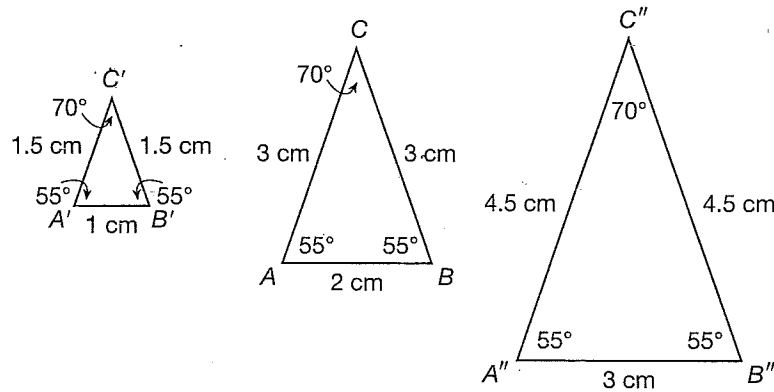


7.5

Understanding Scale

Try These

How are the small and large triangles related to $\triangle ABC$?



Jeb drives a truck. He often needs to read a map. His map of British Columbia shows a scale of 1 cm to 10 km.

scale ratio

a ratio, using the same units, that expresses the scale on a map or drawing

Hint

The scale factor is the number you multiply by. If the scale ratio is 1:x, then the scale factor is x.

- ① What is the **scale ratio** on this map?

$$\frac{1 \text{ cm}}{10 \text{ km}} = \frac{1 \text{ cm}}{\boxed{} \text{ cm}} \quad \text{The scale ratio is } \underline{\hspace{2cm}}$$

- ② What **scale factor** must Jeb use to convert a distance on the map to the actual distance?

1 cm on the map equals $\underline{\hspace{2cm}}$ cm on land. He must multiply distances on the map by a scale factor of $\underline{\hspace{2cm}}$.

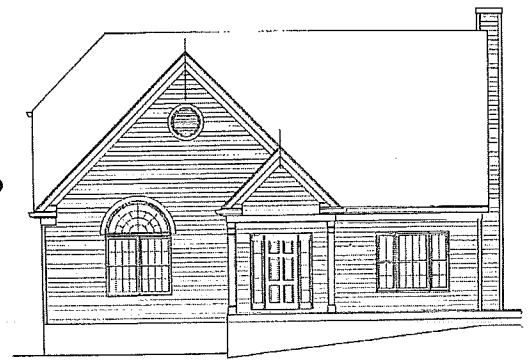
- ③ The distance between Calgary and Medicine Hat on the map is 27 cm. What is the actual distance in kilometres?

$$27 \text{ cm} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \text{ cm}$$

$$\underline{\hspace{2cm}} \text{ cm} \times \frac{1 \text{ km}}{\boxed{} \text{ cm}} = \underline{\hspace{2cm}} \text{ km}$$

Example 1

Architects draw scale drawings of homes. A common scale is $\frac{1}{4}$ in. to 1 ft. The height, length, and width of a home are 6.5 in., 6.5 in., and 10.0 in. on the drawing. What are the actual measurements?



FRONT ELEVATION

Solution

A. What is the scale ratio on the drawing?

$$\frac{\square \text{ in.}}{\square \text{ ft}} = \frac{\square \text{ in.}}{\square \text{ in.}}$$

Express both terms in the ratio as whole numbers.

$$\frac{\square \times 4}{\square \times 4} = \frac{\square}{\square} \quad \text{The scale ratio is } \underline{\hspace{2cm}}.$$

B. What are the actual dimensions of the home in feet?

$$\text{H: } \underline{\hspace{1cm}} \times 6.5 \text{ in.} = \underline{\hspace{1cm}} \text{ in.}; \underline{\hspace{1cm}} \text{ in.} \times \frac{1 \text{ ft}}{\square \text{ in.}} = \underline{\hspace{1cm}} \text{ ft}$$

$$\text{L: } \underline{\hspace{1cm}} \times 6.5 \text{ in.} = \underline{\hspace{1cm}} \text{ in.}; \underline{\hspace{1cm}} \text{ in.} \times \frac{1 \text{ ft}}{\square \text{ in.}} = \underline{\hspace{1cm}} \text{ ft}$$

$$\text{W: } \underline{\hspace{1cm}} \times 10.0 \text{ in.} = \underline{\hspace{1cm}} \text{ in.}; \underline{\hspace{1cm}} \text{ in.} \times \frac{1 \text{ ft}}{\square \text{ in.}} = \underline{\hspace{1cm}} \text{ ft}$$

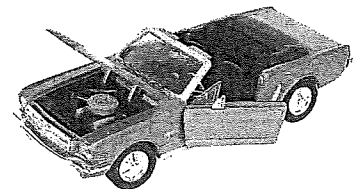
The height is \square ft. The length is \square ft. The width is \square ft.

REFLECTING

How could you use a proportion to determine the dimensions?

Example 2

Noreen collects model toy cars. Many of her cars are built using a 1:64 scale. A model of a 1966 convertible is 9.8 cm long and 3.5 cm wide. What does this scale mean? What are the dimensions of the actual car?



Solution

A. The scale means that $\underline{\hspace{1cm}}$ unit of measurement on the model equals $\underline{\hspace{1cm}}$ units of the measurement on the actual car. So actual dimensions of the car are $\underline{\hspace{1cm}}$ times the dimensions of the model.

B. What is the length of the car?

$$\underline{\hspace{1cm}} \times 9.8 \text{ cm} = \underline{\hspace{1cm}} \text{ cm, or } \underline{\hspace{1cm}} \text{ m}$$

The length of the car is about $\underline{\hspace{1cm}}$ m.

C. What is the width of the car?

$$\underline{\hspace{1cm}} \times 3.5 \text{ cm} = \underline{\hspace{1cm}} \text{ cm, or } \underline{\hspace{1cm}} \text{ m}$$

The width of the car is about $\underline{\hspace{1cm}}$ m.

REFLECTING

The diameter of the tires on the actual car are 590 mm. What is the diameter of the tires on the model?

Practice

Hint

Ratios are expressed using whole numbers and the same units. See the charts on the back cover for unit conversions.

1. Write each scale as a scale ratio.

a) 1 cm to 1 m

$$\frac{1 \text{ cm}}{\boxed{} \text{ cm}}, \text{ or } \underline{\hspace{2cm}}$$

c) 6 in. to 5 ft

$$\frac{6 \text{ in.}}{\boxed{} \text{ in.}}, \text{ or } \underline{\hspace{2cm}}$$

b) 5 mm to 1 m

$$\frac{5 \text{ mm}}{\boxed{} \text{ mm}}, \text{ or } \underline{\hspace{2cm}}$$

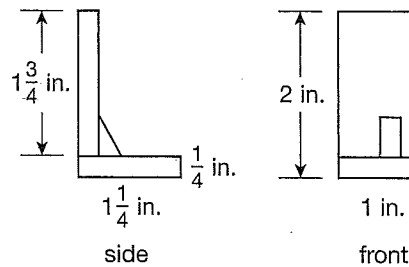
d) 2 ft to 4 yd

$$\frac{2 \text{ ft}}{\boxed{} \text{ ft}}, \text{ or } \underline{\hspace{2cm}}$$

Hint

Determine and use the scale factor for this problem.

2. Tajana found plans for a bookend in a woodworking magazine. The plans include a scale diagram. The scale ratio is 1:4. What are the length, thickness, and height of the bookend?



3. Akio drew a building plan. He used a scale of 5 in. on the diagram to represent 6 ft in the building.

a) What is the scale of the plan?

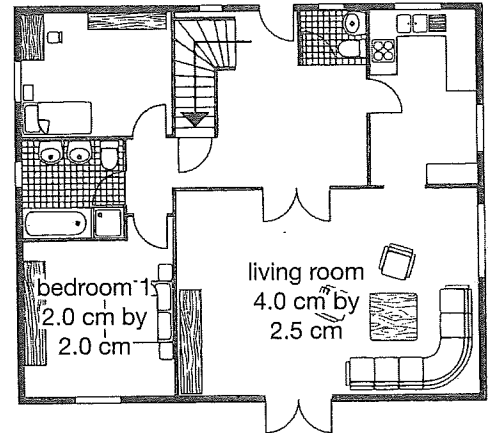
b) What is the scale ratio of the plan?

4. Priya has a 1:20 scale toy glider that has a length of 33.6 cm, a wingspan of 90.0 cm, and a height of 6.8 cm. Determine these dimensions on the real glider.



5. This floor plan of an apartment is drawn with a scale of 1:200.

- a) What are the actual dimensions of bedroom 1?
- b) What are the actual dimensions of the living room?



6. Umiaks are boats used in the Arctic for transportation and traditional whale hunting.

A typical umiak is 32 ft long. The beam, or width, is 48 in. Hilda is making a scale model with a scale ratio of 1:24. What dimensions should Hilda use for the length and the beam of her scale model?



7. What are some situations where scale diagrams are used?