Multiplication as Scaling

Multiplication as Scaling: Find, Fix, and Work Backward

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. Correct: Multiplying 11 by 1 must make it larger because multiplication always increases.

2. A length changes from 8 cm to 6 cm. Find the scale factor and say whether it is below, equal to, or above 1.

3. Jo says $15 \times \frac{2}{3}$ is larger than 15 because 2 is larger than 1. Fix the comparison and explain what to compare.

4. A picture is 10 cm wide after scaling by $\frac{5}{4}$. Find its original width by thinking in quarters.

5. Multiply a positive starting length by $\frac{3}{2}$, then by $\frac{2}{3}$. Without knowing the length, decide whether the result is bigger, smaller, or equal.

6. A drawing grows from 12 cm to 16 cm. A student writes $\frac{12}{16}$ for the scale factor. Explain why that cannot be right and find the correct factor.

7. Use the factors to predict the larger product: $9 \times \frac{9}{8}$ or $9 \times \frac{6}{5}$. Then find the difference.

8. The blank in $14 \times \square$ must make a number strictly between 0 and 7. Give one possible factor and explain why $\frac{1}{2}$ does not work.

Answer Key

1. 11; equal to 11.
2. Scale factor $\frac{3}{4}$, less than 1.
3. $15 \times \frac{2}{3} = 10 < 15$; compare $\frac{2}{3}$ with 1.
4. 8 cm.
5. Equal to the starting length.
6. $\frac{4}{3}$; the correct factor is above 1.
7. $9 \times \frac{6}{5}$ is larger by $\frac{27}{40}$.
8. Example: $\frac{1}{4}$; $\frac{1}{2}$ makes exactly 7.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The factor 1 is equal to 1, so the product is equal to the original.
2. Multiply: $11 \times 1 = 11$.
3. The computed result 11 is equal to 11, as predicted.

Problem 2

1. Use the same unit for both: 8 original parts and 6 new parts, each $\frac{1}{1}$ cm.
2. New size is 6 out of every 8 original parts: $\frac{6}{8} = \frac{3}{4}$, less than 1.
3. Check: $8 \times \frac{3}{4} = 6$ cm.

Problem 3

1. Three thirds make one, so $\frac{2}{3} < \frac{3}{3} = 1$.
2. Two of the three equal groups in 15 give $15 \div 3 \times 2 = 10$.
3. $10 < 15$; the numerator alone does not determine growth.

Problem 4

1. The new width is 5 equal parts, each one quarter of the original.
2. One part is $10 \div 5 = 2$ cm, so four parts are $4 \times 2 = 8$ cm.
3. Check: $\frac{5}{4} \times 8 = 10$ cm.

Problem 5

1. The combined factor is $\frac{3}{2} \times \frac{2}{3} = \frac{6}{6} = 1$.
2. The first step enlarges, but the second reverses that change exactly.
3. Multiplication by 1 keeps the starting length.

Problem 6

1. Growing requires a factor above 1, but $\frac{12}{16} < 1$.
2. Compare new to original: $\frac{16}{12} = \frac{4}{3}$.
3. Check: $12 \times \frac{4}{3} = 16$ cm.

Problem 7

1. $\frac{9}{8} = \frac{45}{40}$ and $\frac{6}{5} = \frac{48}{40}$; compare the two factors for the same positive 9.
2. The larger factor exceeds the smaller by $\frac{3}{40}$.
3. Nine copies of that difference give $9 \times \frac{3}{40} = \frac{27}{40}$.

Problem 8

1. Half of 14 is 7, so the factor must be positive and less than $\frac{1}{2}$.
2. Try $\frac{1}{4}$: $14 \times \frac{1}{4} = \frac{7}{2}$.
3. $0 < \frac{7}{2} < 7$, but $14 \times \frac{1}{2} = 7$ is not strictly below 7.

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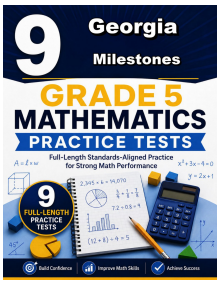

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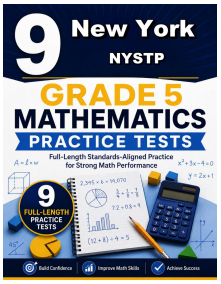

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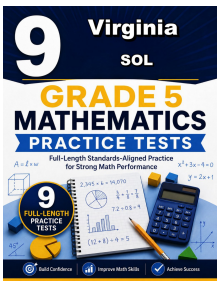

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