7-4 Scale Drawings

Use Math Tools **Find the actual distance between the pair of locations in South Carolina. Use a ruler to measure.**

1. Columbia and Charleston

   SOLUTION:

   Sample answer: Using the student edition, the distance between the two cities on the map is 3.8 centimeters. Write and solve a proportion using the scale. Let d represent the actual distance between the cities.

   $$\frac{\text{map} \rightarrow 1 \text{ cm}}{\text{actual} \rightarrow 27 \text{ m}} = \frac{3.8 \text{ cm} \leftarrow \text{map}}{d \text{ m} \leftarrow \text{actual}}$$
   $$1 \times d = 3.8 \times 27$$
   $$d = 102.6$$

   So, the actual distance between Columbia and Charleston is 102.6 miles.

   ANSWER:

   102.6 mi; Approximate distances are given.

2. Hollywood and Sumter

   SOLUTION:

   Sample answer: Using the student edition, the distance between the two cities on the map is 3 centimeters. Write and solve a proportion using the scale. Let d represent the actual distance between the cities.

   $$\frac{\text{map} \rightarrow 1 \text{ cm}}{\text{actual} \rightarrow 27 \text{ m}} = \frac{3 \text{ cm} \leftarrow \text{map}}{d \text{ m} \leftarrow \text{actual}}$$
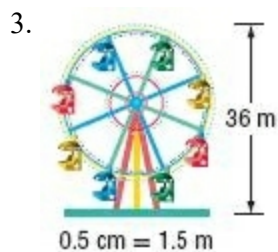 $$1 \times d = 3 \times 27$$
   $$d = 81$$

   So, the actual distance between Hollywood and Sumter is 81 miles.

   ANSWER:

   81 mi; Approximate distances are given.

Find the length of the model. Then find the scale factor.

3.

0.5 cm = 1.5 m

SOLUTION:

$$\frac{0.5 \text{ cm}}{1.5 \text{ m}} = \frac{x \text{ cm}}{36 \text{ m}}$$

$$0.5 \bullet 36 = 1.5 \bullet x$$

$$18 = 1.5x$$

$$\frac{18}{1.5} = \frac{1.5x}{1.5}$$
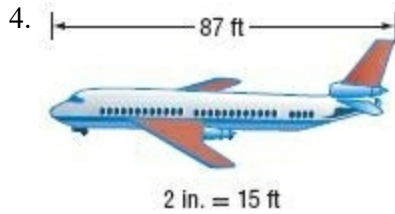
$$12 = x$$

The model is 12 cm tall.

To find the scale factor, first convert cm to m: 0.5 cm = 0.005 m. Next make a ratio and simplify.

$$\frac{0.005}{1.5} = \frac{5}{1500} \text{ or } \frac{1}{300}$$

ANSWER:

12 cm; $\frac{1}{300}$

7-4 Scale Drawings

4.

87 ft

2 in. = 15 ft

SOLUTION:

$$\frac{2 \text{ in.}}{15 \text{ ft}} = \frac{x \text{ in.}}{87 \text{ ft}}$$
$$2 \cdot 87 = 15 \cdot x$$
$$174 = 15x$$
$$\frac{174}{15} = \frac{15x}{15}$$
$$11\frac{9}{15} = x$$
$$11\frac{3}{5} = x$$

The model is $11\frac{3}{5}$ inches long.

To find the scale factor, first convert ft to in.: 15 ft = 180 in. Next make a ratio and simplify.

$$\frac{2}{180} = \frac{1}{90}$$

ANSWER:

$11\frac{3}{5}$ in.; $\frac{1}{90}$

5. A model of an apartment is shown where $\frac{1}{4}$ inch represents 3 feet in the actual apartment. Find the actual area of the master bedroom.

SOLUTION:

The scale is $\dfrac{1}{4}$ inch $= 3$ feet. Use the scale to find the dimensions of the master bedroom.

$$\frac{\frac{1}{4}\text{ in.}}{3\text{ ft}} = \frac{1\text{ in.}}{x\text{ ft}}$$

$$\frac{1}{4} \bullet x = 1 \bullet 3$$

$$\frac{1}{4}x = 3$$

$$(4) \bullet \frac{1}{4}x = (4) \bullet 3$$

$$x = 12$$

The length of the master bedroom is 12 feet.

$$\frac{\frac{1}{4}\text{ in.}}{3\text{ ft}} = \frac{\frac{3}{4}\text{ in.}}{x\text{ ft}}$$

$$\frac{1}{4} \bullet x = \frac{3}{4} \bullet 3$$

$$\frac{1}{4}x = \frac{9}{4}$$

$$(4) \bullet \frac{1}{4}x = (4) \bullet \frac{9}{4}$$

$$x = 9$$

The width of the master bedroom is 9 feet.

The dimensions of the master bedroom is 12 feet by 9 feet.
Multiply the length by the width to find the area.
$12 \times 9 = 108$
So, the area of the master bedroom is 108 square feet.

ANSWER:

108 ft^2

6. **Model with Mathematics** Refer to the graphic novel frame at the beginning of the chapter. The scale on the map shows that 1 centimeter is equal to 75 yards. If the red line represents the path they took, how far have Raul, Caitlyn, and Jamar traveled since they left the lake? The red line is 17 centimeters long.
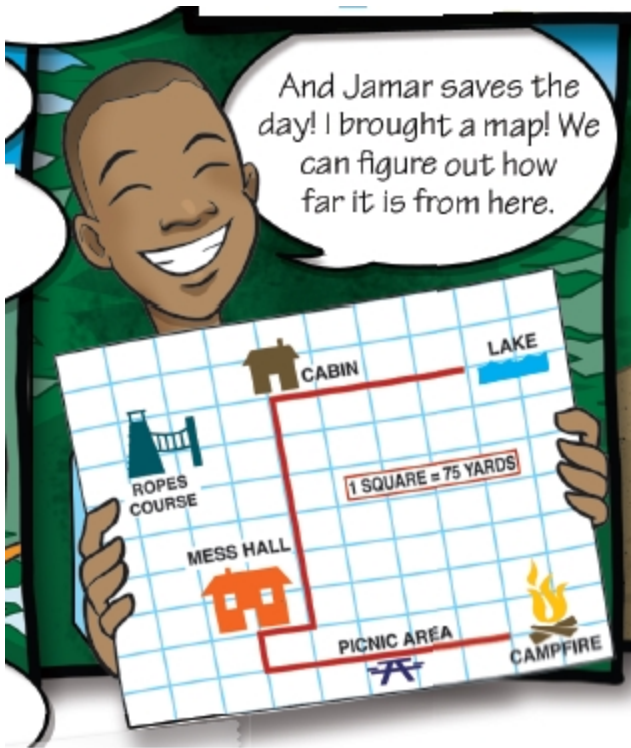
SOLUTION:

Since the length of the red line is 17 centimeters long and 1 centimeter is equal to 75 yards, multiply 17 times 75.
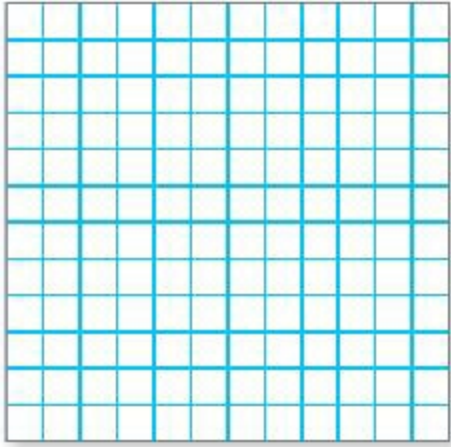
$17 \times 75 = 1,275$

So, Raul, Caitlyn, and Jamar traveled 1,275 yards.

ANSWER:

1,275 yards

7-4 Scale Drawings

7. **Model with Mathematics** On the grid paper, create a scale drawing of a room in your home. Include the scale that you used.

SOLUTION:

Student work will vary, but should include the basic dimensions of a room, including length and width. If the room is oddly shaped, students should have attempted to model the actual shape of the room. Students should correctly use scale to represent the actual size of the room.

ANSWER:

See students' work.

8. **Reason Abstractly** The statue of Thomas Jefferson was made using a scale of 1 foot = 3 feet. Write an expression to represent the height of the statue if Thomas Jefferson is x feet in height. Then find his actual height if the height of the statue is 19 feet.

SOLUTION:

The expression $3x$ shows that the height of the statue is 3 times the height x of Thomas Jefferson.
Using the scale of 1 foot = 3 feet, write a proportion to find the actual height of Thomas Jefferson if the height of the statue is 19 feet. Let x represent the actual height of Thomas Jefferson.

$$\frac{1 \text{ ft}}{3 \text{ ft}} = \frac{x \text{ ft}}{19 \text{ ft}}$$

$$1 \bullet 19 = 3 \bullet x$$

$$19 = 3x$$

$$\frac{19}{3} = \frac{3x}{3}$$

$$6\frac{1}{3} \text{ or } 6.333... = x$$

Since $\frac{1}{3}$ foot = 4 inches, Thomas Jefferson's actual height was about $6\frac{1}{3}$ feet or 6 feet 4 inches.

ANSWER:

$3x$; $6\frac{1}{3}$ ft or 6 ft 4 in.

9. **Justify Conclusions** Determine whether the following statement is *always, sometimes,* or *never* true. Justify your reasoning.

   If the scale factor of a scale drawing is greater than one, the scale drawing is larger than the actual object.

   SOLUTION:

   always; Sample answer: A sale factor of $\frac{3}{1}$ means that 3 units of the drawing is equal to 1 unit of the object, so the scale drawing or model will be larger than the actual object.

   ANSWER:

   always; Sample answer: A sale factor of $\frac{3}{1}$ means that 3 units of the drawing is equal to 1 unit of the object, so the scale drawing or model will be larger than the actual object.

   Use Math Tools Find the actual distance between the pair of cities in New Mexico. Refer to page 581 in the book and use a ruler to measure.

10. Carlsbad and Artesia

    SOLUTION:

    Sample answer: Using the student edition, the distance between the two cities on the map is 2 centimeters. Write and solve a proportion using the scale. Let *d* represent the actual distance between the cities.

$$\frac{\text{map} \rightarrow \ 1\ \text{cm}}{\text{actual} \rightarrow 25\ \text{km}} = \frac{2\ \text{cm} \leftarrow \text{map}}{d\ \text{km} \leftarrow \text{actual}}$$
$$1 \times d = 2 \times 25$$
$$d = 50$$

    So, the actual distance between Carlsbad and Artesia is 50 kilometers.

    ANSWER:

    50 km; Approximate distances are given.

7-4 Scale Drawings

11. Hobbs and Eunice

   SOLUTION:

   Sample answer: Using the student edition, the distance between the two cities on the map is 1.2 centimeters. Write and solve a proportion using the scale. Let *d* represent the actual distance between the cities.

   $$\frac{\text{map} \rightarrow 1 \text{ cm}}{\text{actual} \rightarrow 25 \text{ km}} = \frac{1.2 \text{ cm} \leftarrow \text{map}}{d \text{ km} \leftarrow \text{actual}}$$
   $$1 \times d = 1.2 \times 25$$
   $$d = 30$$

   So, the actual distance between Hobbs and Eunice is 30 kilometers.

   ANSWER:

   30 km; Approximate distances are given.

12. Artesia and Eunice

   SOLUTION:

   Sample answer: Using the student edition, the distance between the two cities on the map is 5.2 centimeters. Write and solve a proportion using the scale. Let *d* represent the actual distance between the cities.

   $$\frac{\text{map} \rightarrow 1 \text{ cm}}{\text{actual} \rightarrow 25 \text{ km}} = \frac{5.2 \text{ cm} \leftarrow \text{map}}{d \text{ km} \leftarrow \text{actual}}$$
   $$1 \times d = 5.2 \times 25$$
   $$d = 130$$

   So, the actual distance between Artesia and Eunice is 130 kilometers.

   ANSWER:

   130 km; Approximate distances are given.

13. Lovington and Carlsbad

   SOLUTION:

   Sample answer: Using the student edition, the distance between the two cities on the map is 4.1 centimeters. Write and solve a proportion using the scale. Let *d* represent the actual distance between the cities.

   $$\frac{\text{map} \rightarrow 1 \text{ cm}}{\text{actual} \rightarrow 25 \text{ km}} = \frac{4.1 \text{ cm} \leftarrow \text{map}}{d \text{ km} \leftarrow \text{actual}}$$
   $$1 \times d = 4.1 \times 25$$
   $$d = 102.5$$

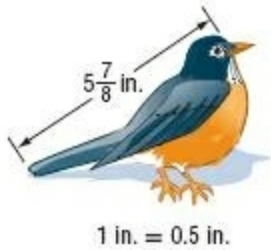   So, the actual distance between Lovington and Carlsbad is 102.5 kilometers.

   ANSWER:

   102.5 km; Approximate distances are given.

14. Find the length of the model. Then find the scale factor. The length of an actual bird is shown at below.

1 in. = 0.5 in.

SOLUTION:

$$\frac{1 \text{ in.}}{0.5 \text{ in.}} = \frac{x \text{ in.}}{5\frac{7}{8} \text{ in.}}$$

$$1 \bullet 5\frac{7}{8} = 0.5 \bullet x$$

$$5\frac{7}{8} = 0.5x$$

$$5\frac{7}{8} = \frac{1}{2}x$$

$$(2) \bullet \frac{47}{8} = (2) \bullet \frac{1}{2}x$$

$$\frac{47}{4} = x$$

$$11\frac{3}{4} = x$$

The model is $11\frac{3}{4}$ inches long.

To find the scale factor, make a ratio and simplify.

$$= \frac{1}{0.5} = \frac{10}{5} = \frac{2}{1}$$

ANSWER:

$11\frac{3}{4}$ in.; $\frac{2}{1}$

7-4 Scale Drawings

Copy and Solve **Show your work on a separate piece of paper.**

15. A model of a tree is made using a scale of 1 inch = 25 feet. What is the height of the actual tree if the height of the model is $4\frac{3}{8}$ inches?

SOLUTION:

$$\frac{1 \text{ in.}}{25 \text{ ft}} = \frac{4\frac{3}{8} \text{ in.}}{x \text{ ft}}$$

$$1 \cdot x = 4\frac{3}{8} \cdot 25$$

$$x = \frac{35}{8} \cdot 25$$

$$x = \frac{875}{8} \text{ or } 109\frac{3}{8}$$

The height of the actual tree is $109\frac{3}{8}$ feet .

ANSWER:

$109\frac{3}{8}$ ft

16. A map of Bakersfield has a scale of 1 inch = 5 miles. If the city is $5\frac{1}{5}$ inches across on the map, what is the actual distance across the city?

SOLUTION:

$$\frac{1 \text{ in.}}{5 \text{ mi}} = \frac{5\frac{1}{5} \text{ in.}}{d \text{ mi}}$$

$$1 \cdot d = 5 \cdot 5\frac{1}{5}$$

$$d = 5 \cdot \frac{26}{5}$$

$$d = 26$$

So, the actual distance is 26 miles.

ANSWER:

26 mi

17. Tyson is creating a scale drawing of the area of his school. The rectangular drawing shows the length as 20 inches and the width as 19 inches. The drawing uses a scale of 1 inch = 3 feet. What is the actual area of the school in square feet?

SOLUTION:

Write and solve a proportion using the scale that 1 inch = 3 feet.

$$\frac{1 \text{ in.}}{3 \text{ ft}} = \frac{20 \text{ in.}}{x \text{ ft}}$$
$$1 \cdot x = 20 \cdot 3$$
$$x = 60$$

The length is 60 feet.

$$\frac{1 \text{ in.}}{3 \text{ ft}} = \frac{19 \text{ in.}}{x \text{ ft}}$$
$$1 \cdot x = 19 \cdot 3$$
$$x = 57$$

The width is 57 feet.

The dimensions of Tyson's school is 60 feet by 57 feet.
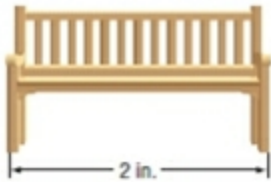Multiply the length by the width to find the area.
$60 \times 57 = 3,420$
So, the area of the school is 3,420 square feet.

ANSWER:

3,420 ft^2

18. A landscape designer created the scale drawing below showing the bench that will be in the garden area.

2 in.

The actual width of the bench is 6 feet, and the actual height is 3 feet. Fill in each space to complete the following statements.

a. The scale drawing is _____ inch(es) = _____ feet.

b. The height of the scale drawing is _____ inch(es).

SOLUTION:

For part a, write and simplify a ratio that compares the width shown on the drawing to the actual width.

$$\frac{2 \text{ in.}}{6 \text{ ft}} = \frac{1 \text{ in.}}{3 \text{ ft}}$$

So, the scale drawing is 1 inch = 3 feet.

For part b, use the scale drawing to set up a proportion and solve.

$$\frac{x \text{ in}}{3 \text{ ft}} = \frac{1 \text{ in}}{3 \text{ ft}}$$

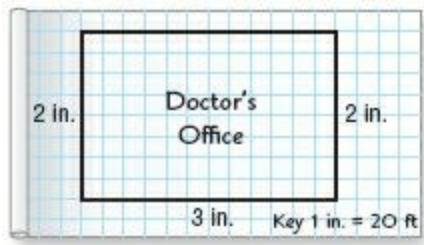$$3 \cdot x = 1 \cdot 3$$

$$\frac{3x}{3} = \frac{3}{3}$$

$$x = 1$$

So, the height if the scale drawing is 1 inch.

ANSWER:

a. 1; 3

b. 1

19. A scale drawing of a doctor's office is shown.

What are the actual dimensions of the doctor's office? Explain how you found your answer.

SOLUTION:

Sample answer: Set up and solve proportions to find the actual length and width: $\dfrac{1 \text{ in.}}{20 \text{ ft}} = \dfrac{2 \text{ in.}}{w \text{ ft}}$ and $\dfrac{1 \text{ in.}}{20 \text{ ft}} = \dfrac{3 \text{ in.}}{\ell \text{ ft}}$

$\dfrac{1 \text{ in.}}{20 \text{ ft}} = \dfrac{2 \text{ in.}}{w \text{ ft}}$

$1 \bullet w = 20 \bullet 2$

$\quad w = 40$

The width is 40 feet.

$\dfrac{1 \text{ in.}}{20 \text{ ft}} = \dfrac{3 \text{ in.}}{\ell \text{ ft}}$

$1 \bullet \ell = 20 \bullet 3$

$\quad \ell = 60$

The length is 60 feet.
So, the actual dimensions of the doctor's office is 40 feet by 60 feet.
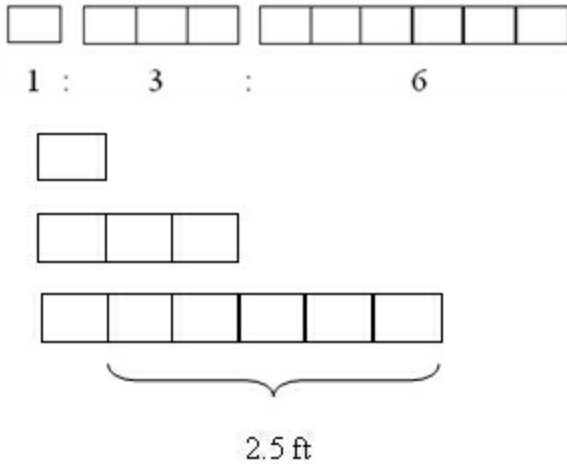
ANSWER:

40 ft by 60 ft; Sample answer: Set up and solve proportions to find the actual length and width: $\dfrac{1 \text{ in.}}{20 \text{ ft}} = \dfrac{2 \text{ in.}}{w \text{ ft}}$ and $\dfrac{1 \text{ in.}}{20 \text{ ft}} = \dfrac{3 \text{ in.}}{\ell \text{ ft}}$

20. A carpenter sawed a piece of wood into 3 pieces. The ratio of wood pieces is 1 : 3 : 6. The longest piece is 2.5 feet longer than the shortest piece. Use the *draw a diagram* strategy to find the length of the original piece.

    SOLUTION:

    Because the longest piece is 6 parts to the smallest piece and 5 of the 6 parts is equal to 2.5 ft, each of the 6 parts must be 0.5ft. The original board before cutting was a total of 10 parts and if each of the parts is 0.5 feet then the entire board is 10 × 0.5 = 5. Therefore, the original piece was 5 feet.

    ANSWER:

    5 feet

    Solve the proportion.

21. $\dfrac{2}{5} = \dfrac{b}{25}$

    SOLUTION:

    $$\frac{2}{5} = \frac{b}{25}$$
    $$2(25) = 5b$$
    $$50 = 5b$$
    $$\frac{50}{5} = \frac{5b}{5}$$
    $$10 = b$$

    ANSWER:

    10

22. $\dfrac{3}{7} = \dfrac{a}{49}$

SOLUTION:

$$\dfrac{3}{7} = \dfrac{a}{49}$$
$$3(49) = 7a$$
$$147 = 7a$$
$$\dfrac{147}{7} = \dfrac{7a}{7}$$
$$21 = a$$

ANSWER:

21

23. $\dfrac{2}{9} = \dfrac{x}{99}$

SOLUTION:

$$\dfrac{2}{9} = \dfrac{x}{99}$$
$$2(99) = 9x$$
$$198 = 9x$$
$$\dfrac{198}{9} = \dfrac{9x}{9}$$
$$22 = x$$

ANSWER:

22

24. Dante has 60 baseball cards. This is at least six more than three times as many cards as Anna. Write and solve an inequality to represent the situation.

SOLUTION:

Write an inequality from the situation: let *a* = the amount of cards Anna has. Dante has six more than three times as many cards as Anna. This is represented by $3a + 6$. Sine Dante has **at least** this amount, Anna has **at most** Dante's amount, which is 60. Therefore, the inequality would be $3a + 6 \le 60$. Now, solve the inequality:

$$3a + 6 \le 60$$
$$\underline{-6 \quad -6}$$
$$\dfrac{3a}{3} \le \dfrac{54}{3}$$
$$a \le 18$$

ANSWER:

$3a + 6 \le 60;\ a \le 18$