

## Lesson 10

# Writing Linear Equations

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### Outline

#### Part A: Writing Equations in Slope-Intercept Form

- Slope-Intercept Form Given Slope and a Point
- Slope-Intercept Form Given Two Points

#### Part B: Applications of Linear Equations

- Applications of Linear Equations

#### Targeted Review

### Vocabulary

- $y$ -intercept
- extraneous information



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.

Encourage your student to look at their formula sheet for the different forms of the line.

**3) Q:** What is  $m$ ?

**A:** *slope*

**Q:** What is  $b$ ?

**A:** *The  $y$ -intercept*

**Q:** What are  $x_1$  and  $y_1$ ?

**A:** *An ordered pair*

## Part A: Writing Equations in Slope-Intercept Form

### Objectives

In this part of the lesson, you will learn about writing equations in slope-intercept form.

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

- ☑ Write an equation in slope-intercept form given the slope and one point.
- ☑ Write an equation in slope-intercept form given two points.

### Why?

As you learned in Lesson 9, one of the most important things you will do in Algebra 1 is use the slope formula to solve linear equations. In this lesson, you will continue to master using slope.

### Warm Up

Use your formula sheet to answer the following questions.

1) What is the formula for slope?

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

2) What is point-slope form?

$$y - y_1 = m(x - x_1)$$

3) What is slope-intercept form?

$$y = mx + b$$

### ▶ **Slope-Intercept Form Given Slope and a Point**

- Point-slope form and slope-intercept form are similar in that they both use slope and a point on the line.
- Point-slope form can be written using any ordered pair from the graph.
- Slope-intercept form uses slope and a specific point, the  $y$ -intercept.
- Slope-intercept form can be derived from a point on the line and the slope of the line by writing an equation for the line in point-slope form first, and then solving for  $y$ .

**Example 1**

The linear function  $g(x)$  has a slope of  $\frac{3}{4}$  and passes through the point  $(6, 4)$ .

Write the equation for  $g(x)$  in slope-intercept form.

**Plan** Identify the information from the problem.  $m = \frac{3}{4}$ ,  $(6, 4)$   
Write an equation in point-slope form using the given slope and point. Then solve for  $y$ .

**Implement**

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

$$y - 4 = \frac{3}{4}x - \frac{18}{4}$$

$$+ \frac{16}{4} \quad + \frac{16}{4}$$

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

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

$$g(x) = \frac{3}{4}x - \frac{1}{2}$$

**Explain**

◀ Distribute  $\frac{3}{4}$  on the right side of the equation

◀ Isolate  $y$

◀ Combine like terms

◀ Simplify fractions

◀ Rewrite in function notation

Now that you know multiple forms for equations of lines, always read carefully so that your answer is in the correct form.

 **Checkpoint**

**Write the equation in slope-intercept form.**

Point:  $(10, 5)$  Slope:  $\frac{4}{5}$

$$y - 5 = \frac{4}{5}(x - 10)$$

$$y - 5 = \frac{4}{5}x - 8$$

$$+ 5 \quad + 5$$

$$y = \frac{4}{5}x - 3$$

**Example 1**

Your student may also be familiar with solving for  $b$  from slope-intercept form and then rewriting the equation using  $m$  and  $b$ . Either method is correct. However, the worked solutions will show solving from point-slope form.

 **Checkpoint**

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

**Q:** What properties are you using to solve when changing from point-slope to slope-intercept form?

**A:** *The Distributive Property and the Additive Property of Equality.*

④ **Slope-Intercept Form Given Two Points**

- Slope-intercept form of a line can be written if two ordered pairs for the function are known.
- Because only one line exists between any two points, either known point can be selected to write the equation in slope-intercept form.
- Picking the point with the fewest number of negative values is a good idea so there is less of a chance of making a mistake with the signs of the numbers.

**Example 2**

Write the equation of a line in slope-intercept form that passes through the points (3, 4) and (2, 7).

**Plan** Find the slope.  
Pick one point and substitute it into point-slope form.  
Isolate  $y$ .

**Implement**

$$\text{Slope: } m = \frac{\Delta y}{\Delta x} = \frac{4-7}{3-2} = -3$$

**Solve for  $y$  using (2, 7):**

$$y - 7 = -3(x - 2)$$

$$y - 7 = -3x + 6$$

$$y = -3x + 13$$

**Solve for  $y$  using (3, 4):**

$$y - 4 = -3(x - 3)$$

$$y - 4 = -3x + 9$$

$$y = -3x + 13$$

**Example 3**

Use the equation  $y = \frac{1}{4}x + 11$  to:

- A) Find the value of  $x$  when  $y = 7$ .  
 B) Find the value of  $y$  when  $x = 8$ .

**Plan** Write the information that you know as an ordered pair.  
 Then substitute the information into the linear equation and solve.

**Implement**

- |   |  |
|---|--|
| <p><b>A)</b> <math>(x, 7)</math></p> $7 = \frac{1}{4}x + 11$ $-4 = \frac{1}{4}x$ $x = -16$ $(-16, 7)$ | <p><b>B)</b> <math>(8, y)</math></p> $y = \frac{1}{4}(8) + 11$ $y = 2 + 11$ $y = 13$ $(8, 13)$ |
|---|--|

 **Checkpoint**

Write an equation of a line in slope-intercept form that passes through both  $(4, -4)$  and  $(-1, 6)$ .

$$m = \frac{-4 - 6}{4 - (-1)} = \frac{-10}{5} = -2$$

$$y + 4 = -2(x - 4)$$

$$y + 4 = -2x + 8$$

$$-4 \qquad -4$$

$$y = -2x + 4$$

 **Checkpoint**

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

Q: What is the first step to writing an equation when given two points?

A: *Find the slope*

Q: Does it matter which point you use?

A: *No, both points are on the line*

 **Practice 1**


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

- 4) In this problem, it is reasonable to write the  $y$ -intercept as a mixed number since finding a common denominator is not necessary.
- 5) Make sure that your student distributes the negative slope to  $-2$  and it simplifies to positive 1.
- 10) Q: What is the  $y$ -intercept?  
A: 3 or  $(0, 3)$
- 15) Q: What is the one-time fee based on your equation?  
A: The  $y$ -intercept, \$49.50
- 17) The steps for solving when given two points always start with finding the slope. Your student may be able to calculate the slope using mental math. If this is the case, they should still be encouraged to write down the values substituted into the formula so that anyone looking at their work can follow their steps.
- Remember that either point can be used to solve for the equation. If your student needs additional practice, have them solve the problem using each point to determine if they get the same answer.

 **Practice 1**

Complete the problems on a separate sheet of paper.

All equations in Lesson 10 should be written in slope-intercept form unless stated otherwise.

Write the equation of the line.

- 1)  $y + 9 = \frac{1}{2}(x - 3)$     $y = \frac{1}{2}x - \frac{21}{2}$       2)  $y - 1 = -\frac{5}{3}(x + 2)$     $y = -\frac{5}{3}x - \frac{7}{3}$
- 3)  $y - 2 = 4(x + 3)$     $y = 4x + 14$       4)  $y + \frac{3}{4} = 12\left(x - \frac{1}{4}\right)$     $y = 12x - \frac{15}{4}$

Write the equation of the line in slope-intercept form given the slope and a point on the line.

- 5)  $m = -\frac{1}{2}$  and  $(2, 5)$     $y = -\frac{1}{2}x + 6$       6)  $m = 3$  and  $(-1, 0)$     $y = 3x + 3$
- 7)  $m = -\frac{4}{5}$  and  $(10, 7)$     $y = -\frac{4}{5}x + 15$

Reanne was walking at a rate of 4 miles per hour. One hour later, she was at mile marker 7.

- 8) What is the rate of change? Explain.   **4 mph, Sample: Every hour Reanne walks 4 miles.**
- 9) What is the ordered pair, ( $time$ ,  $distance$ ), that is provided in the information?    **$(1, 7)$**
- 10) Write an equation that represents Reanne's walk.    **$y = 4x + 3$**
- 11) At what mile marker will she be after two and a half hours?  
**Reanne will be at mile marker 13 in 2.5 hours.**

An internet company charges \$42 per month plus a one-time setup fee. After five months, Joey had paid \$259.50.

- 12) What is the rate of change?   **\$42 per month**
- 13) Define the variables as an ordered pair in words.   **(month, money)**
- 14) What is the ordered pair in the given information?    **$(5, 259.50)$**
- 15) Write an equation that represents this scenario.    **$y = 42x + 49.50$**
- 16) Joey noticed that after having internet for  $x$  months, he had paid a total of \$511.50. How many months did Joey have the internet? Show your work.   **Joey had the internet service for 11 months.**

Write an equation for the line that passes through the given points.

- 17)  $(-3, 7)$  and  $(4, 14)$
- A) Use the slope formula to determine the slope.    **$m = 1$**
- B) Use the point  $(-3, 7)$  to write the point slope form.    **$y - 7 = x + 3$**
- C) Write the equation in slope-intercept form.    **$y = x + 10$**

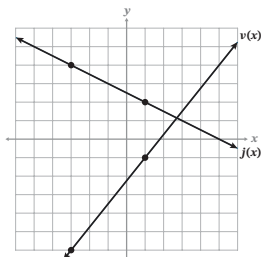
Write an equation for the line that passes through the given points.

- 18)  $(-2, -6)$  and  $(-4, 3)$   $y = -\frac{9}{2}x - 15$       19)  $(-5, 2)$  and  $(1, 4)$   $y = \frac{1}{3}x + \frac{11}{3}$   
 20)  $(-7, 9)$  and  $(-4, 7)$   $y = -\frac{2}{3}x + \frac{13}{3}$

21) Write an equation for the given functions using the graph provided.

$$j(x) = -\frac{1}{2}x + \frac{5}{2}$$

$$v(x) = \frac{5}{4}x - \frac{9}{4}$$



18) The point  $(-4, 3)$  can also be used to write the equation in point-slope form, but the slope-intercept form should be the same.

21) If they prefer, your student can find the slope from the graph rather than solving for it algebraically. This is more efficient since the slope can be determined quickly from the graph.

This function,  $v(x)$ , looks like it crosses the  $y$ -axis at  $(0, -2)$ , but it is really at  $(0, -\frac{9}{4})$ . Be sure your student checks their equation algebraically.

## Mastery Check

### Show What You Know

Your student needs to have the ordered pairs marked on the graph and the line drawn through the points.

**A) Q:** What is the  $y$ -intercept?

**A:** *Your student should give an estimate between 1.5 and 2. The exact value needs to be solved algebraically in Part B.*

**B) Q:** Does the line you graphed match the  $y$ -intercept you found algebraically?

**A:** Yes.

Your student should have this correct. If not, have them draw their line again more carefully.

**E)** This is in reference to the  $y$ -intercept only. In Lesson 8, your student translated the parent function up/down the  $y$ -axis when the value of the  $y$ -intercept changed.

### 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.

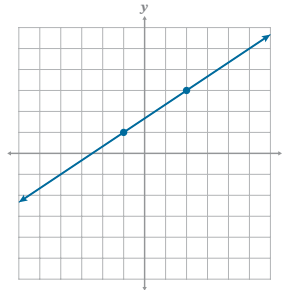
- ① Write an equation in slope-intercept form given the slope and one point.
- ② Write an equation in slope-intercept form given two points.

## Mastery Check

### Show What You Know

Use the ordered pairs  $(-1, 1)$  and  $(2, 3)$ .

- A)** Graph the ordered pairs and draw the line formed between these points. **B)** Find the equation of the line algebraically.



$$m = \frac{1-3}{-1-2} = \frac{2}{3}$$

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

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

$$y = \frac{2}{3}x + \frac{5}{3}$$

- C)** Explain why it is not possible to determine either intercept from the graph accurately.

**The graphed line does not intersect the  $x$  or  $y$ -axis on a grid line (or at an integer value). Thus, an estimate can be made, but solving for the intercept algebraically will provide the exact value for the intercepts.**

- D)** Solve for the  $x$ -intercept using your equation.

$(a, 0)$

$$0 = \frac{2}{3}a + \frac{5}{3}$$

$$-\frac{5}{3} = \frac{2}{3}a$$

$$a = -\frac{5}{2}$$

- E)** How has this line been translated related to the origin? Explain.

**The line has been translated up  $\frac{5}{3}$  units (or  $1\frac{2}{3}$  units up).**

### 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 problems on a separate sheet of paper.

All equations in Lesson 10 should be written in slope-intercept form unless stated otherwise.

Write the equation of the line.

- 1)  $y - 2 = \frac{6}{5}\left(x - \frac{1}{2}\right)$     $y = \frac{6}{5}x + \frac{7}{5}$       2)  $y - 1 = -\frac{1}{3}(x - 5)$     $y = -\frac{1}{3}x + \frac{8}{3}$   
 3)  $y + 3 = \frac{3}{2}(x + 1)$     $y = \frac{3}{2}x - \frac{3}{2}$       4)  $y - 7 = -\frac{3}{4}(x + 5)$     $y = -\frac{3}{4}x + \frac{13}{4}$

Write an equation of the line given the slope and a point on the line.

- 5)  $m = -7; \left(-\frac{1}{2}, 0\right)$     $y = -7x - \frac{7}{2}$       6)  $m = \frac{5}{7}; (-14, 2)$     $y = \frac{5}{7}x + 12$   
 7)  $m = \frac{2}{3}; (3, 2)$     $y = \frac{2}{3}x$

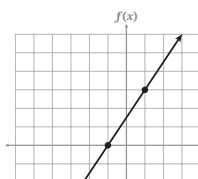
The price of fuel at a local station was \$3.25 per gallon. Katrina used a gift card to put 2 gallons in her car. When she saw the receipt for her purchase, there was still \$20 left on the gift card.

- 8) What is the ordered pair, (*gallons bought, money remaining*), provided in the information? **(2, 20)**  
 9) What is the slope? Why is it negative?  
 10) Write the linear equation for this scenario.  **$y = -3.25x + 26.50$**   
 11) How many gallons of fuel could Katrina have bought using the entire gift card? Round to the nearest hundredth.  **$x = 8.15$  gallons**

Write the equation for a line given two points from the line.

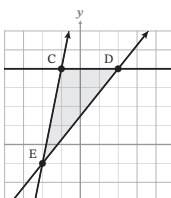
- 12) (1, 3) and (-1, -5)    **$y = 4x - 1$**       13) (-4, -1) and (-2, 2)    **$y = \frac{3}{2}x + 5$**   
 14) (-3, 7) and (6, -5)    **$y = -\frac{4}{3}x + 3$**

- 15) Use the marked points to find the equation in slope-intercept form. Write your final answer in function notation.



$f(x) = \frac{3}{2}x + \frac{3}{2}$

- Find the equation of each line that forms triangle CDE in slope-intercept form. List the ordered pairs you are using before solving algebraically.



- 16) Line  $\overleftrightarrow{CD}$   
 17) Line  $\overleftrightarrow{DE}$   
 18) Line  $\overleftrightarrow{CE}$

**Practice 2**

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

- 9) -3.25; Katrina is spending money. For every gallon she puts in her car, the amount on the gift card goes down.

12–14)

The points can be written in either order, and either point can be used to solve for slope-intercept form.

16)  $y = 4$

This is a horizontal line.

17)  $y = \frac{5}{4}x + \frac{3}{2}$

Q: Describe how a slope of zero would be graphed.

A: *Sample:*

*Zero spaces up and one space over.*

18)  $y = 5x + 9$

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

- 2) Both questions help your student think about the word choice in the following application problems and identify key information in the problems.

## Part B: Applications of Linear Equations

### Objectives

In this part of the lesson, you will learn about applications of linear equations.

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

- ☑ Write an equation in slope-intercept form given any type of scenario.
- ☑ Explain what a given point, the slope, and the  $x$ - and  $y$ -intercept represent within the context of a word problem.

### Why?

It's not enough to simply know how to solve linear equations. For them to be useful, you need to understand how to apply them properly to real-world scenarios.

### Warm Up

- 1) What does the word "per" help determine in a word problem?  
**The rate of change and the (independent, dependent) variables**
  
- 2) When graphing an equation in slope-intercept form, where do you start the graph?  
**At the  $y$ -intercept**

### Applications of Linear Equations

- Your advantage over a calculator when solving linear equations is that you understand \_\_\_\_\_ **the meaning and relationships** \_\_\_\_\_ of slope, the  $y$ -intercept, and all points.
- Once you have a linear equation, you should be able to explain each part as it relates to a given problem. This means you will be able to explain the following:
  - Slope as a \_\_\_\_\_ **rate of change** \_\_\_\_\_.
  - The \_\_\_\_\_  **$y$ -intercept** \_\_\_\_\_ as more than just a starting point on the graph.
  - Any \_\_\_\_\_ **ordered pair** \_\_\_\_\_ as it relates to the equation and the context of the problem.
- \_\_\_\_\_ **Extraneous** \_\_\_\_\_ information is information that is irrelevant to the problem and is sometimes provided to distract from the needed values.

- Helpful ways to plan when given an application problem (word problem):
  - Identify **key information** by highlighting, circling, or underlining it.
  - Label **numbers**.
  - Define the **variables** as an ordered pair.
  - Use your **Formula Sheet** to write down the formulas you will use to solve the problem.

**Example 1**

Carrie got in her car at **8 a.m.** to drive to work. After a **half-hour**, she had traveled **25 miles**. When she parked her car **45 minutes** after leaving her house, she had traveled **37.5 miles**.

Write the linear equation that represents the scenario and explain what the slope and y-intercept represent in context.

**Plan** Find the key information, then circle, highlight, or underline it.  
Write the ordered pair in words.  
Organize the four values provided.  
Find the slope and explain its meaning.  
Write the linear equation.  
Find the y-intercept and explain its meaning.

**Implement**

Ordered pair in words: **(hour, miles)**

Values provided:

**(0.5, 25)**

**(0.75, 37.5)**

$$\text{Slope: } m = \frac{37.5 - 25}{0.75 - 0.5} = \frac{12.5}{0.25} = 50$$

Linear equation (use either point):

$$m = 50, (0.5, 25)$$

$$y - 25 = 50(x - 0.5)$$

$$y - 25 = 50x - 25$$

$$y = 50x$$

Determine the time that Carrie got to work.

$$8:00 \text{ a.m.} + 45 \text{ min} = \mathbf{8:45 \text{ a.m. arrival time}}$$

**Explain**

◀ When  $m = \frac{50}{1}$ , Carrie was traveling 50 miles every hour, or Carrie was driving 50 mph.

◀ **The y-intercept means at 0 hours, Carrie had traveled 0 miles.**

**Example 1**

8 a.m.: This is not needed to find the equation

half hour:  $\frac{1}{2} = 0.5$  hour

45 minutes after leaving:  $45 = .75$  hour

Remember that, when solving word problems, the Explain part of Plan, Implement, Explain is the explanation of the answer to the problem.

Going back to the problem, you can see that she left at 8 a.m. This was extraneous to solve the equation but is needed to determine her arrival time.

**Example 2**

assessment fee: This is a fee but it is not listed; this is  $b$ .

plus \$22 per hour: The word per is used; this is  $m$ .

quarter-hour: Here is a number in words that may be useful, but not to write the equation.

3.75 hours: There are 3 given values,  $m$ , and  $(x, y)$ .

**Example 2**

Marco is a residential electrician. He charges an assessment fee for each job plus \$22 per hour of work completed, rounded up to the quarter-hour. Marco's last job took 3.75 hours, and he charged the customer \$127.50.

Write an equation that Marco can use to find his earnings for a job of any length of time.

**Plan** Identify the key information.  
Write the ordered pair in words and organize your values.  
Write the equation and explain its meaning.

**Implement**

Ordered pair in words:

Equation:

(hours, money charged)

$$y - 127.50 = 22(x - 3.75)$$

Values provided:

$$y - 127.50 = 22x - 82.50$$

(3.75, 127.50)

$$y = 22x + 45$$

$m = 22$

**Explain**

The  $y$ -intercept is  $(0, 45)$ . This means for 0 hours of work, \$45 will be charged as an assessment fee.

If Marco needed to earn at least \$160 to pay his bills this week, how many hours would you suggest he work?

To solve for hours when Marco needs \$160:  $(x, 160)$

$$160 = 22x + 45$$

$$160 - 45 = 22x$$

$$115 = 22x$$

$$x = \frac{115}{22} = 5.227$$

Since Marco calculates earnings by the quarter-hour, Marco should work at least 5.25 hours to earn \$160.

**Checkpoint**

JaJuan opened a savings account and plans to deposit the same amount of money in the account weekly. JaJuan had \$250 three weeks after opening his savings account. Seven weeks after opening the account, he had saved \$550.

- A) Write an equation to find his savings for any number of weeks.

<b>(week, money)</b>	$m = \frac{550 - 250}{7 - 3} = \frac{300}{4} = 75$
<b>(3, 250) and (7, 550)</b>	$y - 250 = 75(x - 3)$
	$y - 250 = 75x - 225$
	$y = 75x + 25$

- B) Name the rate of change. Explain what it means in this problem.

**The rate of change is \$75 per week. This means that every week JaJuan is putting \$75 in his savings account.**

- C) Name the y-intercept. Explain what it means in this problem.

**The y-intercept is 25. This means when JaJuan opened the savings account, he deposited \$25.**

- D) If JaJuan is saving to purchase a used car that costs \$3,500, how many weeks will he need to save?

**(x, 3,500)**

$$3,500 = 75x + 25$$

$$3,475 = 75x$$

$$x = 46\frac{1}{3}$$

**JaJuan will need to save for 47 weeks to have enough for the car.**

 **Checkpoint**

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

- D) Encourage your student to keep going. The problems have more parts to them now that they know how to find out more information. This may be challenging at first, but perseverance is a learned skill.


 **Practice 1**



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

The rates for the practice problems are constant.

- 1) Q: What is the rate of change in the scenario?  
A: *The rate of change is 2 cm per day.*
- 5) Q: What number is not needed to solve this problem?  
A: *That the tank holds 100 gallons.*
- 6) This is the starting point for the trip. Recall that time needs to be counted in hours, so 9 a.m. (EST) = hour 0.
- 7) Q: How far did the plane travel before it left for Los Angeles?  
A: *Zero miles.*  
  
Q: How long was the flight before leaving?  
A: *Zero minutes.*
- 8) Any two points can be used to calculate the slope.
- 9) The  $y$ -intercept is 150. This means for 0 sheets of drywall, \$150 was already spent. It is greater than zero because Tarek likely needed supplies to complete his project in addition to the drywall.
- 10) Since the ordered pair is (drywall, cost), this means that 11 sheets of drywall cost \$303.78, including the \$150  $y$ -intercept.

 **Practice 1**

Complete the problems on a separate sheet of paper.

Write an equation in slope-intercept form. Make sure to label information and watch for extraneous information.

- 1) Padma started a vegetable garden in the spring. Once the plants sprouted, she began measuring them daily to track the plant growth. Padma noticed that her plants grew 2 cm per day, and on day 13, she measured the plants at 27 cm. Write an equation to show plant growth for any number of days.  $y = 2x + 1$
- 2) Marshall eats eggs every morning for breakfast. He went to the store in the afternoon of August 31st and purchased 5 dozen eggs (60 eggs) for September. On September 25th, 10 eggs were remaining. Write an equation to represent Marshall's egg consumption for September.  $y = -2x + 60$

Cedar-Oak School was selling yearbooks. The school was charged a publishing fee of \$325 and a \$35 per book fee for the yearbooks.

- 3) Write an equation to represent the cost for the yearbooks for any number of books that the school will purchase.  $y = 35x + 325$
- 4) How much will it cost for the school to purchase 100 yearbooks? **It will cost \$3,825 for 100 yearbooks.**

- 5) A propane company fills a 100-gallon tank to 85% capacity. Edward had propane delivered from the company, and after one month, the tank was 80% full. Four months later, Edward checked the tank and saw it was now 65% full. Write an equation to demonstrate propane usage if the same amount is used each month.  $y = -5x + 85$

A plane left an airport in Philadelphia at 9 a.m. (EST) on a direct flight to Los Angeles. At 2:30 p.m. (EST), the plane landed after flying 2,400 miles. (EST = Eastern Standard Time).

- 6) Write an equation for the flight from Philadelphia to Los Angeles. Round to the nearest whole number.  $y = 436x$
- 7) What was the cruising speed of the plane? **The speed of the plane was 436 mph.**

Tarek was installing new drywall in his house. He recorded his costs for drywall in the table.

	Sheets of drywall	Cost (\$)
	5	219.90
	7	247.86
	11	303.78
	15	359.70

- 8) Write an equation to calculate his cost for any number of sheets of drywall and supplies.  $y = 13.98x + 150$
- 9) Name the  $y$ -intercept. Explain what you think it means in this problem. Why is it greater than 0?
- 10) Explain what the point (11, 303.78) represents.
- 11) Suppose Tarek only wanted the cost of drywall. What would he pay for only three sheets of drywall? **\$41.94**

## PRACTICE 1 10B

Garrison paid a one-time fee for a music card to purchase any number of songs on the site for the same price. After purchasing three songs, he had spent \$21 for the card and the songs. After purchasing six songs, he paid \$30 for the card and the songs.

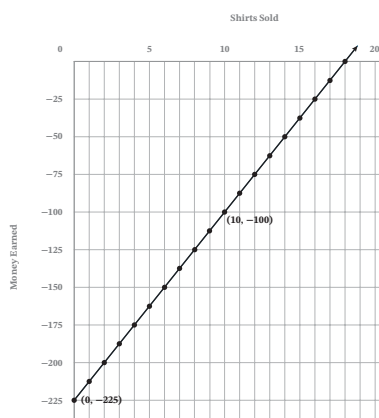
- 12) Write an equation for the given scenario in slope-intercept form, where  $n$  is the number of songs and  $d$  is dollars spent.  $d = 3n + 12$
- 13) How many songs could Garrison purchase along with the music card for \$45?
- 14) What does the slope represent for this function?
- 15) What does the  $y$ -intercept represent for this function? **The  $y$ -intercept of (0, 12) means that the music card initially costs \$12 before any songs are purchased.**

Kristina was emptying 10,000 gallons of water from her swimming pool. The water was removed from the pool at a rate of 125 gallons per minute.

- 16) Write an equation for the given scenario in slope-intercept form.  $y = -125x + 10,000$
- 17) What does the slope represent for this function? What does the  $y$ -intercept represent for this function?
- 18) How long would it take to empty the pool? How do you know this? **It would take 80 minutes to empty the pool. When (80, 0), this means at 80 minutes, 0 gallons of water remain.**

The graph represents the company T-shirts R Cool. The  $y$ -intercept is the amount of money borrowed from the bank to start the company.

- 19) Find the equation of the line.
- 20) Explain the meaning of the marked point (10, -100).
- 21) A **break-even point** is a business term used when you have earned back all of the money you invested into your company but have not earned any income (money) yet. Find the  $x$ -intercept (or break-even point) using your equation. Explain what the  $x$ -intercept means.
- 22) Why do you think the points on the line are marked?



13) Garrison could purchase 11 songs and the music card for \$45.

14) The slope of 3 means that each song purchased costs an additional \$3 (or \$3 per song).

17) The slope of  $-125$  represents the gallons of water removed each minute.

The  $y$ -intercept of 10,000 represents the number of gallons in the pool before any water was removed.

19)  $y = 12.50x - 225$

20) Since (shirts sold, money earned), when 10 shirts are sold at T-shirts R Cool, the company still owes \$100 to the bank.

21) (18, 0) This means when 18 shirts are sold, \$0 have been earned.

22) The points are marked to show each t-shirt sold. You cannot sell a fraction of a t-shirt, so it makes sense to mark the points to show individual sales.

**Mastery Check**

**Show What You Know**

Q: Why do all of the graphs have the same y-intercept?

A: Because they all started the race at the same time, 0 minutes, and the same distance, 0 kilometers.

D) Q: Is there any extraneous information in the problem?

A: Yes, the \$1,200 raised.

**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.

- ✔ Write an equation in slope-intercept form given any type of scenario.
- ✔ Explain what a given point, the slope, and the x- and y-intercept represent within the context of a word problem.

**Mastery Check**

**Show What You Know**

Three siblings—Mark, Steven, and Elizabeth—all completed a 5K charity race and raised a combined total of \$1,200. The graph shows how each person did in the race.

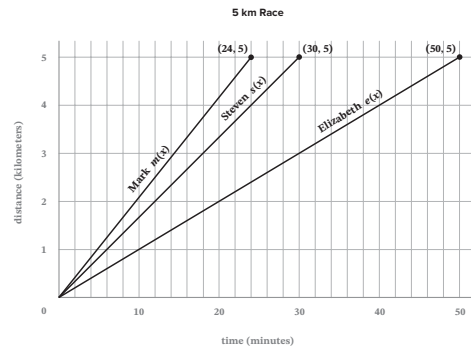
A) Find the equation, in function notation, for each sibling.

$$m(x) = \frac{5}{24}x$$

$$s(x) = \frac{1}{6}x$$

$$e(x) = \frac{1}{10}x$$

Note: all graphs start at (0, 0)



B) Explain the rate of change for each runner.

(minutes, kilometers)

Mark: 5 kilometers in 24 minutes.

Steven: 5 kilometers in 30 minutes or 1 kilometer every 6 minutes.

Elizabeth: 5 kilometers in 50 minutes or 1 kilometer every 10 minutes.

C) Who won the race? Justify your response with mathematical details.

Mark is the winner of the race. His slope is the steepest, which means he had the fastest rate. You can also see that Mark had the shortest time, and the winner finishes the race the fastest.

D) Why do all of the graphs stop when y = 5?

The equation y = 5 represents the distance of 5 kilometers. The graph stops when each person reaches the 5-kilometer mark (the finish line) for the race.

**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 problems on a separate sheet of paper.

Write the equations in slope-intercept form. Watch for extraneous information.

Miguel needed to dig 300 feet to install a well for his new house. The construction manager said that this would take 40 hours to complete. Miguel hopes that the digging will only take 30 hours.

- List the ordered pairs for the problem and explain their meaning.
- Write an equation to find the rate the drill is digging at.  $y = -7.5x + 300$

A class trip was being planned to the science museum. The school would pay the transportation fee, and the students would pay the cost of admission. Mrs. Wallace created a table to track total expenses.

Students	Cost (\$)
15	550
30	700
45	1,250
60	14,000

- Write an equation representing the class trip.  $y = 10x + 400$
- How much did the bus ride cost for the trip? Explain how you know this.


Devon had a bank account from which he withdrew \$55 each week for his bills. There was \$3,170 remaining in the account after six weeks.

- Write an equation to represent Devon's spending.  $y = -55x + 3,500$
- At what week will he run out of money? **During the 64th week, Devon will run out of money, but he cannot withdraw the full amount in week 64.**

Agnes was getting her swimming pool filled by the fire company and predicted it would take them 2.5 hours to complete. The fire chief said that the fire hose has a flow rate of 150 gallons per minute. After 20 minutes, the pool had 2,200 gallons of water in it.

- Write an equation to model the pool being filled.  $y = 150x - 800$
- If it took 86 minutes to fill the pool, how much water was in the pool when it was filled? **The pool had 12,100 gallons of water when it was filled.**

 Practice 2

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

- (hours, feet)  
(0, 300) At hour 0 (start of the job), 300 feet remain.  
(40, 0) At hour 40, 0 feet remain.
- The bus cost \$400. The problem states that the school will pay the transportation fee, which is the cost no matter the number of students who attend the trip.

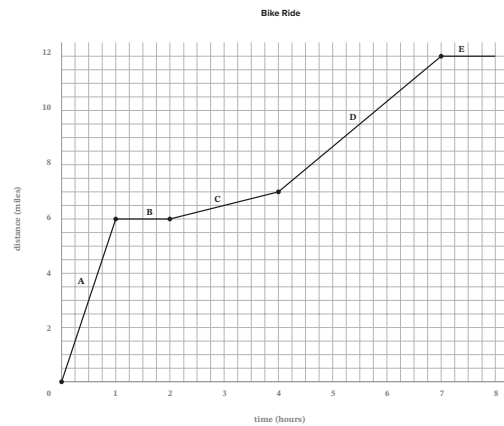
- 9)  $y = 6x$
- 10) The rate of change is 6 miles per hour. This means the bike rider traveled 6 miles in their first hour of riding.
- 11)  $m = \frac{1}{2}$
- 12)  $m = \frac{5}{3}$
- 13) Miles traveled: Part A = 6 miles, Part B = 0 miles, Part C = 1 mile, Part D = 5 miles, Part E = 0 miles.  
Part A was the farthest distance traveled. This can be found by looking at the y-coordinate of the ordered pairs and finding the difference for each part.
- 14) Parts B and E are horizontal line segments. The ordered pair is (hours, distance). In both B and E, the time continues, but the distance does not change. This means that the bike rider is not moving from hour one to two or past hour seven. It is possible in part B, the rider stopped for a break, and in part E, the rider reached their destination.
- 15) The intercept (0, 0) means that at hour 0, the rider had traveled 0 miles.
- 16)  $y = 120x + 60$   
 $d(r) = 120r + 60$
- 18) The slope of 120 means that it costs \$120 for each additional room reserved.
- 21) The slope of  $-\frac{5}{2}$  represents that five gallons of propane leaked out of the tank every two minutes.  
The y-intercept of 500 represents the number of gallons in the tank before any propane leaked out.
- 24) Christina has unlimited data because the bill was the same for both months regardless of how much data she used.

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.

The graph shows a Bike Ride over the course of several hours. The distance is in miles.



- 9) Find the equation of the line for part A.
- 10) What does the rate of change mean for part A?
- 11) Find the slope for part C.
- 12) Find the slope for part D.
- 13) During which part of the graph did the rider travel the farthest? Justify your response with mathematical details.
- 14) From the graph, what type of line segments are parts B and E? What do parts B and E represent in the context of the problem?
- 15) What does the intercept (0, 0) mean for this scenario?

A team of students will be taking an overnight trip. The coach needs to pay a one-night deposit to reserve rooms in a hotel and purchase a parking space. The deposit for six rooms and the parking space will cost \$780. The deposit for twelve rooms and the parking space will cost \$1,500. Write an equation to provide the deposit,  $d(r)$ , needed to reserve the appropriate number of rooms and the parking space.

- 16) Write an equation for the given scenario in slope-intercept form and function notation.
- 17) How much would it cost to reserve 15 rooms and the parking space? **\$1,860**
- 18) What does the slope represent for this function?
- 19) What does the y-intercept represent for this function? **The y-intercept of \$60 means that the parking space costs \$60 to purchase.**

A full 500-gallon propane tank started leaking at a rate of  $2\frac{1}{2}$  gallons per minute.

- 20) Write an equation for the given scenario in slope-intercept form.  **$y = -\frac{5}{2}x + 500$**
- 21) What does the slope represent for this function? What does the y-intercept represent for this function?
- 22) How long would it take for the tank to be empty? **It would take 200 minutes ( $3\frac{1}{3}$  hours) for 500 gallons of propane to leak from the tank.**

Christina used 2.9 GB of data and owed \$75 for her cell phone bill in January. In February, she doubled her data, and her bill was \$75.

- 23) Write an equation to represent her cell phone bill each month.  **$y = 75$**
- 24) What type of cell phone plan do you think Christina has (unlimited data or limited data)? Explain.
- 25) What information was extraneous in the problem? **The value 2.9 GB was not needed to calculate the equation.**

### 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.

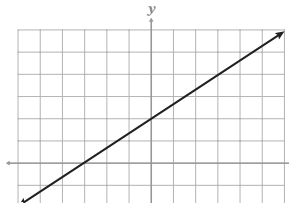
- Name the  $x$  and  $y$ -intercepts as ordered pairs from the table.
- Name the domain and the range for the table.
- The table has a constant rate of change. Find the slope using any two points. **The slope between any two points on the table is  $m = \frac{1}{3}$ .**

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

- Mark the  $x$  and  $y$ -intercepts on the graph. Write the intercepts as ordered pairs.

$x$ -intercept:  $(-3, 0)$

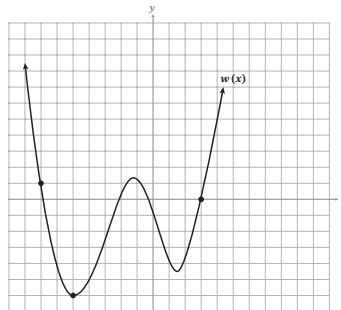
$y$ -intercept:  $(0, 2)$



- Write an equation in point-slope form.  $m = -\frac{5}{2}, (-1, 15)$   **$y - 15 = -\frac{5}{2}(x + 1)$**
- Loretta mailed two cards ( $c$ ) each day ( $d$ ). Determine which variable is dependent and independent for the scenario and write an equation in function notation.  **$c(d) = 2d$**

Use the graph to answer the following questions.

- Does  $w(2) = 1$ ? Explain. **No, the ordered pair is not on the graph.**
- Does  $w(3) = 0$ ? Explain. **Yes, the ordered pair is on the graph.**



### 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)  $x$ -intercept:  $(\frac{3}{2}, 0)$

$y$ -intercept:  $(0, -\frac{1}{2})$

2) Domain:  $\{-3, 0, \frac{3}{2}, 3\}$

Range:  $\{-\frac{3}{2}, -\frac{1}{2}, 0, \frac{1}{2}\}$

- 3) The work is not shown for this question. The change in  $y$  is 1, and the change in  $x$  is 3. Therefore,  $m = \frac{1}{3}$ . This can be found from the table using mental math.

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

**11)** On a number line you only graph on the  $x$ -axis, or horizontally. The problems in Unit 2 are on the coordinate plane so the graph can move left and right ( $x$ -values) as well as up and down ( $y$ -values).

**12)** Distractor Rationale:

- A) This occurs if your student divides  $\frac{4}{-2}$  rather than  $-\frac{2}{4}$ .
- C) This ignores the negative sign when solving for  $r$ .
- D) This answer would occur if the problem was  $\frac{y}{x}$  rather than  $\frac{y}{x}$ .

**13)** Distractor Rationale:

- A) and D) have the slope and the  $y$ -intercept switched.
- B) and D) are written in point-slope form.

TARGETED REVIEW 10

**Solve. Graph the solution(s) on a number line.**

**9)**  $|-2x - 6| = 3$     $x = -\frac{3}{2}$    **OR**    $x = -\frac{9}{2}$

**10)**  $|x - 2| - 4 > -4$     $x > 2$    **OR**    $x < 2$

**11)** How is graphing on a number line different from the graphing in Unit 2?

**Multiple Choice**

**B**   **12)** Find the value of  $r$ .

$m = 4$ ,  $(-3, 2)$  and  $(r, 12)$

- A)**  $-2$
- B)**  $-\frac{1}{2}$
- C)**  $\frac{1}{2}$
- D)**  $37$

**C**   **13)** Determine the equation in slope-intercept form when

$m = 6$  and  $b = \frac{1}{3}$

- A)**  $y = \frac{1}{3}x + 6$
- B)**  $y - \frac{1}{3} = 6(x - 0)$
- C)**  $y = 6x + \frac{1}{3}$
- D)**  $y - 6 = \frac{1}{3}(x - 0)$

<b>Problem</b>	1	2	3	4	5	6	7	8	9	10	11	12	13
<b>Lesson Origin</b>	8	7	9	8	9	7	7	7	3	4	PA	9	9