8•9 Using Ratios to Describe Size Changes

Objective To explore the use of ratios to describe size changes.

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1 Teaching the Lesson

Key Concepts and Skills

- Multiply fractions by whole-number scalars. [Operations and Computation Goal 4]
- Use ratios to solve size-change problems. [Operations and Computation Goal 6]
- Express ratios in words, with colons, as fractions, or as proportions. [Operations and Computation Goal 6]
- Measure line segments to the nearest $\frac{1}{16}$ inch and millimeter. [Measurement and Reference Frames Goal 1]
- Recognize properties of similar figures. [Geometry Goal 2]

Key Activities

Students explore the use of ratios to describe size changes for geometric figures, scale models, and maps. They practice using notations to show the size-change factor.

Ongoing Assessment: Informing Instruction See page 745.

Ongoing Assessment: Recognizing Student Achievement Use journal page 310. [Measurement and Reference Frames Goal 1]

Key Vocabulary

size-change factor (scale factor or scale) ◆ *n*-to-1 ratio ◆ enlargement ◆ reduction

Materials

Math Journal 2, pp. 310 and 311
Student Reference Book, pp. 121–124
Study Link 8•8
Math Masters, p. 264; p. 408 (optional)
calculator ◆ inch ruler ◆ Geometry Template (optional)

2 Ongoing Learning & Practice

Math Boxes 8•9

Math Journal 2, p. 312
Students practice and maintain skills through Math Box problems.

Study Link 8•9

Math Masters, p. 265
centimeter ruler
Students practice and maintain skills through Study Link activities.

3 Differentiation Options

READINESS

Considering What Size Change Means

Math Masters, p. 266
centimeter ruler
Students explore the effect of increasing or reducing a measurement or an event by a factor of 10.

EXTRA PRACTICE

Finding Dimensions of Objects Based on Scale Models

Math Masters, p. 267
Students use scale drawings to find the dimensions of objects. They examine whether size-change factors apply to area.

EXTRA PRACTICE

Investigating Perimeter and Size-Change Factor

Math Masters, p. 268
centimeter ruler
Students investigate the relationship between the size-change factors in polygons and their perimeters.

ELL SUPPORT

Illustrating Terms

posterboard ◆ markers
Students make posters illustrating enlargements and reductions.

Advance Preparation

For the Math Message, make one copy of *Math Masters,* page 264 for every two students.

***Teacher's Reference Manual,* Grades 4–6** pp. 65, 66, 199

Getting Started

CCSS

Mathematical Practices
SMP1, **SMP2, SMP3,** SMP4, SMP5, SMP6
Content Standards
6.RP.1, 6.RP.2, 6.RP.3, 6.RP.3d

Mental Math and Reflexes

Students use proportional reasoning to convert between units of measurement. *Suggestions:*

●○○ 150 minutes = $2\frac{1}{2}$ hours
360 months = 30 years

●●○ 3.6 kilometers = 360,000 centimeters
782 milliliters = 0.782 liters

●●● 3.7 square decimeters = 370 square centimeters
7 square feet = 1,008 square inches

Math Message

Take a copy of the Math Message and solve the problem.

Study Link 8·8 Follow-Up

Remind students they must complete *Math Masters,* pages 260 and 261 within the next two or three days.

Name Date Time

LESSON 8·9 **A Pizza Problem**

Math Message

Zach and Regina both wanted cheese pizza. An 8-inch pizza costs $2 and a 12-inch pizza costs $4.

Zach said that they should buy two 8-inch pizzas because the 12-inch pizza costs twice as much as the 8-inch pizza, and 2 times 8 is more than 12.

Regina disagreed. She said that the 12-inch pizza was a better deal.

Who was right? Regina Explain your answer. Answers vary.

Math Masters, page 264

1 Teaching the Lesson

Math Message Follow-Up

WHOLE-CLASS DISCUSSION

(*Math Masters,* p. 264)

Ask students to share their solutions and explanations. Address the following points in the discussion:

▷ The diameter of a 12-inch pizza is 50% greater than the diameter of an 8-inch pizza ($8 * 1.5 = 12$).

$$\frac{\text{(diameter of larger pizza)}}{\text{(diameter of smaller pizza)}} \; \frac{12 \text{ inches}}{8 \text{ inches}} = \frac{1.5}{1}$$

▷ Considering only the ratio of the diameters ($\frac{1.5}{1}$), it appears that a 12-inch pizza is not worth twice the price of an 8-inch pizza. This is what misled Zach.

▷ The area of a pizza is a better measure of its value than the diameter.

Have students use their calculators to find the areas of an 8-inch and a 12-inch pizza.

Area of 8-inch pizza: $\pi * (4 \text{ inches})^2$ is about 50 in^2

Area of 12-inch pizza: $\pi * (6 \text{ inches})^2$ is about 113 in^2

Because the area of a 12-inch pizza is more than twice as much as the area of an 8-inch pizza, it is a better buy than two 8-inch pizzas.

Adjusting the Activity

Have students follow these steps to extend the investigation comparing the areas of the two pizzas.

Step 1 Use the Geometry Template to make scale drawings of the pizzas as concentric circles using the scale: 1 centimeter represents 1 inch. The inner circle will represent the 8-inch pizza.

Step 2 Cut off the part of the larger circle that is not covered by the smaller one. Then cut this rim into pieces and place them inside the smaller circle.

Students will find that the pieces of the rim will more than cover the smaller circle, proving that the 12-inch pizza has more than twice as much area as the 8-inch pizza.

AUDITORY ◆ KINESTHETIC ◆ TACTILE ◆ VISUAL

Using Ratios to Describe Size Changes

WHOLE-CLASS DISCUSSION

ELL

(*Student Reference Book,* pp. 121–123)

Algebraic Thinking Read and discuss the essay on *Student Reference Book,* pages 121–123 as a class. Emphasize the following ideas in the discussion:

▷ The **size-change factor** is really an ***n*-to-1 ratio:** a ratio of some number to 1. It tells the amount of enlargement or reduction that occurs in a size-change situation. For example, a size-change factor of 3X describes an enlargement in which each length is three times the size of the corresponding length in the original object. That is, the ratio of the **enlargement** to the original is 3 to 1. To support English language learners, discuss the different meanings of the word *factor,* including its meaning in this context. Provide some examples of enlargements.

$$\frac{\text{(enlarged length)}}{\text{(original length)}} \quad \frac{3}{1}$$

The same size-change factor applies to every length in the original figure. A size-change factor that is less than 1, such as 0.4X, describes a **reduction** of the original figure. To support English language learners, discuss the meaning of *reduction,* using examples.

$$\frac{\text{(enlarged length)}}{\text{(original length)}} \quad \frac{0.4}{1}$$

▷ The size-change factor applies only to lengths, not to areas, volumes, or angle sizes. This is what misled Zach in the Math Message. The size-change factor of the diameter from the 8-inch pizza to the 12-inch pizza is 1.5. Zach interpreted this ratio to mean that a 12-inch pizza is only 1.5 times larger than an 8-inch pizza, which is less than the increase in price. But the area changes by a factor of 2.25 ($1.5 * 1.5 = 2.25$), which is more than the increase in price and considerably more than the 1.5 size-change factor.

Student Page

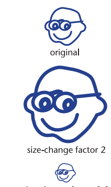
Rates, Ratios, and Proportions

Using Ratios to Describe Size Changes

Many situations produce a **size change.** For example, a magnifying glass, a microscope, and an overhead projector all produce size changes that enlarge the original images. Most copying machines can create a variety of size changes—both enlargements and reductions of the original document.

Similar figures are figures that have the same shape but not necessarily the same size. Enlargements or reductions are **similar** to the originals; that is, they have the same shape as the originals.

The **size-change factor** is a number that tells the amount of enlargement or reduction that takes place. For example, if you use a copy machine to make a 2X change in size, then every length in the copy is twice the size of the original. The size-change factor is 2, or 200%. If you make a 0.5X change in size, then every length in the copy is half the size of the original. The size-change factor is $\frac{1}{2}$, or 0.5, or 50%.



You can think of the size-change factor as a ratio. For a 2X size change, the ratio of a length in the copy to the corresponding length in the original is 2 to 1.

$$\text{size-change factor 2: } \frac{\text{copy size}}{\text{original size}} = \frac{2}{1}$$

For a 0.5X size change, the ratio of a length in the copy to a corresponding length in the original is 0.5 to 1.

$$\text{size-change factor 0.5: } \frac{\text{copy size}}{\text{original size}} = \frac{0.5}{1}$$

If the size-change factor is greater than 1, then the copy is an **enlargement** of the original. If it is less than 1, then the copy is a **reduction** of the original.

A photographer uses an enlarger to make prints from negatives. If the size of the image on the negative is 2" by 2" and the size of the image on the print is 6" by 6", then the size-change factor is 3. Binoculars that are 8X, or "8 power," magnify all the lengths you see with the naked eye to 8 times their actual size.

***Student Reference Book,* page 121**

Student Page

Rates, Ratios, and Proportions

Scale Models

A model that is a careful, reduced copy of an actual object is called a **scale model.** You have probably seen scale models of cars, trains, and airplanes. The size-change factor in scale models is usually called the **scale factor.**

Dollhouses often have a scale factor of $\frac{1}{12}$. You can write this as "$\frac{1}{12}$ of actual size," "scale 1 : 12," "$\frac{1}{12}$ scale," or as a proportion:

$$\frac{\text{dollhouse length}}{\text{real house length}} = \frac{1 \text{ inch}}{12 \text{ inches}}$$

All the dimensions of an E-scale model railroad are $\frac{1}{96}$ of the actual size. The scale factor is $\frac{1}{96}$. We can write this as "scale 1 : 96," or as a proportion:

$$\frac{\text{model railroad length}}{\text{real railroad length}} = \frac{1 \text{ inch}}{96 \text{ inches}}$$

We can also write this as "scale: $\frac{1}{8}$ inch represents 1 foot," or as "scale: 0.125 inch represents 12 inches." To see this, write

$$\frac{\frac{1}{8}}{12} = \frac{\frac{1}{8} * 8}{12 * 8} = \frac{1}{96}$$

$\frac{1}{8}$ inch : 12 inches is the same as 1 inch : 96 inches.

Scale Drawings

The size-change factor for scale drawings is usually called the **scale.** If an architect's scale drawing shows "scale $\frac{1}{4}$ inch : 1 foot" or "scale: $\frac{1}{4}$ inch represents 1 foot," then $\frac{1}{4}$ inch on the drawing represents 1 foot of actual length.

$$\frac{\text{drawing length}}{\text{real length}} = \frac{\frac{1}{4} \text{ inch}}{1 \text{ foot}}$$

Since 1 foot = 12 inches, we can rename

$$\frac{\frac{1}{4} \text{ inch}}{1 \text{ foot}} \text{ as } \frac{\frac{1}{4} \text{ inch}}{12 \text{ inches}}.$$

Multiply by 4 to change this to an easier fraction:

$$\frac{\frac{1}{4} \text{ inch} * 4}{12 \text{ inches} * 4} = \frac{1 \text{ inch}}{48 \text{ inches}}.$$

The drawing is $\frac{1}{48}$ of the actual size.

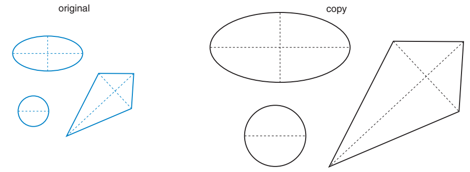
***Student Reference Book,* page 122**

Student Page

Date Time

LESSON 8•9 **Enlargements** SRB 121 122

A copy machine was used to make 2X enlargements of figures on the Geometry Template.



1. Use your ruler to measure the line segments shown in the figures above to the nearest $\frac{1}{16}$ inch. Then fill in the table below.

Line Segment	Length of Original	Length of Enlargement	Ratio of Enlargement to Original
Diameter of circle	$\frac{7}{16}$"	$\frac{7}{8}$"	$\frac{2}{1}$
Longer axis of ellipse	1"	2"	$\frac{2}{1}$
Shorter axis of ellipse	$\frac{1}{2}$"	1"	$\frac{2}{1}$
Longer side of kite	1"	2"	$\frac{2}{1}$
Shorter side of kite	$\frac{1}{2}$"	1"	$\frac{2}{1}$
Longer diagonal of kite	$1\frac{5}{16}$"	$2\frac{5}{8}$"	$\frac{2}{1}$
Shorter diagonal of kite	$\frac{11}{16}$"	$1\frac{3}{8}$"	$\frac{2}{1}$

2. Are the figures in the enlargements similar to the original figures? Yes

3. What does a 3.5X enlargement mean? Sample answer: Each length in the enlarged figure is 3.5 times the corresponding length in the original figure.

Math Journal 2, p. 310

ELL Caution students that at times they may see scales written in this way:

scale: 1 inch = 1 foot

The two measures are obviously not equal. The equal sign is being used as a symbol for the word *represents.* To support English language learners, also discuss the meaning of the word *scale* in this context.

Size Change	Size-change Factor $\frac{\text{Changed length}}{\text{original length}}$
8X	$\frac{8}{1}$
scale 1:12	$\frac{1}{12}$
scale 1:96	$\frac{1}{96}$
scale 1:48	$\frac{1}{48}$
scale 1:24,000	$\frac{1}{24{,}000}$

Adjusting the Activity

Have students draw a 5 × 5 square on a sheet of grid paper (*Math Masters,* p. 408). Then have them draw and label a 2X enlargement of the square (a 10 × 10 square). Ask students to measure the angles, find the side lengths, and calculate the area of each square. Discuss their findings.

The angles of each square measure 90°. The side lengths of the enlargement are twice as great as the side lengths of the original. The enlargement's area is 4 times the area of the original.

AUDITORY ◆ KINESTHETIC ◆ TACTILE ◆ VISUAL

▷ The size-change factor is often identified by other names, such as **scale factor** or **scale.** Many different notations indicate this ratio. Use the following examples to show a variety of notations:

aX	scale 1:a	$\frac{1}{a}$ actual size
0.aX	$\frac{1}{a}$ scale	
a power	a unit 1 = b unit 2	

In practice, any of these notations will serve. However, more explicit notations are easier for students to understand. For this reason, use $\frac{\text{(changed size)}}{\text{(original size)}} = \frac{a}{1}$ whenever possible, even though it is not the most common notation.

Each size-change factor has two possible forms, because a ratio may be expressed in either order. Context will always dictate which size-change factor is being used, and students are unlikely to be confused in this regard. For example, for 8X binoculars, the size-change factor 8 clearly refers to the view of the object through the binoculars compared to the view of the object without binoculars. The size-change factor $\frac{1}{8}$ refers to the size of the object when viewed without binoculars compared to the size of the object when viewed through the binoculars.

▷ Make a table on the board or a transparency and record each new notation (from *Student Reference Book,* pp. 122 and 123) as it arises. Then write the size-change factor for this notation and its reciprocal. Refer to the table as you read about the binoculars, dollhouse, model railroad examples, and map scales.

▷ In cases where two different units convey size-change factor information, caution students to convert one of the quantities, so both have the same unit, before making a ratio calculation. For example, for the architect's scale, $\frac{1}{4}$ *inch represents 1 foot,* converting all units to inches means that 1 inch represents 48 inches, which yields the scale of 1:48.

Solving Size-Change Problems

PARTNER ACTIVITY

PROBLEM SOLVING

(*Math Journal 2,* pp. 310 and 311; *Student Reference Book,* pp. 121–124)

Assign the journal pages to partnerships. Suggest that students keep the *Student Reference Book* open to pages 121–124 so they can refer to vocabulary and examples of notation. For Problem 4 on journal page 311, students may need to look up the number of feet in a mile in the back of their journals or in the *Student Reference Book.*

Ongoing Assessment: Informing Instruction

Watch for students who are unsure of how to calculate the number of inches in a mile. Suggest that they apply their knowledge of proportions to set up the following comparison:

$$\begin{matrix}\text{(in.)}\\\text{(ft)}\end{matrix}\ \frac{12}{1} = \frac{x}{5{,}280}$$

Ongoing Assessment: Recognizing Student Achievement

Journal Page 310 Problem 1

Use **journal page 310, Problem 1** to assess students' ability to measure line segments to the nearest $\frac{1}{16}$ inch. Students are making adequate progress if they can complete the table in Problem 1.

[Measurement and Reference Frames Goal 1]

Student Page

Date Time

LESSON 8•9

Map Scale

SRB 123 124

This map shows the downtown area of the city of Chicago. The shaded area shows the part of Chicago that was destroyed in the Great Chicago Fire of 1871.

The map was drawn to a scale of 1:50,000. This means that each 1-inch length on the map represents 50,000 inches (about $\frac{3}{4}$ mile) of actual distance.

$$\frac{\text{map distance}}{\text{actual distance}} = \frac{1}{50{,}000}$$

1. Measure the distance on the map between Fullerton Parkway and Roosevelt Road, to the nearest $\frac{1}{4}$ inch. This is the approximate north–south length of the part that burned.

   Burn length on map = 5 inches

2. Measure the width of the part that burned along Chicago Avenue, to the nearest $\frac{1}{4}$ inch. This is the approximate east–west length of the part that burned.

   Burn width on map = $1\frac{1}{2}$ inches

3. Use the map scale to find the actual length and width of the part of Chicago that burned.

   a. Actual burn length = 250,000 inches

   b. Actual burn width = 75,000 inches

4. Convert the answers in Problem 3 from inches to miles, to the nearest tenth of a mile.

   a. Actual burn length = 3.9 miles

   b. Actual burn width = 1.2 miles

5. Estimate the area of the part of Chicago that burned, to the nearest square mile.

   About 4 square miles

Math Journal 2, p. 311

2 Ongoing Learning & Practice

Math Boxes 8•9

INDEPENDENT ACTIVITY

(*Math Journal 2,* p. 312)

Mixed Practice Math Boxes in this lesson are paired with Math Boxes in Lesson 8-11. The skill in Problem 5 previews Unit 9 content.

Portfolio Ideas

Writing/Reasoning Have students write a response to the following: *Explain the method you used to find the difference in Problem 3b.* Sample answer: Convert $1\frac{5}{6}$ to an improper fraction ($\frac{11}{6}$). Use the LCM to rename each fraction ($\frac{15}{6} - \frac{11}{6}$). Subtract and simplify ($\frac{4}{6} = \frac{2}{3}$).

Student Page

Date Time

LESSON 8•9

Math Boxes

1. 15 is what percent of 25?

   Complete the proportion. Then solve.

   $$\frac{\text{(part)}}{\text{(whole)}}\quad \frac{15}{25} = \frac{x}{100}$$

   15 is 60 % of 25.

   SRB 51 52

2. Find the value of x so each ratio is expressed in terms of a common unit.

   a. 4 inches:5 feet = 4 inches:x inches

      x = 60

   b. $\frac{2.4\text{ m}}{80\text{ cm}} = \frac{2.4\text{ m}}{x\text{ m}}$ x = 0.8

   c. 840 mm to 7 cm = x cm to 7 cm

      x = 84

   SRB 371

3. Subtract. Write your answer as a fraction or a mixed number in simplest form.

   a. $7\frac{3}{4} - 3\frac{3}{8} = 4\frac{3}{8}$

   b. $\frac{2}{3} = \frac{5}{2} - 1\frac{5}{6}$

   c. $2\frac{7}{9} = 5\frac{1}{3} - 2\frac{5}{9}$

   d. $3\frac{1}{5} = 17 - 13\frac{4}{5}$

   SRB 85 86

4. Write 5 names for the number 10 in the name-collection box. Each name should include the number (−2) and involve subtraction. Sample answers:

10
$8 - (-2)$
$(-6 * -2) - 2$
$\sqrt{64} - (-2)$
$(6 * 5) - (-2 * -10)$
$\frac{-2 * -50}{4} - 15$

   SRB 95 96

5. The spreadsheet shows how Jonas spent his money for the first quarter of the year.

   a. In which cell is the largest amount that Jonas spent? D2

   b. Calculate the values for cells E2, E3, and E4 and enter them in the spreadsheet.

	A	B	C	D	E
1	Month	Food	Movies	Music	Total
2	January	\$38.50	\$34.00	\$62.50	\$135.00
3	February	\$29.45	\$28.70	\$26.89	\$85.04
4	March	\$34.90	\$41.86	\$48.30	\$125.06

   c. Circle the correct formula for calculating the amount of money Jonas spent in February.

   D1 + D2 + D3 D3 − C2 + C3 B3 + C3 + D3

   SRB 143 144

Math Journal 2, p. 312

Study Link Master

Name Date Time

STUDY LINK 8•9 **Scale Drawings**

Measure the object in each drawing to the nearest millimeter. Then use the size-change factor to determine the actual size of the object.

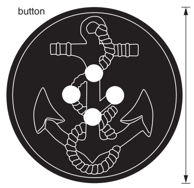
Size-change Factor: $\frac{\text{changed length}}{\text{actual length}}$

1. a. Diameter in drawing: 64 mm

b. Actual diameter: 32 mm

Size Change	Size-change Factor
Scale 2:1	2

button



2. a. Height in drawing: 45 mm

b. Actual height: 180 mm

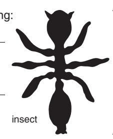
glue bottle

Size Change	Size-change Factor
$\frac{1}{4}$X	$\frac{1}{4}$

3. a. Length in drawing: 45 mm

b. Actual length: 15 mm

insect



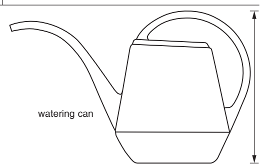
Size Change	Size-change Factor
Scale 3:1	3

4. a. Height in drawing: 55 mm

b. Actual height: 165 mm

Size Change	Size-change Factor
Scale 1:3	$\frac{1}{3}$

watering can



Math Masters, p. 265

Study Link 8•9

INDEPENDENT ACTIVITY

(*Math Masters,* p. 265)

Home Connection Students calculate the original size of objects shown in scale drawings.

3 Differentiation Options

READINESS

PARTNER ACTIVITY

5–15 Min

ELL

Considering What Size Change Means

(*Math Masters,* p. 266)

Students explore the effect of increasing or reducing a measurement or an event by a factor of 10. They complete a table of "10 times as much" and "$\frac{1}{10}$ as much" for everyday items or events. Have students share the item or the event they wrote in the last row. This is especially beneficial for English language learners.

Teaching Master

Name Date Time

LESSON 8•9 **Considering Size Changes**

A size change of "10 times as many" or "$\frac{1}{10}$ as many" can mean a big difference when considering events or items.

Complete the table below. Use the last row to write your own event or item.

Event or Item	Original Measure or Count	10 Times as Much or Many	$\frac{1}{10}$ as Much or Many
Length of your math journal (in millimeters)			
Length of your stride (in millimeters)		Answers vary.	
Number of students in your math class			
Length of school day (in minutes)			

Name Date Time

LESSON 8•9 **Considering Size Changes**

A size change of "10 times as many" or "$\frac{1}{10}$ as many" can mean a big difference when considering events or items.

Complete the table below. Use the last row to write your own event or item.

Event or Item	Original Measure or Count	10 Times as Much or Many	$\frac{1}{10}$ as Much or Many
Length of your math journal (in millimeters)			
Length of your stride (in millimeters)			
Number of students in your math class			
Length of school day (in minutes)			

Math Masters, p. 266

EXTRA PRACTICE

PARTNER ACTIVITY

15–30 Min

Finding Dimensions of Objects Based on Scale Models

(*Math Masters,* p. 267)

Students study scale drawings of objects and then calculate the actual dimensions. They discover that a size-change factor, which applies to lengths, does not apply to areas.

EXTRA PRACTICE

INDEPENDENT ACTIVITY

5–15 Min

Investigating Perimeter and Size-Change Factor

(*Math Masters,* p. 268)

Students measure the dimensions of polygons and determine the size-change factors. This activity is a review of scale factors from *Fifth Grade Everyday Mathematics.*

Illustrating Terms

PARTNER ACTIVITY

15–30 Min

Students make posters illustrating the meaning of *enlargement* and *reduction*. The posters should include labels. After students present their posters to the class, display the posters in the classroom to facilitate vocabulary development.

Planning Ahead

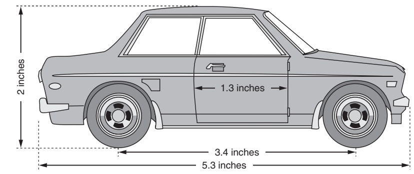
Students will use pattern blocks in Lesson 8-10. Each partnership will need at least 16 triangles and 10 trapezoids. Other shapes are useful but not required. If you do not have these materials, you might be able to borrow them from another teacher.

Teaching Master

Name Date Time

LESSON 8•9 **Reductions: Scale Models**

The dimensions in the drawing below are for a scale model of an actual car. Every length measured on the scale model is $\frac{1}{30}$ of the same length on the actual car.

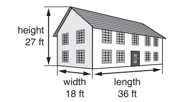


$\frac{1}{30}$ actual size Scale: 1:30 1 inch represents 30 inches.

1. Use the information in the drawing to find the dimensions of the actual car.
   - a. length = 159 inches = $13\frac{1}{4}$ feet
   - b. wheel base = 102 inches = $8\frac{1}{2}$ feet
   - c. height = 60 inches = 5 feet
   - d. door width = 39 inches = $3\frac{1}{4}$ feet

2. Aletta's dad built her a dollhouse that is a scale model of the house pictured at the right. The model was built to a scale of 1 to 12.

   $\frac{\text{model length}}{\text{actual length}} = \frac{1 \text{ ft}}{12 \text{ ft}}$



   - a. Find the dimensions of the scale model.
     length = 3 feet width = 1.5 feet height = 2.25 feet
   - b. Find the area of the first floor.
     Scale model = 4.5 ft^2 Actual house = 648 ft^2
   - c. Find the following ratios.
     $\frac{\text{(length of actual house)}}{\text{(length of scale model)}}$ $\frac{\boxed{12} \text{ ft}}{1 \text{ ft}}$ $\frac{\text{(first-floor area of actual house)}}{\text{(first-floor area of scale model)}}$ $\frac{\boxed{648} \text{ ft}^2}{\boxed{4.5} \text{ ft}^2} = \frac{\boxed{144} \text{ ft}^2}{1 \text{ ft}^2}$
   - d. Compare the ratio of the lengths to the ratio of the areas. Are they the same? No
   - e. How many times greater is the ratio of the areas than the ratio of the lengths? 12 times

Math Masters, p. 267

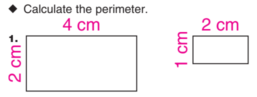
Teaching Master

Name Date Time

LESSON 8•9 **Perimeter of Figures**

- Measure the sides of each polygon below to the nearest half-centimeter. Record your measurements next to the sides. Circle Enlargement or Reduction.
- Record the size-change factor. (*Reminder:* This is the ratio of the measures of the enlarged or reduced polygon to the measures of the original polygon.)
- Calculate the perimeter.

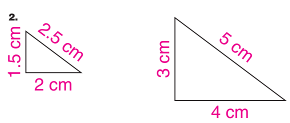
1.



Perimeter 12 cm

Enlargement Reduction
Size-change factor $\frac{1}{2}$
Perimeter 6 cm

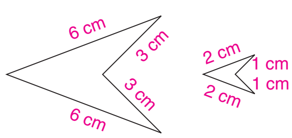
2.



Enlargement Reduction
Size-change factor 2
Perimeter 12 cm

Perimeter 6 cm

3.



Enlargement Reduction
Size-change factor $\frac{1}{3}$
Perimeter 6 cm

Perimeter 18 cm

4. Explain how the perimeter and the size-change factor are related.
Sample answer: The perimeter is enlarged or reduced by the same size-change factor as the sides of the polygons.

Math Masters, p. 268