

Review What You Know!

GET READY! **TOPIC 10**

Vocabulary

Choose the best term from the box to complete each definition.

- The number of square units that a figure covers is its _____.
- The _____ of a triangle is the length of the perpendicular line segment from a vertex to the opposite side.
- The _____ of a solid figure is the number of cubic units needed to fill it.
- Any line segment that connects the center of a circle to a point on the circle is called a _____.

area
base
diameter
height
radius
volume

Area and Volume

Find each measure.

- Area of a triangle with a base 6 feet and height 9 feet
- Volume of a rectangular prism with length 4 inches, width 2 inches, and height 2 inches

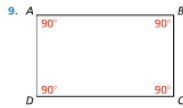
Measure Angles

Use a protractor to find the measure of each angle.



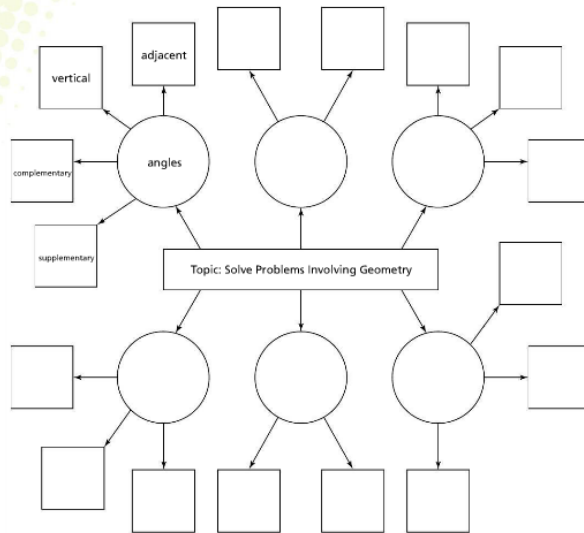
Describe Characteristics of Shapes

Describe this figure using as many geometry terms as you can.




Build Vocabulary

As you work through Topic 10, use this Word Web to connect key words. As an example, the word *angles* has been placed in the web along with four related words. You can draw additional lines and boxes to make more connections if you want.



Explore It!

Calvin made a scale model of the plane shown.



A. How can you represent the relationship between the model of the plane and the actual plane?

B. What do you notice about the relationship between the model of the plane and the actual plane?

Lesson 10-1
Solve Problems Involving Scale Drawings

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I can...
use the key in a scale drawing to find missing measures.

Focus on math practices

Look for Relationships If the model and the actual plane are to scale, what do you know about the relationship between all the other parts of the model and the actual plane, aside from the total length?

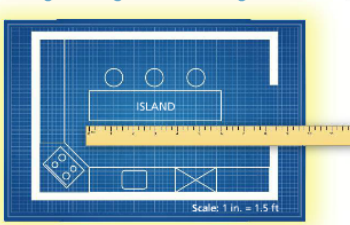
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Essential Question How do scale drawings and actual measurements represent proportional relationships?

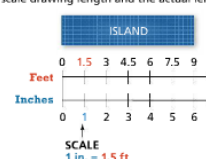
EXAMPLE 1 Find Actual Lengths Using a Scale Drawing

The island in the blueprint is 6 inches long. What is the actual length of the island in the kitchen?

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



Use a double number line to represent the scale drawing length and the actual length.



SCALE
1 in. = 1.5 ft

Use a proportion to find the actual length, x , of the island.

$$\frac{1.5}{1} = \frac{x}{6}$$

Use the scale $\frac{1.5 \text{ ft}}{1 \text{ in}}$ to write the proportion.

$$\frac{1.5}{1} \cdot 6 = \frac{x}{6} \cdot 6$$

$$9 = x$$

Look for Relationships The ratio $\frac{1.5 \text{ ft}}{1 \text{ in}}$ will be the constant scale factor for all lengths in the drawing relative to the actual lengths.

The actual length of the island is 9 feet.

Try It!

What is the actual width, w , of the island if the width in the drawing is 2.5 inches?

Convince Me! How would the proportion for Example 1 change if the scale changed?

$$\frac{1.5}{1} \cdot \square = \frac{w}{\square}$$

$$\square = w$$

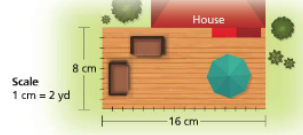
The actual width of the island is \square feet.

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EXAMPLE 2 Use Scale Factors to Solve Area Problems

What is the area, in square yards, of the deck represented by the scale drawing?

Use Structure You can use an equation in the form $y = kx$ to represent the proportional relationship between lengths in the scale drawing, x , and actual lengths, y . The constant of proportionality, k , is the scale factor.



- STEP 1** Find the actual length, L , of the deck using the length, l , in the scale drawing.
 $L = kl$
 $= 2 \cdot 16$
 $= 32$
 The actual length is 32 yards.
- STEP 2** Find the actual width, W , of the deck using the width, w , in the scale drawing.
 $W = kw$
 $= 2 \cdot 8$
 $= 16$
 The actual width is 16 yards.
- STEP 3** Calculate the actual area of the deck.
 $\text{Area} = \text{Length} \times \text{Width}$
 $= 32 \times 16$
 $= 512$
 The actual area of the deck is 512 square yards.

EXAMPLE 3 Reproduce a Scale Drawing at a Different Scale

Students are recreating the landscape drawing shown at the right for a mural. They want the length of the drawing on the mural to be 80 inches. What will be the new scale and the height of the drawing on the mural?

Look for Relationships What is the scale factor, k , that relates the actual lengths to the lengths in the scale drawing?



- STEP 1** Find the actual length, L , and actual height, H , of the landscape.
 $L = k \cdot 10$
 $= 4 \cdot 10$
 $= 40$
 The actual dimensions of the landscape are 40 feet by 32 feet.
- $H = k \cdot 8$
 $= 4 \cdot 8$
 $= 32$
- STEP 2** Find the new scale for the mural to the actual landscape.
 $\frac{40 \text{ ft}}{80 \text{ in.}} = \frac{7 \text{ ft}}{1 \text{ in.}}$
 $? = 0.5$
 The new scale of 1 in. = 0.5 ft means 1 inch on the mural represents 0.5 feet in the actual landscape.
- STEP 3** Find the height, h , of the drawing on the mural using the new scale.
 $H = kh$
 $32 = 0.5 \cdot h$
 $64 = h$
 The dimensions of the drawing on the mural are 80 inches by 64 inches.

Try It!

The scale drawing shown represents an existing barn. The shortest side of the barn measures 150 meters. If a new barn that is $\frac{2}{3}$ its size replaces the existing barn, what will be the scale of this drawing?



KEY CONCEPT

The scale factor of a scale drawing is the ratio of an actual length, y , to the corresponding length, x , in the drawing. The ratio is the constant of proportionality, k , that relates the actual figure to the scale drawing. You can use a proportion or use an equation of the form $y = kx$ to solve problems involving scale drawings.



Do You Understand?

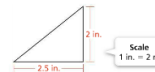
1. **Essential Question** How do scale drawings and actual measurements represent proportional relationships?

2. **Generalize** Describe the ratio of corresponding measures in scale drawings and the actual measures they represent.

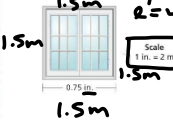
3. **Reasoning** Mikayla is determining the actual distance between Harriville and Lake Town using a map. The scale on her map reads 1 inch = 50 miles. She measures the distance to be 4.5 inches and writes the following proportion:
 $\frac{1 \text{ in.}}{4.5 \text{ in.}} = \frac{50 \text{ mi}}{x \text{ mi}}$
 Explain why her proportion is equivalent to $30 \text{ mi} = x \text{ mi}$ and $1 \text{ in.} = 4.5 \text{ in.}$.

Do You Know How?

4. What is the actual base length of the triangle depicted in the scale drawing?



5. What is the area of the actual square window shown in the scale drawing?



Handwritten work for question 5:
 $\frac{1 \text{ in.}}{2 \text{ m}} = \frac{1.5 \text{ m}}{x \text{ m}}$
 $1 \cdot x = 2 \cdot 0.75$
 $x = 1.5 \text{ or } \frac{1}{2}$
 $A = 1.5 \text{ m} \cdot 1.5 \text{ m}$
 $A = 2.25 \text{ m}^2$
 or $2 \frac{1}{4} \text{ m}^2$

6. A distance of 30 miles on a map is represented by a 2-inch line. If the map is enlarged to $\frac{2}{3}$ times its size, what will be the length of the enlarged map?

Handwritten work for question 6:
 Actual $y = k \cdot x$ or map
 $30 = k \cdot 2 \cdot \frac{2}{3}$
 $30 = k \cdot \frac{4}{3}$
 $30 = \frac{4k}{3}$
 $5 = k$
 $y = 5x$
 New Scale: 1 in = 5 mi

Name: _____

Practice & Problem Solving

Leveled Practice For 7 and 8, fill in the boxes to find the actual measures.

7. On a map, 1 inch equals 5 miles. Two cities are 8 inches apart on the map.
What is the actual distance between the cities?

$\frac{\square}{\square} = \frac{x}{8}$
 $x = \square$ miles

8. Ryan makes a scale drawing of a banner for a school dance. He uses a scale of 1 inch = 3 feet, and the width of the drawing is 5 inches.
What is the actual width, w , of the banner?

$\frac{\square}{1} = \frac{w}{5}$
 $w = \square$ feet

9. On a map, 1 inch equals 7.2 miles. Two houses are 1.5 inches apart on the map. What is the actual distance between the houses?

10. The original blueprint for the Morenos' living room has a scale of 2 inches = 5 feet. The family wants to use a new blueprint that shows the length of the living room to be 15 inches. If the width of the living room on the original blueprint is 6 inches and the length is 9.6 inches, what are the scale and the width of the new blueprint?

11. The scale for a drawing of the tennis court is 1 centimeter = 2 meters. What is the area of the actual tennis court?

Handwritten notes for problem 11:
 Length: $\frac{1 \text{ cm} \times 10}{2 \text{ m} \times 10} = \frac{10 \text{ cm}}{2 \text{ m}}$
 $2 = 20 \text{ m}$
 $A = 20 \times 11 = 220 \text{ m}^2$
 $\frac{11}{20} \times 20 = 11 \text{ m}$
 The area of the actual tennis court is $220 \text{ m}^2 = 11 \text{ m}$
 $1 \text{ cm} = 2 \text{ m}$
 $2 \text{ m} = 5.5 \text{ cm}$
 $\frac{1 \text{ cm}}{2 \text{ m}} = \frac{5.5 \text{ cm}}{w \text{ m}}$
 $1 \times w = 11.0$
 $w = 11.0$

12. The scale for the drawing of a rectangular playing field is 2 inches = 5 feet.
 a. Write an equation you can use to find the dimensions of the actual field, where x is a dimension of the scale drawing (in inches) and y is the corresponding dimension of the actual field (in feet).
 b. What is the area of the field?

Diagram for problem 12: A rectangle with Length 20 in. and Width 10 in.

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13. How many square feet of flooring are needed to cover the entire floor of Bedroom 1?

Diagram for problem 13: A floor plan of Bedroom 1 with a grid. Scale: 1 in. = 4 ft. The gridlines are spaced 1 inch apart.

14. The actual distance between Point A and Point B is 200 meters. A length of 1.9 feet represents this distance on a certain wall map. Point C and Point D are 3.8 feet apart on this map. What is the actual distance between Point C and Point D?

Diagram for problem 14: A map showing a path with points A, B, C, and D. Distance AB is 1.9 ft, distance CD is 3.8 ft.

Assessment Practice

16. The original blueprint of a concrete patio has a scale of 2 inches = 3 feet.
 Victoria wants to make a new blueprint of the patio with a length of 16.8 inches.

PART A
 What is the scale for the new blueprint?

PART B
 What is the width of the blueprint with the new scale?

Diagram for problem 16: A rectangle labeled "Original Blueprint" with Length 14 in. and Width 12 in.

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