Please get your clickers - there are only 2 clicker questions in today's lesson.

4-6 Scale Models and Maps

Check Skills You'll Need

1. **Vocabulary Review** A *product* is the result of which operation?

Multiply.

2. 4×3.2
3. 7.6×5.9
4. 1.8×22
5. 13×6.5

GO for Help Skills Handbook

What You'll Learn

To use proportions to solve problems involving scale

New Vocabulary scale model, scale

Why Learn This?

When building a large object, such as a car, you can make a scale model first to get an idea of what the object will look like.

A **scale model** is a model similar to the actual object it represents. The **scale** of a model is the ratio of the length of the model to the corresponding length of the actual object.

Why Learn This?

When you know how scales work, you can see them in everything from maps to giant sculptures.

A **scale drawing** is an enlarged or reduced drawing of an object that is similar to the actual object.

A **scale** is the ratio that compares a length in a drawing or model to the corresponding length in the actual object. If a 15-foot boat is 1 inch long on a drawing, you can write the scale of the drawing in these three ways.

$1 \text{ in.} : 15 \text{ ft}$ (1 in. ↑ drawing, 15 ft ↑ actual)

$\frac{1 \text{ in.}}{15 \text{ ft}}$

$1 \text{ in.} = 15 \text{ ft}$

1 cm = 2.5 m

EXAMPLE 1 Using a Scale Drawing

Algebra The length of the side of a house is 3 cm on a scale drawing. What is the actual length of the side of the house?

You can write the scale of the drawing as $\frac{1 \text{ cm}}{2.5 \text{ m}}$. Then write a proportion. Let n represent the actual length of the house.

drawing (cm) → $\frac{1}{2.5} = \frac{3}{n}$ ← drawing (cm)
actual (m) → ← actual (m)

$1n = 2.5(3)$ ← Write the cross products.

$n = 7.5$ ← Simplify.

The actual length is 7.5 m.

Example

1 Using a Scale Drawing The scale of a drawing is 1 in. : 6 ft. The length of a wall is 4.5 in. on the drawing. Find the actual length of the wall.

You can write the scale of the drawing as $\frac{1 \text{ in.}}{6 \text{ ft}}$. Then write a proportion.

Let n represent the actual length.

drawing (in.) → $\frac{1}{6} = \frac{\boxed{4.5}}{n}$ ← drawing (in.)
actual (ft) → ← actual (ft)

$\boxed{1}n = \boxed{6}(4.5)$ ← Write the cross products.

$n = \boxed{27}$ ← Simplify.

The actual length is $\boxed{27}$ ft.

EXAMPLE Using Proportions to Solve Problems

1 Museums The Museum of Science and Industry in Chicago has a scale model of a human heart that is large enough for people to walk through. The height of the model is 16 ft. The scale used is 1 ft : $\frac{9}{32}$ in. What is the height of the actual heart on which the model is based?

Let h = the height of the actual heart.

model height (ft) → $\frac{1}{\frac{9}{32}}$ = $\frac{16}{h}$ ← model height (ft)
actual height (in.) → ← actual height (in.)

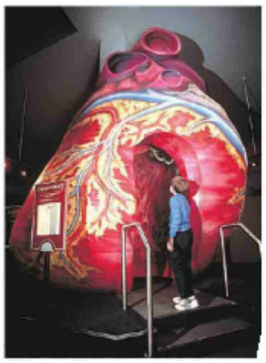
$1 \cdot h = 16 \cdot \frac{9}{32}$ ← Write the cross products.

$h = \overset{1}{\cancel{16}} \cdot \frac{9}{\cancel{32}_{2}}$ ← Divide 16 and 32 by the GCF.

$h = \frac{9}{2}$ ← Simplify.

$h = 4\frac{1}{2}$ ← Write the improper fraction as a mixed number.

The height of the actual heart is $4\frac{1}{2}$ in.



This model heart would fit in a person who is 28 stories tall!

The Museum of Science and Industry in Chicago has a scale model of a human heart that is large enough for people to walk through. The scale used is 1 foot : 9/32 in. Suppose the width of the scale model is 10 feet. What is the width of the actual heart?

A 3 1/16 inch

B 10 9/32 inch

C 35 5/9 inch

D 2 13/16 inch

You can use the scale of a map to find actual distances between locations.

EXAMPLE 2 Application: Geography

Multiple Choice Find the map distance from Columbus, Georgia, to Birmingham, Alabama. Which is closest to the actual distance?

(A) 120 mi (C) 140 mi
(B) 130 mi (D) 150 mi

The map distance is about $1\frac{3}{4}$ in., or 1.75 in.

Let x = the actual distance.

$$\begin{array}{rl} \text{map (in.)} \rightarrow \text{actual (mi)} \rightarrow & \dfrac{1}{75} = \dfrac{1.75}{x} \quad \begin{array}{l}\leftarrow \text{map (in.)} \\ \leftarrow \text{actual (mi)}\end{array} \\ 1 \cdot x = 75 \cdot 1.75 & \leftarrow \text{Write the cross products.} \\ x = 131.25 & \leftarrow \text{Simplify.} \end{array}$$

The distance from Birmingham to Columbus is about 130 mi. The correct answer is choice B.

Examples

2 Finding the Scale of a Model The actual length of the wheelbase of a mountain bike is 260 cm. The length of the wheelbase in a scale drawing is 4 cm. Find the scale of the drawing.

$$\begin{array}{rl} \text{scale length} \rightarrow \text{actual length} \rightarrow & \dfrac{4}{260} = \dfrac{4 \div \boxed{4}}{260 \div \boxed{4}} = \dfrac{\boxed{1}}{\boxed{65}} \end{array} \quad \leftarrow \text{Write the ratio in simplest form.}$$

The scale is $\boxed{1}$ cm : $\boxed{65}$ cm.

3 Multiple Choice You want to make a scale model of a house that is 72 feet long and 24 feet tall. You plan to make the model 12 inches long. Which equation can you use to find x, the height of the model?

A. $\frac{24}{72} = \frac{x}{12}$ **B.** $\frac{12}{72} = \frac{x}{24}$ **C.** $\frac{12}{24} = \frac{x}{72}$ **D.** $\frac{x}{24} = \frac{72}{12}$

model (in.) → $\frac{12}{72} = \frac{?}{?}$ ← model (in.), ← actual (ft) ← Write a proportion.

actual (ft) →

$\frac{12}{72} = \frac{x}{24}$ ← Fill in the information you know. Use x for the information you don't know.

The correct answer is **B**.

A carpenter is making some furniture based on tiny furniture from an old dollhouse. The *scale* of the models is $\frac{5}{2}$ in. : 1 ft. The height of a footstool in the dollhouse is 3 in. What is the height of the carpenter's footstool?

① Write a proportion. Let h = height of the carpenter's footstool. Be sure the terms of the ratios match.

$$\frac{\frac{5}{2}}{1} = \frac{3}{h} \quad \frac{\text{model height (in.)}}{\text{actual height (ft)}}$$

② Use cross products.

$$\frac{5}{2}h = 3$$

③ Solve.

$$h = \frac{6}{5}$$

$$h = 1\frac{1}{5}$$

The height of the carpenter's footstool is $1\frac{1}{5}$ ft.

The carpenter wants to make a dresser based on the dollhouse furniture. The scale is 5/2 inch : 1 foot. The height of the dresser in the dollhouse is 15 inches. What is the height of the carpenter's dresser?

Text in your answer.

You can power down your clickers and put them away. You have an assignment worksheet.

Name _____ Class _____ Date _____

Reteaching 4-6

Scale Models and Maps

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① Write a proportion. Let h = height of the carpenter's footstool. Be sure the terms of the ratios match.

$$\frac{\frac{5}{2}}{1} = \frac{3}{h} \quad \frac{\text{model height (in.)}}{\text{actual height (ft)}}$$

② Use cross products.

$$\frac{5}{2}h = 3$$

③ Solve.

$$h = \frac{6}{5}$$

$$h = 1\frac{1}{5}$$

The height of the carpenter's footstool is $1\frac{1}{5}$ ft.

Write a proportion, then solve. Label your answers.

1. The carpenter wants to make a dresser based on the dollhouse furniture. The scale is $\frac{5}{2}$ in. : 1 ft. The height of the dresser in the dollhouse is 10 in. What is the height of the carpenter's dresser?

_____

2. The carpenter uses colonial doll furniture with a scale of $\frac{9}{2}$ in. : 1 ft as a model. The length of a doll's bed is 27 in. What is the length of the carpenter's bed?

_____

3. The scale of some Victorian doll furniture is $\frac{15}{4}$ in. : 1 ft. The height of the doll's table is 12 in. What is the height of the carpenter's table?

_____

4. The scale of some modern doll furniture is $\frac{7}{2}$ in. : 1 ft. The length of a doll's sofa is 28 in. What is the length of the carpenter's sofa?

_____

5. The carpenter wants to make a desk like a doll's desk that is $10\frac{1}{2}$ in. high. The scale is $\frac{7}{5}$ in. : 1 ft. What is the height of the carpenter's desk?

_____

6. Ruth makes a scale drawing of her room. She uses the scale $\frac{3}{2}$ in. : 1 ft. In the drawing, the dimensions of her room are 18 in. by 24 in. What are the actual dimensions of her room?

_____ **and** _____