Name Answer Key Date _____ Class _____

LESSON 11-1

Representing Proportional Relationships

Reteach

235
234
240
241
247
246

A **proportional relationship** is a relationship between two sets of quantities in which the ratio of one quantity to the other quantity is constant. If you divide any number in one group by the corresponding number in the other group, you will always get the same quotient.

Example: Martin mixes a cleaning spray that is 1 part vinegar to 5 parts water.

Proportional relationships can be shown in tables, graphs, or equations.

Table

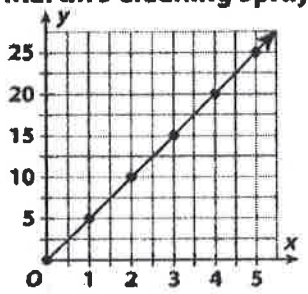
The table below shows the number of cups of vinegar Martin needs to add to certain amounts of water to mix his cleaning spray.

Martin's Cleaning Spray

Water (c)	5	10	15	20	25
Vinegar (c)	1	2	3	4	5

Notice that if you divide the amount of water by the amount of vinegar, the quotient is always 5.

Martin's Cleaning Spray



Graph

On the graph, you can see that for every 1 unit you move to the right on the *x*-axis, you move up 5 units on the *y*-axis.

Equation

Let *y* represent the number of cups of water.
Let *x* represent the cups of vinegar.

$y = 5x$

Use the table below for Exercises 1–3.

Distance Driven (mi)	100	200	300	400	500	600
Gas Used (gal)	5	10	15	20	25	30

1. There is a proportional relationship between the distance a car drives and the amount of gas used. Complete the table.

2. Find each ratio. $\frac{\text{miles}}{\text{gallons}} \rightarrow \frac{100}{5} = \frac{200}{10} = \frac{300}{15} = \frac{400}{20} = \frac{500}{25} = \frac{600}{30}$

   Each ratio is equal to 20.

3. a. Let *x* represent gallons of gas used. Let *y* represent distance driven.

   b. The equation that describes the relationship is $y = 20x$.

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LESSON 11-1

Representing Proportional Relationships

Practice and Problem Solving: D

Use the table to answer Exercises 1–3.

Yards	1	2	3	4	5	6
Feet	3	6	9	12	15	18

1. The table shows the relationship between lengths in feet and lengths in inches. Complete the table. The first column has been done for you.

2. Write each pair as a ratio. $\frac{\text{feet}}{\text{yards}} \rightarrow \frac{3}{1} = \frac{6}{2} = \frac{9}{3} = \frac{12}{4} = \frac{15}{5} = \frac{18}{6}$

   Each ratio is equal to 3.

3. Let x represent the number of yards. Let y represent the number of feet. The equation that describes the relationship is $y = 3x$.

Write the equation that describes the relationship.

4. There are 50 stars on each United States flag. Two flags have 100 stars. Three flags have 150 stars.

   Let x be the number of flags. Let y be the number of stars.

   The equation that describes the relationship is $y = 50x$.

Use the table to answer problems 5–7. Tell whether each relationship is proportional. The first one is done for you.

Lemonade Recipe

Lemons	1	2	3	4	5	6
Sugar (cups)	1.5	3	4.5	6	7.5	9
Water (cups)	7	14	21	28	35	42

5. the ratio of lemons to cups of sugar **yes**

6. the ratio of cups of sugar to cups of water yes

7. the ratio of lemons to cups of water yes

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LESSON 11-1

Representing Proportional Relationships

Practice and Problem Solving: C

Use the table for Exercises 1 and 2.

Length (ft)	2.85	5.7	7.6	9.88	11.4
Width (ft)	1.5	3	4	5.2	6

1. The table shows the length and width of various United States flags.

   a. Is the relationship proportional? yes.

   b. If so, write the equation that describes the relationship. Let x represent the width of the flags. Let y represent the length of the flags.

   $y = 1.9x$

2. Another flag in the same collection has a length of 12.6 feet.

   How wide would you expect the flag to be? 6.63 feet

Use the table for Exercise 3.

Map Distance, x (in.)	$1\frac{1}{2}$	$3\frac{1}{2}$	4	5	$7\frac{1}{4}$
Actual Distance, y (mi)	75	175	200	250	$362\frac{1}{2}$

3. The table shows the distance between various cities on a map in inches, x, and the actual distance between the cities in miles, y.

   a. Is the relationship proportional? yes

   b. If so, write the equation that describes the relationship.

   $y = 50x$

   c. The distance between Jacksonville and Daly City on the map is $9\frac{1}{8}$ inches.

   How far apart are the cities in miles? $456\frac{1}{4}$ mi.

   d. San Diego, CA and San Francisco, CA are about 550 miles apart. If you were putting these two cities on a map, how many inches apart would they be?

   11 in

Name _____ Date _____ Class _____

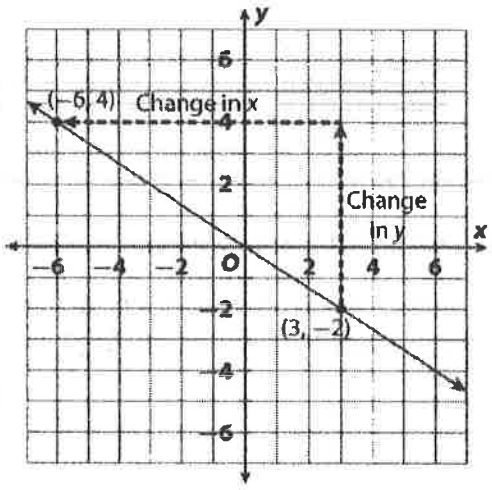
LESSON 11-2

Rate of Change and Slope

Reteach

Look at the relationships between the table, the graph, and the slope.

First value (x)	Second value (y)
–6	4
–3	2
0	0
3	–2



To find the slope, choose two points, using the table or graph. For example, choose (–6, 4) and (3, –2).

Change in y: $4 - (-2) = 6$

Change in x: $-6 - 3 = -9$

$$\text{Slope} = \frac{\text{change in } y}{\text{change in } x} = \frac{6}{-9} = -\frac{2}{3}$$

Use the example above to complete Exercises 1 and 2.

1. The slope is negative. In the table, as the values of x decrease, the values of y increases.

2. The slope is negative. In the graph, as you move from left to right, the line of the graph is going down (up or down).

Solve.

3. Suppose the slope of a line is positive. Describe what happens to the value of x as the value of y increases.

the valu of x would increase

4. Suppose the slope of a line is positive. Describe what happens to the graph of the line as you move from left to right.

it would go up.

5. Two points on a line are (3, 8) and (–3, 2). What is the slope of the line? $\frac{8-2}{3+3}$ $\frac{6}{6}$ (1)

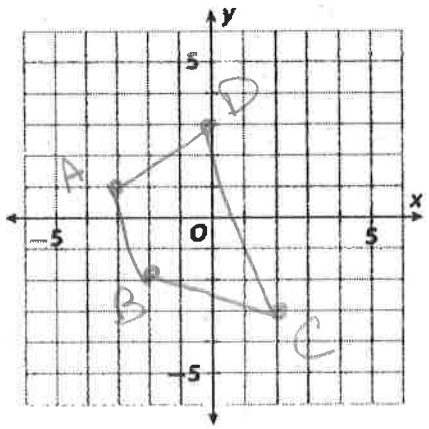
Name _____ Date _____ Class _____

LESSON 11-2

Rate of Change and Slope

Practice and Problem Solving: C

Use the grid at the right for 1–7.



1. Draw a quadrilateral with vertices at $A(-3, 1)$, $B(-2, -2)$, $C(2, -3)$, and $D(0, 3)$. Label each vertex with its letter.

2. Find the slope of $\overline{AB}$. -3

3. Find the slope of $\overline{BC}$. $-\frac{1}{4}$

4. Find the slope of $\overline{CD}$. -3

5. Find the slope of $\overline{DA}$. $2/3$

6. Describe the relationships between the opposite sides of the quadrilateral you drew.

only two opposite sides have the same slope. The other sides have different slopes.

7. What kind of quadrilateral did you draw? trapezoid.

The table at the right shows how many peanuts one company uses to make peanut butter.

8. Suppose you graph the information in the table. Find the slope of a line drawn through the points.

$\frac{1}{46}$

9. How many peanuts would be needed to fill a 40-ounce jar with peanut butter?

1840 peanuts

Number of Peanuts Needed to Make Peanut Butter

Peanuts	368	552	828
Amount Made (oz)	8	12	18

$\frac{1}{46} = \frac{40}{x}$ $\quad \frac{12-8}{552-368}$ $\quad \frac{4}{184}$

46 40 1840

Solve.

10. You graph a triangle on grid paper. The slopes of the sides are 0, –3, and undefined. What kind of triangle did you draw? Explain how you know.

right triangle. undefined is vertical and 0 is horizontal, creating a right angle.

Name _____ Date _____ Class _____

LESSON 11-2

Rate of Change and Slope

Practice and Problem Solving: D

Tell whether the rates of change are constant or variable. The first one is done for you.

1. calories per serving **constant**

Servings	1	2	5	7
Calories	150	300	750	1,050

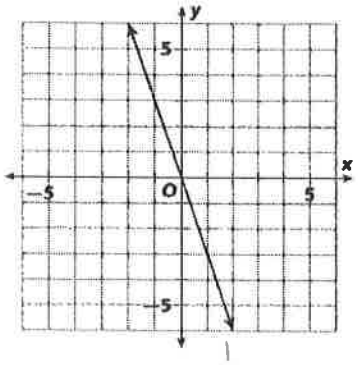
2. distance jumped variable

Jumps	2	4	7	10
Distance (ft)	12	24	35	55

6 6 5 5.5

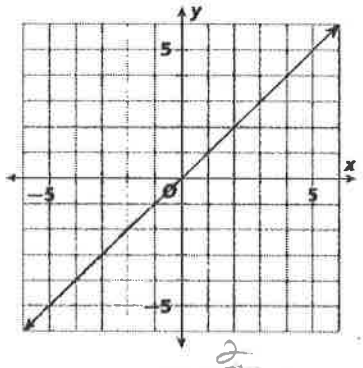
Find the slope of each line. The first one is done for you.

3. slope = **–3**

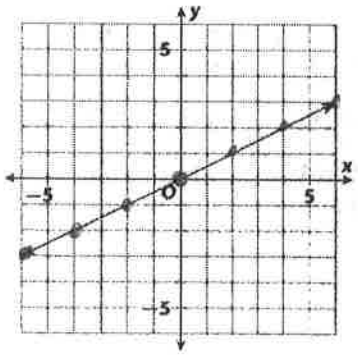


1

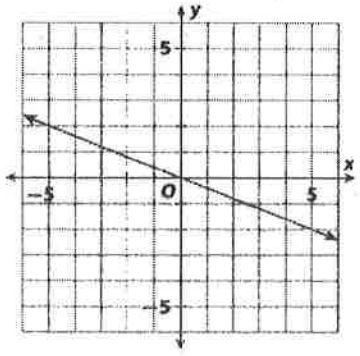
4. slope = 1



5. slope = $\frac{1}{2}$



6. slope = $-\frac{2}{5}$



Solve. The first one is done for you.

7. In 3 hours, 654 gallons of water passed through a pipe. What was the average rate in gallons per hour at which the water passed through the pipe?

218 gallons per hour

200 mi / 4 hr

8. A car traveled 200 miles in 4 hours. What was the car's average rate of speed in miles per hour?

50 mi per hr.

Name _____ Date _____ Class _____

LESSON 11-3

Interpreting the Unit Rate as Slope

Reteach

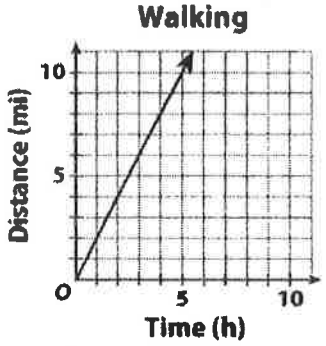
A rate is a comparison of two quantities that have different units.

A **unit rate** is a rate in which the second quantity is 1 unit.

For example, walking 10 miles every *5 hours* is a rate. Walking 2 miles every *1 hour* is the equivalent unit rate.

$$\frac{10 \text{ miles}}{5 \text{ hours}} = \frac{2 \text{ miles}}{1 \text{ hour}} = 2 \text{ mi/h}$$

The slope of a graph represents the unit rate. To find the unit rate, find the slope.



Step 1: Use the origin and another point to find the slope.

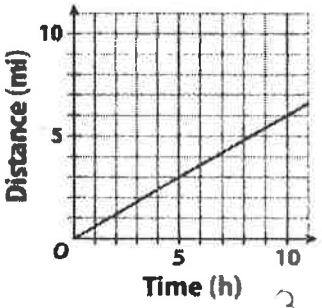
$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{10 - 0}{5 - 0} = \frac{10}{5} = 2$$

Step 2: Write the slope as the unit rate.

slope = unit rate = 2 mi/h

Find the slope of the graph and the unit rate.

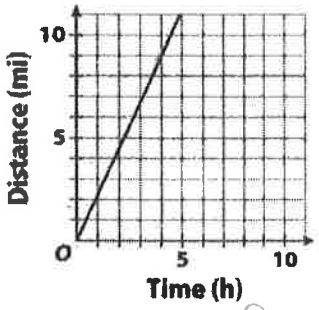
1.



$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{3}{5}$

unit rate = 3/5 mi/h

2.



$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{9}{4}$

unit rate = 9/4 mi/h

Name _____ Date _____ Class _____

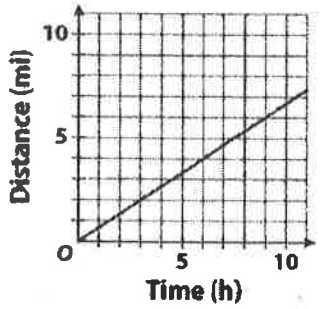
LESSON 11-3

Interpreting the Unit Rate as Slope

Practice and Problem Solving: D

Find the slope. Name the unit rate. The first one is done for you.

1. **Miguel Hiking**

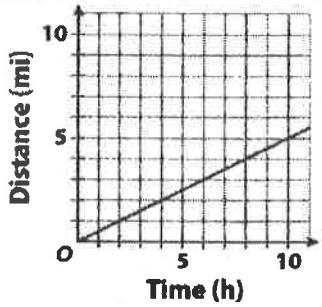


Slope = $\frac{2}{3}$

Unit rate: $\frac{2}{3}$ **mile/hour**

2. **Brianna Hiking**

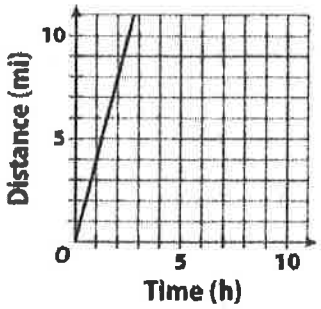
Time (h)	2	4	6	8
Distance (mi)	1	2	3	4



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

Unit rate: $\frac{1}{2}$ mi per hr.

3. The graph at right represents the rate at which Poonam walks.



a. What is the slope of the line?

4

b. What is the speed (unit rate) at which Poonam walks?

4 mi per hr

The equation $y = 3x$ represents the rate, in miles per hour, at which Latrice walks.

c. The graph of the equation is a line. What is the slope of the line?

3

d. What is the unit rate at which Latrice walks?

3 mi per hr

e. Who walks faster, Poonam or Latrice? Explain

Poonam. She has a faster rate.

Name _____ Date _____ Class _____

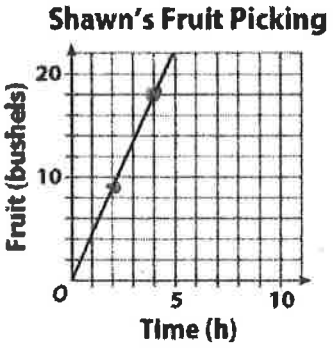
LESSON 11-3

Interpreting the Unit Rate as Slope

Practice and Problem Solving: C

Solve.

1. Shawn picked 4 bushels of apples and 5 bushels of pears in 2 hours. Carla picked 4 bushels of apples and 6 bushels of pears in 3 hours.



   a. The graph at right shows the rate at which Shawn picked fruit. Find the slope and name the unit rate.

   $\frac{9}{2}$ $\frac{9 \text{ bushels of fruit}}{2}$ per hr.

   b. The table below shows the rate at which Carla picked fruit. Complete the table.

Carla's Fruit Picking

Time (h)	3	6	9	12
Fruit (bushels)	10	20	30	40

$\frac{9}{2} = \frac{27}{6}$

$\frac{10}{3} = \frac{20}{6}$

   c. Who picked fruit at a faster pace? Explain.

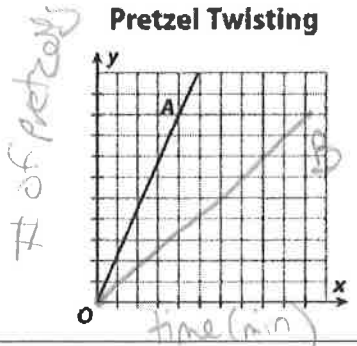
   Shawn. He has a faster unit rate.

2. Vehicles drive across Bridge A at a steady rate of 20 cars per hour. Twice as many vehicles drive across Bridge B in twice as much time. Jermain says the unit rate for Bridge B would be twice as great as the unit rate for Bridge A. Is Jermain correct? Explain.

$\frac{20 \text{ cars}}{\text{hr.}}$ $\frac{40}{2 \text{ hr.}}$

   NO. they have the same unit rate.

3. Alicia works at a pretzel factory. In the graph at right, the *x*-axis represents time in minutes and the *y*-axis represents the number of pretzels twisted. Line A represents the rate at which Alicia can twist pretzels.



   a. Using the graph, draw a line, *B*, representing the rate of someone who twists pretzels more slowly than Alicia.

   b. Explain how you determined where to draw line B.

   the slope had to be smaller than A. the line should be less steep.