

Chapter 5

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Chapter 5

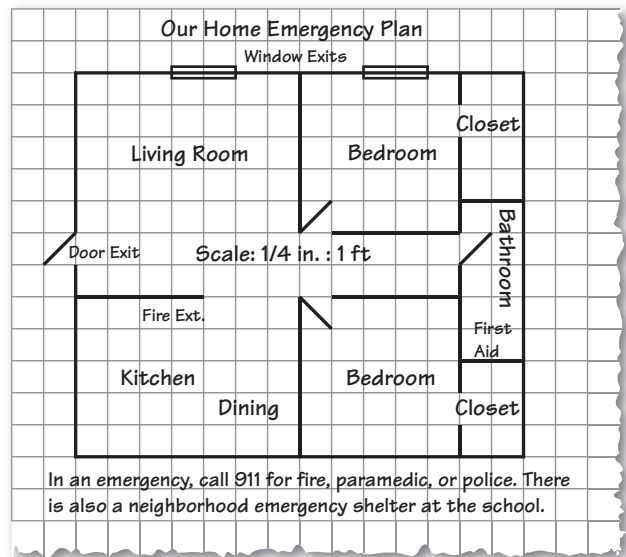
Ratios and Proportions

Dear Family,

An emergency evacuation plan is required in most commercial buildings. A good plan shows the locations of exits in the building as well as the locations of fire extinguishers and other emergency equipment. The plan is usually shown on a scale drawing of the building's floor plan.

Creating an emergency evacuation plan for your home is a good idea as well. You and your student can work together to make a scale drawing of your home.

Choose a scale that will make measurements relatively easy and allow the plan to fit on a single piece of paper. A common scale is $\frac{1}{4}$ inch for every foot. This scale will allow a building as large as 34 x 44 feet to fit on a letter-sized piece of paper. If your home won't fit within those dimensions, you can choose larger paper or a smaller scale—such as $\frac{1}{8}$ inch for every foot.



Mark the exits, fire extinguishers, and any alarms in red. If you have emergency medical equipment available, such as a first aid kit, mark those in blue.

Ask your student to help you with the following.

- Make measurements of each room in the home. Include measurements of doors and windows that will work as exits.
- Convert your measurements to the scale you have chosen.
- Draw the plan on $\frac{1}{4}$ -inch graph paper. The sides of each square have a length of $\frac{1}{4}$ -inch which makes it easier to use for $\frac{1}{4}$ -inch and $\frac{1}{8}$ -inch scales.

It's a good idea to include other information on the plan as well, such as the numbers for fire, paramedic, and police services (provided by 911 in many towns). Work with your student to decide what information should be included.

Being prepared will give you great peace of mind!

Capítulo 5

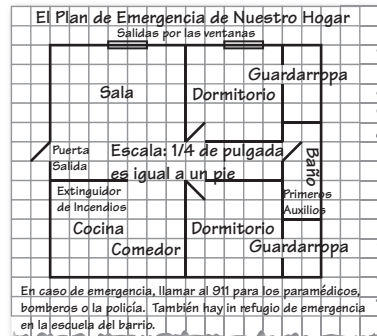
Razones y Proporciones

Estimada Familia:

En la mayoría de edificios comerciales se requiere un plano de evacuación de emergencia. Un buen plano muestra las ubicaciones de las salidas del edificio, así como las ubicaciones de los extintores de incendios y otros equipos de emergencia. El plano generalmente se muestra en un dibujo a escala del plano del piso del edificio.

Crear un plano de evacuación de emergencia para su hogar también puede ser una buena idea. Usted y su estudiante pueden trabajar juntos para hacer un dibujo a escala de su hogar.

Elijan una escala en la que puedan hacerse medidas de manera relativamente fácil y permita que el plano quepa en una sola hoja de papel. Una escala común es $\frac{1}{4}$ pulgada por cada pie. Esta escala permite que un edificio tan grande como de 34 x 44 pies quepa dentro de una hoja de papel tamaño carta. Si su hogar no cupiera dentro de esas dimensiones, puede elegir un papel más grande o una escala más pequeña—como por ejemplo $\frac{1}{8}$ pulgada por cada pie.



Marque las salidas, extintores y alarmas en rojo. Si tiene disponible equipo médico de emergencia, como por ejemplo un equipo de primeros auxilios, márkelo en azul.

Pida a su estudiante que lo ayude con lo siguiente:

- Hagan medidas de cada habitación de la casa. Incluyan medidas de las puertas y ventanas, ya que funcionarán como salidas.
- Conviertan sus medidas en la escala elegida.
- Dibujen el plano en un papel para gráficos de $\frac{1}{4}$ pulgada. Los lados de cada cuadrado miden $\frac{1}{4}$ pulgada de largo, lo que los hace más fácil de usar con las escalas de $\frac{1}{4}$ pulgada y $\frac{1}{8}$ pulgada.

Es una buena idea incluir también otra información en el plano, como los teléfonos de los servicios de bomberos, paramédicos y policías (proporcionados por 911 en muchas ciudades). Trabaje con su estudiante para decidir qué información debe incluirse.

¡Estar preparado le dará una gran tranquilidad!

Activity
5.1**Start Thinking!**

For use before Activity 5.1

You are planning a trip to Atlanta, Georgia. Discuss with a partner the factors you need to consider to determine if it would be better to fly or to drive. Determine which method of transportation you would use and explain why.

Activity
5.1**Warm Up**

For use before Activity 5.1

Convert the measurement.

1. 30 min = ? h

2. 4 h = ? min

3. 15 sec = ? min

4. 60 h = ? days

5. 3 days = ? h

6. 1 wk = ? h

You and your sister go to a store. You buy 3 erasers for \$1.00. Your sister buys 4 erasers for \$1.25. Explain who gets the better deal.

Find the product. List the units.

1. $6 \text{ h} \times \frac{\$7}{\text{h}}$

2. $2 \text{ gal} \times \frac{\$24}{\text{gal}}$

3. $8 \text{ h} \times \frac{25 \text{ mi}}{\text{h}}$

4. $9 \text{ mo} \times \frac{\$650}{\text{mo}}$

5. $12 \text{ lb} \times \frac{\$2.50}{\text{lb}}$

6. $6 \text{ yr} \times \frac{35 \text{ in.}}{\text{yr}}$

5.1

Practice A

Find the product. List the units.

1. $12 \text{ h} \times \frac{\$5}{\text{h}}$

2. $6 \text{ oz} \times \frac{\$0.59}{\text{oz}}$

3. $9 \text{ h} \times \frac{70 \text{ mi}}{\text{h}}$

Write the ratio as a fraction in simplest form.

4. 12 to 15

5. 24 : 9

6. 14 tetras : 6 angelfish

Find the unit rate.

7. 360 miles in 6 hours

8. 18 bowlers on 6 lanes

9. \$28 for 7 people

Use the ratio table to find the unit rate with respect to the specified units.

10. Laps per minute

Minutes	0	2	4	6
Laps	0	1	2	3

11. Grams of protein per serving

Servings	0	1	2	3
Grams of Protein	0	15	30	45

12. At 9 A.M. you have run 2 miles. At 9:24 A.M. you have run 5 miles. What is your running rate in minutes per mile?

13. Are the two statements equivalent? Explain your reasoning.

- The ratio of orange to blue is 3 to 4.
- The ratio of blue to orange is 12 to 9.

14. There are 234 students in 9 different classrooms. What is the ratio of students to classrooms?

15. Dishwasher detergent is sold in individual packs. It is sold in 20-, 60-, and 90-pack containers.

- Which container do you think has the lowest unit rate of dollars per pack? Why?
- The 20-pack container sells for \$5.49. What is the unit rate in dollars per pack? Round your answer to the nearest cent.
- The 60-pack container sells for \$10.97. What is the unit rate in dollars per pack? Round your answer to the nearest cent.
- The 90-pack container sells for \$18.95. What is the unit rate in dollars per pack? Round your answer to the nearest cent.
- Which container has the lowest unit rate? How does this compare with your answer in part (a)?

5.1

Practice B

Write the ratio as a fraction in simplest form.

1. 35 to 63
2. 10.8 seconds : 36 feet
3. 198 women to 110 men
4. 1000 songs : 2 megabytes
5. 26.1 miles : 3.6 hours
6. 12 completions to 28 attempts

Find the unit rate.

7. \$5.40 for 24 cans
 8. \$1.29 for 20 ounces
 9. 50 meters in 27.5 seconds
10. There are 16 bacteria in a beaker. Four hours later there are 228 bacteria in the beaker. What is the rate of change per hour in the number of bacteria?

11. The table shows nutritional information for three energy bars.

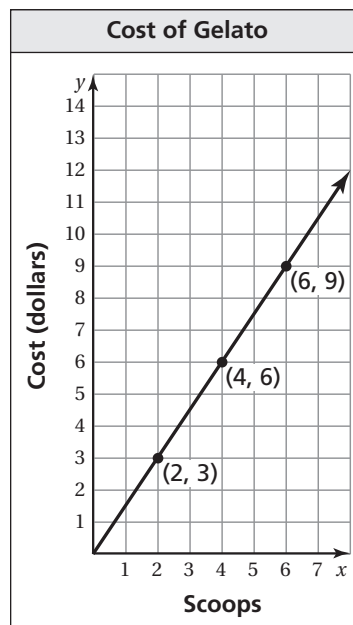
- a. Which has the most protein per calorie?
- b. Which has the least sugar per calorie?
- c. Which has the highest rate of sugar to fiber?

Energy Bar	Calories	Protein	Fiber	Sugar
A	220	20 g	12 g	14 g
B	130	12 g	8 g	10 g
C	140	4 g	9 g	9 g

- d. Compare bar A with bar B. Which nutritional item do you think has the highest ratio: calories, protein, fiber, or sugar?
- e. Calculate the ratios in part (d). Which one has the highest ratio?

12. The graph shows the cost of buying scoops of gelato.

- a. What does the point (4, 6) represent?
- b. What is the unit cost?
- c. What is the cost of 12 scoops?
- d. Explain how the graph would change if the unit rate was \$1.75 per scoop.
- e. How would the coordinates of the point in part (a) change if the unit rate was \$1.75 per scoop?



Write a situation for the ratio.

13. $\frac{9}{5}$
14. 2 : 3

5.1 Enrichment and Extension

Ratios, Rates, and On-the-Job Decisions

Sally Smith has been offered two employment opportunities. Help her decide which job is better by answering the following questions.

1. Job A will pay \$32,448 per year. How much money would Sally be making per hour? Assume pay is based on fifty-two 40-hour weeks.
2. Job B pays \$14.80 per hour. How much money would she make in a year? Assume the pay is based on fifty-two 40-hour weeks.
3. Which job pays better? Explain your reasoning.
4. Sally lives 18 miles from Job A. A work week is five days. How many miles would she have to drive each week just to get to and from work?
5. For Job A, Sally would have to put 7.5 gallons of gas in her tank every 3 days that she drives to and from work only. How many gallons of gas would she use in a five-day work week?
6. Based on your answers to Exercises 4 and 5, what is Sally's gas mileage? (*Hint:* Gas mileage is a unit rate that is calculated as miles per gallon.)
7. If gas costs \$4 per gallon, how much will gas cost Sally per day just to get to and from Job A per day? per week? per year?
8. The ratio of the length of Sally's drive to Job A to the length of Sally's drive to Job B is 2 : 3. How much money would she save on gas in a week with Job A as opposed to Job B?
9. Other than distance and cost of gas, what other factors should Sally consider when comparing commutes to work?
10. Macaroni and cheese is one of Sally's favorite lunch foods. In the cafeteria at Job A, $1\frac{1}{4}$ cups of macaroni and cheese contains 6.5 grams of fat. The macaroni and cheese at Job B contains 10 grams of fat per pint. Which one has a lower fat content? Explain your reasoning.
11. Both places sell macaroni and cheese by weight. Job A's cafeteria charges \$7.25 per pound and Job B's cafeteria charges \$0.58 per ounce. Which cafeteria has the cheaper macaroni and cheese? Explain your reasoning.
12. Based on the information on this page, would you recommend that Sally take Job A or Job B? Explain your reasoning.
13. Other than pay, transportation costs, and cafeteria selections, what other factors should Sally consider when choosing a job?

5.1 Puzzle Time

What Do You Get If You Cross A Duck With A Firework?

Write the letter of each answer in the box containing the exercise number.

Find the product.

1. $4 \text{ tbsp} \times \frac{20 \text{ cal}}{\text{tbsp}}$

P. 5 cal Q. 80 cal R. 5 tbsp

2. $3 \text{ lb} \times \frac{\$1.29}{\text{lb}}$

E. \$0.43 F. \$3.87 G. 3.87 lb

3. $4 \text{ gal} \times \frac{17.5 \text{ mi}}{\text{gal}}$

C. 70 mi D. 35 mi E. 70 gal

4. $40 \text{ h} \times \frac{\$8.50}{\text{h}}$

T. 340 h U. \$340 V. \$300

Write the ratio as a fraction.

5. 12 to 36

I. $\frac{1}{6}$ J. $\frac{1}{4}$ K. $\frac{1}{3}$

6. 15 : 75

E. $\frac{1}{5}$ F. $\frac{1}{4}$ G. $\frac{1}{3}$

7. 10 out of 25

E. $\frac{2}{5}$ F. $\frac{1}{5}$ G. $\frac{1}{25}$

8. 52 males to 28 females

P. $\frac{27}{14}$ Q. $\frac{7}{13}$ R. $\frac{13}{7}$

Find the unit rate.

9. 48 cups in 12 quarts

R. $\frac{4 \text{ c}}{\text{qt}}$ S. $\frac{3 \text{ c}}{\text{qt}}$ T. $\frac{2 \text{ c}}{\text{qt}}$

10. \$17.85 for 3 pounds

A. $\frac{\$5.95}{\text{lb}}$ B. $\frac{\$5.56}{\text{lb}}$ C. $\frac{\$3.65}{\text{lb}}$

11. 26.2 miles in 4 hours

A. $\frac{6.55 \text{ mi}}{\text{h}}$ B. $\frac{7.5 \text{ mi}}{\text{h}}$ C. $\frac{6.5 \text{ mi}}{\text{h}}$

12. \$12.60 for 3 boxes

G. $\frac{\$3.15}{\text{box}}$ H. $\frac{\$4.15}{\text{box}}$ I. $\frac{\$4.20}{\text{box}}$

10		2	12	8	6		1	4	11	3	5	7	9
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Activity
5.2**Start Thinking!**

For use before Activity 5.2

Give an example of two fractions that are equivalent. Show that they are equivalent.
Give an example of two fractions that are not equivalent. Explain why they are not equivalent.

Activity
5.2**Warm Up**

For use before Activity 5.2

Write the fraction in simplest form. Do not change improper fractions to mixed numbers.

1. $\frac{24}{48}$

2. $\frac{64}{48}$

3. $\frac{30}{24}$

4. $\frac{9}{21}$

5. $\frac{45}{63}$

6. $\frac{10}{41}$

7. $\frac{144}{12}$

8. $\frac{50}{35}$

You go to the grocery store to buy cereal.
How do you determine which cereal brand
is the better buy?

Tell whether the two rates form a proportion.

1. 5 feet in 4 hours; 15 feet in 12 hours
2. 8 pages in 40 minutes; 15 pages in 70 minutes
3. 3 pounds for \$3.75; 5 pounds for \$6.50
4. 2 cups in 4 servings; 5 cups in 10 servings

5.2 Practice A

Tell whether the ratios form a proportion.

1. $\frac{1}{4}, \frac{3}{12}$

2. $\frac{1}{7}, \frac{4}{28}$

3. $\frac{2}{5}, \frac{30}{80}$

4. $\frac{18}{24}, \frac{15}{20}$

5. $\frac{35}{16}, \frac{5}{2}$

6. $\frac{5}{7}, \frac{35}{49}$

7. $\frac{15}{21}, \frac{40}{56}$

8. $\frac{33}{63}, \frac{26}{42}$

9. $\frac{54}{10}, \frac{81}{15}$

Tell whether the two rates form a proportion.

10. 8 feet in 15 seconds; 16 feet in 40 seconds
11. 28 people in 4 rooms; 63 people in 9 rooms
12. 14 girls to 6 boys; 35 girls to 15 boys
13. 45 marbles in 9 bags; 150 marbles in 36 bags
14. You can run 4 laps in 10 minutes. Your friend can run 6 laps in 15 minutes. Are these rates proportional? Explain.

Tell whether the ratios form a proportion.

15. $\frac{7}{4}, \frac{17.5}{10}$

16. $\frac{1.5}{6}, \frac{2}{8}$

17. $\frac{8}{5}, \frac{68}{45}$

18. You get \$27 to spend at the mall for doing 6 chores. Your friend gets \$36 for doing 8 chores.
 - a. What is your pay rate?
 - b. What is your friend's pay rate?
 - c. Are the pay rates equivalent? Explain.
19. You can buy 4 tickets for \$75 or 5 tickets for \$94. Are the costs proportional? If not, rewrite one of the rates so the costs are proportional.
20. A recipe requires a ratio of 4 potatoes to 6 carrots. You accidentally use 5 potatoes with 6 carrots. What is the least number of potatoes and carrots that you can add to get the correct ratio of potatoes to carrots?

5.2 Practice B

Tell whether the ratios form a proportion.

1. $\frac{25}{16}, \frac{65}{56}$

2. $\frac{30}{75}, \frac{24}{60}$

3. $\frac{27}{48}, \frac{108}{192}$

Tell whether the two rates form a proportion.

4. \$24 for 16 burgers; \$15 for 10 burgers
5. 10 used books for \$4.50; 15 used books for \$6.00
6. 125 horsepower motor for an 18-foot boat; 225 horsepower motor for a 32-foot boat

Tell whether the ratios form a proportion.

7. $\frac{28.5}{42}, \frac{19}{28}$

8. $\frac{3.5}{4}, \frac{11.9}{13.6}$

9. $\frac{124}{98}, \frac{315}{225}$

10. The seventh-grade band has 15 drummers and 12 trumpet players. The eighth-grade band has 10 drummers and 8 trumpet players. Do the ratios form a proportion? Explain.
11. One mixture contains 6 fluid ounces of water and 10 fluid ounces of vinegar. A second mixture contains 9 fluid ounces of water and 12 fluid ounces of vinegar. Are the mixtures proportional? If not, how much water or vinegar would you add to the second mixture so that they are proportional?
12. A wholesale warehouse buys pairs of sandals to sell.
 - a. The warehouse can purchase 5 pairs of sandals for \$65. What is the cost rate?
 - b. The warehouse can purchase 8 pairs of sandals for \$96. What is the cost rate?
 - c. The warehouse can purchase 10 pairs of sandals for \$126.50 and will get one free pair. What is the cost rate?
 - d. Are any of the cost rates proportional? Explain.
 - e. Your buyer is to purchase 40 pairs of sandals. Use any combination of parts (a), (b), and (c) for your buyer to purchase the 40 pairs of sandals at the lowest possible cost.

Find the value of x so that the ratios form a proportion.

13. $\frac{3}{7}, \frac{x}{21}$

14. $\frac{16}{12}, \frac{20}{x}$

5.2 Enrichment and Extension

The Big Paint “Mix Up”

Oh no! The paint mixing machine has gone crazy! Can you help figure out how to fix these batches by adding the least amount of paint possible? Otherwise all the paint will go to waste. For each situation, tell how much of one or more colors should be added to each batch. The machine can only measure in cups, pints, quarts, and gallons.

1. *Brick Red* is supposed to be 7 parts red to 2 parts blue. Today, the machine mixed 35 quarts of red with 5 quarts of blue.
2. *Ocean Blue* is supposed to be 8 parts blue to 3 parts yellow. Today, the machine mixed 55 quarts of blue with 15 quarts of yellow.
3. *Sour Apple* is supposed to be 9 parts yellow to 2 parts blue. Today, the machine mixed 2 gallons of yellow with 2 quarts of blue.
4. *Midnight Navy* is supposed to be 7 parts blue to 3 parts red. Today, the machine mixed 3 quarts of blue with 1 pint of red.
5. *Sunset Yellow* is supposed to be 6 parts yellow to 1 part red. Today, the machine mixed 70 pints of yellow with 11 pints of red.
6. The last correct batch of *Burnt Orange* had 15 quarts of yellow and 30 quarts of red. Today, the machine mixed 42 gallons of yellow with 72 gallons of red.
7. The last correct batch of *Perfectly Grape* had 20 pints of red and 24 pints of blue. Today, the machine mixed 28 quarts of red with 32 quarts of blue.
8. The last correct batch of *Mustard Brown* had 96 pints of yellow, 72 pints of red, and 24 pints of blue. Today the machine mixed 45 cups of yellow, 20 cups of red, and 8 cups of blue.



Puzzle Time

What Can You Hold Without Ever Touching?

For each exercise, circle the letter in the columns under Yes or No to indicate the correct answer. The circled letters will spell the answer to the riddle.

	Yes	No
1.	Y	T
2.	A	O
3.	U	H
4.	R	S
5.	C	B
6.	O	R
7.	E	O
8.	A	L
9.	T	M
10.	S	H

Tell whether the ratios form a proportion.

1. $\frac{2}{5}, \frac{8}{20}$

2. $\frac{3}{7}, \frac{6}{13}$

3. $\frac{5}{6}, \frac{15}{18}$

4. $\frac{18}{24}, \frac{12}{16}$

Tell whether the two rates form a proportion.

5. 55 miles in 1 hour; 450 miles in 8 hours

6. \$3.00 for 32 ounces of strawberries; \$1.75 for 24 ounces of strawberries

7. 45 baskets in 85 shots; 54 baskets in 102 shots

8. 18 push-ups in 60 seconds; 27 push-ups in 90 seconds

9. One type of cereal has 2 grams of protein per 1-cup serving. Another cereal has 1 gram of protein per half-cup serving. Do these rates form a proportion?

10. A 50-fluid ounce bottle of laundry detergent washes 32 loads of laundry. A 100-fluid ounce bottle washes 60 loads of laundry. Are they proportional? Do these rates form a proportion?

Extension
5.2**Start Thinking!**

For use before Extension 5.2

Your friend spent \$7 in 2 days on lunch. He says that he will need \$21 for 6 days to spend on lunch. Is your friend correct? Explain your reasoning.

Extension
5.2**Warm Up**

For use before Extension 5.2

Tell whether x and y are proportional.

1.

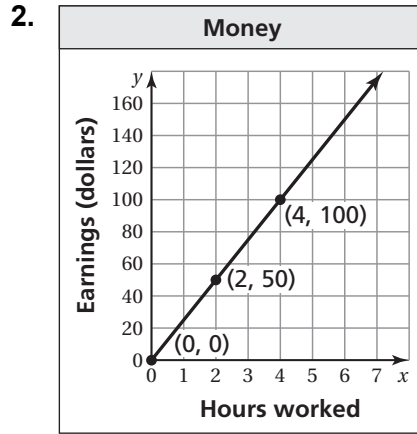
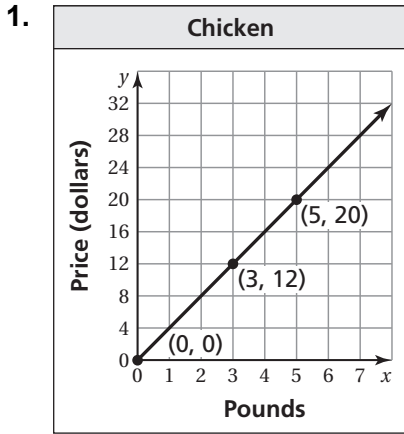
x	1	2	3	4
y	4	8	12	16

2.

x	2	3	4	5
y	2	4	6	8

Extension 5.2 Practice

Interpret each plotted point in the graph of the proportional relationship.



The graph of a proportional relationship passes through the given points. Find y .

3. $(4, 8), (1, y)$

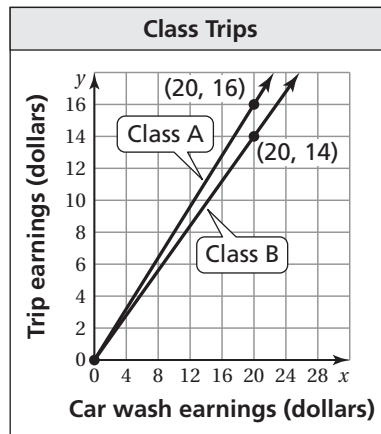
4. $(3, 21), (1, y)$

5. $(1.5, 9), (1, y)$

6. $(3.5, 14), (1, y)$

7. Two classes have car washes to raise money for class trips. A portion of the earnings will pay for using the two locations for the car washes. The graph shows that the trip earnings of the two classes are proportional to the car wash earnings.

- Express the trip earnings rate for each class as a percent.
- What trip earnings does Class A receive for earning \$75 from the car wash?
- How much less does Class B receive than Class A for earning \$75 from the car wash?



Activity
5.3**Start Thinking!**

For use before Activity 5.3

How do you determine if two ratios are proportional? Explain giving an example of ratios that are proportional.

Activity
5.3**Warm Up**

For use before Activity 5.3

Write two equivalent ratios for the ratio given.

1. $\frac{10}{15}$

2. $\frac{11}{20}$

3. $\frac{6}{14}$

4. $\frac{4}{10}$

5. $\frac{12}{20}$

6. $\frac{6}{15}$

7. $\frac{8}{9}$

8. $\frac{14}{24}$

You scored 15 points in 3 minutes. Your cousin scored 25 points in 5 minutes.

Are the scores proportional? Explain.

Write a proportion to find how many points a student needs to have on the test to get the given score.

1. test worth 100 points; test score of 85%
2. test worth 50 points; test score of 74%
3. test worth 25 points; test score of 80%
4. test worth 110 points; test score of 90%

5.3 Practice A

Write a proportion to find how many points a student needs to earn on the test to get the given score.

1. test worth 70 points; test score of 90% 2. test worth 30 points; test score of 72%

Write a proportion to find how many free throws a player needs to get the given score.

3. 15 free-throw attempts; free-throw score of 60%
4. 24 free-throw attempts; free-throw score of 75%

Use the table to write a proportion.

5.

	August	September
Hurricanes	2	1
Storms	6	n

6.

	Day 1	Day 2
Wins	w	8
Races	21	12

7. The county requires 2 teachers for every 45 students. Write a proportion that gives the number t of teachers needed for 315 students.

Solve the proportion.

8. $\frac{2}{3} = \frac{a}{15}$

9. $\frac{4}{7} = \frac{44}{m}$

10. $\frac{d}{6} = \frac{72}{48}$

11. A paint color requires the ratio of green paint to yellow paint to be 4 : 9.
- A container of this paint has 36 pints of yellow paint. Write a proportion that gives the number g of pints of green paint in the container.
 - How many pints of green paint are in the container?
 - How many *gallons* of paint are in the container altogether?
12. An orchestra has 10 cellists.
- There are 3 violin players for every cellist in the orchestra. How many violin players are there?
 - There are 6 viola players for every 5 cellists in the orchestra. How many viola players are there?
 - What is the ratio of viola players to violin players? Give your answer in simplest form.

13. Give two possible pairs of values for p and q : $\frac{2}{5} = \frac{p}{q}$.

5.3 Practice B

In Exercises 1 and 2, write a proportion to find how many strikes a bowler needs to get the given score.

- 32 strike attempts; strike score of 75%
- 80 strike attempts; strike score of 95%
- Describe and correct the error in writing the proportion.
- There are 3 referees for every 16 players. Write a proportion that gives the number of referees r for 128 players.

	Day 1	Day 2
	3.1	15.5
Length		
Height	h	45

$$\frac{15.5}{h} = \frac{3.1}{45}$$

Solve the proportion.

5. $\frac{5}{12} = \frac{x}{36}$

6. $\frac{20}{3.4} = \frac{800}{y}$

7. $\frac{2.8}{r} = \frac{70}{3}$

8. $\frac{48}{15} = \frac{k}{37.5}$

9. $\frac{21}{p} = \frac{252}{78}$

10. $\frac{2.3}{1.6} = \frac{46}{w}$

11. A recipe calls for $\frac{3}{4}$ cup of sugar and $\frac{1}{2}$ cup of brown sugar. You are reducing the recipe. You will use $\frac{1}{6}$ cup of brown sugar. How much sugar will you use?
12. A calculator has 50 keys in five colors: gray, black, blue, yellow, and green.
- There are 6 gray keys for every 7 blue keys. Write the possible ratios for gray to blue keys.
 - There are 6 gray keys for every 11 black keys. Write the possible ratios for gray to black keys.
 - There are 6 gray keys for every 11 black keys. Also, the number of black keys is 2 less than twice the number of gray keys. Use your answer to part (b) to determine how many gray keys and how many black keys there are.
 - There is 1 yellow key for every 1 green key. How many keys of each color are there?

5.3 Enrichment and Extension

Using Slope to Design Handicap Ramps

According to the Americans with Disabilities Act, the maximum rise to run ratio for all handicap ramps is 1 : 12. Also, there must be a landing, or flat rest area, at the top and bottom of all ramps. These landings must be at least 60 inches in length. If there is a change in direction on the ramp, there must be a flat landing that is at least 60 inches by 60 inches.

1. A ramp with a rise of 5 inches must have a run of at least how many inches? how many feet?
2. Why do you think there is a maximum slope for handicap ramps?
3. What would be the advantages and disadvantages of making a ramp that is less steep?
4. Your school is being renovated and a new handicap ramp must be built. The bottom of the new front door is 20 inches above the sidewalk. What is the minimum length (in feet) of a straight ramp to this door, including the landings at the top and bottom?
5. An existing ramp on the old part of the school has a rise of 10.5 inches and a run of 12 feet 3 inches, not including the landings. Does it meet the requirements or will it have to be changed? Explain.
6. At the main bus entrance, there is a ramp with a change in direction. It has a sloping part with a rise of 5 inches and a run of 6 feet 8 inches, a landing where there is a 90 degree turn, and another sloping part with a rise of 7.5 inches and a run of 13 feet 9 inches. Which part of the ramp is steeper? Why might the ramp have been designed in this way?
7. Another ramp with an overall rise of 30 inches has to be built to replace the ramp described in Exercise 6. It must have two sloping parts that should have the same slopes as the two sloping parts of the ramp in Exercise 6. Both parts should have a rise of 15 inches, with a landing in between. Find the lengths of both sloping parts of the ramp.
8. Find a place in your school, home, neighborhood, or elsewhere that could use a ramp. Measure the rise of that area. Then design a ramp, and draw a picture or describe it in detail. Be sure to tell how long each portion of the ramp should be as well as the overall length.



Puzzle Time

Who Do Whales Go To See When Their Teeth Need To Be Fixed?

Write the letter of each answer in the box containing the exercise number.

Solve the proportion.

1. $\frac{3}{5} = \frac{h}{20}$

2. $\frac{4}{7} = \frac{24}{a}$

3. $\frac{1}{x} = \frac{5}{45}$

4. $\frac{2}{13} = \frac{m}{39}$

5. $\frac{t}{28} = \frac{3}{4}$

6. $\frac{18}{21} = \frac{6}{w}$

7. $\frac{3.4}{4.2} = \frac{r}{21}$

8. $\frac{1.5}{2.5} = \frac{6}{s}$

9. $\frac{q}{1.7} = \frac{16}{17}$

10. $\frac{2.2}{n} = \frac{44}{66}$

Answers

- | | |
|--------|--------|
| I. 27 | T. 10 |
| O. 12 | H. 9 |
| T. 1.6 | N. 17 |
| D. 4 | C. 20 |
| E. 7 | T. 3.3 |
| A. 42 | R. 21 |
| S. 6 | O. 15 |

- You need 3 tickets for one go-kart ride. How many tickets do you need for five go-kart rides?
- Yesterday you downloaded 3 songs for \$2.97. How many songs did you download today for \$3.96?
- There are 32 students in the school play. The ratio of girls to all students in the play is 5 : 8. How many girls are in the play?
- Two out of three vehicles in a parking lot are SUVs. There are 18 SUVs in the parking lot. How many vehicles are in the parking lot?

9	3	6		11	5	13	2	-	12	1	7	10	14	4	8
---	---	---	--	----	---	----	---	---	----	---	---	----	----	---	---

Activity
5.4

Start Thinking!

For use before Activity 5.4

Give a real-world example of things that are proportional.

Activity
5.4

Warm Up

For use before Activity 5.4

Find the unit rate.

1. 140 students in 4 buses
2. 605 miles in 5 hours
3. 312 pages in 4 hours
4. 54 seats in 2 rows
5. 1023 miles in 3 hours
6. 544 pages in 4 days

Describe how someone who works in a bakery might use proportions.

Use the Cross Products Property to solve the proportion.

1. $\frac{a}{4} = \frac{15}{12}$

2. $\frac{11}{4} = \frac{m}{16}$

3. $\frac{2}{3} = \frac{v}{18}$

4. $\frac{8}{n} = \frac{11}{22}$

5. $\frac{t}{10} = \frac{15}{25}$

6. $\frac{10}{3} = \frac{8}{k}$

5.4 Practice A

Use multiplication to solve the proportion.

1. $\frac{7}{4} = \frac{y}{28}$

2. $\frac{d}{48} = \frac{3}{4}$

3. $\frac{j}{8} = \frac{35}{56}$

Use the Cross Products Property to solve the proportion.

4. $\frac{14}{21} = \frac{b}{9}$

5. $\frac{10}{p} = \frac{6}{9}$

6. $\frac{55}{4} = \frac{h}{6}$

7. Eighteen oranges are packaged in 3 containers. How many oranges are packaged in 7 containers?
8. It costs \$270 for 3 people to go on a fishing trip. How much does it cost for 10 people to go on the fishing trip?

Solve the proportion.

9. $\frac{3x}{10} = \frac{9}{4}$

10. $\frac{5x}{3} = \frac{80}{12}$

11. $\frac{7}{2} = \frac{x+1}{6}$

12. Tell whether the statement is *true* or *false*. Explain.

$$\text{If } \frac{p}{q} = \frac{3}{5}, \text{ then } \frac{5}{p} = \frac{3}{q}.$$

13. The dimensions of a miniature model are proportional to the dimensions of the actual building.
- a. A wall that is 12 feet high on the building is 36 centimeters high on the model. Find the height on the model of a door that is 9 feet high on the building.
- b. Use a different method than the one you used in part (a) to find the number of centimeters on the model for a window that is 3 feet wide.
14. The ratio of men to women at a lecture is 2 to 5. A total of 63 people are at the lecture. How many are men? Explain how you found your answer.

15. The distance traveled (in feet) is proportional to the number of seconds. Find the values of x , y , and z .

Feet	3	x	15	z
Seconds	5	65	y	3.5

16. You train for a race by running at a speed of 6 miles per hour.
- a. At this speed, how many *minutes* does it take you to run 3.2 miles?
- b. On race day, you run 3.2 miles in 30 minutes. What is your speed in miles per hour?

5.4 Practice B

Use either multiplication or the Cross Products Property to solve the proportion.

1. $\frac{16}{9} = \frac{q}{36}$

2. $\frac{57}{r} = \frac{38}{18}$

3. $\frac{50}{14} = \frac{w}{98}$

4. $\frac{n}{121} = \frac{52}{22}$

5. $\frac{96}{45} = \frac{b}{20}$

6. $\frac{24}{f} = \frac{15}{36}$

7. Three shirts cost \$9.99. How much does it cost for 8 shirts?

Solve the proportion.

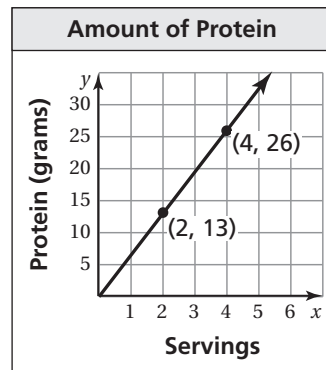
8. $\frac{8x}{13} = \frac{64}{52}$

9. $\frac{c-3}{6} = \frac{7}{3}$

10. $\frac{20}{9} = \frac{10}{s+2}$

11. The number of grams of protein is proportional to the number of servings.

- How many servings provide 32.5 grams of protein?
- Use a different method than part (a) to find how many servings provide 52 grams of protein.
- How many grams of protein will 7 servings provide?
- If 1 serving is equal to $\frac{3}{4}$ cup, how many cups does it take to get 19.5 grams of protein?



- One day 176 people visited a small art museum. The ratio of members to nonmembers that day was 5 to 11. How many people who visited the museum that day were nonmembers?
- Solve the proportion: $\frac{|h|}{3} = \frac{4}{9}$.
- One gallon of water weighs about 8.34 pounds.
 - How much does 3.5 gallons of water weigh?
 - One inch of rain on a square foot of land weighs 5.2 pounds. About how many gallons of rain are there? Round your answer to the nearest tenth.

5.4 Enrichment and Extension

Sports Statistics and Proportions

In baseball, WHIP is a pitching statistic used to find the average number of walks and hits allowed per inning. It is calculated by adding the walks and hits that a pitcher allows and then dividing that by the number of innings pitched.

$$\text{WHIP} = \frac{\text{Walks} + \text{Hits}}{\text{Innings Pitched}}$$

In hockey, a goalie's save percentage is the number of saves divided by the number of shots on goal.

$$\text{Save percentage} = \frac{\text{Saves}}{\text{Shots on goal}}$$

1. A pitcher allowed 26 walks and 104 hits in 85 innings pitched. What is his WHIP? Round your answer to the nearest hundredth.
2. The pitcher in Exercise 1 wants to lower his WHIP to 1.3. How many more innings would he have to pitch without any walks or hits? Is this a reasonable goal? Explain your reasoning.
3. Another pitcher has a WHIP of 1.28 with 92 hits in 82 innings pitched. How many walks has he allowed? Explain how you used proportions to get your answer.
4. The pitcher from Exercise 3 wants to keep his WHIP under 1.3. How many more hits and walks can he allow in the next 9 innings? Is this a reasonable goal? Explain your reasoning.
5. A goalie has a save percentage of 0.914 after playing his first 6 games. He has made 191 saves. How many shots on goal has he faced?
6. Another goalie has a save percentage of 0.907 with 204 saves in his first 6 games. Your friend says that you could find their combined save percentage by adding 0.907 and 0.914 and then dividing by 2. Explain why this is incorrect. Then show how you would correctly calculate their combined save percentage. Round your answer to the nearest thousandth.
7. The goalie from Exercise 5 wants to finish the next game with an overall save percentage of 0.925. How many shots on goal would he have to face without allowing any goals? Based on the goalie's first 6 games, is it reasonable for him to achieve this goal in one game? Explain your reasoning.

5.4 Puzzle Time

Did You Hear About...

A	B	C	D	E	F
G	H	I	J	K	L
M	N	O	P	Q	R

Complete each exercise. Find the answer in the answer column. Write the word under the answer in the box containing the exercise letter.

44 THE
20 BECAUSE
18 IN
16 DAY
3.8 MINUTES
45 SECONDS
9 FOR
5.2 LUNCH
12 $\frac{3}{4}$ TIME
18 $\frac{3}{4}$ CAFETERIA

Use multiplication to solve the proportion.

A. $\frac{m}{8} = \frac{3}{4}$

B. $\frac{7}{9} = \frac{y}{18}$

C. $\frac{6}{13} = \frac{r}{39}$

D. $\frac{g}{48} = \frac{11}{12}$

E. $\frac{z}{24} = \frac{25}{32}$

F. $\frac{b}{21} = \frac{5}{7}$

G. $\frac{11}{27} = \frac{n}{18}$

H. $\frac{9}{28} = \frac{s}{42}$

Use the Cross Products Property to solve the proportion.

I. $\frac{c}{12} = \frac{5}{3}$

J. $\frac{9}{4} = \frac{x}{16}$

K. $\frac{7}{8} = \frac{14}{p}$

L. $\frac{12}{7} = \frac{36}{n}$

M. $\frac{k}{20} = \frac{13}{50}$

N. $\frac{15}{a} = \frac{25}{14}$

O. $\frac{6.6}{1.2} = \frac{w}{4.2}$

P. $\frac{1.6}{3.2} = \frac{2.8}{t}$

Q. $\frac{5}{\$13.75} = \frac{p}{\$24.75}$

R. $\frac{230 \text{ cal}}{30 \text{ min}} = \frac{345 \text{ cal}}{x \text{ min}}$

36 EVERY
14 CLOCK
5.6 BACK
15 THAT
6 THE
21 AT
23.1 WENT
8.4 IT
13 $\frac{1}{2}$ SLOW
7 $\frac{1}{3}$ WAS

Activity
5.5**Start Thinking!**

For use before Activity 5.5

Explain how judges use math to determine who receives the first place prize at a dance competition.

Activity
5.5**Warm Up**

For use before Activity 5.5

Plot and label the points in a coordinate plane.

1. $A(2, -4)$

2. $B(-3, 1)$

3. $C(0, -3)$

4. $D(2, 0)$

5. $E(-1, -1)$

6. $F(-3, 0)$

**Lesson
5.5****Start Thinking!**

For use before Lesson 5.5

What math concepts are related to auto racing?

**Lesson
5.5****Warm Up**

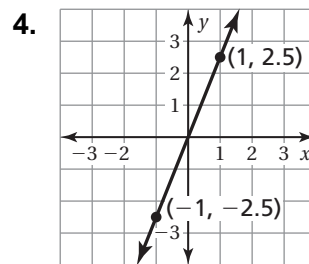
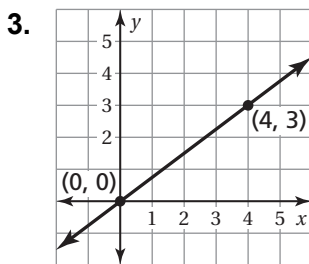
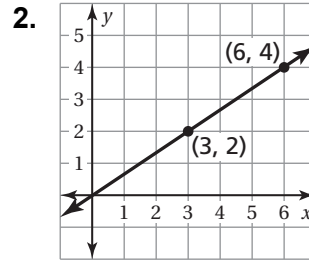
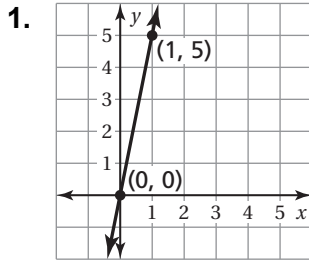
For use before Lesson 5.5

Find the missing distances. Use the table to complete a line graph for each distance. Which graph is steeper?

Time (seconds)	Distance 1 (feet)	Distance 2 (feet)
0	0	0
1	12	6
2		
3		
4		

5.5 Practice A

Find the slope of the line.



Graph the data. Then find and interpret the slope of the line through the points.

5.

Days, x	2	4	6	8
Pages, y	80	160	240	320

6.

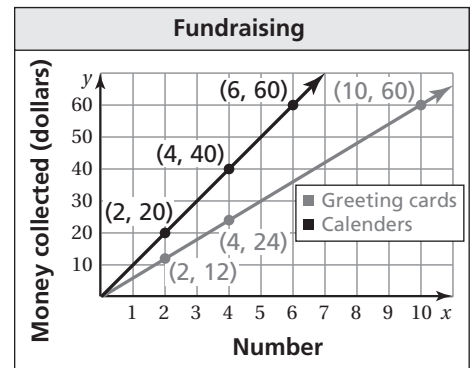
Seconds, x	10	20	30	40
Feet, y	22	44	66	88

Graph the line that passes through the two points. Then find the slope of the line.

7. $(0, 0), (4, 3)$ 8. $(-1, -2), (2, 4)$ 9. $(-4, -1), (8, 2)$

10. The graph shows the amounts that you are collecting for selling calendars and boxes of greeting cards to raise money for the school band.

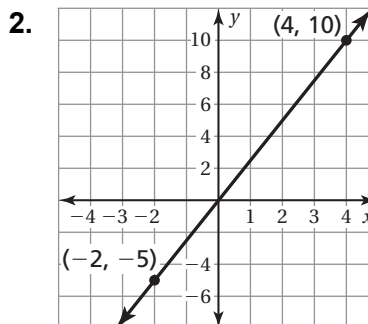
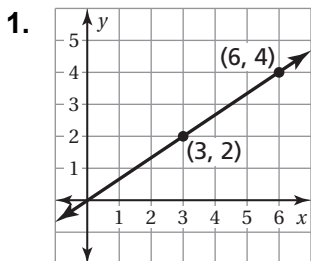
- Compare the steepness of the lines. What does this mean in the context of the problem?
- Find the slope of each line. What does each slope mean in the context of the problem?
- How much more does it cost to buy 3 calendars than 4 boxes of greeting cards?
- Find two different ways that you could collect exactly \$36.



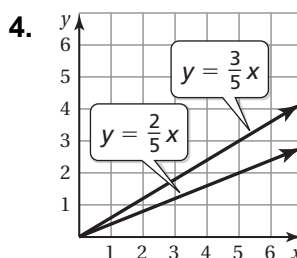
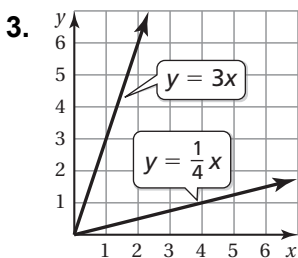
5.5

Practice B

Find the slope of the line.



Which line has the greater slope? Explain your reasoning.



Graph the line that passes through the two points. Then find the slope of the line.

5. $(-2, -3), (3, 4.5)$

6. $(-8, -10), (-2, -2.5)$

7. Graph the line that passes through the points $(0, 1)$ and $(0, 4)$. Explain why the slope of this line is undefined.

8. You and a friend throw tennis balls up in the air at the same time. The table shows the height (in feet) of each ball.

Seconds, x	2	4	5
You, y	12	24	30
Friend, y	11	22	27.5

- Graph the data on the same coordinate axes. Draw lines through the points. Label each graph.
- Find the slope of the line for each tennis ball. What does each slope mean in the context of the problem?
- Which ball is moving faster? How is this indicated in the slope?
- Find the height of each ball 3.5 seconds after being thrown.

9. A line has a slope of $\frac{3}{5}$. It passes through the points $(5, 3)$ and $(x, 9)$.
What is the value of x ?

5.5 Enrichment and Extension

Finding Slope Without Drawing a Graph

You can find the slope of a line through two points without drawing a graph. To find the change in y without a graph, subtract the y -values of two points. To find the change in x without a graph, subtract the x -values of two points. Be sure to put the coordinates of the points in the same order when subtracting.

Example: Find the slope of the line that passes through the points $(2, 7)$ and $(3, 10)$.

Let (x_1, y_1) be $(2, 7)$ and (x_2, y_2) be $(3, 10)$.

$$\begin{aligned}\frac{\text{change in } y}{\text{change in } x} &= \frac{y_2 - y_1}{x_2 - x_1} && \text{Write coordinates in the same order.} \\ &= \frac{10 - 7}{3 - 2} && \text{Substitute.} \\ &= \frac{3}{1} = 3 && \text{Simplify.}\end{aligned}$$

The slope of the line is 3.

Without graphing, find the slope of the line through the points.

- $(2, 5), (5, 6)$
- $(-1, -2), (-5, -7)$
- $(-6, 0), (2, 8)$
- $(4, 1), (-8, 10)$
- In the example above, let (x_1, y_1) be $(3, 10)$ and (x_2, y_2) be $(2, 7)$. Would the slope still be the same? Explain your reasoning.
- A line has a slope of $\frac{3}{2}$. It passes through the point $(4, 5)$. Give the coordinates of three other points on this line.
- A line has a slope of $\frac{4}{7}$. It passes through the points $(2, -4)$ and $(-5, y)$. What is the value of y ?
- A line has a slope of 5. It passes through the points $(-5, -1)$ and $(x, 9)$. What is the value of x ?



Puzzle Time

What Is The Invisible Man’s Favorite Drink?

Circle the letter of each correct answer in the boxes below. The circled letters will spell out the answer to the riddle.

Graph the line that passes through the two points. Then find the slope of the line.

- | | | |
|--------------------------|-------------------------|-------------------------|
| 1. $(0, 0), (6, 7)$ | 2. $(0, 0), (-3, -5)$ | 3. $(1, 2), (4, 8)$ |
| 4. $(2, 2), (5, 5)$ | 5. $(-4, -12), (2, 6)$ | 6. $(-9, -2), (18, 4)$ |
| 7. $(-6, -2), (6, 2)$ | 8. $(-2, -8), (5, 20)$ | 9. $(10, 12), (20, 24)$ |
| 10. $(-12, -8), (12, 8)$ | 11. $(-12, -2), (6, 1)$ | 12. $(8, 1), (24, 3)$ |

In Exercises 13 and 14, use the table below for the price of admission to a water park.

Water Park Admission				
Number of Persons	2	4	6	8
Child	\$46	\$92	\$138	\$184
Adult	\$62	\$124	\$186	\$248

13. Find the slope of the line for the price of a child’s admission to the water park.
14. Find the slope of the line for the price of an adult’s admission to the water park.

C	A	E	R	V	L	A	T	D	P	G	I	O	N	E	R
8	$\frac{1}{2}$	3	$\frac{2}{5}$	$\frac{1}{6}$	$\frac{3}{4}$	$\frac{1}{8}$	5	$\frac{1}{4}$	$\frac{2}{9}$	$\frac{6}{7}$	$\frac{5}{4}$	1	7	$\frac{1}{12}$	2
A	M	K	T	L	E	D	I	M	A	R	I	T	L	K	S
23	$\frac{7}{8}$	6	$\frac{7}{6}$	$\frac{3}{5}$	$\frac{1}{3}$	$\frac{2}{3}$	12	4	9	25	$\frac{5}{3}$	90	31	$\frac{6}{5}$	0

Activity
5.6**Start Thinking!**

For use before Activity 5.6

You made a sketch of the school mascot. Your sketch has a height of 2 inches and a width of 4 inches. Describe the proportions you would use to make a mural of your sketch on a wall in your school. What would be the dimensions of your mural?

Activity
5.6**Warm Up**

For use before Activity 5.6

Plot the point in a coordinate plane. Describe the location of the point.

1. $A(-4, -2)$

2. $B(-2, -1)$

3. $C(0, 0)$

4. $D(2, 1)$

5. $E(4, 2)$

6. $F(6, 3)$

You receive \$20 every time you mow your neighbor's lawn. How many times do you need to mow the lawn so that you can buy a digital camera that costs \$189? Write an equation to represent the situation. Does the equation show direct variation? Why or why not?

Graph the ordered pairs in a coordinate plane. Do you think that the graphs show that the quantities vary directly? Explain your reasoning.

1. $(0, 0), (1, 6), (2, 12), (3, 18)$
2. $(-3, 6), (4, 8), (-5, 10), (6, 12)$
3. $(4, 6), (8, 12), (12, 18), (18, 27)$

5.6 Practice A

Graph the ordered pairs in a coordinate plane. Do you think that graph shows that the quantities vary directly? Explain your reasoning.

1. $(-2, -2), (0, 0), (2, 2), (4, 4)$

2. $(-1, -4), (0, -1), (1, 2), (2, 5)$

Tell whether x and y show direct variation. Explain your reasoning. If so, find k .

3.

x	-1	0	1	2
y	2	0	2	4

4.

x	2	4	6	8
y	1	2	3	4

5. $y - 2 = 3x - 2$

6. $y + 3 = x$

7. $xy = 5$

8. The table shows the grams of fiber y for the grams of protein x . Graph the data. Tell whether x and y show direct variation. If so, write an equation that represents the line.

Grams of protein, x	3	6	9	12
Grams of fiber, y	2	4	6	8

The variables x and y vary directly. Use the values to find the constant of proportionality and write an equation that relates x and y .

9. $y = 6; x = 2$

10. $y = 15; x = 3$

11. $y = 40; x = 10$

12. To prepare an aquarium for use, you can clean it with a saltwater solution. The amount of salt varies directly with the volume of the water. The solution has 2 teaspoons of aquarium salt for every gallon of water.
- How many teaspoons of aquarium salt are needed for 5 gallons of water?
 - Write an equation that relates x gallons of water to y teaspoons of salt.
 - Use the equation to find the number of gallons of water to use for 12 teaspoons of salt.
13. The total cost of football tickets varies directly with the number of tickets purchased. Four tickets cost \$32. How many tickets can you buy for \$56?
14. One quart is equivalent to 0.95 liter.
- Write a direct variation equation that relates x quarts to y liters.
 - Write a direct variation equation that relates x gallons to y liters.
 - Write a direct variation equation that relates x liters to y quarts.
 - What is the relationship between the values of k in the direct variation equations in parts (a) and (c)?

5.6

Practice B

Graph the ordered pairs in a coordinate plane. Do you think that graph shows that the quantities vary directly? Explain your reasoning.

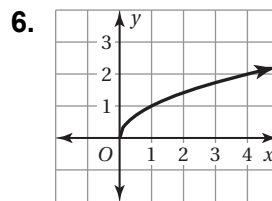
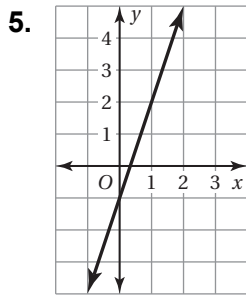
1. $(-3, -1), (3, 1), (6, 2), (9, 3)$

2. $\left(-2, -\frac{5}{2}\right), (4, 5), \left(6, \frac{15}{2}\right), (12, 15)$

Tell whether x and y show direct variation. Explain your reasoning. If so, find k .

3. $y - 2x = x$

4. $y - 5 = 5x + 2$



7. The percent y of correct answers on a test varies directly with the points x earned on the test.

Points earned, x	?	48	?	64	72	?
Percent, y	50	60	70	80	90	100

- a. Copy and complete the table.
- b. Write an equation that relates x and y .
- c. Graph the points. Draw a line through the points. Does the graph confirm that x and y show direct variation? Explain your reasoning.

The variables x and y vary directly. Use the values to find the constant of proportionality and write an equation that relates x and y .

8. $y = 36; x = 18$

9. $y = 51; x = 34$

10. $y = 55; x = 10$

11. The table shows the heights of the vertical supports for two skateboard ramps. Which ramp(s) show direct variation between distance and height?

Distance from base (feet)	1	2	3	4
Height for your ramp (feet)	1	1.5	2	2.5
Height for friend's ramp (feet)	0.5	1	1.5	2

12. Does the graph of every direct variation equation pass through the origin? Is every relationship whose graph passes through the origin direct variation? Explain your reasoning.

5.6 Enrichment and Extension

More on Direct Variation

1. A store's profit P varies directly with the number of items n that they purchase from a warehouse. Greg's Gadgets buys 75 Wacky Widgets from the Gadget Supply Warehouse. The store's profit for this purchase is $-\$190.50$.
 - a. Write a direct variation equation. Then, explain what the equation means.
 - b. Explain why the profit is negative. Predict what a graph of the equation will look like.
 - c. Fill in the table and make a graph of the data. Then compare the graph with your prediction.

Items purchased, n	0	5	10	15	20
Profit, P					

2. The volume V of blood that your heart pumps varies directly with your pulse rate p . Tomiqua's heart pumps 2.6 liters of blood in one minute when she is at her resting heart rate of 52 beats per minute.
 - a. Write a direct variation equation. Then, explain what the equation means.
 - b. After Tomiqua has been running on a treadmill, she measures her pulse for 10 seconds and gets 15 beats. How much blood is her heart pumping per minute?
3. The weight of an object on the moon varies directly with its weight on Earth. For example, the Apollo 13 Command Module weighed approximately 6 tons on Earth and about 1 ton on the moon.
 - a. Write a direct variation equation. Then, explain what the equation means.
 - b. Find your approximate weight on the moon.

5.6 Puzzle Time

How Do Bees Get To School?

For each exercise, circle the letter in the columns under Yes or No to indicate the correct answer. The circled letters will spell the answer to the riddle.

	Yes	No
1.	T	S
2.	H	T
3.	A	E
4.	Y	R
5.	M	T
6.	E	A
7.	L	K
8.	E	R
9.	T	S
10.	O	H
11.	E	K
12.	A	B
13.	U	N
14.	Z	T
15.	Y	Z

Tell whether x and y show direct variation.

- $(1, 1), (2, 2), (3, 3), (4, 4)$
- $(1, 3), (2, 6), (3, 9), (4, 12)$
- $(-2, 3), (0, 0), (2, 3), (4, 12)$
- $(-4, -1), (4, 1), (8, 2), (12, 3)$
- $(-1, -1), (0, 1), (1, 3), (2, 5)$
- $(1, 1), (2, 4), (3, 9), (4, 16)$
- $(1, 3), (2, 3), (3, 3), (4, 3)$
- $y = 12x$
- $y = \frac{1}{7}x$
- $y = 4x^2$
- $y = -2x$
- $y = 7x - 3$
- $x = 5y$
- $6 = \frac{x}{y}$
- $x^3 = 12y$

Chapter 5

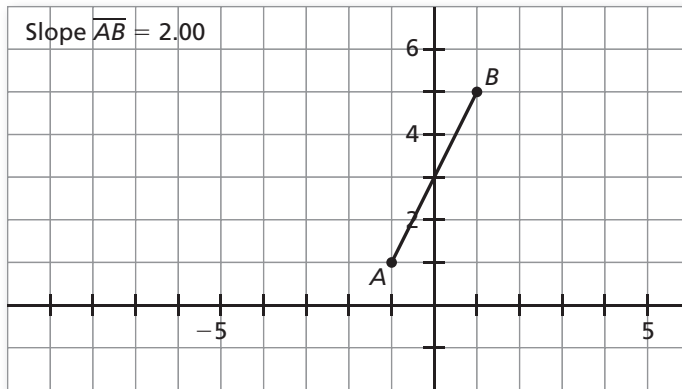
Technology Connection

For use after Section 5.5

Exploring Slope

Dynamic geometry software allows you to explore the slope of a line or line segment. The directions below might not correspond exactly to your software, but the same actions can be performed using similar commands.

Open a **New Sketch**. Use the **Segment** tool on the left side of the screen to draw a short segment that slants upward.



Click on the middle of the segment you made. In the **Measure** menu, select **Slope**. A grid and the slope of the segment will appear on the screen. In the **Graph** menu, select **Snap Points**. This will make it so that the segment will always have integer coefficients.

Move the endpoints of the segment you made so that it has the given slope. Sketch the line segment on a piece of paper and label the slope.

1. 1
2. $\frac{1}{2}$
3. $\frac{2}{3}$
4. $-\frac{4}{5}$
5. 0
6. -0.75
7. $1\bar{3}$
8. -2.5
9. Which line segments are the steepest? Which are the least steep? Describe their slopes.
10. What is the slope of a horizontal line segment?
11. What happens to the slope when you make the line segment vertical? Why?
12. Can you move the line segment without changing the slope? How?