

**Cluster 3: Using Models to Multiply and Divide Fractions**

**Duration:** 3-4 weeks

**Content Standards:**

*This list includes standards that will be addressed in this cluster, but not necessarily mastered, since all standards are benchmarks for the end of the year. Please note strikethroughs and recommendations in the Important Considerations section for more information.*

**NC.5.NF.3**

Use fractions to model and solve division problems.

- Interpret a fraction as an equal sharing context, where a quantity is divided into equal parts.
- Model and interpret a fraction as the division of the numerator by the denominator.
- Solve one-step word problems involving division of whole numbers leading to answers in the form of fractions and mixed numbers, with denominators of 2, 3, 4, 5, 6, 8, 10, and 12, using area, length, and set models or equations.

**NC.5.NF.4**

Apply and extend previous understandings of multiplication to multiply a ~~fraction or~~ whole number by a fraction, including mixed numbers.

- Use area and length models to multiply ~~two fractions~~ [a fraction by a whole number], with the denominators 2, 3, 4.
- Explain why multiplying a given number by a fraction greater than 1 results in a product greater than the given number and when multiplying a given number by a fraction less than 1 results in a product smaller than the given number.
- ~~Solve one-step word problems involving multiplication of fractions using models to develop the algorithm.~~

**NC.5.NF.7**

Solve one-step word problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions using area and length models, and equations to represent the problem.

**NC.5.OA.2**

Write, explain, and evaluate numerical expressions involving the four operations to solve up to two-step problems. Include expressions involving:

- Parentheses, using the order of operations.
- Commutative, associative and distributive properties.

**Mathematical Practices:**

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

**What is the mathematics?**

- Students build on the work in multiplication and division in Cluster 2 to recognize that the meaning of operations do not change when the problem includes fractions. Division is still sharing fairly into equal groups and multiplication is still finding the quantity of a number of equal groups with a set amount in each group.
- Students solve problems in context to share fairly. Problems begin with simple mixed number solutions (ex. 2 people are sharing 5 brownies, how many does each person get?).
- In these problems students are still working with whole numbers division, but deciding how to name the remainders as fractions. They then move on to situations where the solution is a fractional answer less than 1 (4 people share 3 brownies). Students solve problems first by building or drawing the situation and labeling the parts. Through discussion of what to label the solution, students discuss the role of the whole in naming the solution, and they model and interpret a fraction as the division of the numerator by the denominator.
- In the context of fair-sharing work, students may divide a unit fraction by a whole number (ex. When using models to divide a pan of brownies into six pieces, a student may cut the pan into thirds and then each third into two parts or  $1/3$  divided by 2).
- Students use models to solve multiple group problems with whole numbers and a fraction (ex. My dog eats  $1/3$  a cup of dog food per day. How much dog food will he eat in a week?; I have 4 cups of dog food. If my dog eats half a cup a day, how many days can I feed the dog before I need to go to the store?). Students use their understanding of multiple groups problems to explore division of a whole number by a unit fraction (ex.  $4 = \underline{\hspace{1cm}}$  groups of  $1/3$ ) focusing on the relationship between multiplication and division.
- In Cluster 6, students extend their reasoning about multiple group problems with a whole number times a fraction to reason about multiplying a fraction by a fraction using area and length models (ex. My dog eats  $2/3$  of a cup of dog food per day. Today he is not very hungry and only eats  $1/2$  of his food, how much of a cup of dog food did he eat?).
- Students reason about the size of two factors and their product to assess the reasonableness of their solutions. They use their work with models and real-world contexts to notice patterns and make conjectures about when the product of a multiplication problem will be more than one and when it will be less than one.

**Important Considerations:**

- In this cluster, students extend their work from fourth grade on fraction multiplication. They continue to use area and length models to solve problems rather than developing the algorithm. Students only multiply a fraction by a whole number in this cluster. In Cluster 5, students build on their experience with fair-sharing and naming of fractions in this cluster to find equivalent fractions in meaningful contexts before adding and subtracting with unlike denominators. Work to connect models for multiplication of a fraction by a fraction will occur in Cluster 6. Students will further solidify their understanding of the algorithm and develop fluency in sixth grade where mastery of the algorithm is expected.
- The focus of this cluster is to emphasize that the meanings of multiplication and division do not change when fractions are used rather than whole numbers and to unpack the concept that a fraction is a division problem. The experiences students had in grade four for adding and subtracting fractions with like denominators provide the necessary prior knowledge to work with these concepts.
- Students need the chance to create their own drawings when working on tasks rather than always being presented with pre-made fraction materials that are already shared fairly for them.
- In fifth grade, students only work with denominators of 2, 3, 4, 5, 6, 8, 10, and 12. When multiplying two fractions they work only with denominators of 2, 3, and 4.