Unit 5 + 6
Additional Topics

Complex Fractions

Conversions

Proportional & Non-Proportional Relationships

Graphing Proportional Relationships

Similar Figures

Percent Change

Simple & Compound Interest

Notes Section:

Notes Section:

Lesson 3 Reteach

Complex Fractions and Unit Rates

> **Complex fractions** are fractions with a numerator that is a fraction, a denominator that is a fraction, or both that are fractions.

Example

Simplify $\dfrac{\frac{2}{3}}{4}$.

$\dfrac{\frac{2}{3}}{4} = 2 \div \dfrac{3}{4}$ Write the complex fraction as a division problem.

$= \dfrac{2}{1} \times \dfrac{4}{3}$ Multiply by the reciprocal of $\frac{3}{4}$, which is $\frac{4}{3}$.

$= \dfrac{8}{3}$ or $2\dfrac{2}{3}$ Simplify.

So, $\dfrac{\frac{2}{3}}{4}$ is equal to $2\dfrac{2}{3}$.

Exercises

Simplify.

1. $\dfrac{3}{\frac{1}{3}}$

2. $\dfrac{5}{\frac{3}{7}}$

3. $\dfrac{4}{\frac{1}{5}}$

4. $\dfrac{2}{\frac{4}{9}}$

5. $\dfrac{1}{\frac{4}{5}}$

6. $\dfrac{10}{\frac{7}{8}}$

7. $\dfrac{\frac{3}{5}}{\frac{3}{7}}$

8. $\dfrac{\frac{1}{6}}{\frac{5}{6}}$

9. $\dfrac{\frac{4}{5}}{\frac{9}{10}}$

10. $\dfrac{\frac{3}{5}}{\frac{3}{10}}$

Lesson 4 Reteach

Converting Rates

Dimensional analysis is the process of including units of measurement as factors when you compute.

Example 1

A cheetah can run short distances at a speed of up to 75 miles per hour. How many feet per second is this?

You need to convert miles per hour to feet per second.

Use 1 mile = 5280 feet and 1 hour = 3600 seconds.

$$\frac{75 \text{ mi}}{1 \text{ h}} = \frac{75 \text{ mi}}{1 \text{ h}} \cdot \frac{5280 \text{ ft}}{1 \text{ mi}} \cdot \frac{1 \text{ h}}{3600 \text{ s}}$$
Multiply by $\frac{5280 \text{ ft}}{1 \text{ mi}}$ and $\frac{1 \text{ h}}{3600 \text{ s}}$.

$$= \frac{\overset{5}{\cancel{75} \text{ mi}}}{1 \cancel{h}} \cdot \frac{\overset{22}{\cancel{5280} \text{ ft}}}{1 \cancel{mi}} \cdot \frac{1 \cancel{h}}{\underset{\underset{1}{\cancel{18}}}{\cancel{3600}} \text{ s}}$$
Divide the common factors and units.

$$= \frac{110 \text{ ft}}{1 \text{ s}}$$
Simplify.

So, 75 miles per hour is equivalent to 110 feet per second.

Example 2

Convert 2 gallons to liters. Round to the nearest hundredth.

Use 1 liter ≈ 0.264 gallons.

$$2 \text{ gal} \approx 2 \text{ gal} \cdot \frac{1 \text{ L}}{0.264 \text{ gal}}$$
Multiply by $\frac{1 \text{ L}}{0.264 \text{ gal}}$.

$$\approx 2 \cancel{\text{gal}} \cdot \frac{1 \text{ L}}{0.264 \cancel{\text{gal}}}$$
Divide out the common units, leaving the desired unit, liter.

$$\approx \frac{2 \text{ L}}{0.264} \text{ or } 7.58 \text{ L}$$
Simplify.

So, 2 gallons is approximately 7.58 liters.

Exercises

1. Jake was in a bicycle race. His average speed was 22 miles per hour. At this rate, how many feet per hour did Jake travel?

2. Giant pandas can spend up to 16 hours a day eating bamboo. How many minutes per day is this?

3. Karin discovered that her leaky faucet was leaking 1.25 cups of water an hour. At this rate, how many gallons a day were leaking?

Complete each conversion. Round to the nearest hundredth.

4. 8 L ≈ ■ qt   **5.** 6 pt ≈ ■ mL   **6.** 22 kg ≈ ■ lb   **7.** 3 m ≈ ■ in.

8. The average American uses about 90 gallons of water per day. How many liters per year is this?

Lesson 5 Reteach

Proportional and Nonproportional Relationships

Two quantities are **proportional** if they have a constant ratio or rate. If they do not have the same ratio or rate, they are said to be **nonproportional**.

Example 1 Determine whether the distance traveled is proportional to the time. Explain your reasoning.

Time (min)	1	2	3	4
Distance (yd)	300	600	900	1200

Write the rate of distance to time for each column. Simplify each fraction.

$$\frac{300}{1} = \frac{300}{1} \qquad \frac{600}{2} = \frac{300}{1} \qquad \frac{900}{3} = \frac{300}{1} \qquad \frac{1200}{4} = \frac{300}{1}$$

Since all of the rates equal $\frac{300}{1}$, the distance traveled is proportional to the time.

Proportional relationships can be described using equations of the form $y = kx$, where k is the constant ratio. The constant ratio is the **constant of proportionality.**

Example 2 The perimeter of a square with a side of 3 inches is 12 inches. A square's perimeter is proportional to the length of one of its sides. Find the constant of proportionality. Then write an equation relating the perimeter of a square to the length of one of its sides. What would be the perimeter of a square with 9-inch sides?

Find the constant of proportionality between perimeter and side length.

$$\frac{\text{perimeter}}{\text{length of sides}} = \frac{12}{3} \text{ or } 4$$

Words: The perimeter is 4 times the length of a side.

Variable: Let P = perimeter and s = the length of a side.

Equation: $P = 4s$

$P = 4s$ Write the equation.
$P = 4(9)$ Replace s with the length of a side.
$P = 36$ Multiply.

The perimeter of a square with a side of 9 inches is 36 inches.

Exercises

Determine whether the set of numbers in each table is proportional. If the relationship is proportional, identify the constant of proportionality. Explain your reasoning.

1.
Cookies	6	9	12	15
Cupcakes	4	6	8	10

2.
Population (100,000)	1.3	2.1	3.3	5.2
Years	1	2	3	4

3. Gloria earned $26 for babysitting 4 hours. Find the constant of proportionality. Then write an equation relating money earned to the number of hours. How much would Gloria earn after babysitting 25 hours?

Math Accelerated • **Chapter 5** Ratio, Proportion, and Similar Figures

Lesson 6 Reteach

Graphing Proportional Relationships

If two quantities are proportional, the graph of the two quantities is a straight line through the origin. You can use a graph of the quantities to find the constant ratio between the quantities, or the **constant of proportionality**.

Example   **Miranda earns \$15 per hour for babysitting. Is the amount of money she earns proportional to the number of hours she spends babysitting?**

Time (hr)	0	1	2	3	4
Money (\$)	0	15	30	45	60

Graph the ordered pairs on the coordinate plane. Then connect the ordered pairs.

The graph passes through the origin and is a straight line. So, the amount of money Miranda earns babysitting is proportional to the number of hours she spends babysitting.

Check   Write the ratio of money to time for each ordered pair in simplest form.

$$\frac{15}{1} \qquad \frac{30}{2} = \frac{15}{1} \qquad \frac{45}{3} = \frac{15}{1} \qquad \frac{60}{4} = \frac{15}{1}$$

The ratios are all the same. The relationship is proportional.
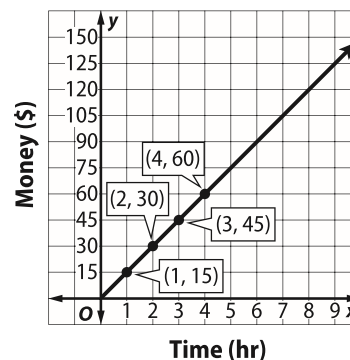
Exercises

Determine whether each relationship is proportional by graphing on the coordinate plane. Explain your reasoning.

1.

Radius	1	2	3	4	5
Circumference	2π	4π	6π	8π	10π

2.

Teachers	1	2	3	4	5
Students	15	28	40	55	75

3. A recipe for chocolate chip cookies uses 3 cups flour and 2 sticks of butter. Is the amount of butter used proportional to the number of cups of flour used? Explain your reasoning.

4. What is the constant of proportionality between the perimeter of a square to its side length, s? Explain what it means.

Math Accelerated • **Chapter 5** Ratio, Proportion, and Similar Figures

Lesson 9 Reteach

Similar Figures

> **Similar figures** are figures that have the same shape but not necessarily the same size. If two figures are similar, then the corresponding angles have the same measure, and the corresponding sides are proportional. Because corresponding sides are proportional, you can use proportions or the scale factor to find the measures of the sides of similar figures when some measures are known. The scale factor is the ratio of a length on a scale drawing to the corresponding length on the real object. It is also the ratio of corresponding sides in similar figures.

Example   If the polygons *ABCD* and *EFGH* are similar, what is the value of *x*?

$\dfrac{AD}{EH} = \dfrac{CD}{GH}$ The corresponding sides are proportional. Write a proportion.

$\dfrac{12}{36} = \dfrac{7}{x}$ Replace *AD* with 12, *EH* with 36, *CD* with 7, and *GH* with *x*.
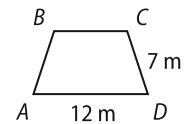
$12 \cdot x = 36 \cdot 7$ Find the cross products.
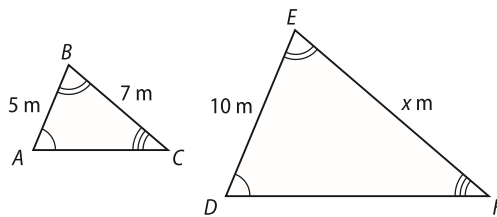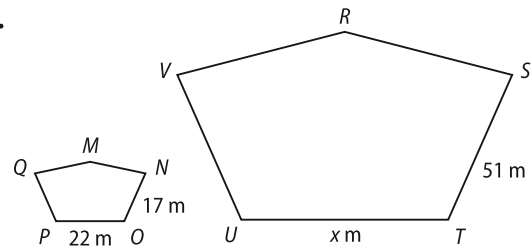
$12x = 252$ Simplify.

$x = 21$ Division Property of Equality
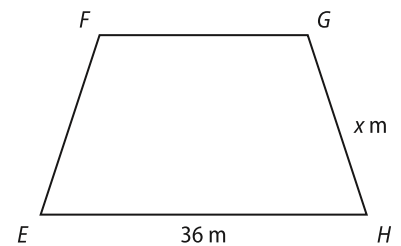
Exercises

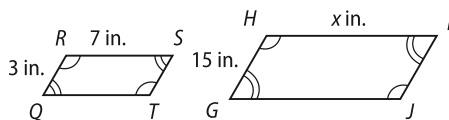**The figures are similar. Find each missing measure.**
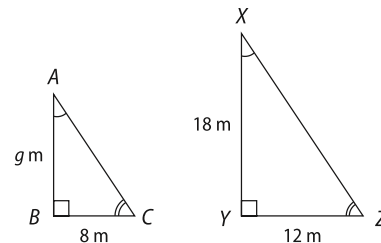
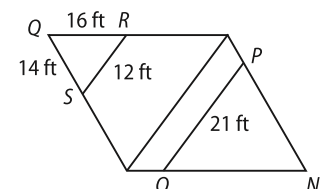**1.**

2.

3.

4.

5. The art club is painting the mural shown at the right on a wall. Triangle *QRS* and triangle *NOP* are similar.

   a. Find the length of $\overline{NO}$.

   b. Find the length of $\overline{PN}$.

Lesson 4 Reteach

Percent of Change

A **percent of change** is a ratio of the amount of change to the original amount.

Example 1 Find the percent of change from 75 yards to 54 yards.

Step 1 Subtract to find the amount of change.

$54 - 75 = -21$ final amount–original amount

Step 2 Write a ratio that compares the amount of change to the original amount. Express the ratio as a percent.

$$\text{percent of change} = \frac{\text{amount of change}}{\text{original amount}}$$
$$= \frac{-21}{75} = -0.28 \text{ or } -28\%$$

A **percent error** is a ratio of the amount of error to the actual value of a measurement.

Example 2 Dominic estimates that the length of a ribbon is 75 centimeters. It is actually 66 centimeters long. What is the percent of error of his estimate?

Step 1 Subtract to find the amount of error.

$75 - 66 = 9$ Subtract the actual value from the estimate.

Step 2 Write a ratio that compares the amount of change to the original measurement. Express the ratio as a percent.

$$\text{percent of error} = \frac{\text{amount of error}}{\text{actual value}} \times 100 = \frac{9}{66} \times 100 \approx 0.13$$

So, the percent error is 13.6%

Exercises

Find the percent of change. Round to the nearest tenth, if necessary. Then state whether the percent of change is an *increase* or *decrease*.

1. from 22 inches to 16 inches

2. from 8 years to 10 years

3. from 55 people to 217 people

4. from 45 mi per gal to 24 mi per gal

Find the percent error.

5. actual cost: $83 meters, estimated cost: $75

6. estimated mass: 250 grams, actual mass: 231 grams

7. projected time: 45 minutes, actual time: 80 minutes

8. estimated length: 15 meters, actual length: 12 meters

Lesson 6 Reteach

Simple and Compound Interest

Interest is the amount of money paid or earned for the use of money by a financial institution. To find interest, use the formula $I = prt$, where I is the interest, p is the principal (the amount of money invested or borrowed), r is the interest rate, and t is the time in years. **Simple interest** is paid only on the initial principal. **Compound interest** is paid on the initial principal and on interest earned in the past.

Example 1   Find the simple interest for $500 invested at 3.2% for 5 years.

$I = prt$ Write the simple interest formula.

$I = 500 \cdot 0.032 \cdot 5$ Replace p with 500, r with 0.032, and t with 5.

$I = 80$ Simplify.

The simple interest is $80.

Example 2   What is the total amount of money in an account where $350 is invested at an interest rate of 7.25% compounded annually for 2 years?

Step 1   Find the amount of money in the account at the end of the first year.

$I = prt$ Write the simple interest formula.

$I = 350 \cdot 0.0725 \cdot 1$ Replace p with 350, r with 0.0725, and t with 1.

$I = 25.375 \approx 25.38$ Simplify.

$350 + 25.38 = 375.38$ Add the amount invested and the interest.

At the end of the first year, there is $375.38 in the account.

Step 2   Find the amount of money in the account at the end of the second year.

$I = prt$ Write the simple interest formula.

$I = 375.38 \cdot 0.0725 \cdot 1$ Replace p with 375.38, r with 0.0725, and t with 1.

$I = 27.21505 \approx 27.22$ Simplify.

$375.38 + 27.22 = 40.260$ Add the amount invested and the interest.

At the end of the first year, there is $402.60 in the account.

Exercises

Find the simple interest to the nearest cent.

1. $300 at 8% for 4 years

2. $1500 at 7.5% for 3 years

3. $1225 at 6.25% for 18 months

4. $900 at 12% for 60 months

Find the total amount in each account to the nearest cent if the interest is compounded annually.

5. $2825 at 4.75% for 2 years

6. $695 at 6.5% for 3 years

7. $530 at 5.5% for 5 years

8. $950 at 6.8% for 2 years

Lesson 3 Homework Practice

Complex Fractions and Unit Rates

Simplify.

1. $\dfrac{\frac{1}{3}}{4}$

2. $\dfrac{\frac{3}{4}}{8}$

3. $\dfrac{3}{\frac{2}{3}}$

4. $\dfrac{4}{\frac{1}{3}}$

5. $\dfrac{\frac{5}{6}}{3}$

6. $\dfrac{\frac{3}{5}}{4}$

7. $\dfrac{\frac{3}{4}}{\frac{6}{7}}$

8. $\dfrac{\frac{4}{15}}{\frac{2}{5}}$

9. $\dfrac{\frac{6}{7}}{\frac{9}{14}}$

10. Jonathan can jog $3\frac{2}{5}$ miles in $\frac{7}{8}$ hour. Find his average speed in miles per hour.

11. A truck driver drove 120 miles in $1\frac{3}{4}$ hours. What is the speed of the truck in miles per hour?

12. Charlotte reads $8\frac{1}{3}$ pages of a book in 10 minutes. What is her average reading rate in pages per minute?

Lesson 4 Homework Practice

Converting Rates

Convert each rate using dimensional analysis. Round to the nearest hundredth.

1. 18 m/min = ■ cm/s

2. 5.7 gal/h = ■ c/min

3. 264 yd/s = ■ mi/h

4. 2 qt/min = ■ gal/h

5. 99 in./s = ■ mi/day

6. 154 mi/h = ■ in./s

7. 44 mi/min = ■ ft/s

8. 15 oz/min = ■ gal/h

9. 88 mi/h ≈ ■ km/min

10. 10 ft/min ≈ ■ m/h

11. 165 L/h ≈ ■ qt/min

12. 26 yd/s ≈ ■ km/h

13. 474 gal/day ≈ ■ L/week

14. 33.6 m/s ≈ ■ ft/min

15. 22 fl oz/min ≈ ■ mL/s

16. 299 km/h ≈ ■ mi/min

Complete each conversion. Round to the nearest hundredth.

17. 10 cm ≈ ■ in.

18. 300 gal ≈ ■ L

19. 250 g ≈ ■ oz

20. 5.5 kg ≈ ■ lb

21. 145 m ≈ ■ mi

22. 9.5 L ≈ ■ pt

23. 13 yd ≈ ■ m

24. 1095 mi ≈ ■ km

25. Rita sprinted 77 feet in 10 seconds. How many miles per hour is this?

26. Lisa is traveling to Europe. The information from the airlines said that she is only allowed to check 25 kilograms worth of baggage. To the nearest pound, how many pounds is this?

27. The space shuttle travels at an orbital speed of about 17,240 miles per hour. How many meters per minute is this? Round to the nearest whole number.

Lesson 5 Homework Practice

Proportional and Nonproportional Relationships

Determine whether the set of numbers in each table is proportional. If the relationship is proportional, identify the constant of proportionality. Explain your reasoning.

1.

Hours Worked	1	2	2.5	3
Earnings ($)	10	20	25	30

2.

Miles Driven	1	2	6	9
Toll Fare	$1.07	$1.14	$1.42	$1.63

3. Sharif started a new job working 15 hours a week. Find the constant of proportionality. Then write an equation relating hours worked to weeks. After how many weeks will Sharif have worked a total of 75 hours?

4. During its first 50 days of growth, a sunflower grows about 4 centimeters per day. Find the constant of proportionality. Then write an equation relating height to days. After how many days will a sunflower be 60 centimeters tall?

Complete each table. Determine whether the pattern forms a proportion. If the relationship is proportional, identify the constant of proportionality.

5. It costs Victoria $0.10 to send a text message.

Number of Messages	4	8	9	11	14
Cost					

6. Water flows out of a kitchen faucet at about 1.5 gallons per minute.

Minutes	0.5	1	1.25	1.5	2
Gallons of Water					

7. The amount of time it takes to cook a turkey increases with the weight of the turkey. It is recommended that you cook a 10-lb turkey for 3 hours. An extra 12 minutes of cooking time is necessary for each additional pound of turkey. Is the cooking time proportional to the weight of the turkey? Explain your reasoning.

Lesson 6 Homework Practice

Graphing Proportional Relationships

Determine whether each relationship is proportional by graphing on a coordinate plane. Explain your reasoning.
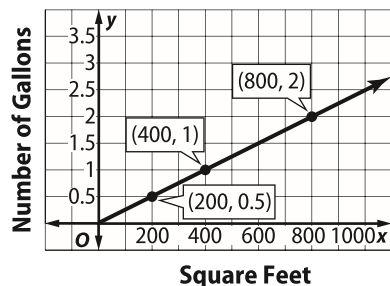
1.

Number of Sandwiches	1	5	10	15	20
Cost ($)	3	13.75	25	33.75	40

2.

Time (hr)	0	1	2	3	5
Number of Gallons	0	600	1200	1800	2400

Find and interpret the constant of proportionality.

3. The number of gallons of paint required is proportional for the number of square feet of surface to be painted. The graph shows the relationship (square feet, number of gallons).

4. The formula for the area A of a rectangle with a length of 5 inches is $A = 5w$, where w is the width in inches. Make a table showing the area of the rectangles with a 5-inch length and a width of 2, 4, 6, and 8 inches. Then graph the ordered pairs. Determine whether the area of all rectangles with a length of 5 inches is proportional to the width in inches. Explain your reasoning.
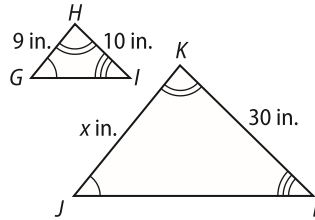
Lesson 9 Homework Practice

Similar Figures

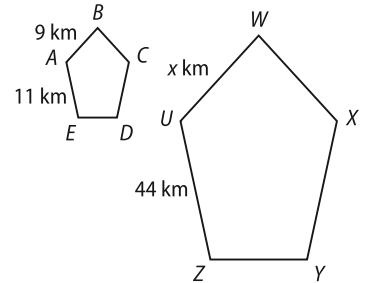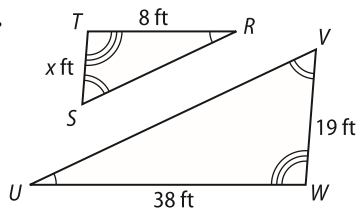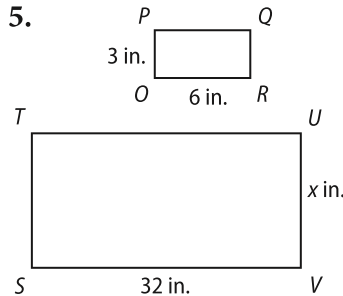The figures are similar. Find each missing measure.

1.
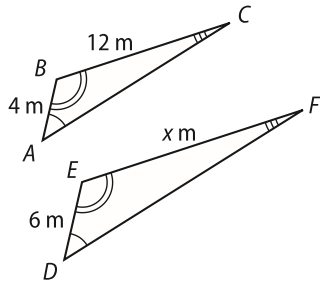
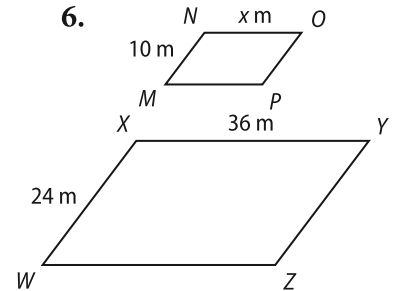

2.

3.

4.
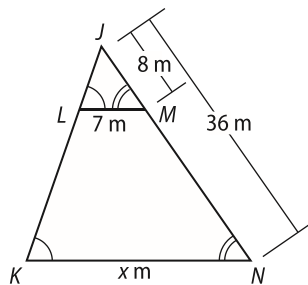

5.

6.

7.

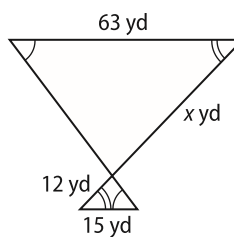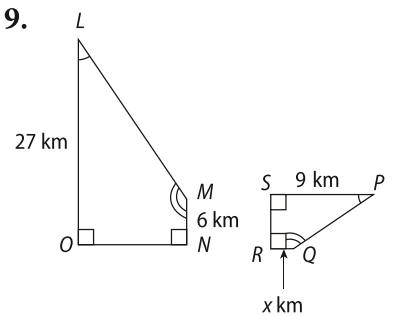

8.

9.

10. Triangle *ABC* is similar to triangle *DEF*. What is the value of *BC* if *EF* is 36 feet, *AC* is 7 feet, and *DF* is 28 feet?

11. Quadrilateral *RSTU* is similar to quadrilateral *LMNO*. What is the value of *LO* if *RU* is 6 inches, *LM* is 45 inches, and *RS* is 9 inches?

12. A woman sews similar quilts for her daughter and her daughter's doll. If the daughter's quilt has a length of 2 yards and a width of 1 yard, and the doll's quilt has a length of $\frac{1}{2}$ yard, what is the width of the doll's quilt?

Math Accelerated • **Chapter 5** Ratio, Proportion, and Similar Figures

Lesson 4 Homework Practice

Percent of Change

Find the percent of change. Round to the nearest tenth, if necessary. Then state whether the percent of change is an *increase* or *decrease*.

1. from 4 m to 5 m

2. from 75 minutes to 100 minutes

3. from $9.25 to $6.50

4. from 45 quarts to 8 quarts

5. from 21 mm to 13 mm

6. from $457 to $1000

7. from $39.50 to $40.00

8. from 9 students to 856 students

9. from 24 kittens to 7 kittens

10. from 15 songs to 105 songs

Find the percent error.

11. projected time: 30 seconds, actual time: 27 seconds

12. estimated cost: $1.00, actual cost: $0.65

13. actual height: 2 meters, estimated height: 1.5 meters

14. measured perimeter: 22 feet, actual perimeter: 24 feet

15. actual number: 220, calculated number: 218

16. projected duration: 4 minutes, actual duration: 3.5 minutes

17. estimated mass: 250 grams, actual mass: 231 grams

18. projected time: 45 minutes, actual time: 80 minutes

19. On Tuesday, a baker sold 132 cookies. On Wednesday, she sold 108 cookies. Find the percent of change to the nearest tenth of a percent.

20. Savannah estimates that her dog weighs 30 pounds. When she takes her dog to the vet for his check-up, the dog is placed on the scale and actually weighs 32.5 pounds. What was Savannah's percent of error of her estimate? Round to the nearest percent.

Lesson 6 Homework Practice

Simple and Compound Interest

Find the simple interest to the nearest cent.

1. $1300 at 6% for 7 years

2. $250 at 8% for 9 months

3. $725 at 3.25% for 6 months

4. $1900 at 5.5% for 36 months

5. $920 at 10.5% for 30 months

6. $1100 at 13% for 54 months

7. $550 at 5.75% for 4 years

8. $875 at 2.3% for 3 months

9. $22,800 at 9.3% for 33 months

10. $54,600 at 4.25% for 42 months

Find the total amount in each account to the nearest cent if the interest is compounded annually.

11. $450 at 5% for 3 years

12. $580 at 11.8% for 4 years

13. $6550 at 6.5% for 2 years

14. $2750 at 2.75% for 3 years

15. $1900 at 9% for 2 years

16. $13,900 at 12.5% for 5 years

17. $600 at 6% for 4 years

18. $2400 at 5.3% for 5 years

19. $64,000 at 3.25% for 3 years

20. $312,000 at 1.99% for 4 years

21. Lane borrowed $1200 for a new drum set. She will be paying 6.5% in simple interest over the next 2 years. What is the total amount of interest she will be paying on the loan?

22. Luke puts $4800 in a savings account. He earns $16 each month for the next 60 months. Find the simple interest rate for his savings account.

23. Toya has a car loan of $8500. Over the course of the loan, she paid a total of $5525 in interest at a rate of 13%. How many months was the car loan?