

Cluster 6: Using Models to Multiply and Divide of Whole Numbers, Decimals, and Fractions.

Duration: 5-6 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.MD.1

Given a conversion chart, use multiplicative reasoning to solve one-step conversion problems within a given measurement system.

NC.5.NBT.5

Demonstrate fluency with the multiplication of two whole numbers up to a three-digit number by a two-digit number using the standard algorithm.

NC.5.NBT.6

Find quotients with remainders when dividing whole numbers with up to four-digit dividends and two-digit divisors using rectangular arrays, area models, repeated subtraction, partial quotients, and/or the relationship between multiplication and division. Use models to make connections and develop the algorithm.

NC.5.NBT.7

Compute and solve real-world problems with multi-digit whole numbers and decimal numbers.

- ~~Add and subtract decimals to thousandths using models, drawings or strategies based on place value.~~
- Multiply decimals with a product to thousandths using models, drawings, or strategies based on place value.
- Divide a whole number by a decimal and divide a decimal by a whole number, using repeated subtraction or area models. Decimals should be limited to hundredths.
- Use estimation strategies to assess reasonableness of answers.

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, 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 continue to build fluency with all multiplication and division through word problems and rich tasks including measurement contexts. Students:

- multiply two whole numbers up to a three-digit number by a two-digit number with the standard algorithm and other strategies for multiplication.
- begin to develop the division standard algorithm by connecting to models and strategies for division used in Cluster 2.
- multiply and divide decimals using models and strategies based on place value.
- use number sense and estimation about the quantity of the numbers to determine the placement of the decimal point.
- multiply a fraction by a fraction using area and length models (with denominators 2, 3, and 4 only)
- build on the meaning of multiplication to reason about 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
- use a conversion chart to solve conversion problems within a given measurement system (ex. convert within customary or convert within metric, but not from customary to metric).
- make sense of size and quantity of units in relation to conversions to judge the reasonableness of their solutions.

Important Considerations

- In this cluster students connect area models and partial products to the standard algorithm for multiplication of whole numbers. Fluency with the multiplication standard algorithm is expected at the end of this cluster.
- Students begin to develop the division algorithm in this cluster building on their work with models and place value strategies in Cluster 2, but fluency of the algorithm is not expected until sixth grade.
- Students should reason about what to do with remainders in real-world situations (ex. Mr. Jones needs 185 pieces of bread for a school project. If 18 pieces of bread come in each bag how many bags does he need to purchase?; Charlie has \$125 to buy packs of socks. If each pack is \$12, how many can he buy?
- In Cluster 3, students multiplied a fraction by a whole number. In this cluster they extend to multiply a fraction by a fraction with area and length models.
- Multiplication and division of fractions and decimals are just being explored in fifth grade. Students do not begin to develop algorithms until sixth grade.
- Measurement is a rich context to explore multiplication and division (ex. My recipe calls for $\frac{2}{3}$ cup of sugar. If I make $\frac{1}{2}$ a recipe, how much sugar should I use?; How many servings of jelly beans can I get from a liter container if a serving is 75 milliliters?).
- Students worked with metric measurement conversions in fourth grade and in Cluster 4.
- In third grade students were exposed to the customary system of measurement however they did not convert measurements between units. It is important to provide students with

opportunities with real-world examples of customary units so they can make sense of the reasonableness of conversions (ex. Doubling or tripling recipes; only having a quart jar when you need to measure a gallon of water for the lemonade).

- Ask questions about the size and quantity of units within conversions to make sense of reasonableness.
- Rich tasks that require multiplication and division can be used to re-visit concepts from earlier clusters (ex. Word problems and real-life situations that involve data, number and shape patterns, volume, etc.)