

Lesson 12.5:

Scale Drawings

Essential Question

How can you enlarge or reduce a drawing proportionally?

Key Ideas

Scale Drawings and Models

A **scale drawing** is a proportional, two-dimensional drawing of an object.

A **scale model** is a proportional, three-dimensional model of an object.

Scale

The measurements in scale drawings and models are proportional to the measurements of the actual object. The **scale** gives the ratio that compares the measurements of the drawing or model with the actual measurements.

A scale can be written without units when the units are the same. A scale without units is called a **scale factor**.



Find the actual dimension. The scale is 1 cm : 4 ft.

1. model: 7 cm

$$\frac{1 \text{ cm}}{4 \text{ ft}} = \frac{7 \text{ cm}}{28 \text{ ft}}$$

2. model: 10.5 cm

$$\frac{1 \text{ cm}}{4 \text{ ft}} = \frac{10.5 \text{ cm}}{42 \text{ ft}}$$

3. model: 30 cm

$$\frac{1 \text{ cm}}{4 \text{ ft}} = \frac{30 \text{ cm}}{120 \text{ ft}}$$

4. model: 19 mm \rightarrow 1.9 cm

$$\frac{1 \text{ cm}}{4 \text{ ft}} = \frac{1.9 \text{ cm}}{7.6 \text{ ft}}$$

5. model: 0.4 m \rightarrow 40 cm

$$\frac{1 \text{ cm}}{4 \text{ ft}} = \frac{40 \text{ cm}}{160 \text{ ft}}$$

6. model: 4.25 m \rightarrow 425 cm

$$\frac{1 \text{ cm}}{4 \text{ ft}} = \frac{425 \text{ cm}}{1700 \text{ ft}}$$

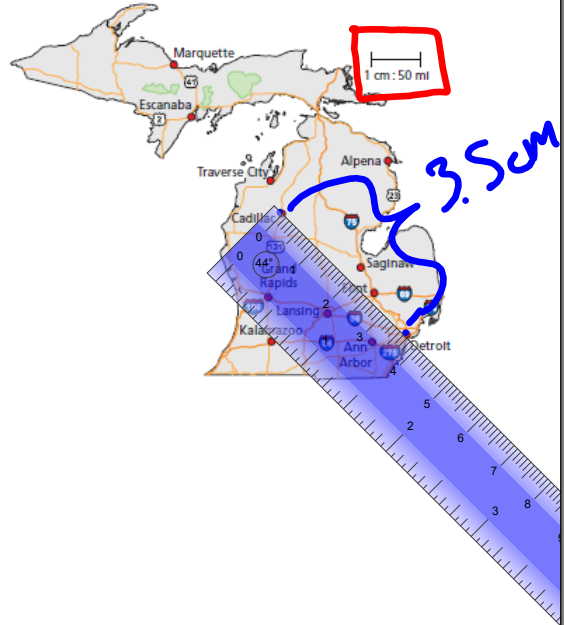
What is the actual distance d between Cadillac and Detroit?

Matching units in numerator
Textbook pg. 532

$$\frac{1 \text{ cm}}{50 \text{ mi}} = \frac{3.5 \text{ cm}}{x}$$

$$x = 50 \cdot 3.5$$

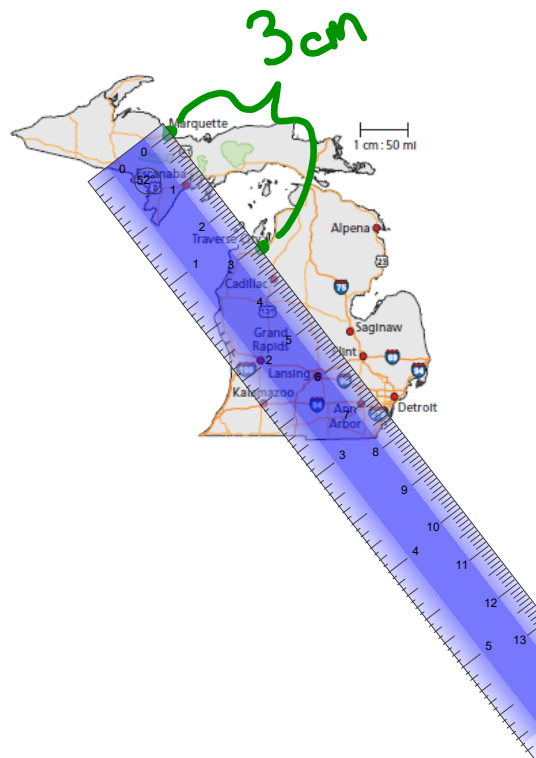
$$x = 175 \text{ mi}$$



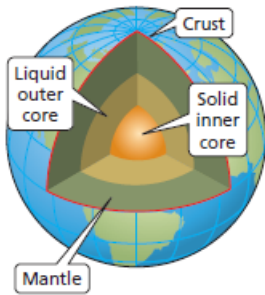
1. What is the actual distance between Traverse City and Marquette?

$$\frac{1 \text{ cm}}{50 \text{ mi}} = \frac{3 \text{ cm}}{x}$$

$$x = 150 \text{ mi}$$



The liquid outer core of Earth is 2300 kilometers thick. A scale model of the layers of Earth has a scale of 1 in. : 500 km. How thick is the liquid outer core of the model?



(A) 0.2 in.

(B) 4.6 in.

(C) 0.2 km

(D) 4.6 km

Wrong unit

$$\frac{1 \text{ in}}{500 \text{ km}} = \frac{x}{2300 \text{ km}}$$

$$\begin{array}{r|l} 2300 & 500x \\ \hline 500 & 500 \end{array}$$

$$4.6 \text{ in} \neq x$$

2. The mantle of Earth is 2900 kilometers thick. How thick is the mantle of the model? (Scale of 1 in. : 500 km)

$$\frac{1 \text{ in}}{500 \text{ km}} = \frac{x}{2900 \text{ km}}$$

$$\begin{array}{r|l} 2900 & 500x \\ \hline 500 & 500 \end{array}$$

$$5.8 \text{ in} \neq x$$

A scale model of the Sergeant Floyd Monument is 10 inches tall. The actual monument is 100 feet tall.

a. What is the scale of the model?

$$10 \text{ in} : 100 \text{ ft}$$

$\div 10$ $\div 10$

$$1 \text{ in} : 10 \text{ ft}$$

like simplifying $\frac{10}{100}$

b. What is the scale factor of the model?

$$10 \text{ ft} \cdot 12 \text{ in/ft} = 120 \text{ in}$$

must have
matching units

$$1 : 120$$

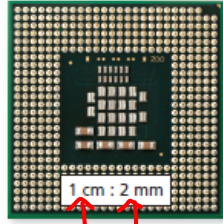
Don't write units
in scale factor

3. A drawing has a scale of 1 mm : 20 cm. What is the scale factor of the drawing?

$$20 \text{ cm} \cdot 10 \text{ mm/cm} = 200 \text{ mm}$$

$$1 : 200$$

The scale drawing of a computer chip helps you see the individual components on the chip. *Textbook page 534*



a. Find the perimeter and the area of the computer chip in the scale drawing.

$$P = 4(4 \text{ cm}) = 16 \text{ cm}$$

$$A = 4 \text{ cm} \cdot 4 \text{ cm} = 16 \text{ cm}^2$$

b. Find the actual perimeter and area of the computer chip.

$$\frac{1 \text{ cm}}{2 \text{ mm}} = \frac{4 \text{ cm}}{8 \text{ mm}}$$

$$P = 4(8 \text{ mm}) = 32 \text{ mm}$$

$$A = 8 \text{ mm} \cdot 8 \text{ mm} = 64 \text{ mm}^2$$

c. Compare the ratios $\frac{\text{drawing perimeter}}{\text{actual perimeter}}$ and $\frac{\text{drawing area}}{\text{actual area}}$ to the scale.

$$S: \frac{1 \text{ cm}}{2 \text{ mm}}$$

$$P: \frac{16 \text{ cm}}{32 \text{ mm}} = \frac{1 \text{ cm}}{2 \text{ mm}}$$

$$A: \frac{16 \text{ cm}^2}{64 \text{ mm}^2} = \frac{1 \text{ cm}^2}{4 \text{ mm}^2} \rightarrow \left(\frac{1 \text{ cm}}{2 \text{ mm}}\right)^2$$

4. **WHAT IF?** The scale of the drawing of the computer chip is 1 cm : 3 mm. How do the answers in parts (a)–(c) change? Justify your answer.

$$\text{Ratio of areas} = \frac{1 \text{ cm}^2}{9 \text{ mm}^2}$$

A common model train scale is called the HO Scale, where the scale factor is 1 : 87. If the diameter of a wheel on a model train is 0.3 inch, what is the diameter of the actual wheel?

$$\frac{1}{87} = \frac{0.3}{x}$$

$$x = 87 \cdot 0.3$$

$$x = \boxed{26.1 \text{ in}}$$