Lesson 8
Using Graphs

Outline

Part A
Intercepts and Slope from a Graph

- The Intercepts
- Slope
- Graphing from the Slope and a Point

Part B
Translating the Linear Parent Function

- Representing the Linear Parent Function
- Translations of the Linear Parent Function

Targeted Review

Vocabulary

- y-intercept
- x-intercept
- slope
- parent function

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.

Remind your student that an ordered pair is (x, y). If an ordered pair is a solution, then both sides of the equation will be equal to the same value. (e.g., $4 = 4$)

8A EXPLORE

Part A: Intercepts and Slope from a Graph

Objectives

In this part of the lesson, you will learn about intercepts and slope.

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

- Identify intercepts of a line from a graph, table, or equation.
- Given a graph of a line, determine the slope using slope triangles or rise over run.
- Plot the graph of a line given a point and the slope.

Why?

Slope and rate of change are key concepts in Algebra 1. Reading graphs and picking out key details like the x- and y-intercepts and the slope will help you solve problems in later lessons.

Warm Up

Determine if the given ordered pair is a solution for the function.

1) $y = -2x + 3; (1, 1)$ **yes**

2) $3x - 4y = -12; (0, -4)$ **no**

3) Explain how you determined your answers for problems 1 and 2.

By replacing (x, y) with the given values, you can see if the equation will be the same on both sides. In problem 1, $1 = -2(1) + 3$ simplifies to the true statement $1 = 1$, so the ordered pair is a solution. In problem 2, $3(0) - 4(-4) = -12$ simplifies to the false statement $16 = -12$, so the ordered pair is not a solution.

The Intercepts

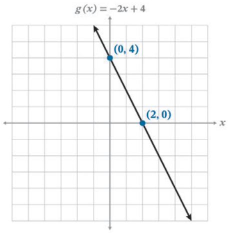
- Each **ordered pair** on a coordinate plane represents an input value from the x-axis and a matching output value from the y-axis.
  - The **order** of an ordered pair determines proper placement on the coordinate plane.

EXPLORE 8A

- The intercepts of a graph are points that **intersect** the axes of the coordinate plane.
  - The **y**-intercept is where the value of x is equal to **zero (0)**.
    - The letter **b** is used to represent the y-intercept.
    - The y-intercept can be written as **$f(0) = b$** or **$(0, b)$**.
  - The **x**-intercept is where the value of y is equal to **zero (0)**.
    - The letter **a** is used to indicate the x-intercept.
    - The x-intercept can be written as **$f(a) = 0$** or **$(a, 0)$**.

Example 1

Determine the x-intercept and y-intercept for the function represented on the graph below. Mark the points and label them on the graph.



$g(0) = 4$, so $b = 4$

The y-intercept of this line is 4, which represents the ordered pair (0, 4).

$g(2) = 0$, so $a = 2$

The x-intercept of this line is 2, which represents the ordered pair (2, 0).

Example 2

Determine the x-intercept and y-intercept for the function represented in the table.

x	$f(x)$
−2	0
−1	$-\frac{1}{2}$
0	−1
2	$-\frac{3}{2}$
2	−2

Plan Find the zeros in the table to get started.

Implement

The x-intercept of this line is **(−2, 0)**.

$f($ **−2** $) =$ **0** , so $a = -2$

The y-intercept of this line is **(0, −1)**.

$f($ **0** $) =$ **−1** , so $b = -1$

Checkpoint

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

Q: What is the ordered pair for the x-intercept?

A: $(a, 0)$

Q: What is the ordered pair for the y-intercept?

A: $(0, b)$

Make sure that your student is writing the solutions as ordered pairs to solidify their understanding that an intercept is an ordered pair on the graph. This becomes more important as students progress through Algebra 1.

Example 3

Determine the x-intercept and y-intercept for the function $h(x) = 2x - 3$.

Plan Find the x-intercept by substituting a for the value of x and 0 for the value of $h(x)$.

Then solve for a.

Find the y-intercept by substituting 0 for the value of x.

Then solve for b.

Implement

x-intercept:

$h(a) = 0$, or $(a, 0)$

$0 = 2a - 3$

$3 = 2a$

$a = \frac{3}{2}$

$a = \frac{3}{2}$

$h\left(\frac{3}{2}\right) = 0$

The x-intercept of this line is $\left(\frac{3}{2}, 0\right)$.

y-intercept:

$h(0) = b$, or $(0, b)$

$h(0) = 2(0) - 3$

$h(0) = 0 - 3$

$h(0) = -3$

$b = -3$

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

Checkpoint

Determine the x-intercept and y-intercept for the function represented below.

$f(x) = 3x + 4$

x-intercept:

$\left(-\frac{4}{3}, 0\right)$

$f(a) = 3a + 4$

$0 = 3a + 4$

$-4 = 3a$

$a = -\frac{4}{3}$

y-intercept:

$(0, 4)$

$f(0) = 3(0) + 4$

$f(0) = 0 + 4$

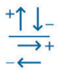
$f(0) = 4$

$b = 4$

EXPLORE 8A

Slope

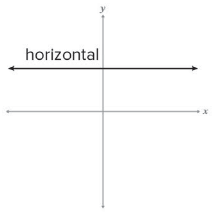
- Slope of a line is the **rise to run (or rise over run)** ratio between any two points on a line.
  - Slope is represented by the letter ***m***.
- A line represents a function that changes at a **constant** rate.
- In this course, when asked to find the slope, the answer should be a **numerical** value written as a **simplified** ratio.
- Two ways to think of slope visually are:

  $\frac{\text{rise}}{\text{run}}$ **or** 

- To determine the sign of the slope before finding its numerical value, always read the graph from **left to right**.

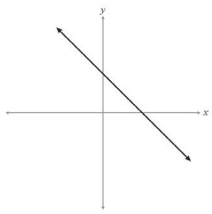
Four Types of Slopes

Zero Slope



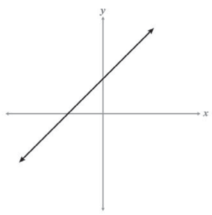
- As the x-values **increase**, the y-values **remain the same**.
- If the line is horizontal (—), then the range value does not change, so the slope is **zero**.

Negative Slope



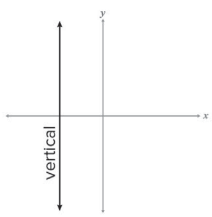
- As the x-values **increase**, the y-values **decrease**.
- If the line slopes down and to the right (\ ), then the range values are decreasing, so the slope is **negative**.

Positive Slope



- As the x-values **increase**, the y-values **increase**.
- If the line slopes up and to the right (/), then the range values are increasing, so the slope is **positive**.

Undefined Slope



- As the x-values **remain the same**, the y-values **increase (going up)**.
- If the line is vertical (|), then the slope is **undefined**. (This type of line is not a function.)

EXPLORE 8A

Example 4

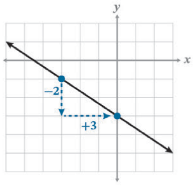
Determine the slope from the graph. Explain the slope.

Plan Mark the two points you chose on the graph.

Start at the point on the left side and work your way across the graph.

Then record the number of spaces you moved up (positive direction) or down (negative direction) and the number of spaces you moved from left to right.

Write the slope as a ratio set equal to m.



Implement

$m = -\frac{2}{3}$

Explain

As the x-values increase, the y-values ____decrease____ .

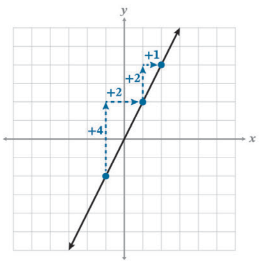
Example 5

Determine the slope from the graph.
Explain the slope.

Implement

This line has a ____positive____ slope.

$m = \frac{4}{2} = \frac{2}{1} = 2$



Explain
When you move from left to right, as the x-values increase, the

y-values ____increase____.

The slope between *any two points on the same line* is equal.

Checkpoint

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

Your student should mark two points and find the slope. Make sure that they simplify the ratio completely.

Q: Is the slope positive or negative? How do you know?

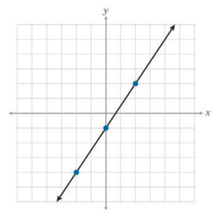
A: *Positive, because as x increases, y increases.*

8A EXPLORE

Checkpoint

Determine the slope from the graph.
Mark your points.

$m = \frac{3}{2}$



Graphing from the Slope and a Point

- Many lines can be drawn through a single point, but **only one** line can be drawn through any two points on the coordinate plane.
- If you have the **slope** and *one point* on a graph, you have enough information to graph the line.

Example 6

Graph the line given the slope and a point when $m = -\frac{1}{2}$ and $(-2, 3)$ create the graph of line h.

Plan Mark the given point on the coordinate plane.
Then use the given slope to find one point in either direction.

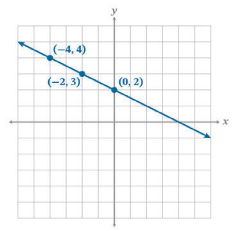
Implement

Mark the point $(-2, 3)$ on the coordinate plane.

Use the slope $-\frac{1}{2}$ to move down 1 unit and right 2 units.

Then, move up 1 unit and left 2 units.

Connect all points with a line.



Checkpoint

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

Your student only needs to graph two points. However, their line should go through the grid lines at the indicated ordered pairs. If they are not able to accurately draw a line, a ruler may be helpful throughout this unit.

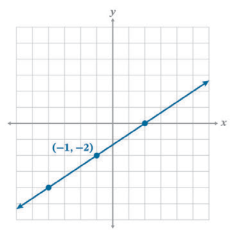
Q: Name another point on your line that only has integer values.

A: *Sample*
$(-4, -4), (2, 0), (5, 2), (-7, -6)$

Checkpoint

Graph a line given a point and the slope.

$(-1, -2), m = \frac{2}{3}$



11–12)

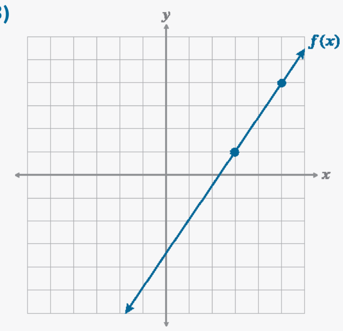
Q: Does the line you graphed show a positive slope? How do you know?

A: *As the x-values increase, the y-values increase. This is a positive slope.*

Q: In 12, what is special about the given point?

A: *It is the y-intercept.*

13)



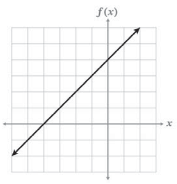
PRACTICE 1 8A

Practice 1

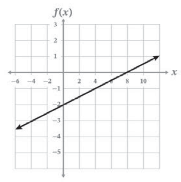
Complete the problems on a separate sheet of paper.

Find the x-intercept and y-intercept for each function, and write them as ordered pairs.

1)



2)



3)

x	$f(x)$
−1	−4
0	−2
1	0
2	2

4)

x	$g(x)$
−3	0
0	1
3	2

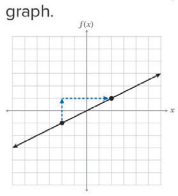
5) $h(x) = x + 2$

6) $f(x) = 3x - 1$

Determine the slope of $f(x)$.

7) Is the slope positive, negative, zero, or undefined? Explain.

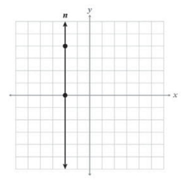
8) Mark the slope of line $f(x)$ on the graph.



Determine the slope of line n.

9) Is the slope positive, negative, zero, or undefined? Explain.

10) Explain what undefined slope means.



Given a point and the slope, graph the line on a coordinate plane. Then, mark the point to the left and right of the given point.

11) $(1, 4), m = -\frac{1}{3}$

12) $(0, -3), m = \frac{2}{5}$

Graph the linear equation on a coordinate plane.

13) $f(x)$: $(3, 1)$ and $m = \frac{3}{2}$

14) $h(x)$: $(0, 4)$ and $m = -1$

15) Suppose you needed to find the next point but you do not have a graph. Determine the next point to the right of the given point.
$f(x)$: $(3, 1)$ and $m = \frac{3}{2}$

Practice 1

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

Remind your student to write the intercepts as ordered pairs for all of the practice problems.

1) x-intercept: $a = -4$ $(-4, 0)$
y-intercept: $b = 4$ $(0, 4)$

2) x-intercept: $a = 8$ $(8, 0)$
y-intercept: $b = -2$ $(0, -2)$

3) x-intercept: $(1, 0)$
y-intercept: $(0, -2)$

Q: What number should you be looking for to find the intercepts from a table?

A: *zero*

4) x-intercept: $(-3, 0)$
y-intercept: $(0, 1)$

5) x-intercept: $a = -2$, or $(-2, 0)$
y-intercept: $b = 2$, or $(0, 2)$

6) x-intercept: $a = \frac{1}{3}$, or $\left(\frac{1}{3}, 0\right)$
y-intercept: $b = -1$, or $(0, -1)$

7) The slope is positive because as the x-values increase, the y-values increase.

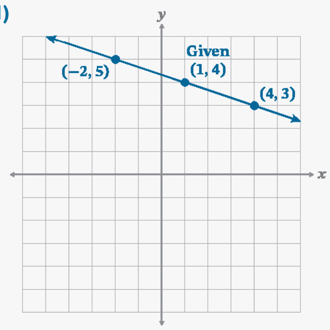
Have your student refer to the figure on the different types of slope if they have trouble answering this question.

8) $m = \frac{2}{4} = \frac{1}{2}$

9) The slope is undefined because the x-values stay the same as the y-values increase.

10) Undefined slope is when you have a vertical line (or when you divide by zero in the slope formula later in this unit).

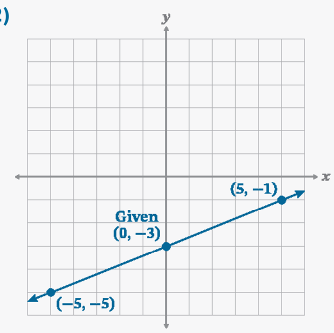
11)



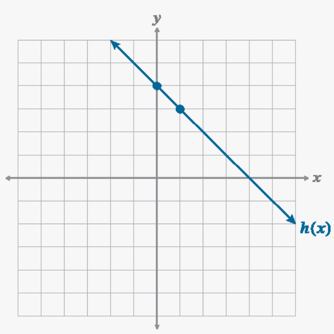
Q: Does the line you graphed show a negative slope? How do you know?

A: *As the x-values increase, the y-values decrease. This is a negative slope.*

12)



14)



15) Q: What is the direction of the numerator (top number) for the given slope?

A: *up three*

Q: Will this be added to the x- or y-value?

A: *y*

Q: What is the direction of the denominator for the given slope?

A: *right 2*

Q: Will this be added to the x- or y-value?

A: *x*

Problem 15 is an extension question to have your student think about what the slope does to the ordered pairs.

Mastery Check

Show What You Know

A) This is the same fraction written in 3 forms.

$-\frac{4}{3} = \frac{-4}{3} = \frac{4}{-3}$

It may help your student to see this written out to understand that they are all equivalent.

B) Encourage your student to visualize the point and try to determine without drawing on a coordinate plane.

C) Remind your student that through any two points is a unique line.

You can also have them estimate the x-intercept for the graph and ask:

Q: Both functions have the same y-intercepts. Do they have the same x-intercepts?

A: *no*

Q: If the two functions have the same y-intercepts but different x-intercepts, will the graphed lines be different?

A: *yes*

If you want to use technology to compare the graphs, the top equation is $y = -\frac{4}{3}x - 2$.

Say What You Know

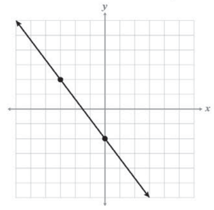
Your student should be able to restate the objectives of the lesson in their own words. If your student is unable to restate the lesson objectives, have them go back and reread the objectives and then explain them.

- Identify intercepts of a line from a graph, table, or equation.
- Given a graph of a line, determine the slope using slope triangles or rise over run.
- Plot the graph of a line given a point and the slope.

Mastery Check

Show What You Know

Marco and Nick were given the graph and asked to find the slope. Both marked the same two points shown on the graph below.



A) Marco says that the slope is $\frac{-4}{3}$. Nick says the slope is $\frac{4}{-3}$. Is it possible that they are both correct? Explain.

Sample:
Marco probably started at point $(-3, 2)$ and went down four, then right three. Nick likely started at $(0, -2)$ and went up four and left three. Both have the same slope because $\frac{-4}{3} = \frac{4}{-3}$. Therefore, both slopes can also be written as $(-1)\left(\frac{4}{3}\right)$.

B) Marco and Nick are given the function $h(x) = \frac{2}{5}x - 2$ and need to determine the intercepts. Who has the correct intercepts for the function? Show your work.

$h(x) = \frac{2}{5}x - 2$

Marco	Nick
(5, 0)	(0, 5)
(0, −2)	(−2, 0)

y-intercept:
$h(0) = \frac{2}{5}(0) - 2$
$h(0) = -2$
$(0, -2)$

x-intercept:
$0 = \frac{2}{5}x - 2$
$2 = \frac{2}{5}x$
$x = 5$
$(5, 0)$

Marco is correct. Nick has the right values, but he got the x- and y-intercept mixed up.

C) How is it possible that both equations have the same y-intercept but are different lines?

Multiple lines can go through the same point. However, since they have different slopes, there are two unique lines.

Say What You Know

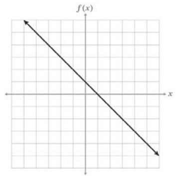
In your own words, talk about what you have learned using the objectives for this part of the lesson and your work on this page.

Practice 2

Complete the practice problems on a separate sheet of paper.

Find the x-intercept and y-intercept for each function below and write them as ordered pairs.

1)

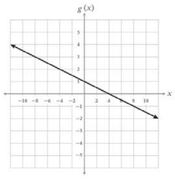


2) $g(x) = x - 7$

3)

x	$f(x)$
−3	−2
0	0
3	2

4)



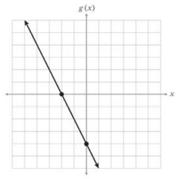
5)

x	$h(x)$
−1	2
$-\frac{1}{2}$	0
0	−2
$\frac{1}{2}$	−4

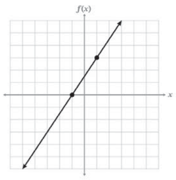
6) $f(x) = -\frac{1}{2}x + 4$

7) Is the slope of $g(x)$ positive, negative, zero, or undefined? Explain.

8) Find the slope of the graph $g(x)$.



9) Determine the slope of $f(x)$.



Graph a line given a point and the slope.

10) $h(x)$: $(-2, -3)$ and $m = 1$

11) $f(x)$: $(2, 0)$ and $m = -\frac{1}{3}$

12) $g(x)$: $(2, 0)$ and $m = -\frac{1}{3}$

13) $k(x)$: $(-4, 1)$ and $m = 4$

14) Describe a graph with a slope of zero. What is happening to the x- and y-values?

Practice 2

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

1) x-intercept: $a = 1, (1, 0)$
y-intercept: $b = 1, (0, 1)$

2) x-intercept: $a = 7, (7, 0)$
y-intercept: $b = -7, (0, -7)$

3) x-intercept: $a = 0\ (0, 0)$
y-intercept: $b = 0\ (0, 0)$

4) x-intercept: $a = 4\ (4, 0)$
y-intercept: $b = 1\ (0, 1)$

5) x-intercept: $a = -\frac{1}{2}\left(-\frac{1}{2}, 0\right)$
y-intercept: $b = -2\ (0, -2)$

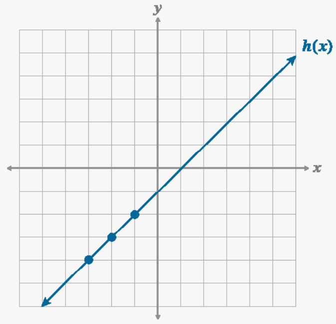
6) x-intercept: $a = 8\ (8, 0)$
y-intercept: $b = 4\ (0, 4)$

7) The slope is negative because the x-values are increasing and the y-values are decreasing.

8) $m = \frac{-4}{+2} = -\frac{2}{1} = -2$

9) $m = \frac{3}{2}$

10)



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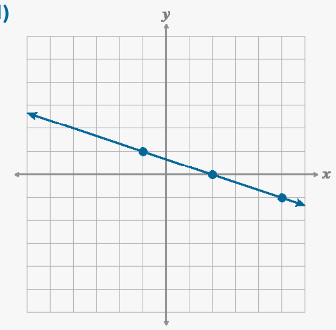

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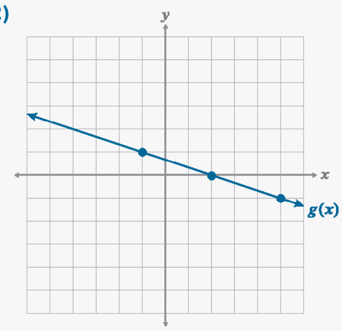
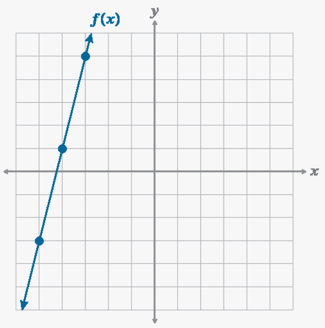


13)



14) When the slope is zero ($m = 0$), the graph is a horizontal line. As the x-values increase, the y-value remains the same.

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

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 can use any of the triangle's vertices, but this lesson's focus is on y-intercepts.

Q: What is the y-intercept of triangle A?

A: $(0, 0)$

Q: How is the movement of the figure related to the y-intercept?

A: The y-intercept is now $(0, -3)$, and the triangle moved down 3 spaces.

8B EXPLORE

Part B: Translating the Linear Parent Function

Objectives

In this part of the lesson, you will learn about the linear parent function and translations.

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

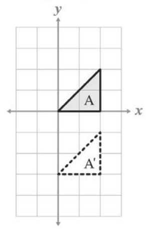
- Express the linear parent function in all forms (table, graph, and equation).
- Demonstrate translations by a factor of b to a linear function.
- Explain how b translates a linear function up or down.

Why?

The linear parent function is the foundation for all other linear functions. Understanding this foundational graph will help you understand and compare all types of linear graphs throughout Algebra 1.

Warm Up

Triangle A was moved to a new location on the coordinate plane (represented by triangle A′).



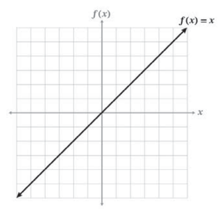
1) How many spaces did the triangle move? **3**

2) What direction was the triangle moved? Would this be considered positive or negative on the coordinate plane?

Triangle A′ was moved down 3 spaces from triangle A. This would be negative on the coordinate plane.

3) What is the y-intercept of triangle A′? $(0, -3)$

Representing the Linear Parent Function



- The **parent function** is the simplest form of a function in the family of functions.
- The equation of the parent graph for the family of linear functions is $f(x) = x$ or $y = x$.
- The graph of the linear parent function *always* travels through the **origin**.
- Both the y-intercept and the x-intercept of this line are zero, or $(0, 0)$.
- The slope of the linear parent function is **always** one.

158 Lesson 8: Using Graphs > Part B: Translating the Linear Parent Function > Explore Algebra 1 Student Worktext

EXPLORE 8B

Example 1

Complete the table for the parent function, $y = x$.

x	$h(x)$	(x, y)
-2	-2	$(-2, -2)$
$-\frac{1}{3}$	$-\frac{1}{3}$	$\left(-\frac{1}{3}, -\frac{1}{3}\right)$
0	0	$(0, 0)$
525	525	$(525, 525)$

Since $y = x$, the value that is chosen for x will also be the y-value.

Checkpoint

Given the parent function, $f(x) = x$, complete the table. What is the slope of the parent function?

x	$f(x)$
-20	-20
$-\frac{1}{2}$	$-\frac{1}{2}$
0	0
11	11

$m = 1$

Translations of the Linear Parent Function

- When you add or subtract any value to x, the ___y-intercept___ changes and translates the parent function.
- Adding a value to the function of any line will ___move___ the graph of that linear function up (if the number is ___positive___) or down (if the number is ___negative___) on the coordinate plane.

Checkpoint

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

If your student does not remember the slope of the parent function, have them find the slope from the graph of the parent function in their notes.

Checkpoint

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

Have your student use technology to see what happens to the graph when the value of b changes.

If your student is having difficulty explaining this in words, have them look at Example 2.

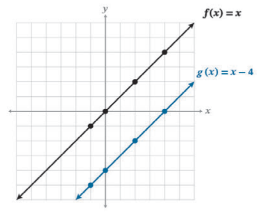
Q: What happened when four was subtracted from x in Example 2?

A: *The graph moved down four spaces.*

Example 2

Complete the table and graph for $f(x)$ and $g(x)$. Then explain how the parent function is translated.

x	$f(x) = x$	$g(x) = x - 4$
-1	**$f(-1) = -1$**	$g(-1) = -5$
0	**0**	-4
2	**2**	-2
4	**4**	0



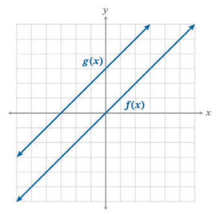
Explain

Adding **−4** to the parent function (or **subtracting 4** from the parent function), changes the y-value of $g(x)$ by **−4 units**. This means every point on the graph of $g(x)$ moves **down 4 units** units from the graph of $f(x)$.

Example 3

Complete the table and graph for $f(x)$ and $g(x)$. Then explain how the parent function is translated.

x	$f(x) = x$	$g(x) = x + 3$
-1	$f(-1) = -1$	**$g(-1) = 2$**
0	0	**3**
2	2	**5**
4	4	**7**



The graph is translated **up** 3 spaces from the **parent graph**.

Checkpoint

How does changing the value of the y-intercept (b) affect the graph of $f(x) = x$? Describe when the y-intercept is positive and negative.

When the y-intercept is positive, the graph will shift up b spaces.
When the y-intercept is negative, the graph will shift down b spaces.

10)

x	$f(x) = x$	$g(x) = x - \frac{1}{2}$
-2	-2	$-2\frac{1}{2} = -\frac{5}{2}$
$-\frac{1}{2}$	$-\frac{1}{2}$	-1
0	0	$-\frac{1}{2}$
$\frac{1}{2}$	$\frac{1}{2}$	0

Your student can write the value for $y(-2)$ as a mixed number or improper fraction. A mixed number may be easier to graph for question 10.

11) Translating the graph of $f(x)$ down $\frac{1}{2}$ unit will create the graph of $g(x)$.

Practice 1

Complete the practice problems on a separate sheet of paper.

1) What is the simplest form of a function in a family of functions? **parent function**
2) What is the x-intercept and y-intercept for the parent graph of a linear function? **zero**
3) Complete a table for the parent function when $x = \{-4, 0, 2, 5\}$.
4) Graph the parent function from your table in problem 3.
5) Would $f(7) = 8$ be a solution to the parent function? Explain.
6) How is it possible that the x-intercept and y-intercept are the same value for the parent function?
7) Complete a table for $f(x) = x$ and $g(x) = x + 1$ using the x-values $\{-4, 0, 2, 3\}$.
8) Explain how to transform the graph of $f(x)$ to create the graph of $g(x)$.
9) Graph $f(x)$ and $g(x)$ from problem 7 on the same coordinate plane.
10) Complete a table for $f(x) = x$ and $g(x) = x - \frac{1}{2}$ using the x-values $\left\{-2, -\frac{1}{2}, 0, \frac{1}{2}\right\}$.
11) Explain how to transform the graph of $f(x)$ to create the graph of $g(x)$.
12) Graph $f(x)$ and $g(x)$ from problem 10 on the same coordinate plane. Consider the scale of the graph.
13) Complete a table for $f(x) = 2x$ and $g(x) = 2x - 1$ using the x-values $\{-2, -1, 0, 1\}$.
14) Will the graph still translate by b when the coefficient of x changes?

Translating the graph of $f(x)$ down 1 unit will create the graph of $g(x)$ even though the coefficient of x is different from the parent function.

Practice 1

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

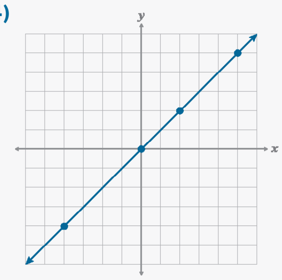
Have your student refer to their notes to answer problems 1–2 if they are unsure of the best word to complete each sentence.

3)

x	$f(x) = x$
−4	−4
0	0
2	2
5	5

Your student does not need to show work here since it was stated that $y = x$ for the parent function.

4)



5) No, $f(7) = 8$ is not a solution to the parent function because the x- and y-values are equal in the parent function.

6) The x-intercept and y-intercept are the same value because the parent function goes through the origin, or $(0, 0)$.

The origin is where the x- and y-axis meet. Therefore, it is considered both an x- and y-intercept.

7)

x	$f(x) = x$	$g(x) = x + 1$
−4	−4	−3
0	0	1
2	2	3
3	3	4

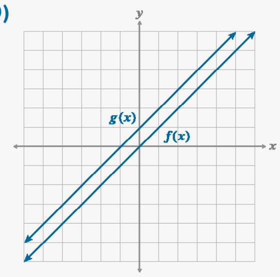
Encourage your student to use the parent function rather than solve for $g(x)$ again. In other words, add 1 to $f(x)$ rather than $g(1) = (1) + 1$.

Q: How do the y-values change from $f(x)$ to $g(x)$?

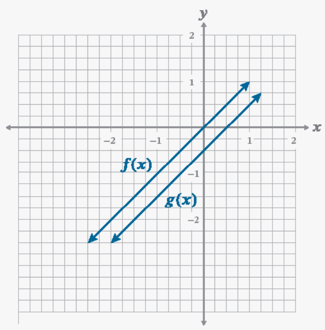
A: The y-values in $g(x)$ are one more than the y-values in $f(x)$.

8) Translating the graph of $f(x)$ up 1 unit will create the graph of $g(x)$.

9)



12)



This is an extension question to have your student think about what the y-intercept does for all linear functions.

13)

x	$f(x) = 2x$	$g(x) = 2x - 1$
−2	−4	−5
−1	−2	−3
0	0	−1
1	2	1

Mastery Check

Show What You Know

A) Your student may show their work if they choose but can also use mental math.

Q: Why do you think these x-values have been chosen for this problem?

A: *So that the fraction is cleared from the equation.*

Q: Why might graphing ordered pairs as fractions be difficult?

A: *Because it is challenging to be accurate with fractions on the coordinate plane.*

Your student can determine the slope by picking two points on the line and finding the rise over run.

Q: How do you know that both equations are functions?

A: *The equations are written in function notation.*

C) This is applying the translation of functions. You can graph the functions using technology to see the translations.

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.

- Express the linear parent function in all forms (table, graph, and equation).
- Demonstrate translations by a factor of b to a linear function.
- Explain how b translates a linear function up or down.

8B MASTERY CHECK

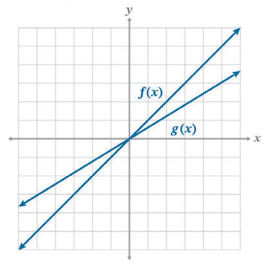
Mastery Check

Show What You Know

A) Complete the table for $g(x) = \frac{3}{5}x$

x	$g(x)$
−5	**−3**
0	**0**
5	**3**

B) Graph the parent function $f(x) = x$ and $g(x) = \frac{3}{5}x$



C) Will the slope or the y-intercept change between the parent function and $g(x)$? Explain.

The slope will change from $m = 1$ in the parent function to $m = \frac{3}{5}$ The graph of $f(x)$ has a rise and run of 1. The graph of $g(x)$ has a rise of 3 and a run of 5. Both graphs have a y-intercept of (0, 0).

D) Name the y-intercepts for the following functions.

	y-intercept
The function $h(x)$ is six spaces above $g(x)$, or $h(x) = g(x) + 6$	**$h(x)$: (0, 6)**
The function $j(x)$ is two spaces below $f(x)$.	**$j(x)$: (0, −2)**
$k(x) = g(x) - \frac{3}{4}$	**$k(x)$: $\left(0, -\frac{3}{4}\right)$**

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

Complete the practice problems on a separate sheet of paper.

1) What is the equation for the parent graph of linear functions in terms of f? **$f(x) = x$**

2) What is the slope for the parent graph of a linear function? **one**

3) Complete the table for the parent function.

x	$f(x) = x$
-2	**-2**
0	0
$\frac{2}{5}$	**$\frac{2}{5}$**
56	56

4) Make a graph of the linear parent function. (Hint: Use some of the ordered pairs from the previous question.)

5) Harrison was given the function $h(x) = x - 20$. He believes that $h(-20) = -20$ is a solution to the translation of the parent graph. Explain why this is incorrect.

6) If the linear parent graph is shifted by the value of b (the y-intercept), will the graph go through the origin? Explain.

7) Complete a table for $f(x) = x$ and $g(x) = x - 5$ using the x-values $\{-4, 0, 2, 5\}$.

8) Explain how to transform the graph of $f(x)$ to create the graph of $g(x)$.

9) Graph $f(x)$ and $g(x)$ from problem 7 on the same coordinate plane.

10) Complete a table for $f(x) = x$ and $g(x) = x + 15$ using the x-values $\{-30, 0, 15, 40\}$.

11) Explain how to transform the graph of $f(x)$ to create the graph of $g(x)$.

12) Graph $f(x)$ and $g(x)$ from problem 10 on the same coordinate plane. Note the scale of the graph.

13) Complete a table for $f(x) = -\frac{1}{2}x$ and $g(x) = -\frac{1}{2}x + \frac{3}{2}$ using the x-values $\{-4, 0, 2, 5\}$.

14) Will the graph still translate by a factor of b when the coefficient of x changes?

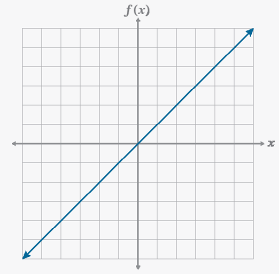
15) What number can be added to the parent function and the graph still remain in the same location on the coordinate plane? Explain.

Zero. $f(x) = x$ and $g(x) = x + 0$ has the parent function translated 0 spaces.

Practice 2

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

4)



5) Harrison used the parent function rather than the translation of the parent function. If he substitutes -20 for x in the equation, the result is -40. $h(-20) = -20 - 20 = -40$

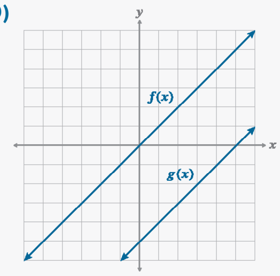
6) No, the parent graph cannot be shifted by a value of b and still go through the origin because the parent graph cannot have two y-intercepts.

7)

x	$f(x) = x$	$g(x) = x - 5$
-4	-4	-9
0	0	-5
2	2	-3
5	5	0

8) Translating the graph of $f(x)$ down 5 units will create the graph of $g(x)$.

9)

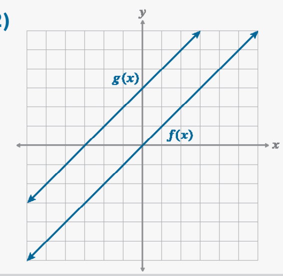


10)

x	$f(x) = x$	$g(x) = x + 15$
-30	-30	-15
0	0	15
15	15	30
40	40	55

11) Translating the graph of $f(x)$ up 15 units will create the graph of $g(x)$.

12)



13)

x	$f(x) = -\frac{1}{2}x$	$g(x) = -\frac{1}{2}x + \frac{3}{2}$
-4	2	$\frac{7}{2}$
0	0	$\frac{3}{2}$
2	-1	$\frac{1}{2}$
5	$-\frac{5}{2}$	-1

14) Translating the graph of $f(x)$ up $\frac{3}{2}$ units will create the graph of $g(x)$ even when the coefficient is different from the parent function.

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.

1) Sample:
A function assigns each unique element of the domain to an element of the range. The domain values cannot repeat, but the range values can.

2) Yes, because $g(-2) = 3(-2) = -6$. The ordered pair is on the graph of the function.

3) No, because $g(-2) = 3(-2) = -6$. The result is -6, not 6, so the ordered pair is not on the graph of the function.

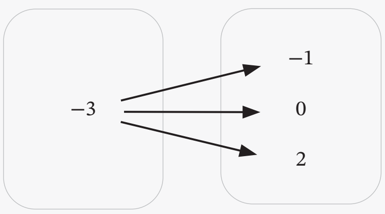
4) (speed of car, distance traveled)
The distance traveled depends on the speed of the car.

5)

x	y
Domain	**Range**
-4	1
-2	1
0	1
2	1

This is a function because the domain values are unique (do not repeat). (This would be a horizontal line when graphed.)

6) **Domain** **Range**



This is not a function because the domain value repeats. (This would be a vertical line when graphed)

7) The vertical line test

8)
$3x - 12 = 6x - 7$ ◀ Distributive Property
$-3x - 12 = -7$ ◀ Addition Property of Equality
$-3x = 5$ ◀ Multiplication Property of Equality
$x = -\frac{5}{3}$

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) Explain what a function is in your own words. Use the words domain and range in your explanation.

Determine if the following ordered pairs are solutions to the graph of the function $g(x) = 3x$. Explain.

2) $(-2, -6)$

3) $(-2, 6)$

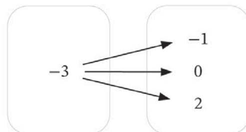
4) Determine the independent and dependent variables as an ordered pair. Then write a sentence that explains the relationship. Speed of a car and distance traveled

Label the domain and range in the table and mapping below. Determine if the given relation is a function. Explain.

5)

x	y
-4	1
-2	1
0	1
2	1

6)



7) What is the name of the test that determines a function from a graph on the coordinate plane?

8) Solve. Justify each step with an algebraic property. $3(x - 4) = 5x + x - 7$

9) Graph the solutions for the inequality $-2p > 3$ on a number line.

10) When does the direction of the inequality symbol change?

11) Convert the following. Round to the nearest unit. 70 miles/hr = _______ km/hr (1 mile ≈ 1.6 km)

12) Solve. $\frac{y-5}{-6} = \frac{-3}{2}$ $\boldsymbol{y = 14}$

Multiple Choice

__D__ **13)** Which equation correctly represents the function $f(x) = \frac{7}{2}x - 6$ as y in terms of x?

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

B) $2y = 7x - 12$

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

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

14) Select *all* true answers for $\pi + 4$.

- ■ **real number**
- ☐ rational number
- ■ **irrational number**
- ☐ whole number

9) $-2p > 3$
$p < -\frac{3}{2}$

10) The direction of the inequality symbol changes when you multiply or divide both sides of the inequality by a negative number.

11) ≈ 113 km/hr

13) Distractor Rationale:
A) This equation is written as x in terms of y.
B) This equation clears the fraction correctly, but y should be isolated.
C) switches x and $f(x)$ in the given equation.

14) An irrational number + a rational number = an irrational number. If a number is not rational, it cannot be a whole number.

Problem	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Lesson Origin	7	7	7	7	7	7	7	1, 2	4	4	5	5	7	1