South Carolina College- and Career-Ready Standards for Mathematics

Support Document

5th Grade

South Carolina College- and Career-Ready Standards for Mathematics

Grade 5 Mathematics Support Document

As support for implementing the *South Carolina College- and Career-Ready Standards for Mathematics*, the standards for each grade K-5 have been grouped into possible units. In the *Table of Contents* below, the titles for those possible units are listed in a column under each grade. To see which standards are addressed in each unit for this grade and to read a brief description of the focus for each unit for this grade, click on the *Overview of Units* in the *Table of Contents*. The completed units for this grade are hyperlinked from/to the *Table of Contents* and the *Overview of Units*. The purpose of this document is to provide guidance as to how all the standards at this grade may be grouped into units and how those units might look. Since this document is merely guidance, districts should implement the standards in a manner that addresses the district curriculum and the needs of students.

Acknowledgments

"Jean Baptiste Massieu, famous deaf educator, made a statement that is now considered a French proverb. *Gratitude is the memory of the heart.* Indeed, appreciation comes when you feel grateful from the depths of your heart. The head keeps an account of all the benefits you received and gave. But the heart records the feelings of appreciation, humility, and generosity that one feels when someone showers you with kindness." It is with sincere appreciation that we humbly acknowledge the dedication, hard work and generosity of time provided by the following individuals who are making the K-5 Mathematics Support Document possible. (http://quotations.about.com/od/ThankYou/a/Gratitude-Quotes.htm)

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	Table of Contents for Grades K-5					
	K	**1st**	**2nd**	**3rd**	**4th**	**5th**
	Overview of Units	**Overview of Units**	**Overview of Units**	**Overview of Units**	**Overview of Units**	**Overview of Units**
Unit 1	Counting and Cardinality	Composing and Decomposing Numbers Through 10	Place Value Concepts	Conceptual Understanding of Multiplication & Division	Place Value, Addition, & Subtraction with Whole Numbers	Expressions, Equations, & the Coordinate Plane
Unit 2	Understanding Relationship of Counting and Quantity	Addition and Subtraction Strategies	Developing Concepts of Addition and Subtraction	Place Value	Algebraic Thinking	Place Value
Unit 3	Count and Compare	Understanding Place Value	Application of Addition and Subtraction	Addition & Subtraction	Multiplication & Division of Whole Numbers	Operations with Whole and Decimal Numbers
Unit 4	Composing and Decomposing Numbers	Applying Place Value Concepts	Attributes Polygons and Fractional Parts	Application of Multiplication & Division	Fraction Equivalence	Adding and Subtracting Fractions
Unit 5	Addition and Subtraction	Comparisons and Data	Measurement: Length	Conceptual Understanding of Fractions	Adding, Subtracting, & Multiplying with Fractions	Multiplying with Fractions
Unit 6	Patterns and Positions	Geometry and Equal Shares	Measurement Time and Money	Data Analysis	Decimal Concepts	Dividing with Fractions
Unit 7	Two Dimensional and Three Dimensional Geometry	Measurement and Data	Creating and Understanding Data	Identification and Classification of Geometric Shapes	Conversions & Problem Solving with Measurement	Classifying 2D Shapes
Unit 8	Foundations of Measurement			Problem Solving with Measurement	Geometric Classifications & Line Symmetry	Perimeter, Area, and Volume
Unit 9	Understanding Graphs and Data			Fluency with Multiplication & Division	Angle Measurement	Converting Measurements within a Single System

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Grade Five Overview of Units

Click here to return to the K-5 Table of Contents

Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9
Expressions, Equations, and the Coordinate Plane	**Place Value**	**Operations with Whole and Decimal Numbers**	**Adding and Subtracting Fractions**	**Multiplying with Fractions**	**Dividing with Fractions**	**Classifying 2D Shapes**	**Perimeter, Area, and Volume**	**Converting Measurements within a Single System**
Standards	**Standards**	**Standards**	**Standards**	**Standards**	**Standards**	**Standards**	**Standards**	**Standards**
5.ATO.1 5.ATO.2 5.ATO.3 5.G.1 5.G.2	5.NSBT.1 5.NSBT.2 5.NSBT.3 5.NSBT.4	5.NSBT.5 5.NSBT.6 5.NSBT.7	5.NSF.1 5.NSF.2 5.MDA.2	5.NSF.4 5.NSF.5 5.NSF.6 5.MDA.2	5.NSF.3 5.NSF.7 5.NSF.8	5.G.3 5.G.4	5.MDA.3 5.MDA.4	5.MDA.1
Unit Focus	**Unit Focus**	**Unit Focus**	**Unit Focus**	**Unit Focus**	**Unit Focus**	**Unit Focus**	**Unit Focus**	**Unit Focus**
Students expand their ability to evaluate numerical expressions that include grouping symbols. Students connect their understanding of numerical expressions to the coordinate plane.	Students work with powers of 10 to extend place value understanding of whole and decimal numbers through thousandths.	Students develop fluency with multiplication and division of multi-digit whole numbers. Students also develop conceptual understanding of operations with decimal numbers.	Students use a variety of models when adding and subtracting fractions with unlike denominators to solve real-world problems.	Students extend their understanding of fractions by multiplying with fractions in a variety of situations to solve real-world problems.	Students divide unit fractions and whole numbers using a variety of models to solve real-world problems.	Students culminate their understanding of two-dimensional figures by classifying them in a hierarchy based on their attributes.	Students investigate volume measurement from concrete exploration to derivation of the formula for right rectangular prisms. Students then differentiate among perimeter, area, and volume when solving real-world problems.	Students convert measurements within a single system by applying operational fluency in problem solving situations.

DRAFT

5th Grade Math Unit 1	Return to Table of Contents	Return to Fifth Grade Overview

Expressions, Equations, and the Coordinate Plane

Content Standards with Clarifying Notes

Open bullets indicate clarifying notes.

- **5.ATO.1** Evaluate numerical expressions involving grouping symbols (i.e., parentheses, brackets, braces).
  - Include the use of all four operations
- **5.ATO.2** Translate verbal phrases into numerical expressions and interpret numerical expressions as verbal phrases.
  - This standard does not include the use of variables
  - Include the use of all four operations
- **5.ATO.3** Investigate the relationship between two numerical patterns.
  a. Generate two numerical patterns given two rules and organize in tables;
  b. Translate the two numerical patterns into two sets of ordered pairs;
  c. Graph the two sets of ordered pairs on the same coordinate plane;
  d. Identify the relationship between the two numerical patterns.
- **5.G.1** Define a coordinate system.
  a. The x- and y- axes are perpendicular number lines that intersect at 0 (the origin);
  b. Any point on the coordinate plane can be represented by its coordinates;
  c. The first number in an ordered pair is the x-coordinate and represents the horizontal distance from the origin;
  d. The second number in an ordered pair is the y-coordinate and represents the vertical distance from the origin.
- **5.G.2** Plot and interpret points in the first quadrant of the coordinate plane to represent real-world and mathematical situations.

New Academic Vocabulary for This Unit

- brackets
- braces
- first quadrant
- x-coordinate
- coordinate system
- coordinate plane
- ordered pair
- y-coordinate
- origin
- x-axis
- y-axis

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Prior Knowledge Required for This Unit
In this unit, students extend their work from grade 3 (3.ATO.5) and grade 4 (4.ATO.3) where students start learning the conventional order when simplifying numerical expressions. In addition, students apply their reasoning of the four operations as well as place value while describing the relationship between numbers. This unit extends the work from grade four, where students generate numerical patterns when they are given one rule. In grade five, students are given two rules and generate two numerical patterns. Additionally, this is the first time students are introduced to the coordinate plane. Students will define a coordinate system, plot, and interpret points in the first quadrant.
Subsequent Knowledge Related to This Unit
Students need multiple experiences with expressions that use grouping symbols throughout the year to develop understanding of when and how to use parentheses, brackets, and braces. First, students use these symbols with whole numbers (extending beyond basic facts.) Then, the symbols can be used as students add, subtract, multiply and divide decimals and fractions throughout the year. In grade 6, students will be formally introduced to the Order of Operations and (6.EEI.1). Additionally, students translate between verbal phrases and numerical expressions. These standards are the foundation for writing and evaluating numerical and algebraic expressions that will include whole-number exponents in Grade 6 (6.EEI.1, 6.EEI.2, 6.EEI.3 and 6.EEI.4). In science units (Force and Motion), students will apply their understanding of the coordinate plane. Students will extend their understanding to graphing in all four quadrants in grade 6 as well as (6.NS.6 and 6.NS.8).
Relationship Among Standards in This Unit
Once students have had rich learning experiences with numerical expressions and the coordinate plane, students apply these skills to model numerical expressions within the coordinate plane. (5.ATO.3)
Potential Instructional Strategies/Lessons
Teacher Note: 5.ATO.1 and 5.ATO.2 Students may believe the order in which a problem with mixed operations is written is the order to solve the problem. The use of the mnemonic phrase "Please Excuse My Dear Aunt Sally" to remember the order of operations (Parentheses, Exponents, Multiplication, Division, Addition, Subtraction) can also mislead students to always perform multiplication before division and addition before subtraction. To correct this thinking, students need to

DRAFT

understand that addition and subtraction are inverse operations and multiplication and division are inverse operations, as they have the same "impact". At this level, students need opportunities to explore the "impact" of the various operations on numbers and solve equations starting with the operation of greatest "impact". In addition to evaluating expressions as required by 5.ATO.1, standard 5.ATO.2 calls for students to verbally describe the relationship between expressions without actually calculating them. 5.ATO.2 calls for students to apply their reasoning of the four operations as well as place value while describing the relationship between numbers. Standard 5.ATO.2 does not include the use of variables, only numbers and signs for operations and serves as the transition from an elementary arithmetic approach to a middle level algebraic approach. (Excerpt from KATM Grade 5 flip book)

Possible Strategies:

Why Do We Need an Order of Operations? (5.ATO.1)

https://www.illustrativemathematics.org/content-standards/5/OA/A/tasks/1606

- The purpose of this task is to help students think about the reason for the mathematical convention known as the "order of operations." However, formal instruction of "Order of Operations" should not be taught in grade 5.

Video Game Scores (5.ATO.2)

https://www.illustrativemathematics.org/content-standards/tasks/590

- This task requires students to write and interpret numerical expressions. The focus of this problem is not on numerical answers, but instead on building and interpreting expressions that could be entered in a calculator or communicated to another student unfamiliar with the context.

Howard County Schools Resources for 5.ATO.1

https://hcpss.instructure.com/courses/108/pages/5-dot-oa-dot-1-about-the-math-learning-targets-and-rigor

- This page includes lesson plans, print resources, LearnZillion video links, and web resources.

Howard County Schools Resources for 5.ATO.2

https://hcpss.instructure.com/courses/108/pages/5-dot-oa-dot-2-about-the-math-learning-targets-and-rigor

- This page includes lesson plans, print resources, LearnZillion video links, and web resources.

The next three activities are similar. All challenge students to reach a target number with a given set of numbers (rolled dice or other random method) by using any operation and including parentheses as needed (5.ATO.1)

Bowling for Numbers https://www.illustrativemathematics.org/content-standards/tasks/969.

Clear the Board http://mathsolutions.com/wp-content/uploads/0-941355-75-6_L.pdf

Target Number Dash http://www.k-5mathteachingresources.com/support-files/target-number-dash.pdf

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Teacher Note: 5.G.1 and 5.G.2

"Students need to understand the underlying structure of the coordinate system and see how axes make it possible to locate points anywhere on a coordinate plane. This is the first time students are working with coordinate planes, and only in the first quadrant. It is important that students create the coordinate grid themselves. This can be related to two number lines, perpendicular lines, and reliance on previous experiences with moving along a number line.

Possible Strategies:

- Multiple experiences with plotting points are needed. Provide points plotted on a grid and have students name and write the ordered pair. Have students describe how to get from the origin to the location of the plotted points . Encourage students to articulate directions, attending to precision as they move and/or plot additional points.

- Present real-world and mathematical problems and have students graph points in the first quadrant of the coordinate plane. Gathering and graphing data is a valuable experience for students. It helps them to develop an understanding of coordinates and what the overall graph represents. Students also need to analyze the graph by interpreting the coordinate values in the context of the situation. For example, students may gather and analyze data comparing speed of a student-made vehicle to the height of a ramp. The ordered pair (5, 20) represents that in 5 seconds the vehicle traveled 20 feet.

- Students may think the order in plotting a coordinate point is not important. Have students plot points so that the position of the positive coordinates is switched. For example, have students plot (3, 4) and (4, 3) and discuss the order used to plot the points. Have students create directions for others to follow so that they become aware of the importance of direction and distance." (Excerpt from KATM Grade 5 flip book)

Meerkat Coordinate Plane Task (5.G.1 and 5.G.2)

https://www.illustrativemathematics.org/content-standards/tasks/1516

- This task presents a real-world mathematical problem that requires students to answer questions by drawing and interpreting the meaning of points in the first quadrant of the coordinate plane.

Howard County Schools Resources for 5.G.1 and 5.G.2

https://hcpss.instructure.com/courses/108/pages/5-dot-g-1-about-the-math-learning-targets-and-rigor

https://hcpss.instructure.com/courses/108/pages/5-dot-g-2-about-the-math-learning-targets-and-rigor

- These pages include lesson plans, print resources, LearnZillion video links, and web resources.

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Culminating Activity for 5.G.1 and 5.G.2:
Graph Points on a Coordinate Grid Using Ordered Pairs (5.G.1 and 5.G.2)
https://learnzillion.com/lesson_plans/1003-graph-points-on-a-coordinate-grid-using-ordered-pairs

- This lesson LearnZillion lesson builds on students' understanding of coordinate grids and locations of points on a plane by introducing ordered pairs as a more specific way of identifying points.

Teacher Note: 5.ATO.3
"Students have experienced generating and analyzing numerical patterns using a given rule in Grade 4. Now in 5th grade, given two rules with an apparent relationship, students should be able to identify the relationship between the resulting sequences of the terms in one sequence to the corresponding terms in the other sequence. For example, starting with 0, multiply the next digit by 4 and starting with 0, multiply the next digit by 8 which generates each sequence of numbers (0, 4, 8, 12, 16, ...) and (0, 8, 16, 24, 32,...). Students should see that the terms in the second sequence are double the terms in the first sequence, or that the terms in the first sequence are half the terms in the second sequence.

Based on data generated in the above example, have students form ordered pairs and graph them on a coordinate plane. Patterns can be also observed from the graphs. The graph of both sequences of numbers is a visual representation that will show the relationship between the two sequences of numbers. Encourage students to represent the sequences in T-Charts so they can see a connection between the graph and the sequences." (Excerpt from KATM Grade 5 flip book)

Possible Strategies:
Generate numerical patterns by examining the context of real-world scenarios (5.ATO.3)
https://learnzillion.com/lesson_plans/1006-generate-numerical-patterns-by-examining-the-context-of-real-world-scenarios

- The goal of this LearnZillion lesson is to build understanding of numerical patterns in the context of real-world problems.

Compare Corresponding Terms in Numerical Patterns by Using Line Graphs on the Coordinate Grid (5.ATO.3)
https://learnzillion.com/lesson_plans/1001-compare-corresponding-terms-in-numerical-patterns-by-using-line-graphs-on-the-coordinate-grid

- This LearnZillion lesson uses science data to show the math skills. Includes student practice, too.

Howard County Schools Resources for 5.ATO.3
https://hcpss.instructure.com/courses/108/pages/5-dot-oa-dot-3-about-the-math-learning-targets-and-rigor

- This page includes lesson plans, print resources, LearnZillion video links, and web resources.

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Resources
Expresso http://gregtangmath.com/expresso ● This game involves filling in missing operators so each expression equals its target number. (5.ATO.1) **Bracket Basics** http://www.bracketbasics.co.uk/activity/ ● This game involves filling in given numbers so that the expression equals a target number. (5.ATO.1) ***The Fly on the Ceiling* by Dr. Julie Glass** https://www.youtube.com/watch?v=HfecU1nqKFc ● Literature connection; introduces students to Rene Descartes and the history of the coordinate plane **EngageNY 5th grade Module 6 - Problem Solving with the Coordinate Plane** https://www.engageny.org/resource/grade-5-mathematics-module-6 ● In this unit, students define a coordinate system for the first quadrant of the coordinate plane and use it to solve problems. This unit includes math background, teacher notes, student activities, practice pages, and a variety of assessments. **Dino Dig** http://www.counton.org/games/virtualmathfest/dinosaur.html ● This game involves selecting points to identify locations of dinosaur bones. (5.G.1, 5.G.2) **Billy Bug** http://www.oswego.org/ocsd-web/games/BillyBug/bugcoord.html ● Interactive game for finding points in the first quadrant of the coordinate plane. (5.G.1, 5.G.2)

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Sample Formative Assessment Tasks/Questions
Performance Task for 5.G.2 **Granny's Balloon Trip** http://www.insidemathematics.org/assets/common-core-math-tasks/granny%27s%20balloon%20trip.pdf ● This task challenges a student to use knowledge of scale to organize and represent data from a table on a graph. https://hcpss.instructure.com/courses/108/pages/5-dot-oa-dot-1-assessment-tasks (assessing 5.ATO.1) https://hcpss.instructure.com/courses/108/pages/5-dot-oa-dot-2-assessment-tasks (assessing 5.ATO.2) https://hcpss.instructure.com/courses/108/pages/5-dot-oa-dot-3-assessment-tasks (assessing 5.ATO.3) https://hcpss.instructure.com/courses/108/pages/5-dot-g-1-assessment-tasks (assessing 5.G.1) https://hcpss.instructure.com/courses/108/pages/5-dot-g-2-assessment-tasks (assessing 5.G.2) Return to Table of Contents

DRAFT

5th Grade Unit 2	Return to Table of Contents Return to Fifth Grade Overview

Place Value

Content Standards with Clarifying Notes
Open bullets indicate clarifying notes

- **5.NSBT.1** Understand that, in a multi-digit whole number, a digit in one place represents 10 times what the same digit represents in the place to its right, and represents $\frac{1}{10}$ times what the same digit represents in the place to its left.
- **5.NSBT.2** Use whole number exponents to explain:
  a. patterns in the number of zeroes of the product when multiplying a number by powers of 10;
  b. patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10.
- **5.NSBT.3** Read and write decimals in standard and expanded form. Compare two decimal numbers to the thousandths using the symbols >, =, or <.
- **5.NSBT.4** Round decimals to any given place value within thousandths

New Academic Vocabulary for This Unit

- exponents
- power(s) of 10
- thousandths

Prior Knowledge Required for This Unit

In 4th grade, place value of whole numbers focused on understanding math periods and the patterns found in those periods. (4.NSBT.1). In 5th grade, students apply the same pattern (math periods) while working with decimal numbers, using whole number exponents to when multiplying and dividing by a power of 10. This is the first time students have been introduced to the use of whole number exponents to denote powers of 10. Students extend their understanding of the base-ten system to how numbers compare and how numbers round for decimal numbers to thousandths.

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Subsequent Knowledge Related to This Unit

In Unit 9, students will use these skills when converting units within the metric system. As the year progresses, having a solid understanding of decimal numbers will strengthen their flexibility when working with fractions, decimals, and percents (in 6th grade) in problem-solving situations. Students need to have a firm grasp of place value (whole numbers and decimal numbers) for future work with computing with numbers, exponents and scientific notation.

Relationship Among Standards in This Unit

The standards included in this unit provide students with a foundation to work flexibly within the base ten place value system.

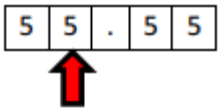
Potential Instructional Strategies/Lessons

Teacher Note: 5.NSBT.1 and 5.NSBT.2

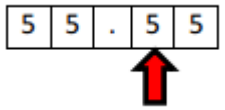
Standard 5.NSBT.1 calls for students to reason about the magnitude of numbers. "Students should work with the idea that the tens place is ten times as much as the ones place, and the ones place is $\frac{1}{10}$th the size of the tens place. In fourth grade, students examined the relationships of the digits in numbers for whole numbers only. This standard extends this understanding to the relationship of decimal fractions. Students use base ten blocks, pictures of base ten blocks, and interactive images of base ten blocks to manipulate and investigate the place value relationships. They use their understanding of unit fractions to compare decimal places and fractional language to describe those comparisons. Before considering the relationship of decimal fractions, students express their understanding that in multi-digit whole numbers, a digit in one place represents 10 times what it represents in the place to its right and $\frac{1}{10}$of what it represents in the place to its left." (Excerpt from KATM Grade 5 flip book)

Example: (from KATM Grade 5 flip book)

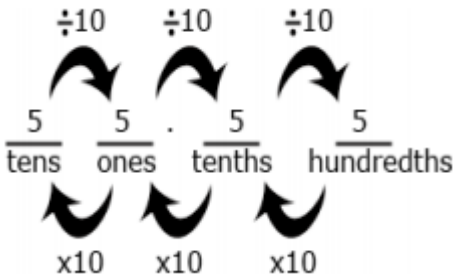
To extend this understanding of place value to their work with decimals, students use a model of one unit; they cut it into 10 equal pieces, shade in, or describe$\frac{1}{10}$ of that model using fractional language ("This is 1 out of 10 equal parts. So it is$\frac{1}{10}$ ". I can write this using$\frac{1}{10}$ or 0.1"). They repeat the process by finding$\frac{1}{10}$of a$\frac{1}{10}$ (e.g., dividing$\frac{1}{10}$ into 10 equal parts to arrive at$\frac{1}{100}$or 0.01) and can explain their reasoning, "0.01 is$\frac{1}{10}$of$\frac{1}{10}$ thus is$\frac{1}{100}$ of the whole unit." In the number 55.55, each digit is 5, but the value of the digits is different because of the placement.



The 5 that the arrow points to is$\frac{1}{10}$of the 5 to the left and 10 times the 5 to the right. The 5 in the ones place is$\frac{1}{10}$of 50 and 10 times five tenths.



The 5 that the arrow points to is $\frac{1}{10}$ of the 5 to the left and 10 times the 5 to the right. The 5 in the tenths place is 10 times five hundredths.



Standard 5.NSBT.2 calls for students to have multiple experiences working with connecting the patterns in the number of zeroes of the product when multiplying a number by powers of 10. In addition, students should have multiple experiences exploring patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10.

Example:

$2.5 \times 10^3 = 2.5(10 \times 10 \times 10) = 2.5 \times 1{,}000 = 2{,}500$. Students should reason that the exponent above the 10 indicates how many places the decimal point is moving (not just that the decimal point is moving but that you are multiplying or making the number 10 times greater three times) when you multiply by a power of 10. Since we are multiplying by a power of 10 the decimal point moves to the right.

$$350 \div 10^3 = 350 \div 1{,}000 = 0.350 = 0.35$$
$$350 \div 10 = 35, 35 \div 10 = 3.5$$
$$3.5 \div 10 = 0.35, or\ 350 \times \frac{1}{10}, 35 \times \frac{1}{10}, 3.5 \times \frac{1}{10},$$

"This will relate well to subsequent work with operating with fractions. This example shows that when we divide by powers of 10, the exponent above the 10 indicates how many places the decimal point is moving (how many times we are dividing by 10 , the number becomes ten times smaller). Since we are dividing by powers of 10, the decimal point moves to the left."

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Students might write:	Students might think and/or say:
• $36 \times 10 = 36 \times 10^1 = 360$ • $36 \times 10 \times 10 = 36 \times 10^2 = 3{,}600$ • $36 \times 10 \times 10 \times 10 = 36 \times 10^3 = 36{,}000$ • $36 \times 10 \times 10 \times 10 \times 10 = 36 \times 10^4 = 360{,}000$	**I noticed that every time, I multiplied by 10 I added a zero to the end of the number. That makes sense because each digit's value became 10 times larger. To make a digit 10 times larger, I have to move it one place value to the left.* **When I multiplied 36 by 10, the 30 became 300. The 6 became 60 or the 36 became 360. So I had to add a zero at the end to have the 3 represent 3 one-hundreds (instead of 3 tens) and the 6 represents 6 tens (instead of 6 ones).*

Students should be able to use the same type of reasoning as above to explain why the following multiplication and division problem by powers of 10 make sense.

- $523 \times 10^3 = 523{,}000$ The place value of 523 is increased by 3 places.
- $5.223 \times 10^2 = 522.3$ The place value of 5.223 is increased by 2 places.
- $52.3 \times 10^1 = 5.23$ The place value of 52.3 is decreased by one place.

(Examples from KATM Grade 5 flip book)

Possible Strategies:

Use a place value chart to show how place value increases to the left in a multi-digit number (5.NSBT.1)
https://learnzillion.com/lesson_plans/599-use-a-place-value-chart-to-show-how-place-value-increases-to-the-left-in-a-multi-digit-number

- In this LearnZillion lesson, students work with the idea that the tens place is ten times as much as the ones place, and the ones place is 1/10th the size of the tens place.

Understand how place value decreases with each shift to the right in a multi-digit number by using a place value chart (5.NSBT.1)
https://learnzillion.com/lesson_plans/602-understand-how-place-value-decreases-with-each-shift-to-the-right-in-a-multi-digit-number-by-using-a-place-value-chart

- In this LearnZillion lesson, students will work with the idea that the ones place is 1/10 of the place to its left.

Kipton's Scale (5.NSBT.1)
https://www.illustrativemathematics.org/content-standards/tasks/1562

- This task is set in the context of weighing objects and bundles of 10, 100, and 1,000 objects, it helps students visualize that bundling 10 units of a given place value will create 1 unit of the next highest place value.

Multiply whole numbers by powers of 10 (5.NSBT.2)
https://learnzillion.com/lesson_plans/601-multiply-whole-numbers-by-powers-of-10-using-knowledge-of-place-value

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- In this LearnZillion lesson, students learn to use whole number exponents to denote powers of ten.

Use place value to explain the pattern when a decimal is divided by a power of 10 (5.NSBT.2)
https://learnzillion.com/lesson_plans/603-use-place-value-to-explain-the-pattern-when-a-decimal-is-divided-by-a-power-of-10

- In this LearnZillion lesson, students divide powers of ten with decimal numbers. Students need to be provided with opportunities to explore this concept and come to this understanding; this should not just be taught as a procedure.

Multiplying Decimals by 10 (5.NSBT.2)
https://www.illustrativemathematics.org/content-standards/tasks/1620

- The purpose of this task is to help students understand and explain why multiplying a decimal number by 10 shifts all the digits one place to the left.

Marta's Multiplication Error (5.NSBT.2)
https://www.illustrativemathematics.org/content-standards/tasks/1524

- This task highlights a common misconception among students deriving the rules for multiplying a number by a power of 10.

Howard County Schools Resources for 5.NSBT.1 and 5.NSBT.2
https://hcpss.instructure.com/courses/108/pages/5-dot-nbt-dot-1-about-the-math-learning-targets-and-rigor
https://hcpss.instructure.com/courses/108/pages/5-dot-nbt-dot-2-about-the-math-learning-targets-and-rigor

- These pages include lesson plans, print resources, LearnZillion video links, and web resources.

Teacher Note: 5.NSBT.3 and 5.NSBT.4
Standard 5.NSBT.3 requires students to read and write decimals in standard and expanded form including fractions. "Students should build on their work from Fourth Grade, where they worked with both decimals and fractions interchangeably. Expanded form is included to build upon work in 5.NSBT.1 and 5.NSBT.2 and deepen students' understanding of place value. Students build on the understanding they developed in fourth grade to read, write, and compare decimals to thousandths. They connect their prior experiences with using decimal notation for fractions and addition of fractions with denominators of 10 and 100. They use concrete models and number lines to extend this understanding to decimals to the thousandths. Models may include base ten blocks, place value charts, grids, pictures, drawings, manipulatives, technology-based, etc. They read decimals using fractional language and write decimals in fractional form, as well as in expanded notation. This investigation leads them to understanding equivalence of decimals (0.8 = 0.80 = 0.800)." (Excerpt from KATM Grade 5 flip book)
Example: Some equivalent forms of 0.72 are:

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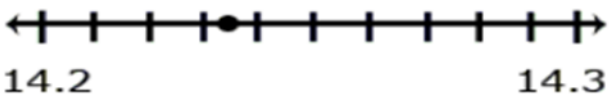
$\frac{72}{100}$	$\frac{7}{10}+\frac{2}{100}$
$7\times\left(\frac{1}{10}\right)+2\times\left(\frac{1}{100}\right)$	$0.70+0.02$
$\frac{70}{100}+\frac{2}{100}$	0.720
$7\times\frac{1}{10}+2\times\frac{1}{100}+0\times\frac{1}{1000}$	$\frac{720}{1000}$

Standard 5.NSBT.4 requires students to round decimals to any given place value within thousandths. "Students should go beyond simply applying an algorithm or procedure for rounding. The expectation is that students have a deep understanding of place value and number sense and can explain and reason about the answers they get when they round. Students should have numerous experiences using a number line to support their work with rounding. When rounding a decimal to a given place, students may identify the two possible answers, and use their understanding of place value to compare the given number to the possible answers." (Excerpt from KATM Grade 5 flip book)

Example: Round 14.235 to the nearest tenth.



Students recognize that the possible answer must be in tenths thus, it is either 14.2 or 14.3. They then identify that 14.235 is closer to 14.2 (14.20) than to 14.3 (14.30).

Possible Strategies:

Compare two decimals using a number line and comparison symbols (5.NSBT.3)

https://learnzillion.com/lesson_plans/314-compare-two-decimals-using-a-number-line-and-comparison-symbols#fndtn-lesson

- In this LearnZillion lesson, students will use their understanding of place value to order and compare decimal numbers using a number line.

Drawing Pictures to Illustrate Decimal Comparisons (5.NSBT.3)

https://www.illustrativemathematics.org/content-standards/tasks/1801

- The purpose of this task is for students to compare decimal numbers using pictures or diagrams.

Comparing Decimals on the Number Line (5.NSBT.3)

https://www.illustrativemathematics.org/content-standards/tasks/1802

- This task involves using number lines to compare decimal numbers. The numbers selected in this task are purposefully chosen to target student

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misconceptions.

Placing Thousandths on the Number Line (5.NSBT.3)
https://www.illustrativemathematics.org/content-standards/tasks/1803

- This task primarily deals with comparing decimal numbers on a number line. It also requires students to draw upon what they know about the base ten system.

Place Value Game (Greg Tang Math) (5.NSBT.3)
http://gregtangmath.com/placevalue

- In this online game, students match numbers to their place value. You can choose two different difficulty levels with whole numbers or decimals

Write decimals in expanded form (5.NSBT.3)
https://learnzillion.com/lessons/3285-write-decimals-in-expanded-form

- In this LearnZillion lesson students will learn how to read and write numbers to the thousandths in expanded notation using base ten blocks.

Are these equivalent to 9.52? (5.NSBT.3)
https://www.illustrativemathematics.org/content-standards/tasks/1813

- The purpose of this Illustrative Math task is to help students develop the understanding that a single base-ten number can be represented in many different ways.

Round Decimals to Any Place Using Number Lines (5.NSBT.4)
https://learnzillion.com/lessonsets/212-round-decimals-to-any-place-using-number-lines

- 3 LearnZillion lessons (similar to powerpoint) focusing on rounding decimals to the nearest tenth and hundredth using number lines.

Rounding to Tenths and Hundredths (5.NSBT.4)
https://www.illustrativemathematics.org/content-standards/tasks/1804

- The purpose of this task is for students to use the position of a number on the number line to round the number without knowing its exact value.

Howard County Schools Resources for 5.NSBT.3 and 5.NSBT.4
https://hcpss.instructure.com/courses/108/pages/5-dot-nbt-dot-3-about-the-math-learning-targets-and-rigor
https://hcpss.instructure.com/courses/108/pages/5-dot-nbt-dot-4-about-the-math-learning-targets-and-rigor

- These pages include lesson plans, print resources, LearnZillion video links, and web resources.

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Resources

EngageNY Grade 5 Module 1: Place Value and Decimal Fractions
https://www.engageny.org/resource/grade-5-mathematics-module-1

- In this unit, students' understanding of the patterns in the base ten system are extended from Grade 4's work with place value of multi-digit whole numbers and decimals to hundredths to the thousandths place. This unit includes math background, teacher notes, student activities, practice pages, and a variety of assessments.

CCGPS (Georgia) 5th Grade, Unit 2 Decimals
https://www.georgiastandards.org/Common-Core/Common%20Core%20Frameworks/CCGPS_Math_5_Unit2Framework.pdf

- Georgia's Decimal unit. Includes many activities, math background, and assessments.

Rounding Decimals (5.NSBT.5)
http://studyjams.scholastic.com/studyjams/jams/math/decimals-percents/rounding-decimals.htm

- Colorful, interactive, step by step directions for rounding decimals from Scholastic Study Jams. Includes a brief assessment after the lesson.

Sample Formative Assessment Tasks/Questions

Decimals Performance Assessment Task (5.NSBT.3 and 5.NSBT.4)
http://www.insidemathematics.org/assets/common-core-math-tasks/decimals.pdf

- This task challenges a student to use knowledge of place value system to represent and compare rational numbers. A student must use place value understanding to justify or explain how to order a set of decimal values. A student must be able to make sense of rational values to generate numbers falling between two values.

https://hcpss.instructure.com/courses/108/pages/5-dot-nbt-dot-1-assessment-tasks (assessing 5.NSBT.1)
https://hcpss.instructure.com/courses/108/pages/5-dot-nbt-dot-2-assessment-tasks (assessing 5.NSBT.2)
https://hcpss.instructure.com/courses/108/pages/5-dot-nbt-dot-3-assessment-tasks (assessing 5.NSBT.3)
https://hcpss.instructure.com/courses/108/pages/5-dot-nbt-dot-4-assessment-tasks (assessing 5.NSBT.4)

Return to Table of Contents

DRAFT

5th Grade Unit 3	Return to Table of Contents Return to Fifth Grade Overview

Operations with Whole and Decimal Numbers

Content Standards with Clarifying Notes

Open bullets indicate clarifying notes.

- 5.NSBT.5 Fluently multiply multi-digit whole numbers using strategies to include a standard algorithm.
- 5.NSBT.6 Divide up to a four-digit dividend by a two-digit divisor, using strategies based on place value, the properties of operations, and the relationship between multiplication and division.
    - Students should have experiences interpreting the remainder in a variety of problem-solving situations. "Students should not just think of remainders as "R3" or "left over." Remainders should be put in context and dealt with accordingly." (*Teaching Student-Centered Mathematics: Grades 3-5* by John A. Van de Walle, pg. 62)
- 5.NSBT.7 Add, subtract, multiply, and divide decimal numbers to hundredths using concrete area models and drawings.

New Academic Vocabulary for This Unit

All vocabulary introduced in prior grades.

Prior Knowledge Required for This Unit

In fourth grade, students expanded their understanding of multiplication through using various strategies, multiplying 4 digit by 1 digit and 2 digits by 2 digits. In division, 4th grade students' experiences were limited to dividing by one-digit divisors. This unit extends students' prior experiences with strategies, illustrations, and explanations.

This unit also builds on the decimal work from fourth grade, where students were introduced to the concept of decimals, using concrete and visual models, compared and ordered decimal numbers to hundredths, converted between fraction and decimal (only with a denominator of 10 or 100). In fifth grade, students begin adding, subtracting, multiplying and dividing decimals, focusing on conceptual development, using concrete area models and drawings.

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Subsequent Knowledge Related to This Unit

Later in the year, 5th grade students will apply these skills in Unit 8 (Perimeter, Area, and Volume) and in Unit 9 (Converting Measurements within a Single System).

Relationship Among Standards in This Unit

This unit further develops fluency with multiplication and division strategies with whole numbers. As students developed efficient strategies to do whole number operations, they begin transferring those strategies to working with decimal numbers.

Potential Instructional Strategies/Lessons

Teacher Note: 5.NSBT.5

Because students have used various models and strategies to solve problems involving multiplication with whole numbers in 4th grade, they should be able to transition to using standard algorithms effectively. With guidance from the teacher, they should understand the connection between the standard algorithm and their strategies. Connections between the algorithm for multiplying multi-digit whole numbers and strategies for multiplication are necessary for students' understanding. Refer to Grade 4 Unit 3 Multiplication and Division with Whole Numbers for strategies taught in previous grades.

Examples of alternative strategies:

There are 225 dozen cookies in the bakery. How many cookies are there?

Student 1

- 225×12
- *I broke 12 up into 10 and 2.*
- $225 \times 10 = 2{,}250$
- $225 \times 2 = 450$
- $2{,}250 + 450 = 2{,}700$

Student 2

- 225×12
- *I broke up 225 into 200 and 25.*
- $200 \times 12 = 2{,}400$
- *I broke 25 up into* 5×5, *so I had* $5 \times 5 \times 12$ *or* $5 \times 12 \times 5$.
- $5 \times 12 = 60, 60 \times 5 = 300$
- *I then added 2,400 and 300* $2{,}400 + 300 = 2{,}700$

Student 3

- I doubled 225 and cut
- 12 in half to get 450×6.
- I then doubled 450
- again and cut 6 in half
- to get 900×3.
- $900 \times 3 = 2{,}700$

(Examples from KATM Grade 5 flip book)

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Possible Strategies:
Multiplication algorithms extended to standard algorithm (free teacher account required)
https://www.matific.com/us/en-us/grades/4G?episode=MultiplicationGridStandardFromExpandedToStandard

Elmer's Multiplication Error (5.NSBT.5)
https://www.illustrativemathematics.org/content-standards/tasks/1812

- This task has students explore a very common multiplication error that occurs when using the standard algorithm.

Howard County Schools Resources for 5.NSBT.5
https://hcpss.instructure.com/courses/108/pages/5-dot-nbt-dot-5-about-the-math-learning-targets-and-rigor

- This page includes teacher notes, lesson plans, print resources, LearnZillion video links, and web resources.

Teacher Note: 5.NSBT.6
This standard references various strategies for division and extends students' prior experiences with strategies, illustrations, and explanations in 4th grade. Refer to Grade 4 Unit 3 Multiplication and Division with Whole Numbers for strategies taught in previous grades.

Example 1:
There are 1,716 students participating in Field Day. They are put into teams of 16 for the competition. How many teams can be created? If you have left over students, what do you do with them?

DRAFT

Student 1

1,716 divided by 16

There are 100 16's in 1,716.

$$1{,}716 - 1{,}600 = 116$$

I know there are at least 6 16's.

$$116 - 96 = 20$$

I can take out at least 1 more 16.

$$20 - 16 = 4$$

There were 107 teams with 4 students left over. If we put the extra students on different team, 4 teams will have 17students.

Student 2

1,716 divided by 16

There are 100 16's in 1,716.

Ten groups of 16 is 160.

That's too big.

Half of that is 80, which is5 groups.

I know that 2 groups of 16's is 32.

I have 4 students left over.

1,716 − 1,600	100
116 − 80	5
36-32	2
4	

Student 3

$$1{,}716 \div 16 = ?$$

I want to get to 1,716

I know that 100 16's equals 1,600

I know that 5 16's equals 80

$$1{,}600 + 80 = 1{,}680$$

Two more groups of 16's equals 32, which gets us to 1,712.

I am 4 away from 1,716.

So we had 100 + 6 + 1 = 107 teams.

Those other 4 students can just hang out.

Student 4

How many 16's are in 1,716?

We have an area of 1,716.

I know that one side of my array is 16 units long.

I used 16 as the height.

I am trying to answer the question what is the width of my rectangle if the area is 1,716 and the height is 16.

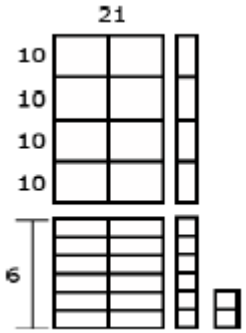
$$100 + 7 = 107\ R4$$

	100	7
16	100 × 16 = 1,600	7 × 16 = 112

$$1{,}716 - 1{,}600 = 116$$
$$116 - 112 = 4$$

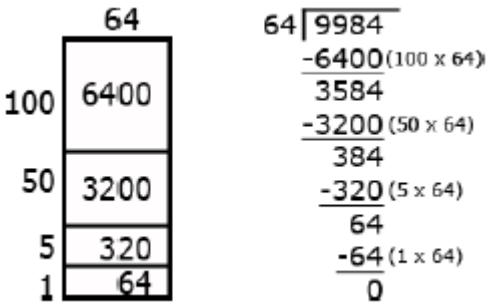
Example 2: 968 ÷ 21 =?

Using base ten models, a student can represent 968 and use the models to make an array with one dimension of 21. The student continues to make the array until no more groups of 21 can be made. Remainders are not part of the array.



Example 3: 9,984 ÷ 64 =?

An area model for division is shown below. As the student uses the area model, s/he keeps track of how much of the 9984 is left to divide.



(Examples from KATM Grade 5 flip book)

Possible Strategies:

Learn Zillion Videos for dividing 4-digit dividends by 2-digit divisors

https://learnzillion.com/lesson_plans/5647-use-an-area-model-for-division-of-4-digit-dividends-by-2-digit-divisors#fndtn-lesson

https://learnzillion.com/lesson_plans/8786-divide-4-digit-dividends-by-2-digit-divisors-by-using-a-rectangular-array#fndtn-lesson

Howard County Schools Resources for 5.NSBT.6

https://hcpss.instructure.com/courses/108/pages/5-dot-nbt-dot-5-about-the-math-learning-targets-and-rigor

- This page includes teacher notes, lesson plans, print resources, LearnZillion video links, and web resources.

Teacher Note: 5.NSBT.7

As students developed efficient strategies to do whole number operations, they begin transferring those strategies to working with decimal numbers. Students should learn to estimate decimal computations before they compute with pencil and paper. The focus on estimation should be on the meaning of the numbers and the operations, not on how many decimal places are involved.

This standard builds on the work from fourth grade where students are introduced to decimals and compare them. In fifth grade, students begin adding, subtracting, multiplying and dividing decimals. This work should focus on concrete models and pictorial representations, rather than relying on the algorithm. The use of symbolic notations involves having students record the answers to computations (2.25 × 3 = 6.75), but this work should not be done without models or pictures.

This standard includes students' reasoning and explanations of how they use models, pictures, and strategies. This standard requires students to extend

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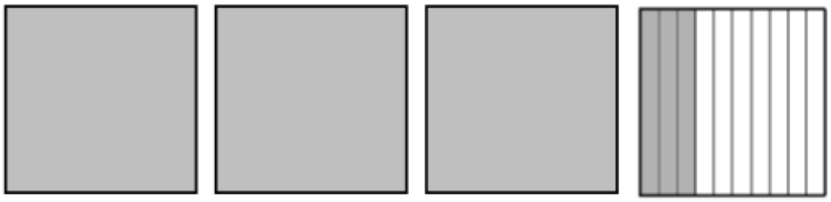
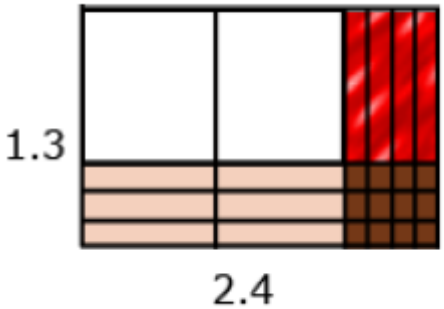
the models and strategies they developed for whole numbers in grades 1-4 to decimal values. Before students are asked to give exact answers, they should estimate answers based on their understanding of operations and the value of the numbers.

Example 1:
$4 - 0.3 = ?$
3 tenths subtracted from 4 wholes. The wholes must be divided into tenths.



The answer is 3 and $\frac{7}{10}$ or 3.7.

Example 2:



$$\begin{array}{r} 2.4 \\ \underline{\times\ 1.3} \\ .12 \\ .60 \\ .40 \\ \underline{+\ 2.00} \\ 3.12 \end{array}$$

Students should be able to **describe** the partial products displayed by the area model. For example, "$\frac{3}{10}$ times $\frac{4}{10}$ is $\frac{12}{100}$. $\frac{3}{10}$ times 2 is $\frac{6}{10}$ or $\frac{60}{100}$.1 group of $\frac{4}{10}$ is $\frac{4}{10}$ or $\frac{40}{100}$.1 group of 2 is 2."

Example of division: find the number of groups
Joe has 1.6 meters of rope. He has to cut pieces of rope that are 0.2 meters long. How many can he cut? To divide to find the number of groups, a student might:

- Draw a segment to represent 1.6 meters. In doing so, s/he would count in tenths to identify the 6 tenths, and be able identify the number of 2 tenths within the 6 tenths. The student can then extend the idea of counting by tenths to divide the one meter into tenths and determine that there are 5 more groups of 2 tenths.

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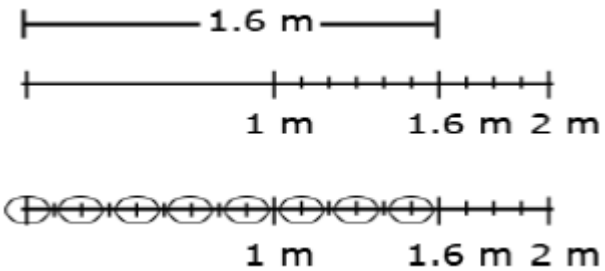

- Count groups of 2 tenths without the use of models or diagrams. Knowing that 1 can be thought of as $\frac{10}{10}$, a student might think of 1.6 as 16 tenths. Counting 2 tenths, 4 tenths, 6 tenths, . . . 16 tenths, a student can count 8 groups of 2 tenths.
- Use their understanding of multiplication and think, "8 groups of 2 is 16, so 8 groups of $\frac{2}{10}$ is $\frac{16}{10}$ or $1\frac{6}{10}$.

(Examples from KATM Grade 5 flip book)

Possible Strategies:

Base Ten Activity (5.NSBT.7)

https://grade5commoncoremath.wikispaces.hcpss.org/file/view/5.NBT.7_BaseTenActivity.pdf/457250342/5.NBT.7_BaseTenActivity.pdf

- This lesson from the Georgia Dept. of Education models decimal multiplication using base ten blocks.

Ten Is the Winner (5.NSBT.7)

https://grade5commoncoremath.wikispaces.hcpss.org/file/view/5.NBT.7_TenIsTheWinner.pdf/457250500/5.NBT.7_TenIsTheWinner.pdf

- This lesson from the Georgia Dept. of Education models decimal addition and subtraction using base ten blocks.

Using models to multiply decimals (5.NSBT.7)

http://www.mathcoachscorner.com/2015/09/29/multiplying-decimals/

Getting the (Decimal) Point with Blocks: Multiplying Two Decimals Using Base Ten Blocks (5.NSBT.7)

http://illuminations.nctm.org/Lesson.aspx?id=3766

- Students will use base ten blocks to model decimal multiplication. They will assign different values to the different base ten blocks to explore the consistent relationship between the types of blocks. They will also discover different factors for the same product. These activities will help students develop a conceptual understanding of decimal multiplication.

Multiplying and Dividing Decimals

http://catalog.mathlearningcenter.org/files/pdfs/SecB5SUP-A11_MultDivDecimals.pdf

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The Value of Education

https://www.illustrativemathematics.org/content-standards/tasks/1293

- The purpose of this task is for students to add, subtract, multiply, and divide decimal numbers in a real-world context.

Howard County Schools Resources for 5.NSBT.7

https://hcpss.instructure.com/courses/108/pages/5-dot-nbt-dot-7-about-the-math-learning-targets-and-rigor

- This page includes teacher notes, lesson plans, print resources, LearnZillion video links, and web resources.

Resources

Multiplying Decimals

https://www.matific.com/us/en-us/curriculum?episode=MultiplyingDecimalsMovingPoint

(Free teacher account required)

- **Multiplying Decimals** is one of many games, lessons, and online worksheets on this site. Can be projected for whole class use, or teachers can set up a class and have students log in to practice/play.

The Quotient Cafe

http://illuminations.nctm.org/activity.aspx?id=4197

- Interactive game for 5.NSBT.6

Engage NY 5th Grade Module 1 - Place Value and Decimal Fractions

http://www.engageny.org/resource/grade-5-mathematics-module-1

- In Module 1, students' understanding of the patterns in the base ten system are extended from Grade 4's work with place value of multi-digit whole numbers and decimals to hundredths to the thousandths place. In Grade 5, students deepen their knowledge through a more generalized understanding of the relationships between and among adjacent places on the place value chart, e.g., 1 tenth times any digit on the place value chart moves it one place value to the right. Toward the module's end students apply these new understandings as they reason about and perform decimal operations through the hundredths place.

Sample Formative Assessment Tasks/Questions

Assessments for HCPSS for 5.NSBT.5: https://hcpss.instructure.com/courses/108/pages/5-dot-nbt-dot-5-assessment-tasks
Assessments for HCPSS for 5.NSBT.6: https://hcpss.instructure.com/courses/108/pages/5-dot-nbt-dot-6-assessment-tasks
Assessments for HCPSS for 5.NSBT.7: https://hcpss.instructure.com/courses/108/pages/5-dot-nbt-dot-7-assessment-tasks

Return to Table of Contents

DRAFT

5th Grade Unit 4	**Return to Table of Contents** **Return to Fifth Grade Overview**

Adding and Subtracting Fractions

Content Standards with Clarifying Notes

Open bullets indicate clarifying notes.

- 5.NSF.1 Add and subtract fractions with unlike denominators (including mixed numbers) using a variety of models, including an area model and number line.
  - This standard should focus on using a variety of models, instead of using "tricks" such as the "butterfly method" which does not contribute to students' fraction understanding.
- 5.NSF.2 Solve real-world problems involving addition and subtraction of fractions with unlike denominators.
- 5.MDA.2 Create a line plot consisting of unit fractions and use operations on fractions to solve problems related to the line plot.

New Academic Vocabulary for This Unit

All vocabulary introduced in prior grades.

Prior Knowledge Required for This Unit

This unit builds on the work in fourth grade where students developed an understanding of addition and subtraction of fractions based on unit fractions. In fourth grade, students add and subtract fractions and mixed numbers with like denominators. Additionally, students solve real-world problems involving addition and subtraction of fractions referring to the same whole and having like denominators.

Subsequent Knowledge Related to This Unit

In units 5 and 6, students will multiply and divide with fractions. In unit 8, students will apply skills from this unit in their work with perimeter and area (volume remains with whole numbers only).

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Relationship Among Standards in This Unit

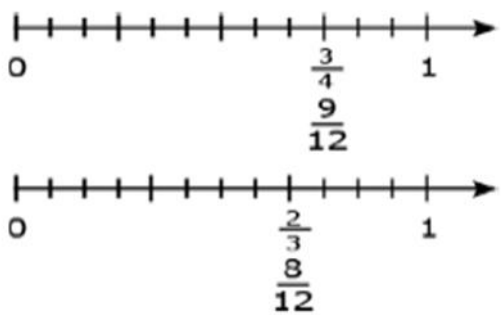
This unit extends understanding of addition and subtraction of fractions to include unlike denominators. Students use a variety of models when adding and subtracting fractions with unlike denominators to solve real-world problems.

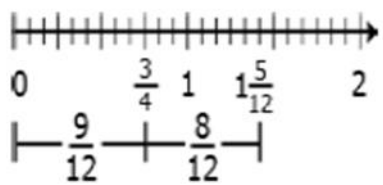
Potential Instructional Strategies/Lessons

Teacher Note: 5.NSF.1 and 5.NSF.2
Allow students to add and subtract fractions using different strategies such as number lines, area models, fraction bars or strips. Have students share their strategies and discuss commonalities in them. Students need to develop the understanding that when adding or subtracting fractions, the fractions must refer to the same whole. Any models used must refer to the same whole.

As with solving word problems with whole number operations, regularly present word problems involving addition or subtraction of fractions. Mental computations and estimation strategies should be used to determine the reasonableness of answers.

Example 1:
Jerry was making two different types of cookies. One recipe needed $\frac{3}{4}$ cup of sugar and the other needed $\frac{2}{3}$ cup of sugar. How much sugar did he need to make both recipes?





Mental estimation: A student may say that Jerry needs more than 1 cup of sugar but less than 2 cups. An explanation may compare both fractions to $\frac{1}{2}$ and state that both are larger than $\frac{1}{2}$ so the total must be more than 1. In addition, both fractions are slightly less than 1 so the sum cannot be more than 2.

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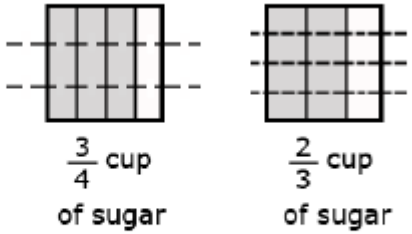
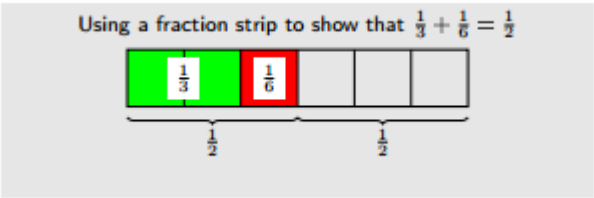
Area model:



$\frac{3}{4} = \frac{9}{12}$ $\frac{2}{3} = \frac{8}{12}$ $\frac{3}{4} + \frac{2}{3} = \frac{17}{12} = \frac{12}{12} + \frac{5}{12} = 1\frac{5}{12}$

Linear model:
(Examples from KATM Grade 5 flip book)



Possible Strategies:
Fraction Progression from Illustrative Mathematics
https://www.illustrativemathematics.org/progressions

- Fractions Progression Module consisting of videos paired with illustrative tasks to help teachers better understand the development of concepts and skills around fractions from grades 3-5.

Finding Common Denominators to Add
https://www.illustrativemathematics.org/content-standards/tasks/848

- Part (a) of this task asks students to find and use two different common denominators to add the given fractions. The purpose of this question

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is to help students realize that they can use any common denominator to find a solution, not just the least common denominator. Part (b) does not ask students to solve the given addition problem in more than one way. Instead, the purpose of this question is to give students an opportunity to choose a denominator and possibly to compare their solution method with another student who chose a different denominator.

Finding Common Denominators to Subtract

https://www.illustrativemathematics.org/content-standards/tasks/859

- Part (a) of this task asks students to use two different denominators to subtract fractions. The purpose of this is to help students realize that any common denominator will work, not just the least common denominator. Part (b) does not ask students to do it in more than one way; the purpose is to give them an opportunity to choose a denominator and possibly compare with another student who chose a different denominator.

Do These Add Up?

https://www.illustrativemathematics.org/content-standards/tasks/481

- This task addresses common errors that students make when adding fractions.

Making S'Mores

https://www.illustrativemathematics.org/content-standards/tasks/861

- The purpose of this instructional task is to motivate a discussion about adding fractions and the meaning of the common denominator.

Leapfrog Fractions

http://achievethecore.org/page/1062/leapfrog-fractions-detail-pg

- Provides students with the opportunity to use a variety of reasoning strategies about fraction equivalence to solve computation problem. Allows for the use of visual fraction models, number lines, or equations to demonstrate thinking and solve the problem. Builds on grade 4 understanding of fraction equivalence to add fractions with unlike denominators. Allows for multiple solution strategies and encourages equivalent answers, without emphasizing least common denominators or lowest terms

Howard County Schools Resources for 5.NSF.1 and 5.NSF.2

https://hcpss.instructure.com/courses/108/pages/5-dot-nf-dot-1-about-the-math-learning-targets-and-rigor
https://hcpss.instructure.com/courses/108/pages/5-dot-nf-dot-2-about-the-math-learning-targets-and-rigor

- These pages include teacher notes, lesson plans, print resources, LearnZillion video links, and web resources.

Teacher Note: 5.MDA.2

Note: This standard specifically requires the use of unit fractions. While students have experienced adding and subtracting with fractions other than unit fractions, you may want to adapt the data used in the resources to eliminate non-unit fractions.

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Example:
During activity time at summer camp, Brooke took one scoop of beads to make her bracelet. She wanted to make sure she had enough to make the bracelet that fit her wrist. She sorted her beads by size. The bead sizes are shown below.

$\frac{1}{4}, \frac{1}{6}, \frac{1}{4}, \frac{1}{6}, \frac{1}{6}, \frac{1}{6}, \frac{1}{3}, \frac{1}{2}, \frac{1}{2}, \frac{1}{3}, \frac{1}{3}, \frac{1}{2}$

a. Create a line plot to display the data.
b. If Brooke only used $\frac{1}{2}$ inch beads, how long would the bracelet be?
c. If Brooke used all of the $\frac{1}{4}$ and $\frac{1}{3}$ inch beads, how long would the bracelet be?

Possible Strategies:

Learn Zillion Video

https://learnzillion.com/lesson_plans/7584-solve-multi-step-problems-using-information-in-a-line-plot

- In this lesson you will learn how to solve a multi-step problem by using information presented in a line plot.

Measurements in Fractions of Unit - Guided Lesson

http://www.mrmaffesoli.com/Printables/4MD4/4MD4-MWL.pdf

Howard County Schools Resources for 5.MDA.2

https://hcpss.instructure.com/courses/108/pages/5-dot-md-dot-2-about-the-math-learning-targets-and-rigor

- This page includes teacher notes, lesson plans, print resources, LearnZillion video links, and web resources.
-

Resources

Learn Zillion - see lesson above

https://learnzillion.com/resources/72258-add-and-subtract-fractions-and-mixed-numbers-with-unlike-denominators-using-area-models

- These Learn Zillion videos address adding and subtracting fractions and mixed numbers with unlike denominators using area models.

EngageNY 5th Grade Module 3 - Addition and Subtraction of Fractions

https://www.engageny.org/resource/grade-5-mathematics-module-3

- In Module 3, students' understanding of addition and subtraction of fractions extends from earlier work with fraction equivalence and

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decimals. This module marks a significant shift away from the elementary grades' centrality of base ten units to the study and use of the full set of fractional units from Grade 5 forward, especially as applied to algebra.

Satisfraction

http://gregtangmath.com/satisfraction

- Interactive game to identify, simplify, compare, and calculate with fractions.

Sample Formative Assessment Tasks/Questions

http://www.insidemathematics.org/assets/common-core-math-tasks/cindy's%20cats.pdf (performance assessment task - 5.NSF.1 and 5.NSF.2)

https://hcpss.instructure.com/courses/108/pages/5-dot-nf-dot-1-assessment-tasks (assessing 5.NSF.1)
https://hcpss.instructure.com/courses/108/pages/5-dot-nf-dot-2-assessment-tasks (assessing 5.NSF.2)
https://hcpss.instructure.com/courses/108/pages/5-dot-md-dot-2-assessment-tasks (assessing 5.MDA.2)

Return to Table of Contents

DRAFT

5th Grade Unit 5 Return to Table of Contents Return to Fifth Grade Overview

Multiplying with Fractions

Content Standards with Clarifying Notes
Open bullets indicate clarifying notes.

- 5.NSF.4 Extend the concept of multiplication to multiply a fraction or whole number by a fraction.
  a. Recognize the relationship between multiplying fractions and finding the areas of rectangles with fractional side lengths;
  b. Interpret multiplication of a fraction by a whole number and a whole number by a fraction and compute the product;
  c. Interpret multiplication in which both factors are fractions less than one and compute the product.
- 5.NSF.5 Justify the reasonableness of a product when multiplying with fractions.
  a. Estimate the size of the product based on the size of the two factors;
  b. Explain why multiplying a given number by a number greater than 1 (e.g., improper fractions, mixed numbers, whole numbers) results in a product larger than the given number;
  c. Explain why multiplying a given number by a fraction less than 1 results in a product smaller than the given number;
  d. Explain why multiplying the numerator and denominator by the same number has the same effect as multiplying the fraction by 1.
- 5.NSF.6 Solve real-world problems involving multiplication of a fraction by a fraction, improper fraction and a mixed number.
  - Once the conceptual understanding has been developed (5.NSF.4), students apply that knowledge in 5.NSF.6 to solve real-world problems involving multiplication of fractions, including mixed number by mixed number.
- 5.MDA.2 Create a line plot consisting of unit fractions and use operations on fractions to solve problems related to the line plot.
-

New Academic Vocabulary for This Unit

All vocabulary introduced in prior grades.

Prior Knowledge Required for This Unit

This unit extends students' work of multiplication of whole numbers from earlier grades. In fourth grade, students multiplied a fraction by a whole number (such as 3 copies that are each one-fifth = 3/5) and solved real world problems involving multiplication of a fraction by a whole number.

Subsequent Knowledge Related to This Unit

In unit 6, students will divide with unit fractions and whole numbers. In unit 8, students will apply skills from this unit in their work with perimeter and area (volume remains with whole numbers only).

Relationship Among Standards in This Unit

In fifth grade, students are expected to multiply fractions including proper fractions, improper fractions, and mixed numbers. In this unit, students extend their understanding of fractions by multiplying with fractions in a variety of situations to solve real-world problems.

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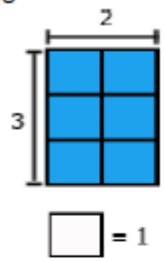
Potential Instructional Strategies/Lessons

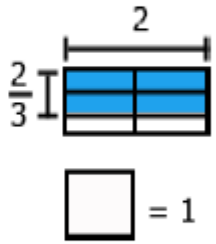
Teacher Notes:
Standard 5.NSF.4 references both the multiplication of a fraction by a whole number and the multiplication of two fractions. Visual fraction models (area models, tape diagrams, number lines) should be used and created by students during their work with this standard.

Example: Building on previous understandings of multiplication (Examples from KATM Grade 5 flip book)

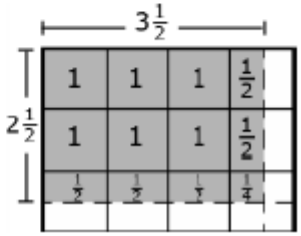
- Rectangle with dimensions of 2 and 3 showing that 2 x 3 = 6.



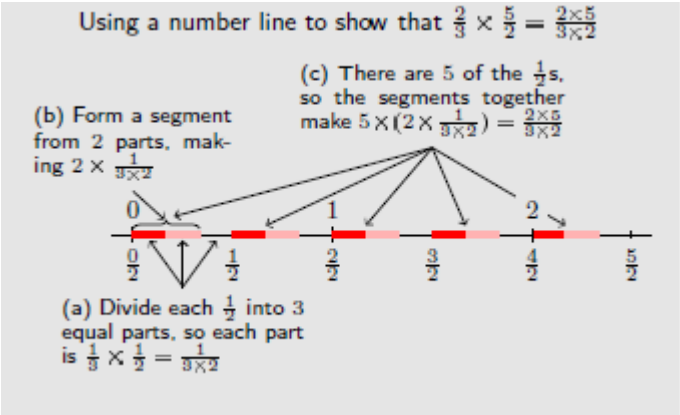
- Rectangle with dimensions of 2 and $\frac{2}{3}$ showing that $2 \times \frac{2}{3} = \frac{4}{3}$

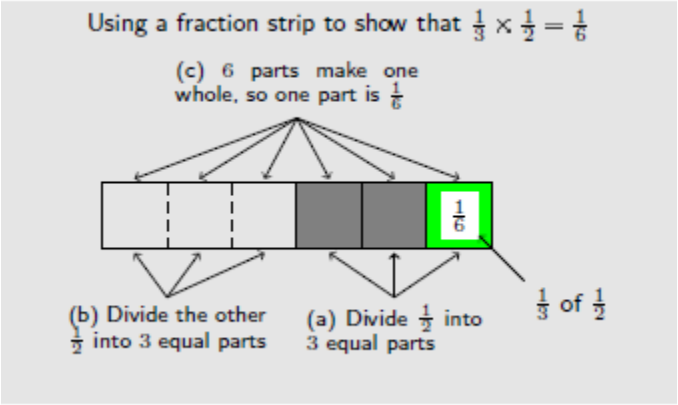


- $2\frac{1}{2}$ groups of $3\frac{1}{2}$:



(Examples from KATM Grade 5 flip book)
Additional examples from Progressions for the Common Core State Standards in Mathematics: 3-5 Number and Operations - Fractions:





Howard County Schools Resources for 5.NSF.4

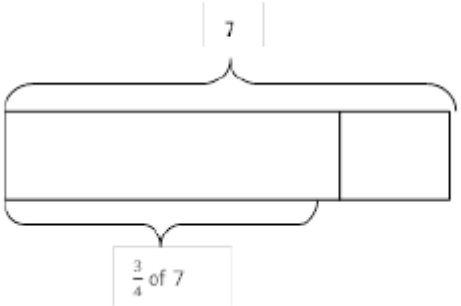
https://hcpss.instructure.com/courses/108/pages/5-dot-nf-dot-4-about-the-math-learning-targets-and-rigor

- This page includes teacher notes, lesson plans, print resources, LearnZillion video links, and web resources.

Standard 5.NSF.5 asks students to examine how numbers change when we multiply by fractions. Students should have ample opportunities to examine both cases in the standard: a) when multiplying by a fraction greater than 1, the number increases, b) when multiplying by a fraction less the one, the number decreases, and c) why multiplying the numerator and denominator by the same number has the same effect as multiplying the fraction by 1. This standard should be explored and discussed while students are working with 5.NF.4, and should not be taught in isolation.

Examples:

- $\frac{3}{4} \times 7$ is less than 7 because 7 is multiplied by a factor less than 1 so the product must be less than 7.



- Mrs. Bennett is planting two flower beds. The first flower bed is 5 meters long and 65 meters wide. The second flower bed is 5 meters long and 56meters wide. How do the areas of these two flower beds compare? Is the value of the area larger or smaller than 5 square meters? Draw pictures to prove your answer.

- 223x 8 must be more than 8 because 2 groups of 8 is 16 and223 is almost 3 groups of 8. So the answer must be close to, but less than 24.
- 34= 5x35x4because multiplying 34 by 55 is the same as multiplying by 1.

(Examples from KATM Grade 5 flip book)

Comparing a Number and a Product (5.NSF.5)
https://www.illustrativemathematics.org/content-standards/tasks/164
- The purpose of this task is for students to compare a number and its product with other numbers that are greater than and less than one.

Howard County Schools Resources for 5.NSF.5
https://hcpss.instructure.com/courses/108/pages/5-dot-nf-dot-5-about-the-math-learning-targets-and-rigor
- This page includes teacher notes, lesson plans, print resources, LearnZillion video links, and web resources.

Standard 5.NSF.6 builds on all of the work done in 5.NSF.4 and 5.NSF.5. Students should be given ample opportunities to use various strategies to solve word problems. This standard could include fraction by a fraction, fraction by a mixed number or mixed number by a mixed number.
Examples:
Painting a Wall
https://www.illustrativemathematics.org/content-standards/tasks/882
- The purpose of this task is for students to find the answer to a question in context that can be represented by fraction multiplication.

Drinking Juice
https://www.illustrativemathematics.org/content-standards/tasks/295
- Task involving fraction multiplication that can be solved with pictures or number lines.

Half of a Recipe
https://www.illustrativemathematics.org/content-standards/tasks/296
- Task involving fraction multiplication that can be solved with pictures or number lines.

Possible Strategies:
A Passion For Fractions (Multiplying a Fraction by a Fraction)
https://www.teachingchannel.org/videos/multiplying-fractions-lesson
- In this video from *The Teaching Channel*, the focus is on the discussion of various strategies for multiplying a fraction by a fraction, and helping students with misconceptions. Great video for teachers to view and discuss prior to teaching this unit.

Fraction Progression from Illustrative Mathematics
https://www.illustrativemathematics.org/progressions
- Fractions Progression Module consisting of videos paired with illustrative tasks to help teachers better understand the development of

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concepts and skills around fractions from grades 3-5.

Connor and Makayla Discuss Multiplication
https://www.illustrativemathematics.org/content-standards/tasks/321

- The purpose of this task is to have students think about the meaning of multiplying a number by a fraction, and use understanding of fraction multiplication to make sense of the commutative property of multiplication in the case of fractions.

Howard County Schools Resources for 5.NSF.6
https://hcpss.instructure.com/courses/108/pages/5-dot-nf-dot-6-about-the-math-learning-targets-and-rigor

- This page includes teacher notes, lesson plans, print resources, LearnZillion video links, and web resources

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Teacher Note: 5.MDA.2
Note: This standard specifically requires the use of unit fractions. While students have experienced adding and subtracting with fractions other than unit fractions, you may want to adapt the data used in the resources to eliminate non-unit fractions.
Example:
During activity time at summer camp, Brooke took one scoop of beads to make her bracelet. She wanted to make sure she had enough to make the bracelet that fit her wrist. She sorted her beads by size. The bead sizes are shown below.

$\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{6}$, $\frac{1}{6}$, $\frac{1}{3}$, $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{3}$, $\frac{1}{2}$

a. Create a line plot to display the data.
b. If Brooke only used 12 inch beads, how long would the bracelet be?
c. If Brooke used all of the 14 and 13 inch beads, how long would the bracelet be?

Possible Strategies:
Learn Zillion Video
https://learnzillion.com/lesson_plans/7584-solve-multi-step-problems-using-information-in-a-line-plot

- In this lesson you will learn how to solve a multi-step problem by using information presented in a line plot.

Measurements in Fractions of Unit - Guided Lesson
http://www.mrmaffesoli.com/Printables/4MD4/4MD4-MWL.pdf

Howard County Schools Resources for 5.MDA.2
https://hcpss.instructure.com/courses/108/pages/5-dot-md-dot-2-about-the-math-learning-targets-and-rigor

- This page includes teacher notes, lesson plans, print resources, LearnZillion video links, and web resources

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Resources
The Teaching Channel - **Multiplying Fractions** (video for teacher information) https://www.teachingchannel.org/videos/multiplying-fractions-lesson?fd=1 • This video shows a teacher's class as she poses a real world problem that involves multiplying a fraction by a fraction. **Learn Zillion** https://learnzillion.com/resources/72266-find-area-of-rectangle-with-fractional-side-lengths-5-nf-b-4b • These Learn Zillion videos address finding the area of rectangles with fractional side lengths. **EngageNY 5th Grade Module 4 - Multiplication and Division of Fractions and Decimal Fractions** https://www.engageny.org/resource/grade-5-mathematics-module-4 • Module 4 extends student understanding of fraction operations to multiplication and division of both fractions and decimal fractions. Work proceeds from interpretation of line plots which include fractional measurements to interpreting fractions as division and reasoning about finding fractions of sets through fraction by whole number multiplication. The module proceeds to fraction by fraction multiplication in both fraction and decimal forms. **Satisfraction** http://gregtangmath.com/satisfraction • Interactive game to identify, simplify, compare, and calculate with fractions.
Sample Formative Assessment Tasks/Questions
https://hcpss.instructure.com/courses/108/pages/5-dot-nf-dot-4-assessment-tasks (assessing 5.NSF.4) https://hcpss.instructure.com/courses/108/pages/5-dot-nf-dot-5-assessment-tasks (assessing 5.NSF.5) https://hcpss.instructure.com/courses/108/pages/5-dot-nf-dot-6-assessment-tasks (assessing 5.NSF.6) https://hcpss.instructure.com/courses/108/pages/5-dot-md-dot-2-assessment-tasks (assessing 5.MDA.2)

Return to Table of Contents

DRAFT

5th Grade Unit 6	Return to Table of Contents Return to Fifth Grade Overview

Dividing with Fractions

Content Standards with Clarifying Notes

Open bullets indicate clarifying notes.

- 5.NSF.3 Understand the relationship between fractions and division of whole numbers by interpreting a fraction as the numerator divided by the denominator (i.e., $\frac{a}{b} = a \div b$).
- 5.NSF.7 Extend the concept of division to divide unit fractions and whole numbers by using visual fraction models and equations.
  a. Interpret division of a unit fraction by a non-zero whole number and compute the quotient;
  b. Interpret division of a whole number by a unit fraction and compute the quotient.
- 5.NSF.8 Solve real-world problems involving division of unit fractions and whole numbers, using visual fraction models and equations.

New Academic Vocabulary for This Unit

All vocabulary introduced in prior grades.

Prior Knowledge Required for This Unit

In fourth grade, students divided whole numbers and multiplied a whole number by a fraction.

Subsequent Knowledge Related to This Unit

This is the first time that students are dividing with fractions. In fifth grade, students experience division problems with whole number divisors and unit fraction dividends or with unit fraction divisors and whole number dividends. In sixth grade, they will use this foundational understanding to compute and represent quotients of positive fractions using a variety of procedures.

Relationship Among Standards in This Unit

Students extend their understanding of fractions, how many unit fractions are in a whole, and their understanding of multiplication and division as involving equal groups or shares and the number of objects in each group or share.

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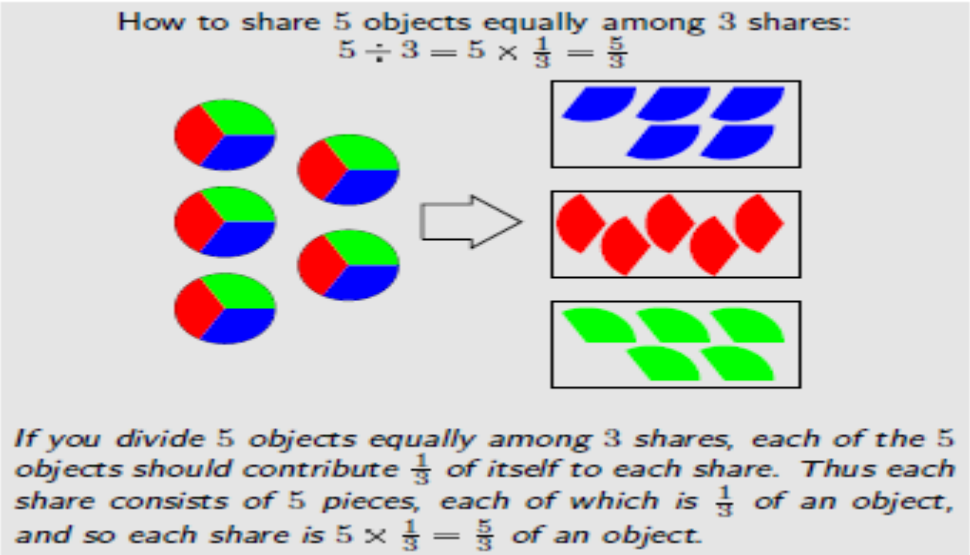
Potential Instructional Strategies/Lessons

Teacher Notes: 5.NSF.3

In Grade 4 students connected fractions with addition and multiplication , understanding that $\frac{5}{3} = \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = 5 \times \frac{1}{3}$. In Grade 5, they connect fractions with division, understanding that $5 \div 3 = \frac{5}{3}$, more generally, $\frac{a}{b} = a \div b$. They can explain this by working with their understanding of division as equal sharing. Example:



Example:

If 9 people want to share a 50-pound sack of rice equally by weight, how many pounds of rice should each person get?

First, they might partition each pound among the 9 people, so that each person gets $50 \times \frac{1}{9} = \frac{50}{9}$ pounds. Second, they might use the equation $9 \times 5 = 45$ to see that each person can be given 5 pounds, with 5 pounds remaining. Partitioning the remainder gives $5\frac{5}{9}$ pounds for each person. (Excerpt from Progressions for the Common Core State Standards in Mathematics: 3-5 Number and Operations - Fractions)

Ten team members are sharing 3 boxes of cookies. How much of a box will each student get?

When working this problem a student should recognize that the 3 boxes are being divided into 10 groups, so s/he is seeing the solution to the following equation, $10 \times n = 3$ (10 groups of some amount is 3 boxes) which can also be written as $n = 3 \div 10$. Using models or diagram, they divide each box into 10 groups, resulting in each team member getting $\frac{3}{10}$ of a box. (Example from KATM Grade 5 flip book)

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Possible Strategies:

Relating Fractions to Division (MARY - delete this resource and link)

https://grade5commoncoremath.wikispaces.hcpss.org/file/view/5.NF.3_relating-fractions-to-division-problems.pdf/457062964/5.NF.3_relating-fractions-to-division-problems.pdf

K-5 Math Teaching Resources – 5th Grade Number Activities

http://www.k-5mathteachingresources.com/5th-grade-number-activities.html

- On this page, scroll down to the fraction standards to see several activities.

Howard County Schools Resources for 5.NSF.3

https://hcpss.instructure.com/courses/108/pages/5-dot-nf-dot-3-about-the-math-learning-targets-and-rigor

- This page includes teacher notes, lesson plans, print resources, LearnZillion video links, and web resources

How Much Pie?

https://www.illustrativemathematics.org/content-standards/tasks/858

The purpose of this task is to help students see the connection between a ÷ b and $\frac{a}{b}$ in a particular concrete example.

Learn Zillion Video

https://learnzillion.com/lesson_plans/4943-use-picture-models-to-divide-whole-numbers-leading-to-answers-in-the-form-of-fractions

Use picture models to divide whole numbers leading to answers in the form of fractions.

Teacher Notes: 5.NSF.7 and 5.NSF.8

Grade 5 is the first time students are dividing with fractions. In fourth grade, students divided whole numbers, and multiplied a whole number by a fraction. In fifth grade, students experience division problems with whole number divisors and unit fraction dividends or with unit fraction divisors and whole number dividends. Students extend their understanding of fractions, how many unit fractions are in a whole, and their understanding of multiplication and division as involving equal groups or shares and the number of objects in each group/share. In sixth grade, they will use this foundational understanding to divide into and by more complex fractions and develop abstract methods of dividing by fractions.

Standards 5.NSF.7 and 5.NSF.8 call for students to extend the concept of division by using visual fraction models and equations. Also, students should use real-world problems to make sense of division problems.

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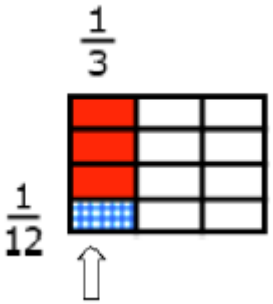
Example: Knowing the number of groups/shares and finding how many/much in each group/share.

(1)How many $\frac{1}{3}$cup servings are in 2 cups of raisins?

Student: I know that there are three $\frac{1}{3}$cup servings in 1 cup of raisins. Therefore, there are 6 servings in 2 cups of raisins. I can also show this since 2 divided by $\frac{1}{3}$= 2 × 3 = 6 servings of raisins.

(2) Four students sitting at a table were given$\frac{1}{3}$of a pan of brownies to share. How much of a pan will each student get if they share the pan of brownies equally?

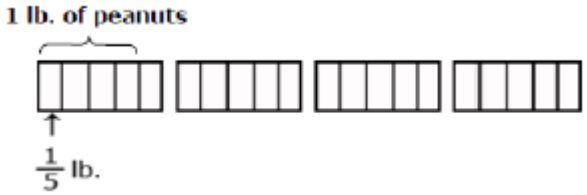
The diagram shows the$\frac{1}{3}$pan divided into 4 equal shares with each share equaling $\frac{1}{12}$ of the pan.



Example: Knowing how many in each group/share and finding how many groups/shares

Angelo has 4 lbs of peanuts. He wants to give each of his friends$\frac{1}{5}$lb. How many friends can receive $\frac{1}{5}$lb of peanuts?

A diagram for 4 ÷ $\frac{1}{5}$ is shown below. Students explain that since there are five fifths in one whole, there must be 20 fifths in 4 lbs.



(Examples from KATM Grade 5 flip book)

Modeling Division of Fractions:

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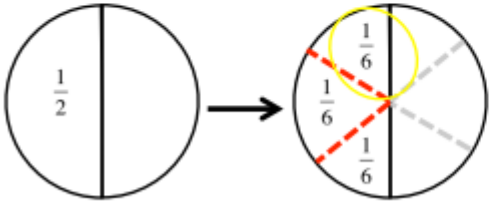
Division of a Whole Number by a Fraction.
http://www.wccusd.net/cms/lib03/CA01001466/Centricity/domain/60/lessons/grade%205%20lessons/ModelingDivisonWholeNubmerByFraction.pdf

Division of Unit Fractions by Whole Numbers (same source as link above)

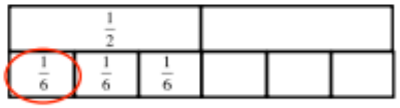
Example 1 Jasmine has $\frac{1}{2}$ of a pizza and would like to share it with 2 of her friends. How much of the whole pizza will Jasmine and her 2 friends get each?

Problem:	Think/Ask:	Simplify
$\frac{1}{2} \div 3$	How can $\frac{1}{2}$ be broken into 3 pieces?	$\therefore \frac{1}{2} \div 3 = \frac{1}{6}$

Model:



Another Model:



Possible Strategies:

Howard County Schools Resources for 5.NSF.7
https://hcpss.instructure.com/courses/108/pages/5-dot-nf-dot-7-about-the-math-learning-targets-and-rigor

- This page includes teacher notes, lesson plans, print resources, LearnZillion video links, and web resources

Division of Unit Fractions by Whole Numbers
http://fractionbars.com/CommonCore/Gd5Les/CCSSDiv5_NF_7aGd5.pdf

Divide a Unit Fraction by a Whole Number
http://www.k-5mathteachingresources.com/support-files/divide-a-unit-fraction-by-a-whole-number.pdf

Dividing a Whole Number by a Unit Fraction
http://www.k-5mathteachingresources.com/support-files/dividing-a-whole-number-by-a-unit-fraction-ver.2.pdf

Learn Zillion Videos
https://learnzillion.com/lesson_plans/5021-divide-a-unit-fraction-by-a-whole-number

Dividing a unit fraction by a whole number.
https://learnzillion.com/lesson_plans/7535
Dividing a whole number by a unit fraction

Banana Pudding
https://www.illustrativemathematics.org/content-standards/tasks/1196

- The purpose of this task is to provide students with a concrete situation they can model by dividing a whole number by a unit fraction. For students who are just beginning to think about the meaning of division by a unit fraction (or students who have never cooked), the teacher can bring in a 1/4 cup measuring cup so that students can act it out.

Dividing by One-half
https://www.illustrativemathematics.org/content-standards/tasks/12

- This task requires students to recognize both "number of groups unknown" (part a) and "group size unknown" (part d) division problems in the context of a whole number divided by a unit fraction.

How Many Servings of Oatmeal?
https://www.illustrativemathematics.org/content-standards/tasks/829

- This task provides a context for performing division of a whole number by a unit fraction. This problem is a "How many groups?" example of division: the "groups" in this case are the servings of oatmeal and the question is asking how many servings (or groups) there are in the package.

Salad Dressing
https://www.illustrativemathematics.org/content-standards/tasks/1172

- The purpose of this task is to have students add fractions with unlike denominators and divide a unit fraction by a whole number. This real-life context provides students with an opportunity to apply their understanding of addition and presents a "how many groups" division

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problem where a unit fraction should be divided into 6 equal groups.

Resources

Fraction Progression from Illustrative Mathematics

https://www.illustrativemathematics.org/progressions

- Fractions Progression Module consisting of videos paired with illustrative tasks to help teachers better understand the development of concepts and skills around fractions from grades 3-5.

EngageNY 5th Grade Module 4 - Multiplication and Division of Fractions and Decimal Fractions

https://www.engageny.org/resource/grade-5-mathematics-module-4

- Module 4 extends student understanding of fraction operations to multiplication and division of both fractions and decimal fractions. Work proceeds from interpretation of line plots which include fractional measurements to interpreting fractions as division and reasoning about finding fractions of sets through fraction by whole number multiplication. The module proceeds to fraction by fraction multiplication in both fraction and decimal forms. Students are introduced to the work of division with fractions and decimal fractions. Division cases are limited to division of whole numbers by unit fractions and unit fractions by whole numbers.

Satisfraction

http://gregtangmath.com/satisfraction

- Interactive game to identify, simplify, compare, and calculate with fractions.

Sample Formative Assessment Tasks/Questions

https://hcpss.instructure.com/courses/108/pages/5-dot-nf-dot-3-assessment-tasks (assessing 5.NSF.3)

https://hcpss.instructure.com/courses/108/pages/5-dot-nf-dot-7-assessment-tasks (assessing 5.NSF.7 and 5.NSF.8)

DRAFT

Return to Table of Contents

5th Grade Unit 7	Return to Table of Contents Return to Fifth Grade Overview

Classifying 2-D Shapes

Content Standards with Clarifying Notes
Open bullets indicate clarifying notes.

- 5.G.3 Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category.
- 5.G.4 Classify two-dimensional figures in a hierarchy based on their attributes.

New Academic Vocabulary for This Unit

- attribute
- subcategory
- hierarchy

Prior Knowledge Required for This Unit

In prior grades, students described, analyzed and compared properties of two-dimensional shapes. At Grade 3, students begin to consider relationships of shape categories, considering two levels of subcategories (e.g., rectangles are parallelograms and squares are rectangles). In Grade 4 students drew and analyzed two-dimensional shapes to deepen their understanding of the properties of two-dimensional shapes. They looked at the presence or absence of parallel and perpendicular lines to classify two-dimensional shapes.

Subsequent Knowledge Related to This Unit

In grade 5, students culminate their understanding of two- dimensional figures by classifying them in a hierarchy based on their attributes. They then use their knowledge of attributes to address the concepts of perimeter, area and volume in the next unit, Unit 8.

Relationship Among Standards in This Unit

These standards call for students to reason about the attributes of shapes. In grade 5, students classify two-dimensional shapes in a hierarchy based on their attributes. Students should have experiences discussing the property of shapes and explaining their reasoning. In grade 5, the expectation is that students classify and understand the relationship among the various subcategories of the classification. Students are no longer simply classifying as in 3rd and 4th grade, but moving to level 2 of van Hiele levels of geometric thought.
From *Teaching Student-Centered Mathematics: Grades 5-8* by John A. Van de Walle and LouAnn H. Lovin, pg. 182

DRAFT

The van Hiele Theory of Geometric Thought

Level 2: Informal Deduction

The objects of thought at level 2 are the properties of shapes. As students begin to be able to think about properties of geometric objects without the constraints of a particular object, they are able to develop relationships between and among the properties. "If all four angles are right angles, the shape must be a rectangle. If it is a square, all angles are right angles. If it is a square, it must be a rectangle." Observations go beyond properties themselves and begin to focus on logical arguments about the properties. The products of thought at level 2 are relationships among properties of geometric objects.

Potential Instructional Strategies/Lessons

Teacher Note: 5.G.3 and 5.G.4

For this section, please read each example and lesson carefully and avoid taking questions out of context. Taking questions out of context could be misleading. For example, when dealing with questions/lessons related to Trapezoids, it should be noted that depending on the source used, "trapezoid" can be defined in two ways:

- *A trapezoid is a quadrilateral with exactly one pair of parallel sides.*
- *A trapezoid is a quadrilateral with at least one pair of parallel sides.*

As a result, if questions are taken out of context it could lead students to one definition or the other when the goal is for students to see that difference sources uses different definitions as illustrated by the lesson from Illustrative Mathematics titled "What is a Trapezoid" which accompanies standard 5.G.4 below.

The goal for these two standards is that students complete this categorization with the understanding that any property of a category also applies to all shapes in any of its subcategories. They should understand that some categories overlap (e.g., not all parallelograms are rectangles) and some are disjoint (e.g., no square is a triangle), and connect these with their understanding of categories and subcategories.

Students can use graphic organizers such as flow charts or T-charts to compare and contrast the attributes of geometric figures. Have students create a T-chart with a shape on each side. Have them list attributes of the shapes, such as number of sides, number of angles, types of lines, etc. they need to determine what's alike or different about the two shapes to get a larger classification for the shapes and be able to explain these properties.

Examples:

(1) Examine whether all quadrilaterals have right angles. Give examples and non-examples.

(2) If the opposite sides on a parallelogram are parallel and congruent, then rectangles are parallelograms.

DRAFT

A sample of questions that might be posed to students include:
(a)A parallelogram has 4 sides with both sets of opposite sides parallel. What types of quadrilaterals are parallelograms? Explain.
(b) Regular polygons have all of their sides and angles congruent. Name or draw some regular polygons. Explain your drawings.
(c) All rectangles have 4 right angles. Squares have 4 right angles so they are also rectangles. True or False? Explain your reasoning.
(d) A trapezoid has 2 sides parallel so it must be a parallelogram. True or False? Explain your reasoning.

(3) Pose questions such as, "Why is a square always a rectangle?" and "Why is a rectangle not always a square?" Expect students to use precision in justifying and explaining their reasoning.

(4) Explore why: A right triangle can be both scalene and isosceles, but not equilateral. A scalene triangle can be right, acute and obtuse.

(5) Create a Hierarchy Diagram using the following terms:

polygons – a closed plane figure formed from line segments that meet only at their endpoints.

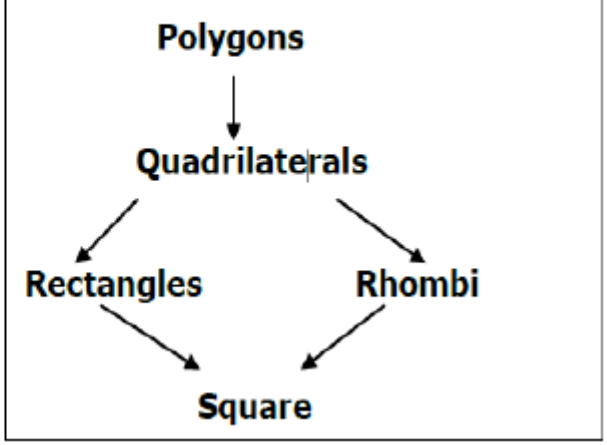
quadrilaterals - a four-sided polygon.

rectangles - a quadrilateral with two pairs of congruent parallel sides and four right angles.

rhombi – a parallelogram with all four sides equal in length.

square – a parallelogram with four congruent sides and four right angles.

Possible student solutions:



quadrilaterals - a four-sided polygon.

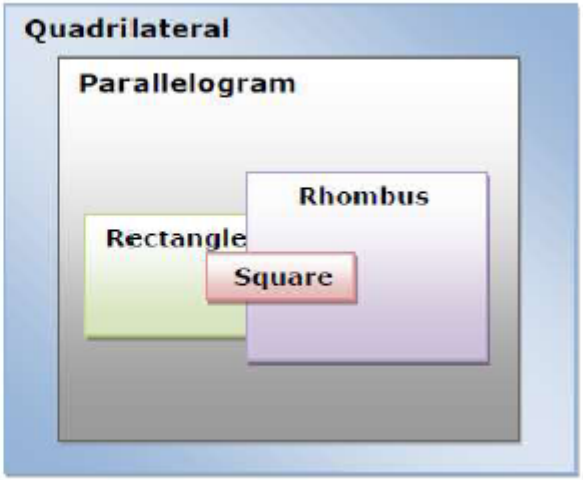
parallelogram: a quadrilateral with two pairs of parallel and congruent sides.

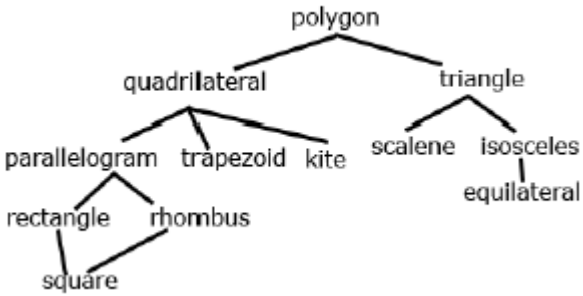
rectangles - a quadrilateral with two pairs of congruent parallel sides and four right angles.

rhombus – a parallelogram with all four sides equal in length.

square – a parallelogram with four congruent sides and four right angles.

Possible student solution:





Students should be able to reason about the attributes of shapes by examining:

- What are ways to classify triangles?
- Why can't trapezoids and kites be classified as parallelograms?
- Which quadrilaterals have opposite angles congruent and why is this true of certain quadrilaterals?
- How many lines of symmetry does a regular polygon have?

(Examples from KATM Grade 5 flip book)

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Possible Strategies:

Howard County Schools Resources for 5.G.3

https://hcpss.instructure.com/courses/108/pages/5-dot-g-3-about-the-math-learning-targets-and-rigor

- This page includes teacher notes, lesson plans, print resources, LearnZillion video links, and web resources

Howard County Schools Resources for 5.G.4

https://hcpss.instructure.com/courses/108/pages/5-dot-g-4-about-the-math-learning-targets-and-rigor

- This page includes teacher notes, lesson plans, print resources, LearnZillion video links, and web resources

Always, Sometimes, Never (5.G.3)

https://www.illustrativemathematics.org/content-standards/5/G/B/3/tasks/1941

- The purpose of this task is to have students reason about different kinds of shapes based on their defining attributes and to understand the relationship between different categories of shapes that share some defining attributes.

What is a Trapezoid? (5.G.4)

https://www.illustrativemathematics.org/content-standards/tasks/1505

- The purpose of this task is for students to compare different definitions for trapezoids.

Learn Zillion Videos

https://learnzillion.com/resources/72818-understand-attributes-of-two-dimensional-figures-and-classifying-figures-in-a-hierarchy-5-g-b-3-5-g-b-4

- Videos that support 5.G.3 and 5.G.4

Resources

EngageNY Grade 5, Module 5 - Addition and Multiplication with Volume and Area

https://www.engageny.org/resource/grade-5-mathematics-module-5

- **Topic D** covers 5.G.3 and 5.G.4

Examples of activities - see 5.G.3 and 5.G.4

http://www.k-5mathteachingresources.com/5th-grade-geometry.html

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Literature Connections
If You Were a Quadrilateral by Molly Blaisdell If you were a quadrilateral, you would have four straight sides. You could be a checkerboard, a kite, or a yoga mat. What else could you be if you were a quadrilateral?
Sample Formative Assessment Tasks/Questions
https://hcpss.instructure.com/courses/108/pages/5-dot-g-3-assessment-task (assessing 5.G.3) https://hcpss.instructure.com/courses/108/pages/5-dot-g-4-assessment-tasks (assessing 5.G.4)

Return to Table of Contents

DRAFT

5th Grade Unit 8 Return to Table of Contents Return to Fifth Grade Overview

Perimeter, Area, and Volume

Content Standards with Clarifying Notes

Open bullets indicate clarifying notes.

- 5.MDA.3 Understand the concept of volume measurement.
  a. Recognize volume as an attribute of right rectangular prisms;
  b. Relate volume measurement to the operations of multiplication and addition by packing right rectangular prisms and then counting the layers of standard unit cubes;
  c. Determine the volume of right rectangular prisms using the formula derived from packing right rectangular prisms and counting the layers of standard unit cubes.
- 5.MDA.4 Differentiate among perimeter, area and volume and identify which application is appropriate for a given situation.
  - Students will identify which application is appropriate by problem solving

New Academic Vocabulary for This Unit

- volume
- height
- cubic units
- right rectangular prism

Prior Knowledge Required for This Unit

Prior experiences with volume were limited to liquid volume. In grade 3, students explored the concept of area measurement. In grade 4, students applied the area and perimeter formulas for rectangles. Students in grades 3 and 4 also solved problems involving perimeter and area.

Subsequent Knowledge Related to This Unit

In grade 6, students will extend this understanding to include finding the volume of right rectangular prisms with whole and fractional edge lengths. In grades 7 and 8, students find the volume and surface area of three-dimensional figures.

Relationship Among Standards in This Unit

This is the first time students begin exploring the concept of volume with right rectangular prisms. The concept of volume is extended from area with the idea that students are covering an area with a layer of unit cubes and then adding layers of unit cubes on top of the bottom layer. Additionally, students use their understanding from grades 3, 4, and 5 to differentiate among perimeter, area, and volume to identify which application is appropriate for a given situation.

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Potential Instructional Strategies/Lessons
Teacher Notes: 5.MDA.3 As noted above, the concept of volume is extended from area with the idea that students are covering an area (the bottom of cube) with a layer of unit cubes and then adding layers of unit cubes on top of the bottom layer (see picture below). Because volume introduces a third dimension and thus a significant challenge to students' spatial structuring, students should have ample experiences with concrete manipulatives before moving to pictorial representations. Students need to be provided with multiple opportunities to find the volume of rectangular prisms by counting unit cubes before the formula for the volume of a rectangular prism is presented. Multiple learning opportunities (similar to example 1 below) are needed for students to develop the formula. Students should have experiences to describe and reason why the formula is true. Specifically, that they are covering the bottom of a right rectangular prism (length x width) with multiple layers (height). Therefore, the formula (length x width x height) is an extension of the formula for the area of a rectangle. Have students build a prism in layers. Then, have students determine the number of cubes in the bottom layer and share their strategies. Students should use multiplication based on their knowledge of arrays and its use in multiplying two whole numbers. Ask what strategies can be used to determine the volume of the prism based on the number of cubes in the bottom layer. Expect responses such as "adding the same number of cubes in each layer." Students will discover multiplying the length times the width of a right rectangular prism can be viewed as determining how many cubes would be in each layer if the prism were packed with unit cubes. Students also learn that the height of the prism tells how many layers would fit in the prism. They understand that volume is a derived attribute that, once a length unit is specified, can be computed as the product of three length measurements or as the product of one area and one length measurement. Then, students can learn the formulas V =l x w x h and V = B x h for right rectangular prisms as efficient methods for computing volume, maintaining the connection between these methods and their previous work with computing the number of unit cubes that pack a right rectangular prism.

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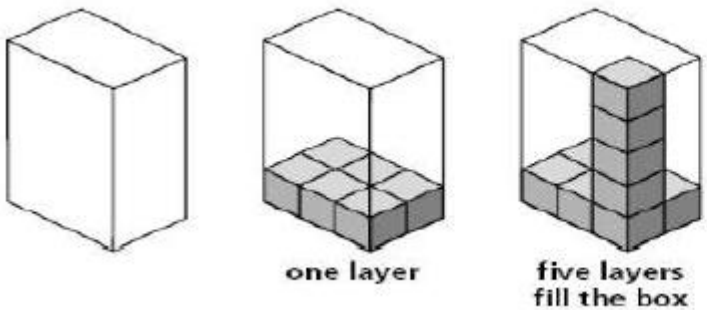
Example:

(1)



(3 x 2) represented by first layer
(3 x 2) x 5 represented by number of
3 x 2 layers
(3 x 2) + (3 x 2) + (3 x 2) + (3 x 2)+ (3 x 2) =
6 + 6 + 6 + 6 + 6 + 6 = 30
6 representing the size/area of one layer

(2) Give students one block (a 1- or 2- cubic centimeter or cubic-inch cube), a ruler with the appropriate measure based on the type of cube, and a small rectangular box. Ask students to determine the number of cubes needed to fill the box. Have students share their strategies with the class using words, drawings or numbers. Allow them to confirm the volume of the box by filling the box with cubes of the same size. By stacking geometric solids with cubic units in layers, students can begin understanding the concept of how addition plays a part in finding volume. This will lead to an understanding of the formula for the volume of a right rectangular prism, b x h, where b is the area of the base.

(3) When given 24 cubes, students make as many rectangular prisms as possible with a volume of 24 cubic units. Students build the prisms and record possible dimensions.

Length	Width	Height
1	2	12
2	2	6
4	2	3
8	3	1

(Excerpt from KATM Grade 5 flip book)

Possible Strategies: 5.MDA.3

Howard County Schools Resources for 5.MDA.3 (and CCSS 5.MD.4 and CCSS 5.MD.5)

https://hcpss.instructure.com/courses/108/pages/5-dot-md-dot-3-about-the-math-learning-targets-and-rigor
https://hcpss.instructure.com/courses/108/pages/5-dot-md-dot-4-about-the-math-learning-targets-and-rigor

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https://hcpss.instructure.com/courses/108/pages/5-dot-md-dot-5-about-the-math-learning-targets-and-rigor

- These pages include teacher notes, lesson plans, print resources, LearnZillion video links, and web resources

Box of Clay
http://achievethecore.org/page/617/box-of-clay-detail-pg

- This task provides an opportunity to compare the relative volumes of boxes in order to calculate the mass of clay required to fill them.

Cari's Aquarium
https://www.illustrativemathematics.org/content-standards/tasks/1308

- This task asks students to use the volume formula and conceptual understanding to solve real-world problems.

The Grass is Always Greener (5.NSBT.5, 5.NSBT.6, 5.MDA.4)
https://grade5commoncoremath.wikispaces.hcpss.org/file/view/5.NBT.5_5.NBT.6_TheGrassIsAlwaysGreener.pdf/457259834/5.NBT.5_5.NBT.6_TheGrassIsAlwaysGreener.pdf

- In this activity, students calculate the cost of each rug (area) to determine the better buy. A great area lesson that reviews multiplication of decimals.

Teacher Notes: 5.MDA.4
In grade 3, students solved problems involving area and perimeter (3.MDA.5 and 3.MDA.6). In grade 4, students applied the area and perimeter formulas for rectangles (4.MDA.3). In grade 5, as noted above, volume is introduced (5.MDA.3). The intent of 5.MDA.4 is for students to use prior learning experiences from grades 3 through 5 to differentiate among perimeter, area and volume. Students will differentiate among perimeter, area and volume and identify which application is appropriate by problem solving. Students should be provided with ample problem-solving scenarios in which they identify which application is appropriate for the scenario and then solve the problem.

Resources

Bridges in Mathematics: Grade 5 Supplement (5.MDA.3)
http://catalog.mathlearningcenter.org/files/pdfs/SecB5SUP-D2_MeasVolume-201309.pdf

- Collection of activities related to volume - some extend beyond standard (fractional edge lengths is not an expectation at 5th grade)

EngageNY 5th Grade Module 5 - Addition and Multiplication with Volume and Area
https://www.engageny.org/resource/grade-5-mathematics-module-5

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- In this module, students work with two- and three-dimensional figures. Volume is introduced to students through concrete exploration of cubic units and culminates with the development of the volume formula for right rectangular prisms. The second half of the module turns to extending students' understanding of two-dimensional figures. Students combine prior knowledge of area with newly acquired knowledge of fraction multiplication to determine the area of rectangular figures with fractional side lengths. They then engage in hands-on construction of two-dimensional shapes, developing a foundation for classifying the shapes by reasoning about their attributes.

LearnZillion Videos (5.MDA.3)
https://learnzillion.com/lesson_plans/6483-find-volume-by-counting-cubes
- Video - finding volume by counting cubes

https://learnzillion.com/lesson_plans/6429-find-volume-by-multiplying-the-base-by-the-height
- Video - finding volume by multiplying the base by the height

Sample Formative Assessment Tasks/Questions

https://hcpss.instructure.com/courses/108/pages/5-dot-md-dot-3-assessment-tasks (assessing 5.MDA.3)
https://hcpss.instructure.com/courses/108/pages/5-dot-md-dot-4-assessment-tasks (assessing 5.MDA.3)
https://hcpss.instructure.com/courses/108/pages/5-dot-md-dot-5-assessment-tasks (assessing 5.MDA.3)

Return to Table of Contents

DRAFT

5th Grade Unit 9	Return to Table of Contents Return to Fifth Grade Overview

Converting Measurements within a Single System

Content Standards with Clarifying Notes
Open bullets indicate clarifying notes.

5.MDA.1 Convert measurements within a single system of measurement: customary (i.e., in., ft., yd., oz., lb., sec., min., hr.) or metric (i.e., mm, cm, m, km, g, kg, mL, L) from a larger to a smaller unit and a smaller to a larger unit.

New Academic Vocabulary for This Unit

All vocabulary introduced in prior grades.

Prior Knowledge Required for This Unit

In grade 4, students converted measurements within a single system of measurement, customary or metric, from a larger to a smaller unit.

Subsequent Knowledge Related to This Unit

In middle school, students will solve real-world and mathematical problems involving multi-step dimensional analysis.

Relationship Among Standards in This Unit

Students convert measurements within a single system (from a larger to a smaller unit **and** a smaller to a larger unit) by applying operational fluency in problem solving situations.

Potential Instructional Strategies/Lessons

5.MDA.1 calls for students to convert measurements within the same system of measurement. Both customary and metric systems are included. In fourth grade, students convert measurements within a single system (metric or customary) from a larger to a smaller unit. In Grade 5, students extend their abilities from Grade 4 to express measurements in larger or smaller units within a measurement system. Students' work with conversions within

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the metric system provides opportunities for practical applications of place value understanding and supports work from prior units in grade 5.

Students should explore how the base-ten system supports conversions within the metric system. This standard allows for an excellent opportunity to reinforce notions of place value for whole numbers and decimals, and connection between fractions and decimals (e.g., 2 ½ meters can be expressed as 2.5 meters or 250 centimeters).

Prior to making actual conversions, students should examine the units to be converted, determine if the converted amount will be more or less than the original unit, and explain their reasoning. When converting metric measurement, students apply their understanding of place value and decimals. Avoid using memory tricks, such as King Henry…, should not be used when teaching conversions within the metric system. Rules become the focus rather than understanding and rules are often misused. "An alternate rationale is to think of decimal point shifting as multiplying or dividing by powers of 10. In an example, since there are 1000 grams in a kilogram, change to grams by multiplying by 1000, or shift the decimal three places to the right." (*Teaching Student-Centered Mathematics: Grades 5-8* by John A. Van de Walle and LouAnn H. Lovin, pg. 251)

Students should gain ease in converting units of measures in equivalent forms within the same system. To convert from one unit to another unit, the relationship between the units must be known. In order for students to have a better understanding of the relationships between units, they need to use measuring tools in class. The number of units must relate to the size of the unit. For example, students have discovered that there are 12 inches in 1 foot and 3 feet in 1 yard. This understanding is needed to convert inches to yards. Using 12-inch rulers and yardsticks, students can see that three of the 12-inch rulers are equivalent to one yardstick (3 × 12 inches = 36 inches; 36 inches = 1 yard). Using this knowledge, students can decide whether to multiply or divide when making conversions.
(Excerpt from KATM Grade 5 flip book)

Converting Fractions of a Unit into a Smaller Unit
https://www.illustrativemathematics.org/content-standards/tasks/293

Resources

EngageNY Grade 5 Measurement Lesson Links
https://www.engageny.org/ccls-math/5md1

- While EngageNY does not have a single unit devoted to this standard, this page contains links to the lessons within various units that fit the standard.

CCGPS Frameworks 5th Grade, Unit 6
https://www.georgiastandards.org/Georgia-Standards/Frameworks/5-Math-Unit-6.pdf

- Go to pages 18-23 for a lesson in which students will estimate and make actual measurements for length, time, liquid volume, weight or mass.

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They will convert those measurements to a different unit within the same measurement system and use that to estimate the measurement of a similar item.

Howard County Schools Resources for 5.MDA.1
https://hcpss.instructure.com/courses/108/pages/5-dot-md-dot-1-about-the-math-learning-targets-and-rigor

- This page includes lesson plans, print resources, LearnZillion video links, and ideas for prompting rigor, web resources, and math center ideas.

Comparing Metric Units
http://www.k-5mathteachingresources.com/support-files/comparing-metric-units.pdf

- This activity asks students to first measure items using millimeters, centimeters, and meters, and then to analyze the relationship between them.

LearnZillion
https://hcpss.learnzillion.com/resources/46411-5-md-1

- This site contains lessons, leveled tasks, and assessments that fit the standard.

Matific Measurement Episodes (free for teachers)
https://www.matific.com/us/en-us/grades/5G/Measurements

- This page offers multiple episodes on measurement skills.

Measurement Games (Sheppard Software)
http://www.sheppardsoftware.com/mathgames/menus/measurement.htm

- This site includes multiple games for students to practice their measurement skills.

Sample Formative Assessment Tasks/Questions

https://hcpss.instructure.com/courses/108/pages/5-dot-md-dot-1-assessment-tasks (assessing 5.MDA.1)

DRAFT

Return to Table of Contents