

Grade 5 • Unit 3 • Assessment Guide

Multiplying and Dividing Fractions

For the Parent or Teacher — What to look for

Unit 3 multiplies fractions by fractions and divides involving unit fractions. The diagnostic is whether the student understands division as either 'how many groups of size X ' OR 'size of each group of X ' — and can pick the right interpretation for each situation. Also: are they fighting the misconception that multiplication grows and division shrinks?

Problem 1 — $1/2 \times 1/3$ with diagram

- Answer: $1/6$.
- ★ The denominator 6 comes from partitioning into $2 \times 3 = 6$ equal small parts.
- Strong: diagram shows 6 small parts and identifies the one part that is in BOTH 'half' and 'one third' — that is the overlap of $1/2$ AND $1/3$.
- Weak: writes $1/6$ from the rule without a diagram showing why.

Problem 2 — Multiply fractions and simplify

- (a) $6/15 = 2/5$
- (b) $20/40 = 1/2$
- (c) $21/8 = 2$ and $5/8$
- ★ Strong: simplifies in (a) and (b); converts to mixed number in (c).
- Watch for: simplification errors, or forgetting to convert improper fractions.

Problem 3 — Compare without computing

- (a) LESS THAN $5/6$ (since $4/7 < 1$)
- (b) GREATER THAN $5/6$ (since $7/4 > 1$)
- (c) EQUAL TO $5/6$ (since $5/5 = 1$)
- ★ THE diagnostic for the 'multiplication can shrink or grow' principle.
- Strong rule: 'If the second factor is less than 1, the product is less than the first factor; if greater than 1, the product is greater; if equal to 1, the product equals the first factor.'

Problem 4 — Diego's error: $2/3 \times 4 = 8/12$

- Diego treated 4 as $4/4$ implicitly, or just multiplied 'across' incorrectly.
- Correct: $2/3 \times 4 = 8/3 = 2$ and $2/3$. (When multiplying by a whole number, the denominator does NOT change.)
- ★ Same error as Unit 2 Problem 11 — recurring misconception.
- Strong: catches it; weak: agrees with Diego.

Problem 5 — $3 / (1/4)$

- Answer: 12. (There are 4 fourths in each whole; 3 wholes $\times 4 = 12$ fourths.)
- ★ The answer is BIGGER than the dividend! This breaks the rule that division shrinks.
- Strong: 'Bigger because we're counting SMALL pieces — there are many fourths in 3 wholes.'
- Weak: writes a number less than 3, or gets confused and answers $3/4$.

Problem 6 — $6 / (1/3)$ muffins

- Answer: 18 muffins. (Equation: $6 \div (1/3) = 18$.)
- ★ Recognize this as the SAME structure as problem 5 — 'how many $1/3$ -groups in 6?'
- Weak: divides 6 by 3 to get 2 — treats the situation as 'split 6 cups among 3' which would make $1/3$ of a cup per portion (wrong direction).

Problem 7 — $(1/4) \div 3$

- Answer: $1/12$. (Each person gets $1/12$ of the whole pizza.)
- ★ This is the OTHER interpretation: 'split this small piece into 3 equal portions.'
- Strong: draws the $1/4$ piece and shows it split into 3 equal smaller pieces, each = $1/12$ of the whole.
- Weak: confuses with $1/4 \times 3$ or writes $3/4$.

Problem 8 — $5 \div (1/2)$ vs $(1/2) \div 5$

- $5 \div (1/2) = 10$. (How many halves are in 5? 10.)
- $(1/2) \div 5 = 1/10$. (Split a half into 5 equal pieces.)
- ★ The TWO interpretations of division are revealed by THIS pair.
- Strong: explains that $5 \div (1/2)$ means 'how many halves in 5' (a LOT) while $(1/2) \div 5$ means 'split half into 5 pieces' (each piece tiny).
- Weak: answers same value for both, OR cannot articulate the difference.

Problem 9 — Sara's confusion: $1/3 + 1/4$ vs $1/3 \times 1/4$

- Correct: $1/3 \times 1/4 = 1/12$.
- Sara conflated addition with multiplication. ALSO her addition of $1/3 + 1/4 = 7/12$ was actually correct! But that has nothing to do with multiplication.
- ★ Strong: 'Multiplication and addition give different answers. $1/3 \times 1/4 = 1/12$ — multiply across.'

Problem 10 — Stories for $(1/2)/4$ and $4/(1/2)$

- $(1/2)/4$ stories: 'I have half a cake. I share it among 4 people. How much does each get?' ($1/8$)
- $4/(1/2)$ stories: 'I have 4 cups of yogurt. Each portion is $1/2$ cup. How many portions?' (8)
- ★ Strong: notices that the FIRST is 'split this small thing' and the SECOND is 'count how many small things fit.'
- Weak: writes the same story for both, or stories do not match the operations.

Problem 11 — $12 \times ? = 3$

- $? = 3/12 = 1/4$.
- Strong: 'This is the same as $3 \div 12$ because we're asking what to multiply 12 by to get 3.'
- ★ Connects multiplication and division as INVERSES (one of the most important Grade 5 themes).

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