Name_____ Class_____ Date_____

4-1

Scale Drawings

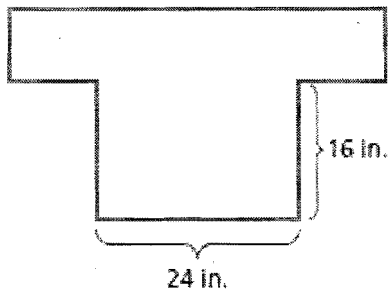
COMMON CORE

CC.7.G.1

Essential question: *How can you use scale drawings to solve problems?*

1 EXPLORE Finding Dimensions

A blueprint is a technical drawing that usually displays architectural plans. Pete's blueprint shows a layout of a house. Every 4 inches in the blueprint represents 3 feet of the actual house. One of the walls in the blueprint is 24 inches long. What is the actual length of the wall?



A Complete the table to find the actual length of the wall.

Blueprint length (in.)	4	8	12	16	20	24
Actual length (ft)	3	6	9	12	15	18

TRY THIS!

1a. In Pete's blueprint the length of a side wall is 16 inches. Find the actual length of the wall.

12 feet

1b. The back wall of the house is 33 feet long. What is the length of the back wall in the blueprint?

44 inches

REFLECT

1c. How do you know your answer to **1b** is reasonable?

Sample answer: For 18 feet of actual length, the blueprint shows 24 inches. 2 times 18 feet gives 36 feet, which would be shown as 24 times 2, or 48 inches in the blueprint. Thus, for 33 feet, 44 inches is reasonable.

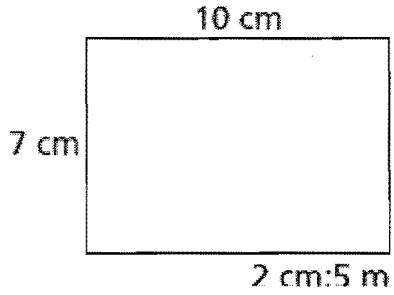
A scale drawing is a proportional two-dimensional drawing of an object. Scale drawings can represent objects that are smaller or larger than the actual object.

A scale is a ratio between 2 sets of measurements. It shows how a dimension in a scale drawing is related to the actual object. Scales are usually shown as two numbers separated by a colon such as 1:20 or 1 cm:1 m. Scales can be shown in the same unit or in different units.

You can solve scale-drawing problems by using proportional reasoning.

2 EXAMPLE Using a Scale Drawing to Find Area

The figure at the right is a scale drawing of a large rectangular room. What is the area of the actual room?



Set up proportions to help you solve the problem.

A Find the number of meters represented by 1 cm in the drawing.

$$\frac{2\text{ cm}}{5\text{ m}} \overset{\div 2}{=} \frac{1\text{ cm}}{?\text{ m}} \quad \frac{2\text{ cm}}{5\text{ m}} = \frac{1\text{ cm}}{2.5\text{ m}}$$

1 cm in this drawing is equal to 2.5 m in the actual room.

B Find the actual length of the room labeled 7 cm in the drawing.

$$\frac{1\text{ cm}}{2.5\text{ m}} \overset{\times 7}{=} \frac{7\text{ cm}}{?\text{ m}} \quad \frac{1\text{ cm}}{2.5\text{ m}} = \frac{7\text{ cm}}{17.5\text{ m}}$$

The length of the side labeled 7 cm represents 17.5 m.

C Find the actual length of the room labeled 10 cm in the drawing.

$$\frac{1\text{ cm}}{2.5\text{ m}} \overset{\times 10}{=} \frac{10\text{ cm}}{?\text{ m}} \quad \frac{1\text{ cm}}{2.5\text{ m}} = \frac{10\text{ cm}}{25\text{ m}}$$

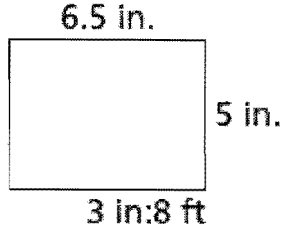
The length of the side labeled 10 cm represents 25 m.

D Since area is length times width, the area of the actual room is

17.5 m × 25 m = 437.5 m^2.

TRY THIS!

2a. Find the length and width of the actual room, then find the area of the actual room. Round your answer to the nearest tenth.



The length is about 17.3 feet and the width is about 13.3 feet. The area is 17.3 feet × 13.3 feet, or 230.1 square feet.

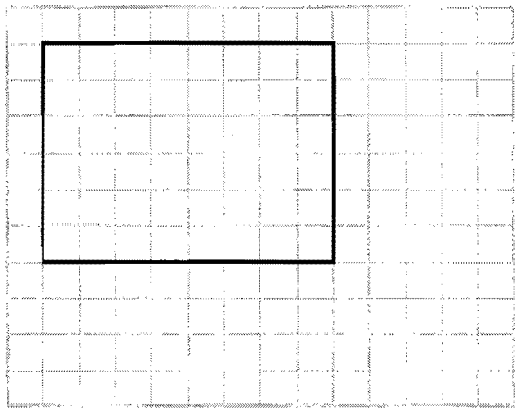
REFLECT

2b. How could you solve **2** without having to determine the number of meters represented by 1 cm?

Sample answer: For the side labeled 10 cm, set up the proportion $\frac{2 \text{ cm}}{5 \text{ cm}} = \frac{10 \text{ cm}}{x \text{ cm}}$, and solve to find $x = 25$. Set up and solve a similar proportion for the side labeled 7 cm.

3 EXPLORE Drawing in Different Scales

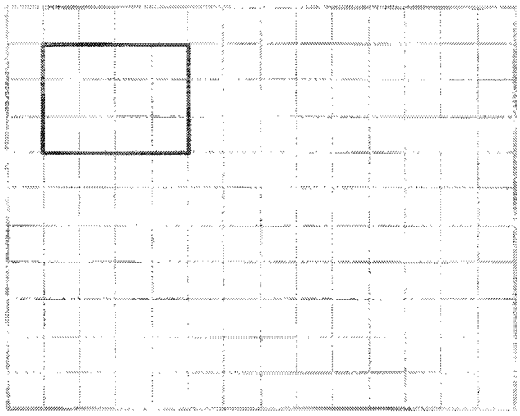
A In the scale drawing, assume the rectangle is drawn on centimeter grid paper. The scale is 1 cm:3 m.



Suppose you redraw the rectangle on centimeter grid paper using a scale of 1 cm:6 m. In the new scale, 1 cm represents (more than) / less than 1 cm in the old scale.

The measurement of each side of the new rectangle will be twice / (half) as long as the measurement of the original rectangle.

B Draw the rectangle for the new scale 1 cm:6 m.



REFLECT

3a. Find the actual length of each side of your original drawing using the old scale, 1 cm:3 m. Find the actual length of each side of your new drawing using the new scale. How do you know your answers are correct?

The side with 6 cm has actual length of $6 \times 3 = 18$ m. The side with 8 cm has actual

length of 8 × 3 = 24 m. With the new scale, the side with 3 cm has an actual length of 3 × 6 = 18 m and the side with 4 cm has an actual length of 4 × 6 = 24 m. The answers are correct because both scales give the same actual lengths.

PRACTICE

The scale of a room in a blueprint is 3 in:5 ft. A wall in the same blueprint is 18 in. Complete the table.

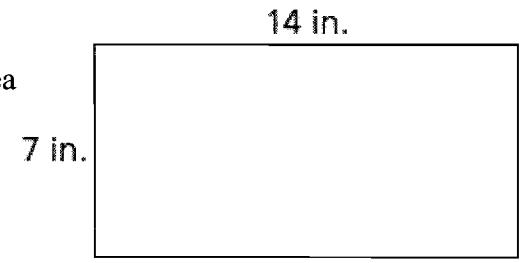
Blueprint length (in.)	3	6	9	12	15	18
Actual length (ft)	5	10	15	20	25	30

a. How long is the actual wall? The wall is 30 feet long.

b. A window in the room has an actual width of 2.5 feet.

Find the width of the window in the blueprint. 1.5 in.

2. The scale in the drawing is 2 in.:4 ft. What are the length and width of the actual room? Find the area of the actual room.



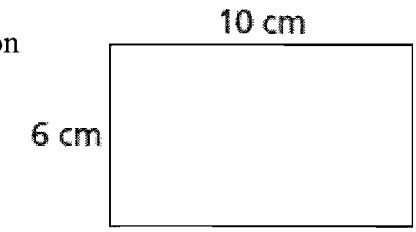
The length is 28 feet and the width is 14 feet.

The area is 28 feet × 14 feet, or 392 square feet.

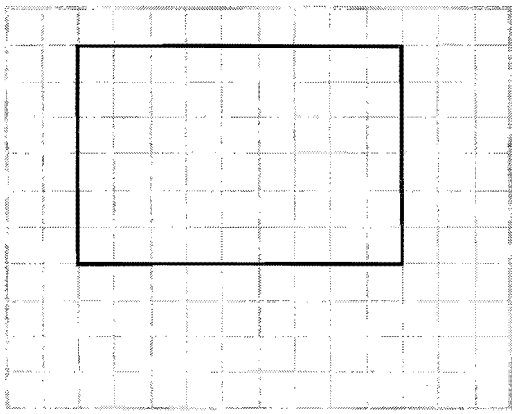
3. The scale in the drawing is 2 cm:5 m. What are the length and width of the actual room? Find the area of the actual room.

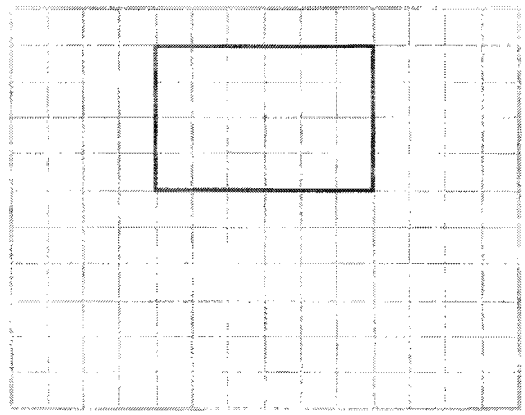
The length is 25 meters and the width is 15 meters. The area is 25 meters × 15 meters, or 375 square meters.

4. In the scale drawing below, assume the rectangle is drawn on centimeter grid paper. The scale is 1 cm:4 m.



a. Redraw the rectangle on centimeter grid paper using a scale of 1 cm:6 m.





b. What is the actual length and width of the rectangle using the original scale? What are the actual dimensions using the new scale?

Length is 36 m and width is 24 m using both scales.