Fifth Grade Instructional Framework

Cluster 1	**Creating Classroom Community through Data and Graphing**
Cluster 2	**Using Models to Explore Properties of Multiplication and Division**
Cluster 3	**Using Models to Multiply and Divide Fractions**
Cluster 4	**Understanding Place Value in the Context of Metric Measurement**
Cluster 5	**Using Models to Add and Subtract Decimals and Fractions**
Cluster 6	**Using Models to Multiply and Divide of Whole Numbers, Decimals, and Fractions**
Cluster 7	**Classifying Quadrilaterals**

Introduction

The purpose of this document is to connect and sequence mathematical ideas to enable teachers to plan learning opportunities for students to develop a coherent understanding of mathematics. **Clusters** and sequencing are designed to foster students' meaning making of the connections among mathematical ideas and procedures. This meaning making occurs over time. Therefore, some concepts are included in multiple clusters with increasing depth. They build across the year beginning with conceptual understanding and moving toward procedural fluency.

Each cluster includes a list of related **content standards** and a range of **suggested duration**. Standards indicate the mathematics expectations of students by the end of the school year. Standards are introduced and developed throughout the year, so the fact that a content standard is listed in a particular cluster does not indicate that it is to be mastered in the cluster. In some clusters, strikethroughs in the content standards denote the portion of the standard that will be taught later. In other clusters, the full standard appears, but suggestions about the intended focus are noted in the cluster descriptions. Because standards may be included in clusters long before mastery is expected, formative assessment is an essential tool for instructional planning and reporting student progress. This assessment naturally occurs as teachers elicit students' mathematical thinking and reasoning while doing mathematics.

Particular **Standards for Mathematical Practice** are indicated for each cluster. The listed suggestions are a guide for teachers. While the practices listed may lend themselves particularly well to the cluster's content, this does not imply that they are the only practices students will use. Students doing rich mathematical tasks will naturally engage in many mathematical practices as they do mathematics. During instruction teachers may observe and decide to highlight the other practices students are using beyond those listed in the cluster.

Each cluster includes a section called **"What is the mathematics?"** that describes the significant concepts and connections within the standards necessary for students to make

sense of and use the mathematics. A second section called **"Important Considerations"** provides guidance based on student learning progressions as well as ideas and models for teaching within problem-solving situations. Problem-solving and mathematical reasoning define what it means to do mathematics. Rich tasks (including word problems) provide students with concrete contexts to use as they are introduced to new mathematics. Later, work within such tasks allows students to develop understanding and eventually to demonstrate mastery. Rich tasks with multiple entry and exit points allow for natural differentiation of instruction and are accessible for all students.

The initial cluster at each grade includes a focus on **building mathematical community**. Learning mathematics involves productive struggle during problem-solving and meaningful discourse as students share strategies and explain their thinking. This requires individual students to have a mathematical mindset, a belief that they can learn and do mathematics, so they will take risks when solving non-routine tasks. Collectively, students must share ideas publicly as they critique mathematical ideas with peers and teacher. A safe community where mistakes and struggles are valued as learning opportunities is essential. Mathematical norms about how students do and talk about mathematics need to be explicitly established in the same way that other routines and expectations are introduced at the beginning of a school year.

Cluster 1: Creating Classroom Community through Data and Graphing

***Duration*:** *2-3 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.2
Represent and interpret data.
- Collect data by asking a question that yields data that changes over time.
- Make and interpret a representation of data using a line graph.
- Determine whether a survey question will yield categorical or numerical data, or data that changes over time.

NC.5.G.1
Graph points in the first quadrant of a coordinate plane, and identify and interpret the x and y coordinates to solve problems.

NC.5.OA.3
Generate two numerical patterns using two given rules.
- Identify apparent relationships between corresponding terms.
- Form ordered pairs consisting of corresponding terms from the two patterns.
- Graph the ordered pairs on a coordinate plane.

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?
- Develop mathematicians with positive attitudes about their ability to do mathematics by:
  - Creating opportunities to develop an appreciation for mistakes
  - Seeing mistakes as opportunities to learn
  - Teaching students to take responsibility for their learning
- Develop mathematicians who respect others by:
  - Demonstrating acceptance, appreciation, and curiosity for different ideas and approaches
  - Establishing procedures and norms for productive mathematical discourse
  - Consider other solution paths
- Develop mathematicians with a mindset for problem solving by:
  - Encouraging student authority and autonomy when problem solving
  - Emphasizing questioning, understanding, and reasoning about math, not just doing math for the correct answer
  - Asking follow-up questions when students are both right and wrong
  - Allowing students to engage in productive struggle and moving them along by questioning, not telling

- Data standards are accessible for all teachers and students at the beginning of the year. Surveys and data collection are a nice way for students to get to know each other (ex. How many seconds does it take you to run a lap around the track? How many minutes are you on electronic devices each day?) and for them to get to know their new classroom (ex. How many books do we have in each genre in our classroom library?). Data standards can also be integrated with Science and Social Studies as appropriate (ex. collecting temperature, rainfall, and humidity data daily); In Grade Five students graph data with line graphs which involve work in the first quadrant of a coordinate plane.
- Students generate shape and numerical patterns which lends itself to x,y coordinate points. The ordered pairs of corresponding terms can be graphed on a coordinate plane.

Important Considerations:

- For success, significant time should be spent setting up the classroom.
  This includes:
  - Developing classroom norms for communication (ex: non-verbal signals, listening and speaking expectations, talk moves for math discussions)
  - Developing math routines (ex: number of the day, number talks, number strings, and other appropriate math routines)
  - Setting various expectations for the structure of the math block (ex: expectations for whole class instruction, cooperative learning, independent learning, effective integration of technology, etc.)
  - Math discourse needs explicit modeling and practice

  This includes students:
  - Sharing their thinking
  - Actively listening to the ideas of others
  - Connecting to others' ideas
  - Asking questions to clarify understanding
- Students should be actively involved in asking questions, collecting data, and developing graphs appropriate for the data source.
- Line graphs are new in fifth grade. In fourth grade, students worked with frequency tables, scaled bar graphs, and line plots. Students need to be able to distinguish between categorical and numerical data (including distinguishing data that changes over time as data that can be represented with a line graph on a coordinate plane).
- Tasks involving shape patterns lend themselves to classroom discussions in which to teaching classroom norms for math talk. Visual patterns can be seen and described in many ways and can be represented in pictures, in a function table, in words, and on a coordinate plane (line graph show how the pattern grows from term to term) to help students begin to listen to and critique others' reasoning and make connections among representations.

Cluster 2: Using Models to Explore Properties of Multiplication and Division

Duration: 4-5 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.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.

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.MD.4
Recognize volume as an attribute of solid figures and measure volume by counting unit cubes, using cubic centimeters, cubic inches, cubic feet, and improvised units.

NC.5.MD.5
Relate volume to the operations of multiplication and addition.

- Find the volume of a rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths.
- Build understanding of the volume formula for rectangular prisms with whole-number edge lengths in the context of solving problems.
- Find volume of solid figures with one-digit dimensions composed of two non-overlapping rectangular prisms.

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 explore volume with multiple experiences building rectangular prisms with unit cubes (ex. cm. cubes, inch cubes, non-standard units - sugar cubes, wooden blocks, etc.). Through discussions of their buildings they develop a common language for describing their prisms (ex. Rows, columns, layers, length, width, base, height, etc.) and connect that language to symbolic notation (ex. A base of 3 rows and 4 columns with 5 layers can be written as 3 x 4 x 5). Through these experiences students develop the formula for volume.
- Students model the associative property of multiplication by showing that the volume of a rectangular prism is the same no matter the orientation [ex. (3 x 4) x 5 = 3 x (4 x 5) or a prism turned on the 3 x 4 base with 5 layers is the same when oriented to use the 4 x 5 as the base with 3 layers].
- Students review mental and alternative multiplication and division strategies from fourth grade (ex. Area models and length models; Strategies based on distributive, associative, commutative, and identity properties). They connect strategies based on the associative property to their work with volume.
  Example: 14 x 5 using associative property to solve
  - 14 can be decomposed into 7 x 2 so that the problem reads (7 x 2) x 5
  - Grouping of factors can be rearranged to make the problem easier to solve mentally. (7 x 2) x 5 = 7 x (2 x 5) = 7 x 10 = 70
- Students extend work to use models and strategies when solving real-world and word problems with bigger numbers in multiplication and division.
- Students develop an understanding of Order of Operations as they record their thinking symbolically.

Important Considerations:

- This cluster does not include developing the standard algorithms for multiplication and division. Algorithm development occurs in Cluster 6. However, if students have had previous experience with the algorithm use this as a point of discussion by asking them to show why the procedure works by using strategies including but not limited to partial products, area models, or other place value strategies.
- Beginning with volume with single digit side lengths allows for multiplication practice at the beginning of the year for students who have not yet mastered multiplication facts.
- Rather than memorizing the properties in generalized form, at this stage, students learn properties by solving multiplication and divisions problems in multiple ways and making connections among those strategies (ex. in a number talks, problem-solving in context, etc.) and the properties that allow them to work.
- Show the connection between multiplication and division. Strategies will be inverses to allow for conceptual understanding.

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 ⅓ 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 = ____ 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 ½ 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.

Cluster 4: Understanding Place Value and Decimals in the Context of Metric Measurement

***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.NBT.1
Explain the patterns in the place value system from one million to the thousandths place.
- Explain that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.
- Explain patterns in products and quotients when numbers are multiplied by 1,000, 100, 10, 0.1, and 0.01 and/or divided by 10 and 100.

NC.5.NBT.3
Read, write, and compare decimals to thousandths.
- Write decimals using base-ten numerals, number names, and expanded form.
- Compare two decimals to thousandths based on the value of the digits in each place, using >, =, and < symbols to record the results of comparisons.

NC.5.MD.2
Represent and interpret data.
- Collect data by asking a question that yields data that changes over time.
- Make and interpret a representation of data using a line graph.
- Determine whether a survey question will yield categorical or numerical data, or data that changes over time.

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 increase their number sense about larger and smaller numbers with experiences estimating (ex. How many tennis balls fit in this shoe box? How many would tennis balls would you estimate fit in our classroom? How much space would you need for 1,000,000 tennis balls?)
- Students build on their knowledge of multiplicative comparison from grade four to explore place value from one million to thousandths. They use various tools (ex. Calculator, zoomable number lines, meter sticks, place value blocks) to notice patterns when a number is continually multiplied or divided by ten to discover that a digit in one place is ten times as much as the digit to the right and ten times less than the digit to the left.
- Students continue to apply place value concepts to solve metric conversion problems using

a conversion table (Grade 4 standard).
- Students use the meter stick as a length model to further explore decimal place values (ex. Roll dice and line up base ten blocks against a meter stick to "Race to a Meter" recording centimeter cubes as hundredths and decimeter cubes as tenths; measure lengths of long jumps), etc.)
- Students compare decimals to thousandths using length and area models using >, =, and < symbols to record the results of comparisons (ex. Who jumped the farthest? Whose race time was the fastest?)
- Students collect data using metric measurement that yields change over time and use it to make and interpret line graphs (ex. plant growth each day using millimeters as thousandths, centimeters as hundredths; rainfall in milliliters; what the class drinks each day in liters).

Important Considerations:

- This cluster extends on the place value ideas that students explored in Grade 4 (100,000 to hundredths) to larger and smaller numbers (1,000,000 to thousandths).
- Students need ample opportunities to explore concepts with concrete models (meter sticks, place value blocks, number lines) to build a strong conceptual understanding of place value.
- Measurement work can be done in the context of data to provide some review from Cluster 1. Students can collect, analyze, and graph measurements to answer a question.
- As students are making conjectures when looking for patterns as they multiply by ten, be sure to help them refine their mathematical language so that their statements are accurate. Students often notice that when they multiply a number by ten a zero is added to the end. This pattern is only true for whole numbers, however. This can create a misconception later as students begin working with decimals. Helping introduce counterexamples (ex. Does your "zero at the end" idea work with fractions? With decimals?) can help students refine their statements. With experience they will begin to refine their own and each other's statements, gaining experience in Mathematical Practice 6, attending to precision.
- In Cluster 6 students will have more experience with measurement and conversion problems in both the customary and metric systems. In this cluster, metric measurement is a context to further examine place value and comparison of decimals.

Cluster 5: Using Models to Add and Subtract Decimals and Fractions

Duration: 4-5 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.1
Add and subtract fractions, including mixed numbers, with unlike denominators using related fractions: halves, fourths and eighths; thirds, sixths, and twelfths; fifths, tenths, and hundredths.

- Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.
- Solve one- and two-step word problems in context using area and length models to develop the algorithm. Represent the word problem in an equation

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.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?

- This cluster continues the natural progression from place value to decimal computation. Students use the same length and area models to add and subtract decimals within real-world and word problem contexts, developing an understanding that the meaning of addition and subtraction do not change simply because the numbers are decimals and fractions rather than whole numbers. They continue to explore addition and subtraction as inverse operations.
- Students deepen their understanding of equivalent fractions by using relational thinking to build on the grade four work where they decomposed fractions (ex. 2 x ⅓ = ___ x ⅙) and the work in Cluster 3 where they solved fair-sharing problems (ex. In the problem 6 children share 4 brownies, how many brownies does each child have?; At the big table,10 children

are sharing 8 brownies so they all get the same amount. How many brownies should the teacher give the small table where 5 people are sitting so that each person at the small table has the same amount as each person at the big table?)

- Students use equivalent fractions to add and subtract fractions with unlike denominators. They connect area models, length models, and other drawings to equations and discuss which strategies are efficient in different contexts. Through these discussions and connections of representations, they begin to develop the standard algorithm for adding and subtracting fractions by understanding the process as expressing both fractions in terms of the same unit fraction.
- Students understand that quantities can be named in different ways (ex. decimal, fraction, mixed number).
- Students use benchmark fractions to estimate and assess the reasonableness of solutions.

Important Considerations:

- Students use models, drawings or strategies based on place value to add and subtract decimals. They explore addition and subtraction of fractions by connecting their knowledge of decimals.
- Students need ample opportunities to explore concepts with concrete models to build a strong conceptual understanding of addition and subtraction of decimals and fractions.
- Students work with fractions within related groups: halves, fourths and eighths; thirds, sixths, and twelfths; fifths, tenths, and hundredths. When adding and subtracting fractions with unlike denominators they first begin with situations where one denominator is a divisor of the other so that only one fraction needs to be changed (ex. 1/3 + 1/6). In sixth grade, they then extend the same reasoning to situations in which both fractions need to be expressed in terms of a new, common denominator (1/2 + 1/3). Although students begin to develop the standard algorithm by exploring finding equivalent fractions by multiplying by one to get a common denominator, this algorithm does not need to be mastered until grade six.
- As students write equations to connect to their models, they continue to use of Order of Operations appropriately.

Cluster 6: Using Models to Multiply and Divide 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 2/3 cup of sugar. If I make ½ 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.)

Cluster 7: Classifying Quadrilaterals

***Duration*:** 1-2 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.G.1
Graph points in the first quadrant of a coordinate plane, and identify and interpret the x and y coordinates to solve problems.

NC.5.G.3
Classify quadrilaterals into categories based on their properties.

- Explain that attributes belonging to a category of quadrilaterals also belong to all subcategories of that category.
- Classify quadrilaterals in a hierarchy based on 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 were expected to identify attributes of quadrilaterals in fourth grade, but in fifth grade they are expected to classify them into a hierarchy to construct classifications based on hierarchy.
- Minimal defining lists help define the subset of properties that are essential to the identification of a shape. All figures that meet the criteria of the minimal defining list for a particular shape can be named as that shape (Ex. A parallelogram has four sides and two sets of parallel sides. All shapes that meet this criteria are parallelograms including squares, rectangles, and rhombuses).
- Students utilize true/false statements to demonstrate mastery of classifications and make arguments for their answers (ex. If is a square, then it is a rhombus. True, because a rhombus has four congruent sides and a square fits this definition).

Important Considerations:

- Classifying quadrilaterals into a hierarchy is a higher level of geometric thought. Even though students identified triangles and quadrilaterals in fourth grade, they may need additional experiences with sorting shapes and discussing the relationships between shapes based on attributes.
- Students learned to use a protractor to measure angles in fourth grade and can use angle measures as part of their noticing and conjecturing about shapes and how they are alike and different.
- Students need opportunities to draw and sketch shapes themselves rather than always being presented with pre-cut shapes.
- A variety of quadrilaterals should be used as to not limit students' experiences to the more traditional visual images (ex. Use a right trapezoid in addition to an isosceles trapezoid). A

variety of shapes shown in different orientations encourages students to focus on relevant properties to name shapes.

- Instructional resources sometimes use different definitions for quadrilaterals that make a difference in how they are classified. For example, when a trapezoid is defined as a quadrilateral with *at least* one set of parallel lines, a parallelogram is a type of trapezoid. When defined as *exactly one* set of parallel lines, a parallelogram is not a type of trapezoid. It is important to make sure to check the glossary of terms from DPI for definitions as those are the ones that will be used for testing purposes.
- Classifying quadrilaterals is easily integrated with coordinate graphing, which they explored in the first cluster (ex. Draw a square on the coordinate plane. What are the coordinates of its points?)