7\}$**

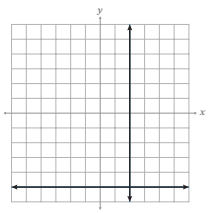
8) Write the equation of a horizontal line in function notation for function g that intersects the point $\left(3, \frac{1}{2}\right)$.

9) What is the general equation or formula for a vertical line given the point (a, b)? $x = a$

10) Find the slope and the equation of the line passing through $(0, 1)$ and $(0, -5)$ m = **undefined**, $x = 0$

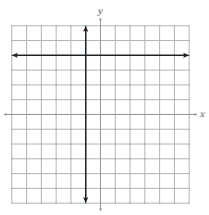
Without graphing, what is the special name for this line? ***y*-axis**

11) Write the equation of the lines given in the graph. Name the intersection point.
$x = 2$ $y = -5$ $(2, -5)$



12) What is the domain for the horizontal line? **Domain: $\{\mathbb{R}\}$**

13) Write the equation of the lines given in the graph. Name the intersection point.
$x = -1$ $y = 4$ $(-1, 4)$



14) What is the domain for the vertical line?
Domain: $\{-1\}$

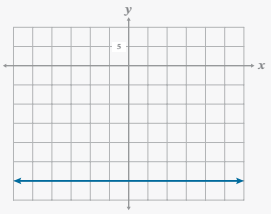
15) Determine the domain and range for the line $x = -12$. **Domain: $\{-12\}$** **Range: $\{\mathbb{R}\}$**

16) Write the equation for the horizontal and vertical line that passes through the point $(-30, 15)$.

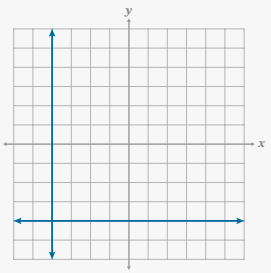
Practice 2

Worked solutions for these problems are located in the Digital Pack.

3)



4)



8) $g(x) = \frac{1}{2}$

16) $x = -30, y = 15$

If needed, have your student go back to the Mastery Check and reapply what they have learned to say and show what they know.

Lesson Test

Refer to the Part B Mastery Check instructor note to determine if your student is ready for the test.

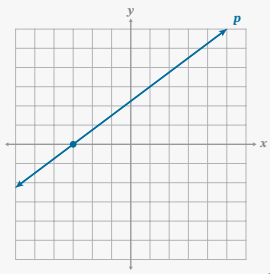
Targeted Review

Worked solutions for these problems are located in the Digital Pack.

If your student is going to take the Lesson Test, it is recommended that they do so before beginning the Targeted Review.

4) It will take Mr. Fred 4 minutes to finish the race.

5)



8) $g(x) = b(x) + 3$ OR $g(x) = -\frac{4}{3}x + 3$
Sample:
Adding three means that the graph will move up three units.

9) Sample:
The domain represents the x-values and is the independent variable. The range represents the y-values and is the dependent variable.

10)

12) Distractor Rationale:
Elle needs to use the equation $y = 45x - 300$ and set y equal to 0.

A) Incorrectly rounds the correct solution.

C) Incorrectly rounds the correct solution.

D) Overestimates the time it will take to pay back the loan.

13) Distractor Rationale:

A) This graphs the point $(-6, 2)$ rather than $(-2, 6)$.

C) This graphs the point $(-2, -6)$.

D) This graphs the point $(-6, -2)$.

Targeted Review

In the Targeted Review, you will practice topics you have mastered in earlier lessons. Reviewing these concepts will help you be successful as you work through this unit.

Complete the problems on a separate sheet of paper.

1) Write the equation for the line (in slope-intercept form) that passes through the points $(-2, 1)$ and $(1, 5)$. $y = \frac{4}{3}x + \frac{11}{3}$

Violet was training her turtle, Mr. Fred, for a race. He was averaging 6 feet per minute and needed his current time recorded. When the timer began, Mr. Fred was 9 feet behind the starting line.

2) Write an equation in slope-intercept form to model this situation. $y = 6x - 9$

3) What does the rate of change mean in context? **The rate of change is 6 feet per minute.**

4) If the track is 15 feet long, how long will it take Mr. Fred to finish the turtle race?

---

18) Graph the line, p, that travels through the point $(-3, 0)$ and has a slope of $\frac{3}{4}$.

6) Determine the equation for the line using the information in problem 5. $y = \frac{3}{4}x + \frac{9}{4}$

7) Given $b(x) = -\frac{4}{3}x$. The function $g(x)$ is translated up three units from $b(x)$. Write the function for $g(x)$ and explain why this will translate $b(x)$ up three units.

8) Write the equation for the context in function notation: Camren spent \$2.50 per week on pencils for her students. **(week, cost)** $c(w) = 2.50w$

9) Explain what the domain and range are in your own words. How do they relate to the independent and dependent values?

10) Solve the compound inequality on a number line. $-19 \le 6x - 7 < 23$ $-2 \le x < 5$

11) Set up the following conversions to find the number of pizzas which must be ordered for each student to get two slices of pizza. (Round to the nearest unit, assuming partial pizzas are not sold.)

8 slices per pizza; 1,252 students; 2 slices of pizza per student

1,252 students $\left(\frac{2 \text{ slices}}{1 \text{ student}}\right)\left(\frac{1 \text{ pizza}}{8 \text{ slices}}\right) = 313$ **pizzas**

Multiple Choice

B **12)** Elle borrowed \$300 to start a business. She was able to earn \$45 per week after expenses. How many weeks will it take for Elle to pay back her debt (owe \$0)?

A) 6 weeks

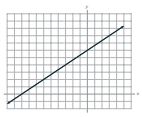
B) $6\frac{2}{3}$ **weeks**

C) 7 weeks

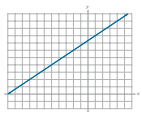
D) 10 weeks

B **13)** Determine the graph that best represents the equation: $y - 6 = \frac{2}{3}(x + 2)$

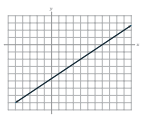
A)



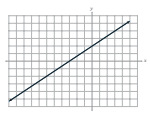
B)



C)



D)



Problem	1	2	3	4	5	6	7	8	9	10	11	12	13
Lesson Origin	0	0	0	0	0	0	0	0	0	0	0	0	0