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 $1\ cm : n\ m$, etc.)

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

Examples

① A blueprint uses a scale of $1\ cm = 5\ m$. A wall measures $6\ cm$ 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 $6\ cm$ on the drawing, multiply by 5 to get the actual length: $6 \times 5 = 30\ m$. Scale drawings always compare the drawing measurement to the real measurement in a constant way.

Answer: $30\ m$

② A map has scale $1\ in = 25\ mi$. Two cities are 3.6 inches apart on the map. What is the actual distance between them? If a third city is $175\ mi$ 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 $3.6 \times 25 = 90\ mi$. 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.

1. On a scale drawing, $1\ cm$ represents $10\ m$. Find the actual distance represented by $4\ cm$. ______

2. On a scale drawing, $1\ cm$ represents $5\ m$. Find the actual distance represented by $7\ cm$. ______

3. On a scale drawing, $1\ in$ represents $20\ mi$. Find the actual distance represented by $3\ in$. ______

4. On a scale drawing, $1\ cm$ represents $10\ m$. Find the drawing length for an actual distance of $80\ m$. ______

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

1) $40\,m$
2) $35\,m$
3) $60\,mi$
4) $8\,cm$
5) $112.5\,mi$
6) $48\,m$
7) $8\,cm$
8) $75\,mi$
9) $75\,km$
10) $6\,cm$
11) $170\,mi$
12) $108\,m$
13) $9\,cm$
14) $5\,in$
15) $45\,km$
16) $14\,ft \times 11\,ft$; area $154\,sq\,ft$
17) Trail: $29.4\,km$; station: $6\,cm$; time: $7.35\,hr$.

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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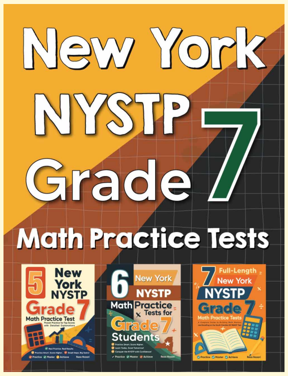

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