MA.4.AR.1.3

Overarching Standard: ***MA.4.AR.1***

Represent and solve problems involving the four operations with whole numbers and fractions.

Benchmark of Focus

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.

> *Examples:* 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?

Benchmark Clarifications

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.

Related Benchmark/Horizontal Alignment

- MA.4.FR.2.4
- MA.4.M.1.2
- MA.4.DP.1.3

Vertical Alignment

Previous Benchmarks	Next Benchmarks
MA.3.FR.1.2	MA.5.AR.1.2/1.3

Terms from the K-12 Glossary

- Equation
- Expression
- Whole Number

Purpose and Instructional Strategies

The purpose of this benchmark is to complement the instruction of MA.4.FR.2.4 with real-world context.

- Instruction should refer back to the two types of problems described in MA.4.FR.2.4 (whole number times a fraction and fraction times a whole number), and give students opportunities to work with real-world examples of both types.
- Instruction should help students bring their understanding of working with units involving whole numbers (1 cup, 3 miles, etc.) to working with units involving fractions ($\frac{1}{2}$cup, $\frac{3}{4}$mile, etc.).
- During instruction it is acceptable to have students work with problems where fractional parts represent more than 1 whole (e.g., a cake recipe calls for $\frac{1}{3}$cup of water and $\frac{1}{8}$ oz of vanilla extract, and the baker wants to double the recipe).
- Instruction may include having students create real-world situations that can be modeled by a given expression like $\frac{3}{5}$ x 10 (I have completed $\frac{3}{5}$ of my 10-mile run).
- During instruction, models and explanations should relate fraction multiplication to equal groups. This will activate prior knowledge and relate what students know to whole number multiplication.
    - For example, teachers can help students make connections to multiplication from Grade 3 by referring to an expression like $4 \times \frac{3}{5}$ as "four *groups of* 3 fifths," that is, "four groups that each contain 3 items and each item is one fifth" (MTR.2.1, MTR.5.1).
    - Example: have table/bar to show that there are 4 groups of $\frac{3}{5}$.
- 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 (MTR.2.1). 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 (MTR.6.1). Using the distributive property to multiply a whole number by a mixed number could look like this.

$$2 \text{ x } 6\frac{1}{3} = (2 \text{ x } 6) + (2 \text{ x } \frac{1}{3}) = 12 + \frac{2}{3} = 12\frac{2}{3}$$

In the example, 2 groups of $6\frac{1}{3}$ was written as "the sum of 2 groups of 6 and 2 groups of 1 third." The products of 12 and 2 thirds are added to show the product of $12\frac{2}{3}$

Common Misconceptions or Errors

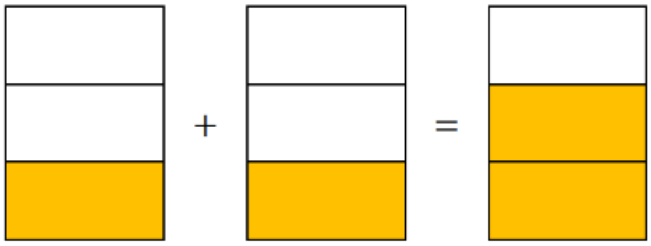
- Students may not understand that fractions are numbers (just as whole numbers are numbers) and this misconception may at first be reinforced by the fact that the phrase "group size" works well with whole numbers, but not so well with fractions; therefore, special attention should be given with many different real-world examples.
- Students may not understand what a fractional portion represents within context of a real-world situation.

Strategies to Support Tiered Instruction

- Instruction includes opportunities to engage in teacher-directed practice using visual representations to solve real-world problems involving multiplication of a fraction by a whole number. Students are directed on how to use models or equations based on real- world situations. Through questioning, the teacher guides students to explain what each fractional portion represents in the problems used during instruction and practice.

- For example, the teacher displays and reads aloud the following problem: "Angelica walks her dog $\frac{4}{5}$ of a mile every day. How far does she walk her dog after 7 days?" Using models, students solve the problem with explicit instruction and guided questioning. Students explain how to use models to solve this problem. The teacher reinforces the concept of multiplication as repeated addition by guiding students to represent this problem as $\frac{4}{5}+\frac{4}{5}+\frac{4}{5}+\frac{4}{5}+\frac{4}{5}+\frac{4}{5}+\frac{4}{5}$ and that $7\times\frac{4}{5}$ is the same as seven groups of four fifths. The teacher guides students to create an equation to represent the problem, repeating with multiple real-world problems that involve multiplication of a whole number by a fraction or a fraction by a whole number.

- Instruction includes opportunities for students to use hands-on models and manipulatives to solve real-world problems involving multiplication of a whole number by a fraction. Students are guided in explaining how each model represents the real-world situation. Explicitly direct students on how to use models or equations based on real-world situations. Through questioning, students explain what each fractional portion represents in the problems used during instruction and practice.
  - For example, the teacher displays and reads aloud the following problem: "Ramon is baking cupcakes for his cousin's birthday party. The recipe calls for 2 cups of sugar. He only needs to make $\frac{1}{3}$ as many cupcakes as the recipe call for. How many cups of sugar will Ramon need to use?" It may be useful to provide students with paper models that represent the cups of sugar. Students should cut the models into thirds to determine how much sugar will be needed for the recipe.



Questions to ask students:

- **Using the sample problems below, ask the student to explain the difference between multiplication of two whole numbers and multiplication of a whole number and a fraction.**

  How many feet of ribbon does Isabella have if she buys 3 ribbons that are each 4 feet?

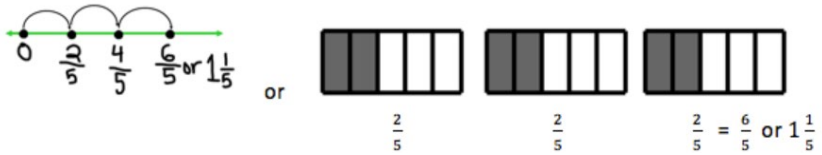
  How many feet of ribbon does Isabella have is she buys 3 ribbons that are each $\frac{1}{4}$ feet?

- Sample answer that indicates understanding: 3 x 4 is 3 groups with 4 in each group while 3 x $\frac{1}{4}$ is 3 groups with $\frac{1}{4}$ in each group. 3 x 4 = 12 and 3 x $\frac{1}{4}$ is $\frac{3}{4}$, which is less than a whole.

- **Ask students to model multiplication between a whole number and a fraction.**

For example, Samantha is making 3 batches of cotton candy. The recipe requires $\frac{2}{5}$ teaspoon of salt for each batch. How much total salt will Samantha need to make 3 batches of cotton candy?

- Sample answer that indicates understanding:



Instructional Tasks

Instructional Task 1

Lorelei is having a dessert party and wants to determine how much sugar she will need. For the party, she will make 4 batches of chocolate chip cookies and 8 vanilla smoothies. 1 batch of chocolate chip cookies requires $\frac{2}{3}$ cup of sugar and 1 vanilla smoothie requires $\frac{1}{3}$ cup of sugar. How much total sugar will she need for her dessert party? Draw a model to explain your thinking.

Instructional Items

Instructional Item 1

A butcher has 10 pounds of meat and sells $\frac{2}{3}$ of it in one day. How many pounds does the butcher sell?

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. **Also Assesses** 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.	Real-world for MA.4.AR.1.3 Both for MA.4.FR.2.4	N/A

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: https://www.cpalms.org/PreviewStandard/Preview/15363

Khan Academy: Multiply Whole Number by a Unit Fraction Practice: https://goo.gl/iRP2yL

Khan Academy: Multiply Fractions by Whole Numbers: https://goo.gl/eAs7Xp

LearnZillion: Multiply by Fractions Using Repeated Addition: http://bit.ly/2O5V7CC

LearnZillion: Use a fraction model for multiplication of Fractions and Whole Numbers: http://bit.ly/2SenwcU

Resources/Tasks to Support Your Child at Home:

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

- LearnZillion: Multiply by Fractions Using Repeated Addition: http://bit.ly/2O5V7CC
- LearnZillion: Use a fraction model for multiplication of Fractions and Whole Numbers: http://bit.ly/2SenwcU