Multiplication as Scaling

Multiplication as Scaling: Apply, Compare, and Design

Name _____ **Date** _____ **Score** _____ / 8

QUICK REVIEW

For a positive quantity, a factor between 0 and 1 shrinks it; factor 1 preserves it; a factor greater than 1 enlarges it. Compare the whole factor with 1, not just its numerator.

Worked example

Without multiplying first, compare $14 \times \frac{5}{7}$ with 14. Then compute to check.

1. The factor $\frac{5}{7}$ is less than 1, so the product is smaller than the original.
2. Multiply: $14 \times \frac{5}{7} = 10$.
3. The computed result 10 is smaller than 14, as predicted.
Answer: 10; smaller than 14.

Practice Problems

Show your thinking.

1. A 12 cm logo is printed at $\frac{2}{3}$ size for a sticker and $\frac{3}{4}$ size for a badge. Which is wider, and by how much?

2. A 16 cm card must scale to a width of at least 11 cm and at most 13 cm. Choose from $\frac{5}{8}$, $\frac{3}{4}$, and $\frac{7}{8}$.

3. An artist scales a $7\frac{1}{2}$ cm picture by $\frac{6}{5}$, then trims $\frac{1}{2}$ cm from its width. Does it fit an $8\frac{1}{2}$ cm frame opening?

4. A banner maker keeps the same width but replaces centimeters with millimeters in the label. Is a scale factor of 10 applied to the physical banner? Explain using a 6 cm width.

5. A 21 cm bookmark is printed at $\frac{2}{3}$ size and a 10 cm bookmark at $\frac{6}{5}$ size. Does the larger factor make the longer copy?

6. A toy rocket is 18 cm tall. Show with an equation how three model rockets, each at $\frac{2}{9}$ size, compare with the original if stacked end to end.

7. Two scaled copies of the same 12 cm drawing must fit side by side in 18 cm. They use the same factor. What is the largest factor that fits?

8. A copier enlarges a 10 cm picture to $\frac{6}{5}$ of its width. A second copier makes that result $\frac{3}{4}$ as wide. Is the final width bigger or smaller than the original, and by how much?

Answer Key

1. The badge, by 1 cm.
2. $\frac{3}{4}$; new width 12 cm.
3. Yes; final width exactly $8\frac{1}{2}$ cm.
4. No; actual scale factor $1.\ 6$ cm and 60 mm are the same width.
5. No. The first copy is 14 cm; the second is 12 cm.
6. 12 cm total; 6 cm shorter.
7. $\frac{3}{4}$.
8. Smaller by 1 cm.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Sticker: $12 \times \frac{2}{3} = 8$ cm.
2. Badge: $12 \times \frac{3}{4} = 9$ cm.
3. $9 - 8 = 1$ cm.

Problem 2

1. $16 \times \frac{5}{8} = 10$ cm is too narrow.
2. $16 \times \frac{7}{8} = 14$ cm is too wide.
3. $16 \times \frac{3}{4} = 12$ cm is within the allowed widths.

Problem 3

1. Scaled width: $\frac{15}{2} \times \frac{6}{5} = 9$ cm.
2. Trimmed width: $9 - \frac{1}{2} = \frac{17}{2} = 8\frac{1}{2}$ cm.
3. It equals the opening width, so it fits.

Problem 4

1. One centimeter is 10 millimeters.
2. $6 \times 10 = 60$ millimeters names the same width in smaller units.
3. Nothing physically grew: the copy is 1 times the original width.

Problem 5

1. The first copy is $21 \times \frac{2}{3} = 14$ cm.
2. The second copy is $10 \times \frac{6}{5} = 12$ cm.
3. $14 > 12$ even though $\frac{2}{3} < \frac{6}{5}$, because the starting lengths differ.

Problem 6

1. One model: $18 \times \frac{2}{9} = 4$ cm.
2. Three models: $3 \times 4 = 12$ cm.
3. $18 - 12 = 6$ cm shorter than the original.

Problem 7

1. Each copy can be at most $18 \div 2 = 9$ cm.
2. Compare the largest allowed copy to the original: $\frac{9}{12} = \frac{3}{4}$.
3. At that factor the total is $2 \times 9 = 18$ cm. A larger factor would exceed the space.

Problem 8

1. After the first copier: $10 \times \frac{6}{5} = 12$ cm.
2. After the second copier: $12 \times \frac{3}{4} = 9$ cm.
3. $10 - 9 = 1$ cm smaller than the original.

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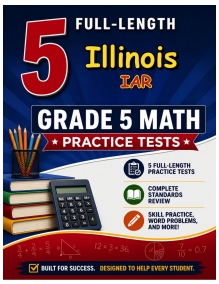

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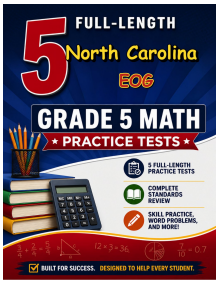

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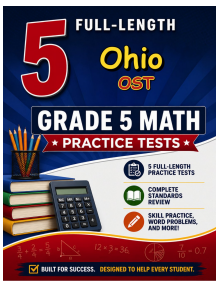

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