

# Scale Drawings and Scale Factors

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Score: \_\_\_\_\_ / 17

Have you ever used a map or looked at a blueprint? Then you have already worked with a **scale drawing**! The key idea is that every length changes by the same **scale factor**, so the picture stays perfectly proportional to the real thing. Once you know the scale, you can hop between drawing measurements and actual measurements with a quick multiplication or division. Maps, floor plans, model cars, video-game design—scale factors are everywhere once you start looking!

## Key Concepts & Quick Review

**Scale ratio:**  $\frac{\text{drawing length}}{\text{actual length}} = \frac{1}{n}$  (or stated as  $1 \text{ cm} : n \text{ m}$ , etc.)

**Actual** = drawing  $\times n$ . **Drawing** = actual  $\div n$ . **Scale factor**  $> 1$ : enlargement.  $< 1$ : reduction.

## Examples

① A blueprint uses a scale of  $1 \text{ cm} = 5 \text{ m}$ . A wall measures  $6 \text{ cm}$  on the blueprint. What is the actual length of the wall?

**Think It Through:** The scale says every 1 centimeter on the blueprint stands for 5 m in real life. Since the wall measures  $6 \text{ cm}$  on the drawing, multiply by 5 to get the actual length:  $6 \times 5 = 30 \text{ m}$ . Scale drawings always compare the drawing measurement to the real measurement in a constant way.

**Answer:** 30 m

② A map has scale  $1 \text{ in} = 25 \text{ mi}$ . Two cities are  $3.6$  inches apart on the map. What is the actual distance between them? If a third city is  $175 \text{ mi}$  away, how far apart are they on the map?

**Think It Through:** When you go from map distance to real distance, multiply by the scale factor. So  $3.6 \times 25 = 90 \text{ mi}$ . When you go the other way, from real distance back to map distance, divide by the scale factor. That gives  $175 \div 25 = 7$  inches. It helps to ask yourself whether the real object should be bigger or smaller than the drawing before you choose multiply or divide.

**Answer:** 90 mi apart; 7 inches on the map

## Practice Problems

Use the given scale to find the actual or drawing measurement.

- On a scale drawing,  $1 \text{ cm}$  represents \_\_\_\_\_  $10 \text{ m}$ . Find the actual distance represented by  $4 \text{ cm}$ .
- On a scale drawing,  $1 \text{ cm}$  represents  $5 \text{ m}$ . Find the actual distance represented by  $7 \text{ cm}$ .
- On a scale drawing,  $1 \text{ in}$  represents \_\_\_\_\_  $20 \text{ mi}$ . Find the actual distance represented by  $3 \text{ in}$ .
- On a scale drawing,  $1 \text{ cm}$  represents \_\_\_\_\_  $10 \text{ m}$ . Find the drawing length for an actual distance of  $80 \text{ m}$ .



5. On a scale drawing, 1 *in* represents \_\_\_\_\_ 25 *mi*. Find the actual distance represented by 4.5 *in*.
6. On a scale drawing, 1 *cm* represents 8 *m*. \_\_\_\_\_ Find the actual distance represented by 6 *cm*.
7. On a scale drawing, 1 *cm* represents 8 *m*. \_\_\_\_\_ Find the drawing length for an actual distance of 64 *m*.
8. On a scale drawing, 1 *in* represents \_\_\_\_\_ 30 *mi*. Find the actual distance represented by 2.5 *in*.
9. On a scale drawing, 1 *cm* represents \_\_\_\_\_ 15 *km*. Find the actual distance represented by 5 *cm*.
10. On a scale drawing, 1 *cm* represents 15 *km*. Find the drawing length for an actual distance of 90 *km*.
11. On a scale drawing, 1 *in* represents \_\_\_\_\_ 50 *mi*. Find the actual distance represented by 3.4 *in*.
12. On a scale drawing, 1 *cm* represents \_\_\_\_\_ 12 *m*. Find the actual distance represented by 9 *cm*.
13. On a scale drawing, 1 *cm* represents \_\_\_\_\_ 12 *m*. Find the drawing length for an actual distance of 108 *m*.
14. On a scale drawing, 1 *in* represents \_\_\_\_\_ 40 *mi*. Find the drawing length for an actual distance of 200 *mi*.
15. On a scale drawing, 1 *cm* represents \_\_\_\_\_ 6 *km*. Find the actual distance represented by 7.5 *cm*.

### Study Tips

- 👉 Always write the scale as a proportion:  $\frac{\text{drawing}}{\text{actual}} = \frac{1}{n}$ , then cross-multiply to find what you need.
- 👉 Keep **units consistent** — if the scale says “1 *cm* = 5 *m*,” make sure you measure the drawing in centimeters before multiplying.
- 👉 A scale factor greater than 1 means the drawing is **larger** than reality (a microscope view); less than 1 means it is **smaller** (a map).

### Word Problems

16. An architect draws a house floor plan using a scale of  $\frac{1}{4}$  inch = 1 foot. The living room measures  $3\frac{1}{2}$  inches by  $2\frac{3}{4}$  inches on the plan. Find the actual dimensions of the room and its actual area in square feet. \_\_\_\_\_
17. A nature reserve map uses the scale 1 *cm* = 3.5 *km*. A hiking trail appears as 8.4 *cm* on the map. A ranger station is 21 *km* from the trailhead. How long is the actual trail? How far is the ranger station on the map? If you hike the trail at 4 *km/hr*, how many hours will it take? \_\_\_\_\_



## Answer Keys

- |  |   |
|--|---|
| <p>1) 40 <i>m</i></p> <p>2) 35 <i>m</i></p> <p>3) 60 <i>mi</i></p> <p>4) 8 <i>cm</i></p> <p>5) 112.5 <i>mi</i></p> <p>6) 48 <i>m</i></p> <p>7) 8 <i>cm</i></p> <p>8) 75 <i>mi</i></p> <p>9) 75 <i>km</i></p> | <p>10) 6 <i>cm</i></p> <p>11) 170 <i>mi</i></p> <p>12) 108 <i>m</i></p> <p>13) 9 <i>cm</i></p> <p>14) 5 <i>in</i></p> <p>15) 45 <i>km</i></p> <p>16) 14 <i>ft</i> × 11 <i>ft</i>; area 154 <i>sq ft</i></p> <p>17) Trail: 29.4 <i>km</i>; station: 6 <i>cm</i>; time: 7.35 <i>hr</i>.</p> |
|--|---|

### Step-by-Step Explanations

**Strategy:** For Laws of Exponents, use exponent laws only when the bases and operations match the rule, combining, subtracting, or multiplying exponents according to the structure. A quick exponent-law check is whether the bases stayed the same when the rule required it.

**Practice 1:**  $2^3 \cdot 2^4 =$  **Answer:**  $2^7 = 128$

At the beginning of the practice, match the expression to the correct exponent law before simplifying the powers.

**Practice 15:**  $(10^2)^3 =$  **Answer:** 1,000,000

For the second model problem, match the expression to the correct exponent law before simplifying the powers.

**Word-problem notes:**

**16. Answer:**  $\frac{2^{20}}{2^{10}} = 2^{10} = 1,024$  kilobytes.

Quotient of Powers:  $\frac{2^{20}}{2^{10}} = 2^{20-10} = 2^{10} = 1,024$ .

**17. Answer:**  $3^2 \cdot 3^4 = 3^6 = 729$  times the original value.

Product of Powers:  $3^2 \cdot 3^4 = 3^{2+4} = 3^6$ .  $3^6 = 729$ .



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