MA.5.AR.1.2

Overarching Standard: ***MA.5.AR.1: Solve problems involving the four operations with whole numbers and fractions.***

Benchmark of Focus

MA.5.AR.1.2: Solve real-world problems involving the addition, subtraction or multiplicationof fractions, including mixed numbers and fractions greater than 1.

> *Examples:* Shanice had a sleepover, and her mom is making French toast in the morning. If her mom had $2\frac{1}{4}$ loaves of bread and used $1\frac{1}{2}$ loaves for the French toast, how much bread does she have left?

Benchmark Clarifications

Clarification 1: Instruction includes the use of visual models and equations to represent the problem.

Related Benchmark/Horizontal Alignment

- MA.5.FR.2.1
- MA.5.FR.2.2
- MA.5.M.1.1
- MA.5.GR.2.1
- MA.5.DP.1.1

Vertical Alignment

Previous Benchmarks	**Next Benchmarks**
MA.4.AR.1.2	MA.6.NSO.2.3
MA.4.AR.1.3	

Purpose and Instructional Strategies

The purpose of this benchmark is to continue the work from Grade 4 (MA.4.AR.1.2/1.3) where students began solving real-world with fractions, and prepares them for Grade 6 (MA.6.NSO.2.3) where they will solve real-world fraction problems using all four operations with fractions. (MTR.7.1).

- Students need to develop an understanding that when adding or subtracting fractions, the fractions must refer to the same whole.
- During instruction, teachers should provide opportunities for students to practice solving problems using models or drawings to add, subtract or multiply with fractions. Begin with students modeling with whole numbers, have them explain how they used the modelor drawing to arrive at the solution, then scaffold using the same methodology using fraction models.
- Models to consider when solving fraction problems should include, but are not limited to,area models (rectangles), linear models (fraction strips/bars and number lines) and set models (counters) (MTR.2.1).
- Please note that it is not expected for students to always find least common multiples or make fractions greater than 1 into mixed numbers, but it is expected that students know and understand equivalent fractions, including naming fractions greater than 1 as mixed numbers to add, subtract or multiply.
- It is important that teachers have students rename the fractions with a common denominator

when solving addition and subtraction fraction problems in lieu of the "butterfly" method (or other shortcut/mnemonic) to ensure students build a complete conceptual understanding of what makes solving addition and subtraction of fractionsproblems true.

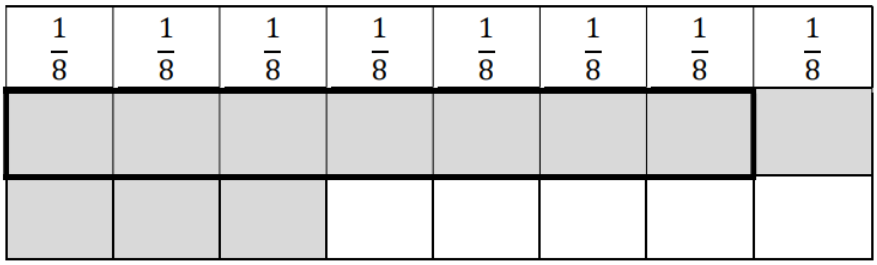
Common Misconceptions or Errors

- When solving real-world problems, students can often confuse contexts that require subtraction and multiplication of fractions. For example, "Mark has $\frac{3}{4}$ yards of rope and he gives half of the rope to a friend. How much rope does Mark have left?" expects students to find $\frac{1}{2}$ of $\frac{3}{4}$, or multiply $\frac{1}{2} \times \frac{3}{4}$to find the product that represents how much is given to the friend. On the other hand, "Mark has $\frac{3}{4}$ yards of rope and gives $\frac{1}{2}$ yard of rope to a friend. How much rope does Mark have left?" expects students to take $\frac{1}{2}$ yard from $\frac{3}{4}$ yard, or subtract $\frac{3}{4} - \frac{1}{2}$ to find the difference. Encourage students to lookfor the units in the problem (e.g., $\frac{1}{2}$ *yard* versus $\frac{1}{2}$ *of the whole rope*) to determine the appropriate operation.
- Students may believe that multiplication always results in a larger number. Using models when multiplying with fractions will enable students to generalize about multiplication algorithms that are based on conceptual understanding (MTR.5.1).
- Students can have difficulty with word problems when determining which operation to use, and the stress of working with fractions makes this happen more often.
    - For example, "Mark has $\frac{3}{4}$ yards of rope and he gives a third of the rope to a friend. How much rope does Mark have left?" expects students to first find $\frac{1}{3}$ of $\frac{3}{4}$ or multiply $\frac{1}{3} \times \frac{3}{4}$, and then to find the difference to find how much Mark has left. On the other hand, "Mark has $\frac{3}{4}$ yards of rope and gives $\frac{1}{3}$ yard of rope to a friend. How much rope does Mark have left?" only requires finding the difference of $\frac{3}{4} - \frac{1}{3}$.

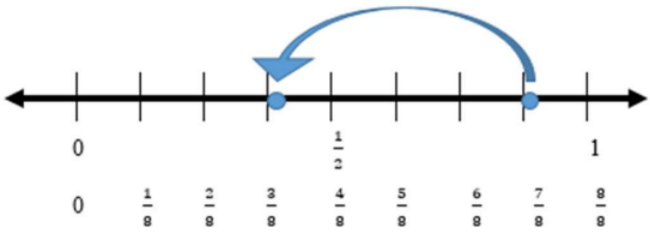
Strategies to Support Tiered Instruction

- Instruction includes opportunities to identify the appropriate operation to use in a real- world problem that requires addition, subtraction, or multiplication of fractions. The teacher guides students to identify the units in the problem for clarification on which operation is appropriate.
    - For example, the teacher displays and reads the following two problems:
        - "Ganie has 7 of a bar of chocolate left and gives half of what she has to her friend Sarah. How much of a whole chocolate bar does she have left?"
        - "Ganie has $\frac{7}{8}$ of a bar of chocolate left and she gives $\frac{1}{2}$ of the original bar of chocolate to her friend Sarah. How much of her chocolate bar does she have left?" (See illustration below)
    - The teacher uses questioning and prompting to have students identify what operations must be used to solve each problem. The teacher asks students to share what they notice about each problem (e.g., the similarities and the differences), placing emphasis on the units (e.g., "half of the amount of chocolate that Janie has in the first problem vs. $\frac{1}{2}$ of the whole chocolate bar" in the second problem). The teacher guides students to identify that in the first problem, they will need to multiply $\frac{7}{8} \times \frac{1}{2}$ and in the second problem, they will need to subtract $\frac{7}{8} - \frac{1}{2}$ to solve. Students solve using models.

$$\frac{7}{8} \times \frac{1}{2} = \frac{7}{16}$$

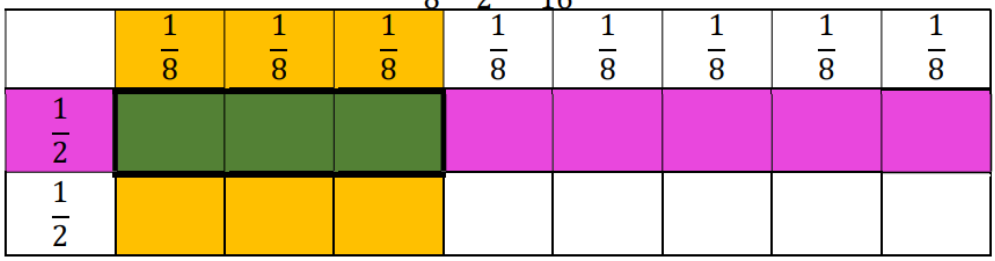


$$\frac{7}{8} - \frac{1}{2} = \frac{7}{8} - \frac{4}{8} = \frac{3}{8}$$



- For example, the teacher displays and reads the following problem: "Tia has $\frac{3}{8}$ yards of ribbon and she gives half of the ribbon to a friend. How much ribbon does Tia have left?" The teacher uses questioning and prompting to have students identify what operation must be used to solve the problem. The teacher asks students, "Did Tia give half of the ribbon or half a yard of ribbon to her friend?" Emphasis is placed on the units (e.g., half of the whole ribbon vs. $\frac{1}{2}$ yard of ribbon) while guiding students to identify that they will need to multiply $\frac{3}{8} x \frac{1}{2}$ to solve. Students solve using the area model and counters. The cells with both color counters indicate the numerator in the solution. This is repeated with similar word problems, using frequent guiding questions to support student understanding.

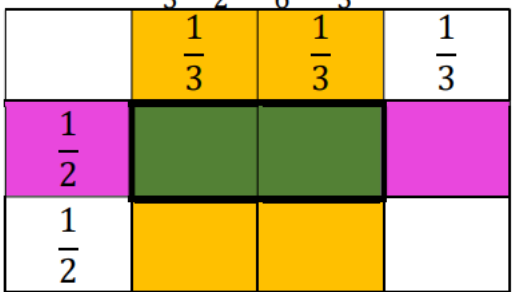
$$\frac{3}{8} \times \frac{1}{2} = \frac{3}{16}$$



- Instruction includes opportunities to use models when solving problems that involve multiplication of fractions to increase understanding that multiplication does not always result in a larger number. The use of models when multiplying with fractions will enable students to generalize about multiplication algorithms that are based on conceptual understanding.
  - For example, the teacher displays and reads aloud the following problem: "Rosalind spent $\frac{2}{3}$ of an hour helping in the garden. Her sister spent $\frac{1}{2}$ the amount of time as Rosalind did helping in the garden. How much time did Rosalind's sister spend helping in the garden?" Students solve the problem using an area model. The teacher uses questioning to help

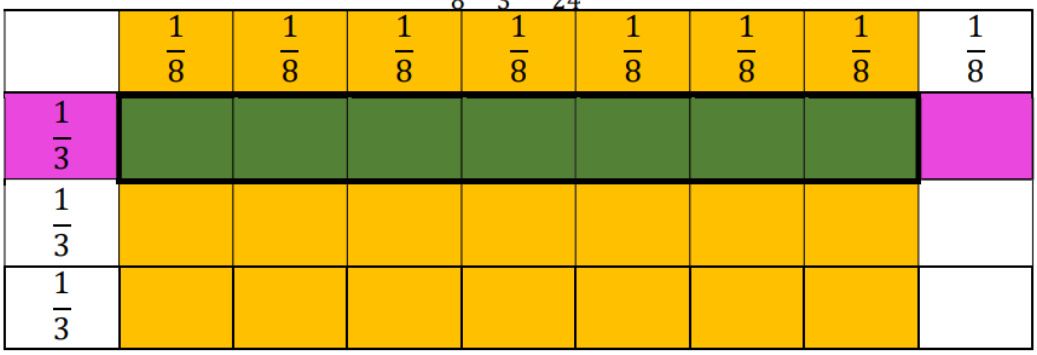
students draw a model to represent the problem. This is repeated with similar word problems involving multiplication of fractions.

$\frac{2}{3} \times \frac{1}{2} = \frac{2}{6}$ *or* $\frac{1}{3}$



- For example, the teacher displays and reads aloud the following problem: "Astrid spent $\frac{7}{8}$ of an hour reading her book. Elliot spent $\frac{1}{3}$ the amount of time as Astrid did reading. How much time did Elliot spend reading?" Students solve using the area model and counters. The cells with both color counters indicate the numerator in the solution. The teacher uses questioning to help students draw a model to represent the problem. This is repeated with similar word problems involving multiplication of fractions, using frequent guiding questions to support student understanding.

$\frac{7}{8} \times \frac{1}{3} = \frac{7}{24}$



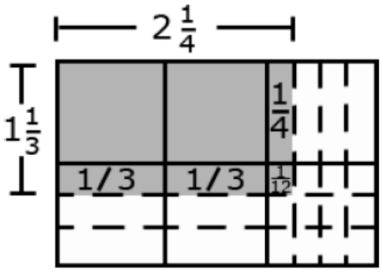
Questions to ask students:

- **Ask students how they knew to add or subtract the fractions based on the actions in the word problem.**
- Sample answer that indicates understanding: Students may describe actions that involve the combination of amounts or distances OR the act of determining the difference between two fractions.

- **In this problem situation, how did you know to multiply?**
- Sample answer that indicates understanding: In the problem, I know the number of groups and the number in each group so I am looking for the product. This makes it a multiplication problem.

- **Why did you draw this type of model when solving this problem?**
- Sample answer that indicates understanding: If I have 3 pieces of ribbon and each piece is 2 ½ inches long, I need to multiply to show 3 groups of 2 ½ inches. My number line model shows the 3 groups of 2 ½ inches.

- **Jaden and Dariel are making a poster for a class assignment. The dimensions of the poster need to be $1\frac{1}{3}$ feet by $2\frac{1}{4}$ feet. What will be the total area for the poster?**
- Sample answer that indicates understanding: A student draws the following to show the array made by multiplying the two factors. The student adds all the partial products in the model for a total of 3 square feet.



Instructional Tasks

Instructional Task 1

Rachel wants to bake her two favorite brownie recipes. One recipe needs $1\frac{1}{2}$ cups of flour and the other recipe needs $\frac{3}{4}$ cups of flour. How much flour does Rachel need to bake her two favorite brownie recipes?

Instructional Task 2

Shawn finished a 100 meter race in $\frac{3}{8}$ of one minute. The winner of the race finished in $\frac{1}{3}$ of Shawn's time. How long did it take for the winner of the race to finish?

Instructional Items

Instructional Item 1

Monica has $2\frac{3}{4}$ cups of berries. She uses $\frac{5}{8}$ cups of berries to make a smoothie. She then uses $\frac{1}{2}$ sup for a fruit salad. After she makes her smoothie and fruit salad, how much of the berries will Monica have left?

Achievement Level Descriptors:

Benchmark	Context	Assessment Limits
MA.5.AR.1.2 Solve real-world problems involving the addition, subtraction or multiplication of fractions, including mixed numbers and fractions greater than 1. Example: Shanice had a sleepover and her mom is making French toast in the morning. If her mom had $2\frac{1}{4}$, loaves of bread and used $1\frac{1}{2}$, loaves for the French toast, how much bread does she have left?	Real-world	Items requiring addition or subtraction must include denominators using unlike whole numbers. Items requiring multiplication must include denominators using whole numbers up to 20.

Clarification 1: Instruction includes the use of visual models and equations to represent the problem.			
ALD 2	**ALD 3**	**ALD 4**	**ALD 5**
Solves real-world problems involving addition and subtraction of fractions with unlike denominators, using models and various strategies.	Solves real-world problems involving addition and subtraction or multiplication of fractions with unlike denominators and those greater than one.	Solves real-world problems involving the addition, subtraction, or multiplication of fractions, including mixed numbers and fractions greater than one.	Identifies an error and solves multi-step, real-world problems involving the addition, subtraction, or multiplication of fractions, including mixed numbers and fractions greater than one.

Additional Resources:
CPALMS Resources

Subtracting Fractions Word Problems

Resources/Tasks to Support Your Child at Home:
Multiply a Fraction by a Fraction

Multiply Mixed Numbers by Mixed Numbers

Find various recipes that contain fractions and mixed number measurements. Pose addition and subtraction types of questions using the recipes.

> For example: How much more sugar than flour? How much butter and milk combined? What is the total of all the ingredients in the recipe?