MA.4.FR.2.4

Overarching Standard: ***MA.4.FR.2*** *Build a foundation of addition, subtraction, and multiplication operations with fractions.*

Benchmark of Focus

MA.4.FR.2.4: Extend previous understanding of multiplication to explore the multiplication of a fraction by a whole number or a whole number by a fraction.

> *Example:* Shanice thinks about finding the product $\frac{1}{4} \times 8$ by imagining having 8 pizzas that she wants to split equally with three of her friends. She and each of her friends will get 2 pizzas since $\frac{1}{4} \times 8 = 2$.
>
> *Example:* Lacey thinks about finding the product $8 \times \frac{1}{4}$ by imagining having 8 pizza boxes each with one-quarter slice of a pizza left. If she put them all together, she would have a total of 2 whole pizzas since $8 \times \frac{1}{4} = \frac{8}{4}$ which is equivalent to 2

Benchmark Clarifications

Clarification 1: Instruction includes the use of visual models or number lines and the connection to the commutative property of multiplication. Refer to Properties of Operation, Equality, and Inequality (Appendix D).

Clarification 2: Within this benchmark, the expectation is not to simplify or use lowest terms.

Clarification 3: Fractions multiplied by a whole number are limited to less than 1. All denominators are limited to 2, 3, 4, 5, 6, 8, 10, 12, 16, 100.

Related Benchmark/Horizontal Alignment

- MA.4.NSO.2.1
- MA.4.AR.1.3

Vertical Alignment

Previous Benchmarks	Next Benchmarks
MA.3.NSO.2.2	MA.5.FR.2.2
MA.3.FR.1.2	MA.5.FR.2.3

Terms from the K-12 Glossary

- Equation
- Expression

Purpose and Instructional Strategies

The purpose of this benchmark is to connect previous understandings of whole-number multiplication concepts (MA.3.NSO.2.2) and apply them to the multiplication of fractions. This

work builds a foundation for multiplying fractions with procedural reliability in Grade 5 (MA.5.FR.2.2).

- Contexts involving multiplying whole numbers and fractions lend themselves to modeling and examining patterns.
- This benchmark builds on students' work of adding fractions with like denominators (MA.4.FR.2.2) and extending that work into the relationship between addition and multiplication.
- Students should use fraction models and drawings to show their understanding. Fraction models may include area models, number lines, set models, or equations.
- During instruction, teachers should relate "total group size" language that was used to introduce whole number multiplication- possibly changing from "total group size" to "total size" or "total amount" (see Appendix A). Using such language, the expression $5 \times \frac{3}{4}$ can be described as the total size or amount of 5 objects, each of which has size or amount of $\frac{3}{4}$. For example, the weight of 5 slabs of chocolate that each weigh $\frac{3}{4}$ of a pound is $5 \times \frac{3}{4}$ pounds. Students need to understand that when multiplying a whole number by a fraction, the most important idea is that the whole number describes the number of objects, and the fraction describes the size of each object.
- Instruction should include representing a whole number times a fraction as repeated addition: $5 \times \frac{3}{4} = \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4}$
- When multiplying a fraction by a whole number, teachers can use language like "portion of" to convey that the fraction represents the "portion of" the whole number. For example, the $\frac{3}{4}$ portion of a 5-mile run is $\frac{3}{4} \times 5$ miles.
- Exploring patterns of what happens to the numerator when a whole number is multiplied by a fraction will help students make sense of multiplying fractions by fractions in Grade 5. When multiplying whole numbers by mixed numbers, students can use the distributive property or write the mixed number as a fraction greater than one. During instruction, students should compare both strategies. Using the distributive property to multiply a whole number by a mixed number could look like this.

$$2 \times 6\frac{1}{3} = (2 \times 6) + \left(2 \times \frac{1}{3}\right)$$
$$= 12 + \frac{2}{3}$$
$$= 12\frac{2}{3}$$

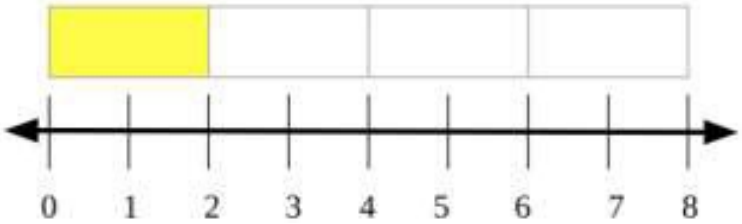
Common Misconceptions or Errors

- Students may multiply both the numerator and the denominator by the whole number. It is important to provide students with visual models, manipulatives, or context to model the computation.
- Students may be confused by the fact that a fraction times a whole number often represents something quite different than a whole number times a fraction, even though the commutative property says the order does not affect the value.

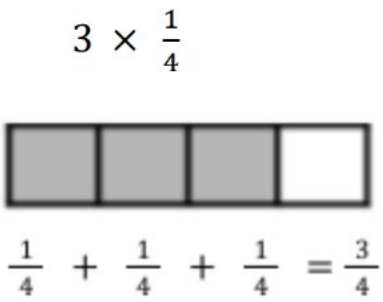
- Without conceptual understanding of how fraction multiplication is modeled, students can be confused regarding why the denominator remains the same when multiplying a whole number by a fraction. During instruction, teachers should relate fraction multiplication to repeated addition to explain why only the numerator changes.

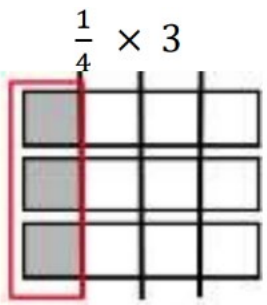
Strategies to Support Tiered Instruction

- Instruction includes connecting repeated addition and models to understand the meaning of the factors in a multiplication equation.
    - For example, $8 \, x \, \frac{1}{4}$ can be shown using repeated addition with 8 groups of $\frac{1}{4}$
      $\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}=\frac{8}{4}$ or 2 wholes
    - For example, $\frac{1}{4} x \, 8$ can be shown as $\frac{1}{4}$ of 8 using a number line.

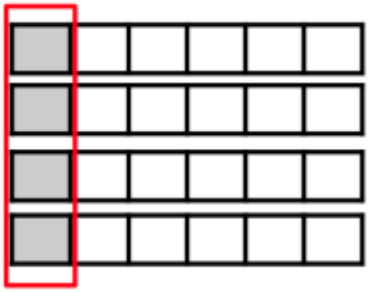


- Instruction includes real-world situations aligned with the content. The teacher provides a multiplication expression with real-world context and items to represent the situation to make connections.
    - For example, the teacher provides the student with the following situation: "The theater class has to make costumes that require $\frac{1}{4}$ foot of ribbon. They need to make 8 costumes. How many feet of ribbon will they need total?" The teacher provides ribbon already cut into $\frac{1}{4}$ foot pieces and has students model the problem. Students then write out the repeated addition problem to match $\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}=\frac{8}{4}$ or 2 feet.
    - For example, the teacher provides the student with the following situation: "The theater class has 8 feet of ribbon. They need to make 4 costumes and they want to use up all of the ribbon. How many feet of ribbon does each costume use?" The teacher will provide the student with a piece of ribbon 8 feet long and have them mark it off into 4 equal sections and find the length of 1 section (2 feet).
- Teacher provides models that represent multiplication expressions to represent the Commutative Property of Multiplication and has students explain the difference in meaning.
    - For example, the teacher provides the student with the following models.





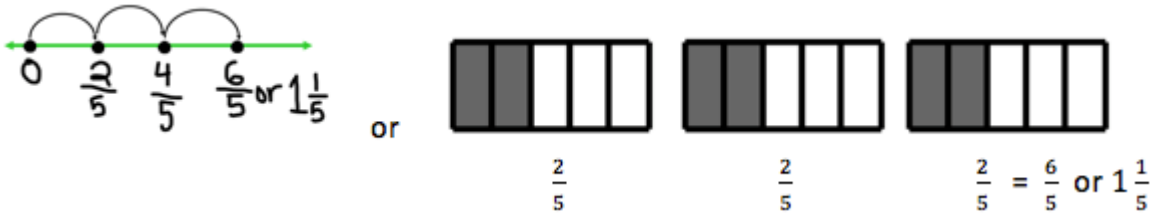
- The teacher provides models and asks students which expression it models.
    - For example, the teacher provides students with the following model and asks if it represents $\frac{1}{6}\ x\ 4$ or $4\ x \frac{1}{6}$



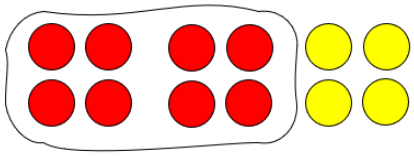
Questions to ask students:

- **See if students can explain the difference between multiplication of two whole numbers and multiplication of a whole number and a fraction. How is 3×4 like $3 \times \frac{1}{4}$?**
- Sample answer that indicates understanding: 3×4 is 3 groups with 4 in each group while $3 \times \frac{1}{4}$ is 3 groups with $\frac{1}{4}$ in each group. $3 \times 4 = 12$ and $3 \times \frac{1}{4}$ is $\frac{3}{4}$, less than a whole.

- **See if students can correctly model multiplication between a whole number and a fraction. *i.e.,*** $3 \times \frac{2}{5}$
- Sample answer that indicates understanding:



- **See if students can model to show what a fraction of a whole number represents, i.e.** $\frac{2}{3} \times 12$
- Ask students to explain what type of model they could use to show a fraction of a whole number, such as using color tiles or two-color counters
- Sample answer that indicates understanding: I can use counters to show 12, then partition 12 into three equal groups to represent thirds, 4 in each group. Finally I count the number of tiles in two of the equal groups to represent $\frac{1}{3}$ of 12 = 4, so $\frac{2}{3}$ of 12 = 8, so $\frac{2}{3} \times 12 = 8$



Instructional Tasks

How many $\frac{2}{5}$ are in $\frac{12}{5}$? Use a visual model to explain your reasoning and show the relationship to the multiplication of a whole number by a fraction.

Instructional Items

Instructional Item 1

An expression is shown.

$\frac{3}{4} \times 9$

What is the product?

a. $\frac{3}{36}$

b. $\frac{27}{4}$

c. $\frac{27}{36}$

d. $\frac{39}{4}$

Instructional Item 2

Choose all the ways to express the product of $\frac{3}{4} \times 5$.

a. $5\frac{3}{4}$

b. $\frac{15}{4}$

c. $\frac{15}{20}$

d. $3\frac{3}{4}$

e. $\frac{3}{4}$

Achievement Level Descriptors:

Benchmark	Context	Assessment Limits
MA.4.AR.1.3 Solve real-world problems involving multiplication of a fraction by a whole number or a whole number by a fraction. Example: Ken is filling his garden containers with a cup that holds $\frac{2}{5}$ pounds of soil. If he uses 8 cups to fill his garden containers, how many pounds of soil did Ken use? Clarification 1: Problems include creating real-world situations based on an equation or representing a real-world problem with a visual model or equation. Clarification 2: Fractions within problems must reference the same whole. Clarification 3: Within this benchmark, the expectation is not to simplify or use lowest terms. Clarification 4: Fractions limited to fractions less than one with denominators of 2, 3, 4, 5, 6, 8, 10, 12, 16 and 100. **<u>Also Assesses</u>** MA.4.FR.2.4 Extend previous understanding of multiplication to explore the multiplication of a fraction by a whole number or a whole number by a fraction. Example: Shanice thinks about finding the	Real-world for MA.4.AR.1.3 Both for MA.4.FR.2.4	N/A

product $\frac{1}{4} \times 8$ by imagining having 8 pizzas that she wants to split equally with three of her friends. She and each of her friends will get 2 pizzas since $\frac{1}{4} \times 8 = 2$. Example: Lacey thinks about finding the product $8 \times \frac{1}{4}$ by imagining having 8 pizza boxes each with one-quarter slice of a pizza left. If she put them all together, she would have a total of 2 whole pizzas since $8 \times \frac{1}{4} = \frac{8}{4}$ which is equivalent to 2. Clarification 1: Instruction includes the use of visual models or number lines and the connection to the commutative property of multiplication. Refer to Properties of Operation, Equality and Inequality (Appendix D). Clarification 2: Within this benchmark, the expectation is not to simplify or use lowest terms. Clarification 3: Fractions multiplied by a whole number are limited to less than 1. All denominators are limited to 2, 3, 4, 5, 6, 8, 10, 12, 16, and 100.			
ALD 2	**ALD 3**	**ALD 4**	**ALD 5**
solves real-world problems involving multiplication of a fraction by a whole number or a whole number by a fraction involving denominators limited to 2, 3, 4, 5, 10, or 100 using visual models.	solves real-world problems involving multiplication of a fraction by a whole number or a whole number by a fraction involving denominators limited to 2, 3, 4, 5, 10, or 100. multiplies a fraction by a whole number or a whole number by a fraction using models or number lines.	solves real-world problems involving multiplication of a fraction by a whole number or a whole number by a fraction. extends previous understanding of multiplication to explore the multiplication of a fraction by a whole number or a whole number by a fraction.	creates real-world situations based on an equation having a variable to represent the unknown and solving for the unknown by multiplying a fraction by a whole number or a whole number by a fraction. multiplies a fraction by a whole number or a whole number by a fraction.

Additional Resources:

CPALMS Resources

Khan Academy: Multiplying Fractions and Whole Numbers https://bit.ly/3uW191J

Khan Academy: Fraction Multiplication on the Number Line https://bit.ly/3GSzXDl

Khan Academy: Multiply Unit Fractions of Whole Numbers https://bit.ly/3Jw6uRf

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Resources/Tasks to Support Your Child at Home:
Next time you order pizza for dinner, count the number of slices. What fraction does each slice represent? (if there are 8 slices in the pie.) How would I represent the whole pie? ( ) Ask your child questions such as, "If I ate 5 slices, how much did I eat and how can I write that as a fraction multiplication problem?"

Ask your child to take a recipe and multiply the ingredients to make a larger portion of the recipe.

Khan Practice "Multiply Whole Number by a Unit Fraction" https://bit.ly/3rUq6bX

Khan Practice "Multiply Fractions and Whole Numbers" https://bit.ly/3gSBQp6

Khan Practice "Multiply Unit Fractions and Whole Numbers" https://bit.ly/3oThQa2

Learnzillion: Multiply Fractions by Whole Numbers Using Repeated Addition

https://bit.ly/3sOEr90

Learnzillion: Multiplying Fractions and Whole Numbers with Model https://bit.ly/3JxA4px