North Carolina Department of Public Instruction
INSTRUCTIONAL SUPPORT TOOLS
FOR ACHIEVING NEW STANDARDS

5th Grade Mathematics ● Unpacked Contents
For the new Standard Course of Study that will be effective in all North Carolina schools in the 2017-18 School Year.

This document is designed to help North Carolina educators teach the 5th Grade Mathematics Standard Course of Study. NCDPI staff are continually updating and improving these tools to better serve teachers and districts.

What is the purpose of this document?
The purpose of this document is to increase student achievement by ensuring educators understand the expectations of the new standards. This document may also be used to facilitate discussion among teachers and curriculum staff and to encourage coherence in the sequence, pacing, and units of study for grade-level curricula. This document, along with on-going professional development, is one of many resources used to understand and teach the NC SCOS.

What is in the document?
This document includes a detailed clarification of each standard in the grade level along with a *sample* of questions or directions that may be used during the instructional sequence to determine whether students are meeting the learning objective outlined by the standard. These items are included to support classroom instruction and are not intended to reflect summative assessment items. The examples included may not fully address the scope of the standard. The document also includes a table of contents of the standards organized by domain with hyperlinks to assist in navigating the electronic version of this instructional support tool.

How do I send Feedback?
Please send feedback to us here and we will use your input to refine our unpacking of the standards. Thank You!

Just want the standards alone?
You can find the standards alone at https://www.dpi.nc.gov/teach-nc/curriculum-instruction/standard-course-study/mathematics.

North Carolina Course of Study – 5th Grade Standards

Standards for Mathematical Practice

Operations & Algebraic Thinking	Number & Operations in Base Ten	Number & Operations-Fractions	Measurement & Data	Geometry
Write and interpret numerical expressions. **NC.5.OA.2** *Analyze patters and relationships.* **NC.5.OA.3**	*Understand the place value system.* **NC.5.NBT.1** **NC.5.NBT.3** *Perform operations with multi-digit whole numbers.* **NC.5.NBT.5** **NC.5.NBT.6** *Perform operations with decimals.* **NC.5.NBT.7**	*Use equivalent fractions as a strategy to add and subtract fractions.* **NC.5.NF.1** *Apply and extend previous understandings of multiplication and division to multiply and divide fractions.* **NC.5.NF.3** **NC.5.NF.4** **NC.5.NF.7**	*Convert like measurement units within a given measurement system.* **NC.5.MD.1** *Represent and interpret data.* **NC.5.MD.2** *Understand concepts of volume.* **NC.5.MD.4** **NC.5.MD.5**	*Understand the coordinate plane.* **NC.5.G.1** *Classify quadrilaterals.* **NC.5.G.3**

Standards for Mathematical Practice

Practice	Explanation and Example
1. Make sense of problems and persevere in solving them.	Mathematically proficient students in grade 5 should solve problems by applying their understanding of operations with whole numbers, decimals, and fractions including mixed numbers. They solve problems related to volume and measurement conversions. Students seek the meaning of a problem and look for efficient ways to represent and solve it. They may check their thinking by asking themselves, "What is the most efficient way to solve the problem?", "Does this make sense?", and "Can I solve the problem in a different way?".
2. Reason abstractly and quantitatively.	Mathematically proficient students in grade 5 should recognize that a number represents a specific quantity. They connect quantities to written symbols and create a logical representation of the problem at hand, considering both the appropriate units involved and the meaning of quantities. They extend this understanding from whole numbers to their work with fractions and decimals. Students write simple expressions that record calculations with numbers and represent or round numbers using place value concepts.
3. Construct viable arguments and critique the reasoning of others.	In fifth grade mathematical proficient students may construct arguments using concrete referents, such as objects, pictures, and drawings. They explain calculations based upon models and properties of operations and rules that generate patterns. They demonstrate and explain the relationship between volume and multiplication. They refine their mathematical communication skills as they participate in mathematical discussions involving questions like "How did you get that?" and "Why is that true?" They explain their thinking to others and respond to others' thinking.
4. Model with mathematics.	Mathematically proficient students in grade 5 experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, making a chart, list, or graph, creating equations, etc. Students need opportunities to connect the different representations and explain the connections. They should be able to use all of these representations as needed. Fifth graders should evaluate their results in the context of the situation and whether the results make sense. They also evaluate the utility of models to determine which models are most useful and efficient to solve problems.
5. Use appropriate tools strategically.	Mathematically proficient fifth graders consider the available tools (including estimation) when solving a mathematical problem and decide when certain tools might be helpful. For instance, they may use unit cubes to fill a rectangular prism and then use a ruler to measure the dimensions. They use graph paper to accurately create graphs and solve problems or make predictions from real world data.
6. Attend to precision.	Mathematically proficient students in grade 5 continue to refine their mathematical communication skills by using clear and precise language in their discussions with others and in their own reasoning. Students use appropriate terminology when referring to expressions, fractions, geometric figures, and coordinate grids. They are careful about specifying units of measure and state the meaning of the symbols they choose. For instance, when figuring out the volume of a rectangular prism they record their answers in cubic units.
7. Look for and make use of structure.	In fifth grade mathematically proficient students look closely to discover a pattern or structure. For instance, students use properties of operations as strategies to add, subtract, multiply and divide with whole numbers, fractions, and decimals. They examine numerical patterns and relate them to a rule or a graphical representation.
8. Look for and express regularity in repeated reasoning.	Mathematically proficient fifth graders use repeated reasoning to understand algorithms and make generalizations about patterns. Students connect place value and their prior work with operations to understand algorithms to fluently multiply multi-digit numbers and perform all operations with decimals to hundredths. Students explore operations with fractions with visual models and begin to formulate generalizations.

Return to Standards

Write and interpret numerical expressions.

NC.5.OA.2 Write, explain, and evaluate numerical expressions involving the four operations to solve up to two-step problems. Include expressions involving:

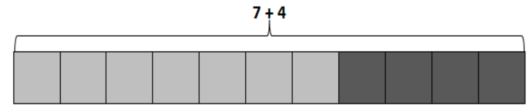
- Parentheses, using the order of operations.
- Commutative, associative and distributive properties.

Clarification

Students will need to be able to describe relationships in expressions, and they will also need to evaluate the expression. This standard calls for two things: describing the relationships between expressions or within expressions and evaluating expressions using order of operations and properties. Calculations are expected, however, there will only be two steps when solving a problem [ex. 5 + (3 x 2) and not (5 x 6) + (3 x 4)]. Expressions in this standard can include whole numbers, decimals, and fractions.

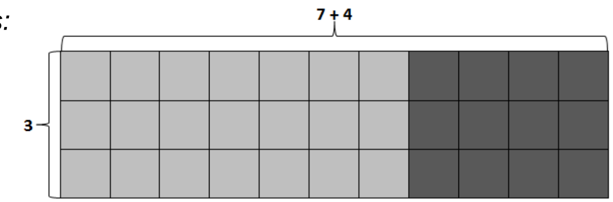
Checking for Understanding

Below is a picture that represents 7 + 4



- Draw a picture that represents 3 x (7 + 4)
- How many times bigger is the value of 3 x (7 + 4) than 7 + 4? Explain your reasoning.

Possible responses:



The value of 3 x (7 + 4) is three times the value of 7 + 4. We can see this in the picture since 3 x (7 + 4) is visually represented as 3 equal rows with 7 + 4 squares in each row.

In this type of picture, the stuent shows that the numbers 7 + 4 are represented by the number of objects, and the number of groups represents the multiplier.

Adapted from Illustrative Mathematics (www.illustrativemathematics.org)

Describe how the expression 5(10 x 10) relates to 10 x 10.

Possible response:

The expression 5(10 x 10) is 5 times larger than the expression 10 x 10 since I know that I that 5(10 x 10) means that I have 5 groups of (10 x 10).

Sandy walked ½ mile on Monday and ½ mile on Tuesday. On Wednesday, she walked 3 times as much as Monday and Tuesday combined. Write an expression to show how many miles Sandy walked on Wednesday

Possible response: 3(½ + ½)

Return to Standards

Analyze patterns and relationships.

NC.5.OA.3 Generate two numerical patterns using two given rules.

- Identify apparent relationships between corresponding terms.
- Form ordered pairs consisting of corresponding terms from the two patterns.
- Graph the ordered pairs on a coordinate plane.

Clarification

This standard extends the work from Fourth Grade, where students generate numerical patterns when they are given one rule. In Fifth Grade, students are given two rules and generate the terms in the resulting sequences. Students should identify, record, and graph ordered pairs on a coordinate plane (first quadrant only). After graphing the ordered pairs for each rule, students can analyze the relationship between the results.

Checking for Understanding

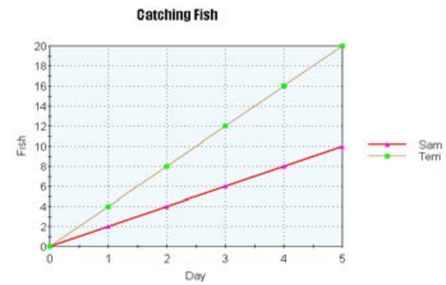
Describe the pattern:
Since Terri catches 4 fish each day, and Sam catches 2 fish, the amount of Terri's fish is always greater. Terri's fish is also always twice as much as Sam's fish. Today, both Sam and Terri have no fish. They both go fishing each day. Sam catches 2 fish each day. Terri catches 4 fish each day. How many fish do they have after each of the five days? Make a graph of the number of fish. Plot the points on a coordinate plane and make a line graph, and then interpret the graph.

Make a chart (table) to represent the number of fish that Sam and Terri catch.

Days	**Sam's Total Number of Fish**	**Terri's Total Number of Fish**
0	0	0
1	2	4
2	4	8
3	6	12
4	8	16
5	10	20

Student:

My graph shows that Terri always has more fish than Sam. Terri's fish increases at a higher rate since she catches 4 fish every day. Sam only catches 2 fish every day, so his number of fish increases at a smaller rate than Terri.



Mary spends $20 a month buying magazines. Tammy spends $15 a month buying magazines. Mary spends $60 in 3 months. How long does it take Tammy to spend $60? Make a table to show the amount each woman spends on magazines. Plot the points on a coordinate plane and interpret the graph.

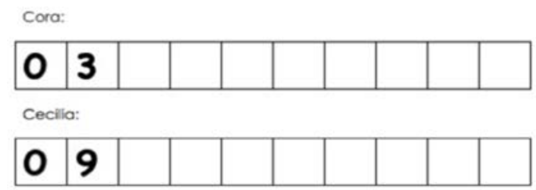
Mary	
Month	Amount
1	20
2	40
3	60

Tammy	
Month	Amount
1	15
2	30
3	45
4	60

Analyze patterns and relationships.
NC.5.OA.3 Generate two numerical patterns using two given rules.

- Identify apparent relationships between corresponding terms.
- Form ordered pairs consisting of corresponding terms from the two patterns.
- Graph the ordered pairs on a coordinate plane.

Clarification	Checking for Understanding
	Cora and Cecilia each use chalk to make their own number patterns on the sidewalk. They make each of their patterns 10 boxes long and line their patterns up so they are next to each other. Cora puts 0 in her first box and decides that she will add 3 every time to get the next number. Cecilia puts 0 in her first box and decides that she will add 9 every time to get the next number.



a. Complete each girl's sidewalk pattern.
b. How many times greater is Cecilia’s number in the 5th box than Cora’s number in the 5th box? What about the numbers in the 8th box? The 10th box?
c. What pattern do you notice in your answers for part b? Why do you think that pattern exists?
d. Write your data as ordered pairs and graph the points on a coordinate plane.
e. What pattern do you notice about your graph? Why do you think that pattern exists?

Use the graph below to determine how much money Jack makes after working exactly 9 hours.

Return to Standards

Understand the place value system.

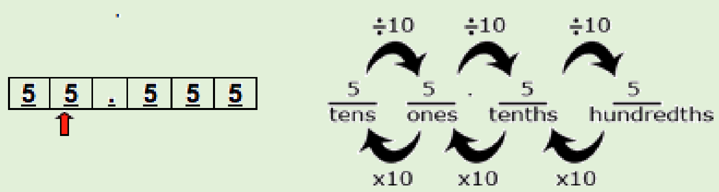
NC.5.NBT.1 Explain the patterns in the place value system from one million to the thousandths place.

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

Clarification

In this standard, students extend their understanding of the base-ten system and the magnitude of digits in a number to the relationship between adjacent places. This standard also extends student understanding of the relationships of digits in whole numbers to the relationship of decimal fractions. Students should work with the idea that the tens place is ten times as much as the ones place, and the ones place is 1/10 the size of the tens place.

For example: 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 1/10 of the 5 to the left and 10 times the 5 to the right. The 5 in the ones place is 1/10 of 50 and 10 times five tenths.



Checking for Understanding

Danny and Delilah were playing a game where they drew digits and placed them on a game board. Danny built the number 247. Delilah built the number 724.

- How much bigger is the 2 in Danny's number than the 2 in Delilah's number?
- How much smaller is the 4 in Delilah's number than the 4 in Danny's number?
- Write a sentence explaining how the size of the 7 in Danny's number compares to the size of the 7 in Delilah's number.

In class Veronica told her teacher that when you multiply a number by 10, you just always add 0 to the end of the number. Think about her statement (conjecture), then answer the following questions.

- When does Veronica's statement (conjecture) work?
- When doesn't Veronica's statement (conjecture) work?
- Is the opposite true? When you divide a number by 10, can you just remove a 0 from the end of the number? When does that work? When doesn't that work?

Return to Standards

Understand the place value system.
NC.5.NBT.3 Read, write, and compare decimals to thousandths.

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

Clarification

In this standard, students build on their previous understandings of reading and writing whole numbers in various forms to reading, writing, and comparing decimals to thousandths.

Written form or number name refers to writing out a number in words like "two thousand, eight hundred fifty-six." Traditional expanded form is 2,856 = 2,000 + 800 + 50 + 6. However, students should explore the idea that 2856 could also be 28 hundreds + 5 tens + 6 ones or 1 thousand + 18 hundreds + 56 ones. They should also show understanding by expanding a number by place value such as (2 x 1,000) + (8 x 100) + (5 x 10) + (6 x 1).

Students read decimals using fractional language and write decimals in fractional form, as well as in expanded notation. The number 361.248 would be read three hundred sixty-one and two hundred forty-eight thousandths. In expanded form this number would be written 300 + 60 + 1 + 0.2 + 0.04 + 0.008. Just as with whole numbers, students should be comfortable with various forms of numbers and with expanding number by place value such as (3 x 100) + (6 x 10) + (1 x 1) + (2 x 0.1) + (4 x 0.01) + (8 x 0.001). Students are expected to use decimal, as well as, fraction notation for tenths, hundredths, and thousandths.

Also, in this standard, students use their understanding of value of digits to compare two numbers by examining the value of each digit. Building on their understanding of comparing whole numbers, students would compare tenths to tenths, hundredths to hundredths, and thousandths to thousandths.

Students are expected to be able to compare numbers presented in various forms. While students may have the skills to order more than 2 numbers, this standard focuses on comparing two numbers and using reasoning about place value to support the use of the various symbols.

Checking for Understanding

Mike's teacher asked him to write 987.654 in expanded notation. Mike wrote 900 + 80 + 7 + .6 + .50 + .400

What is Mike's misconception? How would you explain expanded notation to help Mike understand expanded notation?

The table below shows the results of the Men's 100 Meter Freestyle Final at the London 2012 Olympics.

Country	Time (in seconds)
Australia	45.53
Brazil	47.92
Canada	47.8
Cuba	48.04
France	47.84
Netherlands	47.88
Russia	48.44
United States	47.52

Put the countries in order from first to last place.

Mackenzie said that if Michael Phelps had swum this race with a time of 48.5 seconds, he would have gotten the gold medal. What misconception does Mackenzie have? Explain.

Using the times above, write 5 expressions comparing the various times. Use symbols for greater than or less than in your expressions. Write a sentence to go with each expression.

Return to Standards

Perform operations with multi-digit whole numbers.

NC.5.NBT.5 Demonstrate fluency with the multiplication of two whole numbers up to a three-digit number by a two-digit number using the standard algorithm.

Clarification

In this standard, students connect the foundational, conceptual work for multiplication from third and fourth grade to an efficient algorithm. In third grade, students explored the meaning of whole number multiplication. In fourth grade, students built on that understanding by multiplying three-digit factors times a one-digit factor and multiplying two two-digit factors. To develop understanding of multiplication, students used a variety of strategies, including area models, partial products, and the properties of operations. The area model helps students visualize the components of the product and connect partial products to an efficient algorithm.

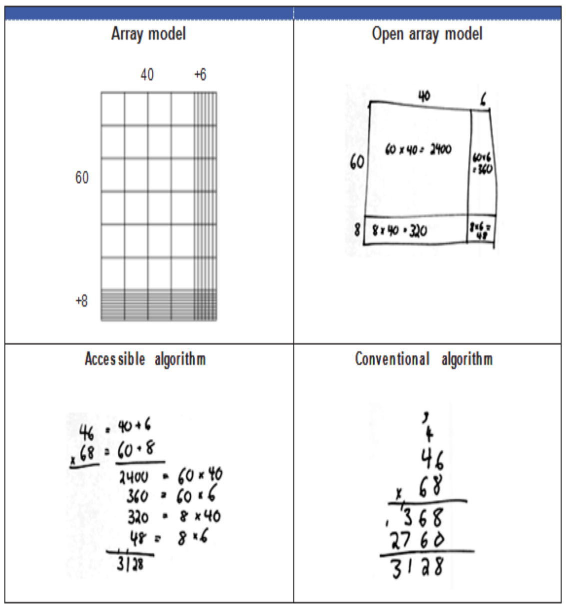


Fig. 18. Methods for multi-digit multiplication, using 68 × 46. Adapted from Fuson (2003, p. 303).

"In mathematics, an algorithm is defined by its steps and not by the way those steps are recorded in writing. With this in mind, minor variations in methods of recording standard algorithms are acceptable." (Fuson & Beckmann, 2013).

Students are fluent when they display accuracy, efficiency, and flexibility. Students develop fluency by understanding and internalizing the relationships that exist between and among numbers. By studying patterns and number relationships, students can internalize strategies for efficiently solving problems.

Checking for Understanding

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

Possible responses:

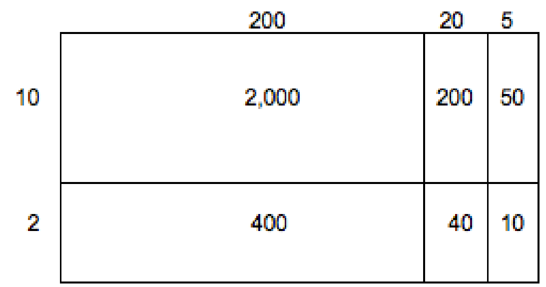
Student A
225 x 12
I broke 12 up into 10 and 2.
225 x 10 = 2,250
225 x 2 = 450
2,250 + 450 = 2,700

Student B
225x12
I broke up 225 into 200 and 25.
200 x 12 = 2,400
I broke 25 up into 5 x 5, so I had 5 x 5 x12 or 5 x 12 x 5.
5 x12= 60. 60 x 5 = 300
I then added 2,400 and 300
2,400 + 300 = 2,700.

Student C
I doubled 225 and cut 12 in half to get 450 x 6.
I then doubled 450 again and cut 6 in half to get 900 x 3.
900 x 3 = 2,700.

Draw an array model for 225 x 12. Explain how this model connects to the standard algorithm.

Possible response:



2,000
400
200
40
50
+ 10
2,700

Return to Standards

Perform operations with multi-digit whole numbers.
NC.5.NBT.6 Find quotients with remainders when dividing whole numbers with up to four-digit dividends and two-digit divisors using rectangular arrays, area models, repeated subtraction, partial quotients, and/or the relationship between multiplication and division. Use models to make connections and develop the algorithm.

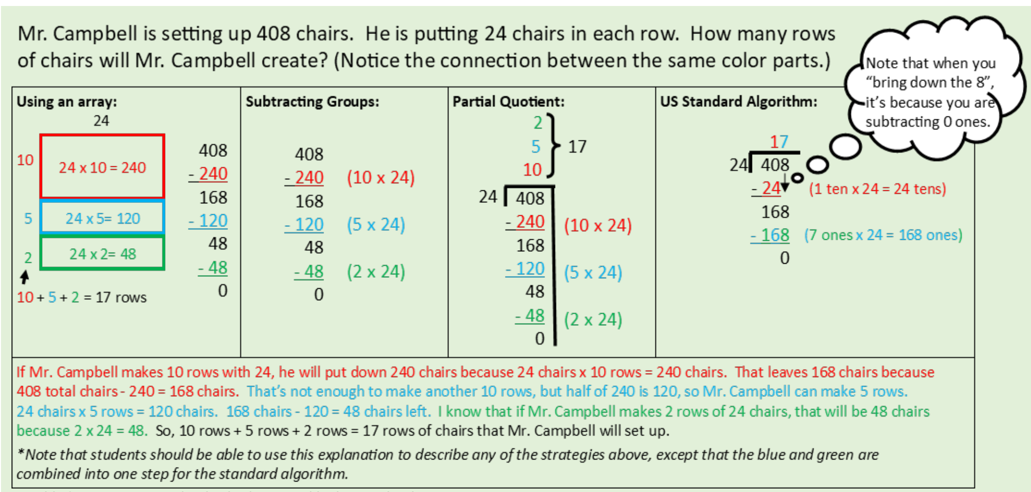
Clarification

In this standard, students extend their work with dividing a multi-digit number by a one-digit number to dividing by two-digit numbers. In previous grades, students built understanding of the meaning of division through partitive and measurement models. Students build deeper understanding of division through the use of various strategies and the relationship between multiplication and division. Experience with using arrays, area models, repeated subtraction, and partial quotients will help students connect to an efficient algorithm in subsequent grades.

This standard also references interpreting remainders. Remainders should be put into context for interpretation. Ways to address remainders:

- Remain as a left over
- Partitioned into fractions or decimals
- Discarded leaving only the whole number answer
- Increase the whole number answer up one
- Round to the nearest whole number for an approximate result

The focus of this standard is to build conceptual understanding of division with larger numbers. Students are expected to use various strategies and explain their thinking. Although the traditional division algorithm may be introduced, students are not expected to master this algorithm until middle school.



Graphic from Susan Copeland, Charlotte-Mecklenberg Schools

Checking for Understanding

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

Possible responses:

Student A
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 17 students.

Student B
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 is 5 groups.
I know that 2 groups of 16's is 32.
I have 4 students left over.

1716 -1600	100
116 -80	5
36 -32	2
4	

Student C
1,716 ÷ 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 + 5 + 2 = 107 teams
Those other 4 students can just hang out

Student D
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 R 4

	100	7
16	100 x 16 = 1,600	7 x 16 =112
	1,716 - 1,600 = 116	116 - 112 = 4

Return to Standards

Perform Operations with decimals.

NC.5.NBT.7 Compute and solve real-world problems with multi-digit whole numbers and decimal numbers.

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

Clarification

This standard extends students' previous experiences with adding and subtracting whole numbers and their understanding of place value with decimals. In this standard, students use various strategies to compute problems in context with the four operations. Computation is limited to products to thousandths and division of decimals to hundredths. Dividends are also limited to four digits (ex. 104.5, 24.58, 9.234).

This standard requires that students utilize models, drawings, and strategies based on place value rather than relying on algorithms. This standard focuses on student understanding of use place value when computing rather than learning rules that involve moving the decimal point with little connection to the meaning of the operations. The use of symbolic notations involves having students record the answers to computations (2.25 x 3= 6.75), but should not be done without models or pictures.

This standard also requires students to use estimation strategies to determine if an answer is reasonable. For example:

- When adding 3.6 + 1.7, a student might estimate the sum to be larger than 5 because 3.6 is more than 3 ½ and 1.7 is more than 1 ½.
- When subtracting 5.4 – 0.8, student might estimate the answer to be a little more than 4.4 because a number less than 1 is being subtracted.
- When multiplying 6 x 2.4, a student might estimate an answer between 12 and 18 since 6 x 2 is 12 and 6 x 3 is 18. Another student might give an estimate of a little less than 15 because s/he figures the answer to be very close, but smaller than 6 x 2 ½ and thinks of 2 ½ groups of 6 as 12 (2 groups of 6) + 3 (½ of a group of 6).

Checking for Understanding

A recipe for a cake requires 1.25 cups of milk, 0.40 cups of oil, and 0.75 cups of water. How much liquid is in the mixing bowl?

Possible responses: 1.25 + 0.40 + 0.75

Student A

- *I broke 1.25 into 1.00 + 0.20 + 0.05*
- *I left 0.40 like it was.*
- *I broke 0.75 into 0.70 + 0.05*
- *I combined my two 0.05s to get 0.10.*
- *I combined 0.20, 0.10, and 0.70 to get 1.0.*
- *I added the 1 whole from 1.25.*
- *I ended up with 2 whole and 4 tenths, which equals 2.40 cups.*

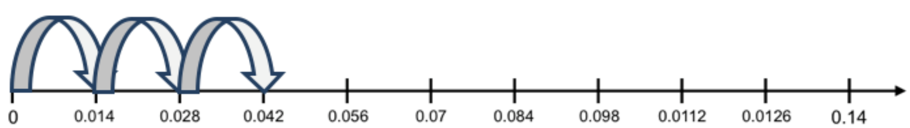
Student B

- *I saw that the 0.25 in 1.25 and the 0.75 for water would combine to equal 1 whole.*
- *I then added the 2 wholes and the 0.40 to get 2.40.*

You live 14 hundredths of a mile from your friends' house. After walking 3 tenths of the distance, you stop to talk to another friend. How much of a mile have your walked? (0.3 x .14)

Possible responses:

Number Line Model



The number line shows the distance marked off from 0 to 0.14 and that distance is partitioned into 10 equal segments. Each segment represents a distance of 0.014 or a tenth of 0.14. Three tenths is 0.014 plus 0.014 plus 0.014 which is 0.042.

Using the Distributive Property

0.3 x 0.14 = 0.3 x (0.1 + 0.04)

0.3 x 0.1 = 0.03 0.3 x 0.04 = 0.012

0.03 + 0.012 = 0.042 miles

Perform Operations with decimals.

NC.5.NBT.7 Compute and solve real-world problems with multi-digit whole numbers and decimal numbers.

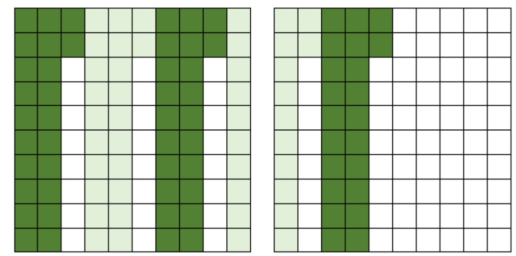
- Add and subtract decimals to thousandths using models, drawings or strategies based on place value.
- Multiply decimals with a product to thousandths using models, drawings, or strategies based on place value.
- Divide a whole number by a decimal and divide a decimal by a whole number, using repeated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

Clarification

Checking for Understanding

A gumball costs $0.22. How much do 5 gumballs cost? Estimate the total, and then calculate. Was your estimate close?

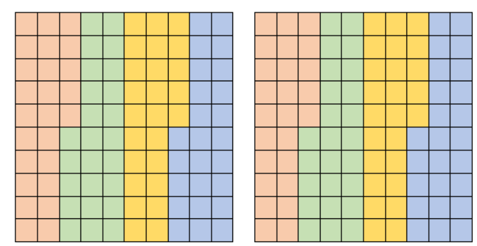
Possible response:



I estimate that the total cost will be a little more than a dollar because 5 20's equal 100 and I have 5 22's. I have 110 boxes shaded, which is one whole and one tenth. My answer is 5 x $0.22 = $1.10.

Sarah makes 2 pounds of trail mix. How many bags will she need if she puts 0.25 pounds of mix in each bag?

Possible response:



I showed the two pounds of mix using decimal squares. Then, I colored in 25 squares to represent 25 hundredths. I continued to do that until all of the squares had been colored. Since 2 pounds ÷ 0.25 pound = 8 bags, Sarah will need 8 bags for her trail mix.

Return to Standards

Use equivalent fractions as a strategy to add and subtract fractions.

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

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

Clarification

While working on NC.5.NF.1 students should be able to estimate and find the answer to one- and two- step word problems involving fractions with unlike denominators using related fractions. Adding and subtracting only related fractions is new to 5th grade. Related fractions are fractions in which one denominator is a multiple of the other, e.g., halves, fourths, and eighths.

Students should be able to assess the reasonableness of answers by estimating sums and differences to the nearest half or whole number.

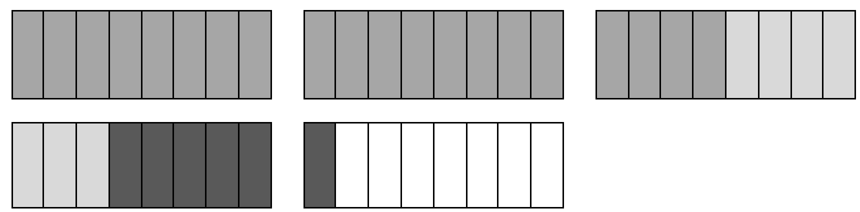
Students should have ample experiences creating area and length models to build understanding. The use of these models allows students to use reasonableness to find a common denominator prior to using the algorithm. For example, when adding 1/3 + 1/6, Grade 5 students should apply their understanding of equivalent fractions and their ability to rewrite fractions in an equivalent form to find common denominators.

Checking for Understanding

There is some ham in the refrigerator. Tyrisha uses ¾ of a pound to make sandwiches and Jacquel uses 7/8 of a pound to make sandwiches. If there is now 2 ½ pounds of ham left over, how much ham was there before Tyrisha and Jacquel used some.

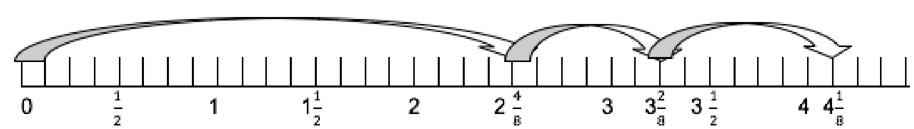
Possible responses:

Student 1:
We do not know what we started with but we know we ended with 2 ½ pounds of ham. Before Jacquel took ham, there was 7/8 of a pound more ham. I need to solve 2 ½ + 7/8 + 3/4. I knew that since 7/8 and ¾ were greater than a half but less than 1, that my total would be close to but less than 4 and ½.



When I found the total amount shaded it was 4 and 1/8, which is close to my estimate.

Student 2:
I know that 2 ½ is the same as 2 and 4/8. I also know that ¾ is 6/8. So, I used the expression:
2 4/8 + 6/8 + 7/8.
I used the number line to jump from zero.



Return to Standards

Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

NC.5.NF.3 Use fractions to model and solve division problems.

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

Clarification

While working on NC.5.NF.3, students are expected to associate fractions with division, understanding that 5 ÷ 3 can be written and expressed as 5/3. Students should explain this by working with their understanding of division as equal sharing and be able to represent this work using area, length, and set models with the denominators specified in the standard.

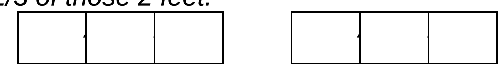
Checking for Understanding

If 3 people want to share a 50-feet of ribbon equally, how many feet of ribbon should each person get?

Possible solutions:

Students might partition each foot among the 3 people, so that each person gets 1/3 of every footd and since there are 50 feet, each person's total length of ribbon would equal 50 x 1/3 = 50/3 = 16 and 2/3 feet.

Students may solve 50 divided by 3 by multiplying by 3 up to 50.
16 x 3 = 48
50 is 2 away from 48 so there is a remainder of 2.
The remaining 2 feet would get divided among the 3 people, so each person gets 2/3 of those 2 feet.



Students would each get 16 + 2/3 or 16 and 2/3 feet of ribbon.

There are 7 packages of crackers on the counter. If Nina divides them equally between herself and 3 friends, how many packages does each person get?

Possible student work:

There are 7 packages that are being equally shared among 4 people. I can write that as 7 divided by 4.

a	b	c	d		a	b	c	d		a	b	c	d		a	b	c	d

a	b	c	d		a	b	c	d		a	b	c	d

Each person gets 7 fourths, which can be represented as 7 x ¼ = 7/4.

Possible student work:

a	b	c	d

a	b	c	d		a	b	c	d		a	b	c	d

Each person will receive 1 whole package and 3 smaller portions of a package. The smaller portions are ¼ of a package each, so each person will receive 1 and ¾ packages.

Return to Standards

Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

NC.5.NF.4 Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction, including mixed numbers.

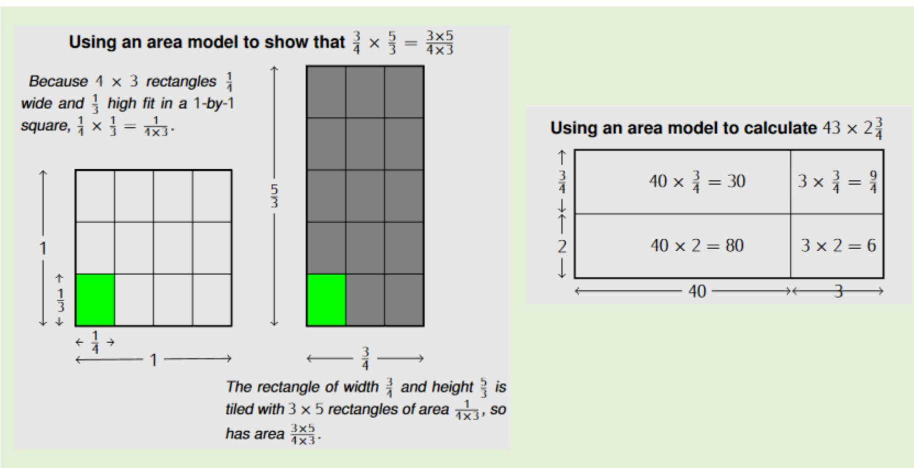
- Use area and length models to multiply two fractions, with the denominators 2, 3, 4.
- Explain why multiplying a given number by a fraction greater than 1 results in a product greater than the given number and when multiplying a given number by a fraction less than 1 results in a product smaller than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

Clarification

This standard extends students' work with multiplication from earlier grades. In fourth grade, students worked with multiplying fractions less than one by whole numbers. The beginning of their exploration with fraction multiplication included recognizing that a fraction such as ¾ can be represented as 3 pieces that are each one-fourth (3 x ¼).

This standard references both the multiplication of a fraction by a whole number and the multiplication of two fractions, including mixed numbers. Multiplication of a fraction by a whole number is open to denominators 2, 3, 4, 5, 6, 8, 10, and 12 because this skill was introduced in fourth grade. Multiplication of a fraction by a fraction is limited to ONLY the denominators 2, 3, and 4. This is new for 5th grade.

Students are expected to create and use visual fraction models (area models, tape diagrams, number lines) during their work with this standard. The language in the Standard "develop the algorithm" means that models should always be used and the algorithm is limited to only exposure at the same time as models in Grade 5.



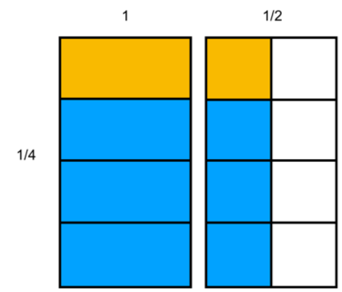
Checking for Understanding

Use area and length models to multiply two fractions, with the denominators 2,3, and 4.

There are 3 ¼ packages of pencils on the desk. One full package weighs 1 ½ pounds. How much do all of the containers weigh?

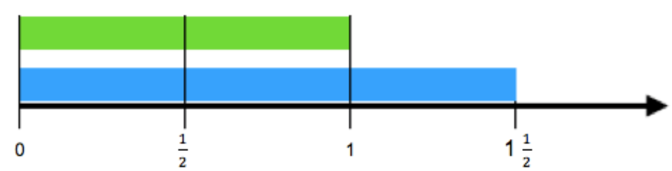
I know 3 packages = 1 ½ + 1 ½ + 1 ½ = 4 ½ pounds.

For the last package in the picture I need ¼ of 1 1/2.



Based on the picture, when I divided 1 ½ into fourths, it shows that ¼ of 1 ½ is equal to 3/8, which is 3/8 of a pound.
I added 3/8 + 4 ½ to get my answer which is 3/8 + 4 and 4/8 which is 4 and 7/8.

Paige has 1 ½ feet of rope for a project. She only needs 2/3 of it. How much rope does she need?



1 ½ is equal to 3/2. Since we needed 2/3 of the rope my picture shows that 1/3 of 3/2 is ½. So, 2/3 of 3/2 is ½ plus ½ which is 1.

Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

NC.5.NF.4 Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction, including mixed numbers.

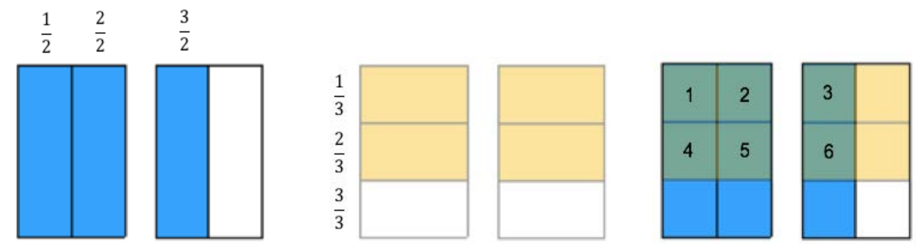
- Use area and length models to multiply two fractions, with the denominators 2, 3, 4.
- Explain why multiplying a given number by a fraction greater than 1 results in a product greater than the given number and when multiplying a given number by a fraction less than 1 results in a product smaller than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

Clarification	Checking for Understanding
	See below

Checking for Understanding

Explain why multiplying a given number by a fraction greater than 1 results in a product greater than the given number and when multiplying a given number by a fraction less than 1 results in a product smaller than given number.

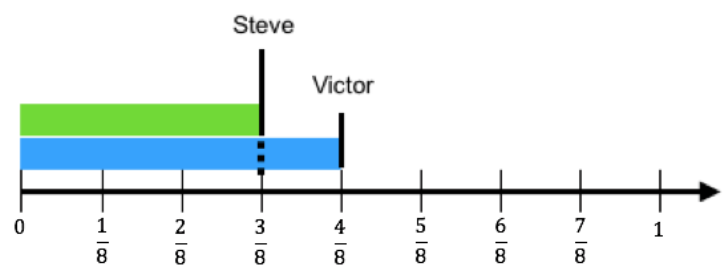
Sonya is multiplying 2/3 * 3/2. She tells Susan that her product will be greater than 2/3. Is Sonya correct? Model the problem and explain why Sonya is correct or not.



*Sonya is correct. Since 3/2 is greater than ,1 the product of 2/3 * 3/2 will be greater than 2/3. In the picture we see that the answer is 3/3 or 1, which is greater than 2/3.*

<u>Solve one-step word problems involving multiplication of fractions using models to develop the algorithm.</u>

Victor runs 1/2 of a mile each day. Steve runs 3/4 of the distance that Victor runs. How long does Steve run? Use a model and write a sentence to support your answer. Explain how the algorithm matches your answer.



Steve runs less than Victor. Victor ran ½ a mile each day which is equal to 4/8 of a mile each day. Steve ran ¾ of Victor's distance. In the picture I partitioned ½ into 4 equal parts and each of those parts was 1/8. Steve ran 3 of those 4 parts, which can be represented by 1/8 + 1/8 + 1/8 or 3 x 1/8, which equals 3/8.

Return to Standards

Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

NC.5.NF.7 Solve one-step word problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions using area and length models, and equations to represent the problem.

Clarification

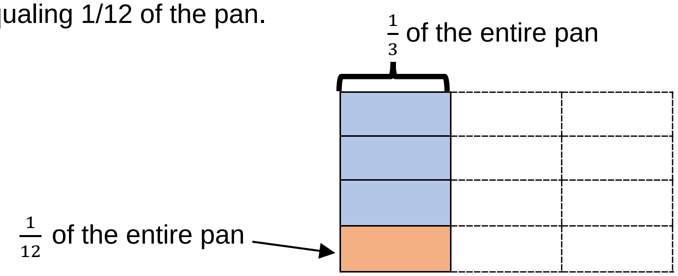
While students are working on NC.5.NF.7, this is the first time that students are dividing with fractions. In fourth grade students divided whole numbers, and multiplied a whole number by a fraction. The concept *unit fraction* is a fraction that has a one as the numerator. Students should be able to model all of the word problems using area and length models. There is no limit with the denominators since they are dividing a whole number by a unit fraction OR a unit fraction by a whole number. The algorithm to divide fractions should not be introduced in Grade 5.

Checking for Understanding

Unit Fraction Divided by a Whole Number:

Four students sitting at a table were given 1/3 of a pan of brownies to share. How much of the whole pan will each student get if they share the section of brownies equally?

The diagram shows the 1/3 pan divided into 4 equal shares with each share equaling 1/12 of the pan.

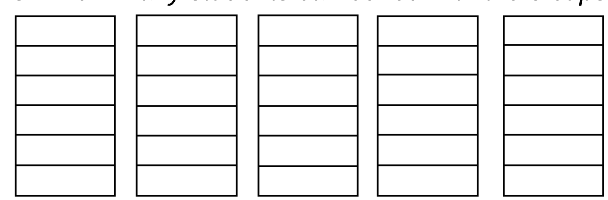


Whole Number Divided by a Unit Fraction:

Create a story context for 5 ÷ 1/6. Find your answer and then draw a picture to prove your answer and use multiplication to reason about whether your answer makes sense. How many 1/6 are there in 5?

Student 1:

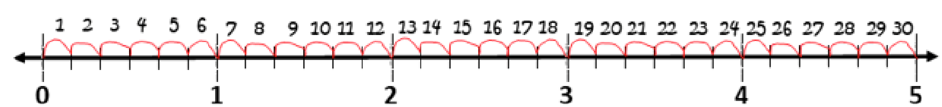
There are 5 cups of goldfish on the counter. Each student receives 1/6 of a cup of goldfish. How many students can be fed with the 5 cups of goldfish?



There are 30 pieces that are 1/6 of a cup. 30 x 1/6 = 30/6 = 5 cups.

Student 2:

I have 5 feet of yarn. For my project I have to cut the yarn into pieces that are one-sixth of a foot long. How many pieces will I have?



Return to Standards

<table>
<tr><td colspan="2">Convert like measurement units within a given measurement system.
NC.5.MD.1 Given a conversion chart, use multiplicative reasoning to solve one-step conversion problems within a given measurement system.</td></tr>
<tr><td>Clarification</td><td>Checking for Understanding</td></tr>
<tr><td>In this standard, students will be provided with the information needed to make a conversion and students will convert measurements within the same system of measurement. Conversions should be limited to one step but may be included within a multi-step problem. Numbers within the conversions can include whole numbers, decimals, and fractions.

Students will work with customary and metric measurement systems, as well as, time, exploring the relationship between the units.</td><td>Tom purchased a 40 lb. bag of dog food. Knowing that there are 16 oz in a pound, how many 5 oz scoops are in the bag?

Possible response:
40 lbs. x 16 oz = 640 oz
640 oz/5 oz = 128 scoops
<hr>There are 24 hours in a day, 60 minutes in an hour, and 60 seconds in a minute. Based on these relationships:
How many seconds are in 2 and a half minutes?
How many minutes are in 5 hours?
How many hours are in 15 days?
<hr>Mrs. Pitchford buys 24 ounces of sweet potatoes, 13 ounces of baked potatoes, and 19 ounces of squash. If there are 16 ounces in a pound how many pounds of vegetables did she buy?</td></tr>
</table>

Return to Standards

Represent and interpret data.
NC.5.MD.2 Represent and interpret data.

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

Clarification

In this standard, students will interact with data through data collection, creation of a line graph, and interpretation of data. Students have previously formulated survey questions that yield categorical or numerical data. In third grade, students collected data by asking a question that yielded categorical data, which is data that can be grouped into categories. Students in fourth grade learned to also ask questions that provide numerical data, which is data that is measurable such as time, height, weight, temperature, etc.

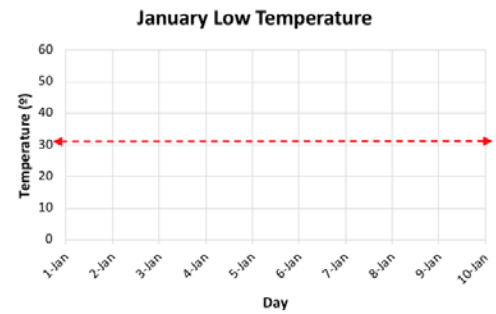
This standard calls for students to be able to formulate questions that provide them with data that changes over time. Once data is collected, students will be able to create a line graph to represent the data. Once graphs are created, students should be able to solve one and two-step problems using the information in the graphs.

Checking for Understanding

Mrs. Smith's class wanted to track the daily low temperatures during the first 10 days in January. The data that the class collected is below.

a. Graph the data on the chart.

January	Temp
1st	4°
2nd	16°
3rd	29°
4th	43°
5th	41°
6th	56°
7th	29°
8th	21°
9th	17°
10th	20°



b. The dashed is the normal low. Approximately what was that temperature?
c. When were the low temperatures above the normal low?
d. What were the coldest 3 days?
e. During the 10 days, how long was the temperature above normal?

Teacher: I am going to give you a cup of room temperature water. You are going to put 6 ice cubes in the cup. You are going to record the water temperature every 30 seconds for 5 minutes. After you collect the data you are going to make a line graph and then write 3 descriptive sentences about your data.

Write 2 survey questions. One should yield categorical data that can be represented on a bar graph. One should yield data that changes over time that can be represented on a line graph.

Possible responses:

Categorical data: On w*hat day of the week (Monday-Friday) is your favorite tv show?*

Changes over time: *What is the average wind speed every day in April?*

Return to Standards

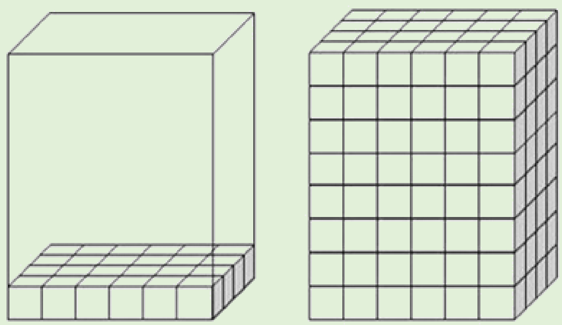
Understand concepts of volume.
NC.5.MD.4 Recognize volume as an attribute of solid figures and measure volume by counting unit cubes, using cubic centimeter, cubic inches, cubic feet, and improvised units.

Clarification

In this standard, students begin their exploration of volume. As students develop their understanding of volume they understand that a 1-unit by 1-unit by 1-unit cube is the standard unit for measuring volume. This cube has a length of 1 unit, a width of 1 unit and a height of 1 unit and is called a cubic unit.

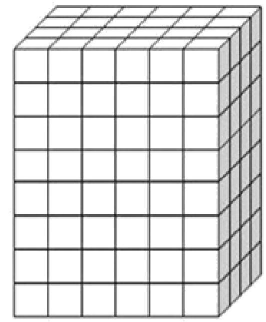
The concept of volume should be extended from area with the idea that students are covering an area (the bottom of cube) with a layer of unit cubes and then adding layers of unit cubes on top of bottom layer. Students pack cubes (without gaps) into right rectangular prisms and count the cubes to determine the volume or build right rectangular prisms from cubes and see the layers as they build

For example:
Students will pack cubes into a rectangular prism and continue layering the unit cubes until the prism is full. Then, students count the number of unit cubes to determine volume.



Checking for Understanding

Find the volume of this figure.



Possible response:
I can see that the top layer of the prism has 24 cubes. Since this is a rectangular prism, I know that each layer will have the same number of cubes. So, if I think about packing the prism with cubes, I would count 24 for each layer. I could build a model of this prism with cubes so I can count the number of cubes, or I can add 24 + 24 + 24 + 24 + 24 + 24 + 24 + 24

While finding the volume of a rectangular prism, Cedrick filled the bottom of the box with unit cubes. How can that help him find the volume of the entire rectangular prism?

Return to Standards

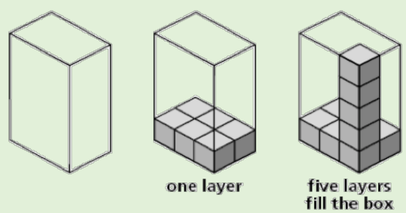
Understand concepts of volume.
NC.5.MD.5 Relate volume to the operations of multiplication and addition.

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

Clarification

This standard involves finding the volume of right rectangular prisms in various contexts. Students will describe and reason about why the formula for volume is true by relating packing and counting cubes to the formula. Students cover the bottom of a right rectangular prism (length x width) with multiple layers (height) to show the volume formula (length x width x height) is an extension of the formula for the area of a rectangle.

For example:

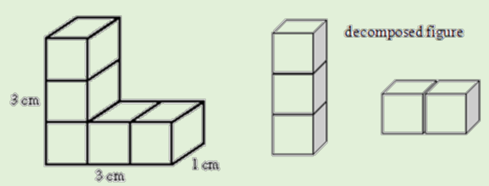


(3 x 2) represented by first layer
(3 x 2) x 5 represented by number of 3 x 2 layers
(l x w) x h = V
B x h = V

Students are expected to find the volumes of right rectangular prisms with edges whose lengths are whole numbers and solve real-world and mathematical problems involving prisms.

Students will extend their work with the area of composite figures into the context of volume. Students should decompose 3-dimensional figures into right rectangular prisms in order to find the volume of the entire 3-dimensional figure, recognizing that volume is additive.

For example:
Students decompose 3-dimensional figures composed of unit cubes into rectangular prisms:



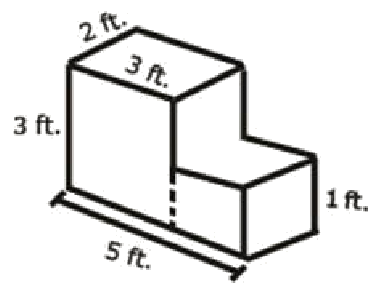
Checking for Understanding

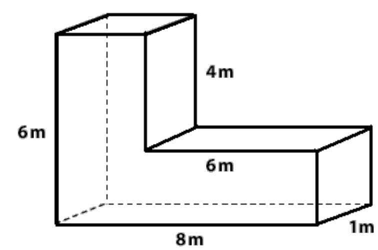
Given 24 cubes, build as many different rectangular prisms as possible and record the dimensions.

Possible response:

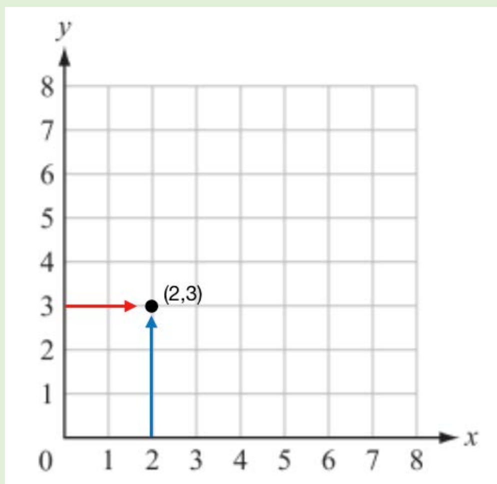
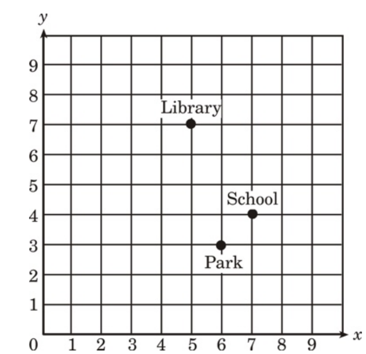
Length	Width	Height
1	2	12
2	2	6
4	2	3
8	3	1

Determine the volume of concrete needed to build the steps in the diagrams below.





Return to Standards

Understand the coordinate plane. **NC.5.G.1** Graph points in the first quadrant of a coordinate plane, and identify and interpret the *x* and *y* coordinates to solve problems.	
Clarification	**Checking for Understanding**
In this standard, students are introduced to the coordinate plane and learn to plot points in the first quadrant in order to solve real-world and mathematical problems. Problems include traveling from one point to another and identifying the coordinates of missing points in geometric figures, such as squares, rectangles, and parallelograms. Students should understand that the coordinate plane is formed by a horizontal number line, called the x-axis, and a vertical number line, called the y-axis. The two axes intersect at a point called the origin (0,0). Students need to understand coordinates define a distance from the y-axis and a distance from the x-axis. Students should distinguish between two different ways of viewing the point (2, 3). First, they should view the coordinates as instructions: “right 2, up 3”. They should also understand the coordinates as the point defined by being a distance 2 from the *y*-axis and a distance 3 from the *x*-axis.  	Plot these points on a coordinate grid. Point A: (2,6); Point B: (4,6); Point C: (6,3); Point D: (2,3) Connect the points in order. Make sure to connect Point D back to Point A. 1. What geometric figure is formed? What attributes did you use to identify it? 2. What line segments in this figure are parallel? 3. What line segments in this figure are perpendicular? *(trapezoid, line segments AB and DC are parallel, segments AD and DC are perpendicular)*  Using the coordinate grid, which ordered pair represents the location of the school? Explain a possible path from the school to the library.

Return to Standards

Classify quadrilaterals.

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

- Explain that attributes belonging to a category of quadrilaterals also belong to all subcategories of that category.
- Classify quadrilaterals in a hierarchy based on properties.

Clarification

This standard calls for students to reason about the attributes (properties) of quadrilaterals in order to classify quadrilaterals into categories. Geometric attributes include properties of sides (parallel, perpendicular, equal length), properties of angles (type, measurement), and properties of symmetry. Students should understand that if a category contains certain attributes, then all quadrilaterals in that category have that attribute.

For example:
If a parallelogram has four sides and opposite sides are parallel and equal, then all shapes that meet these criteria are parallelograms including squares, rectangles, and rhombuses.

The notion of congruence ("same size and same shape") may be part of classroom conversation but the concepts of congruence and similarity do **not** appear until middle school.

Note: North Carolina has adopted the exclusive definition for a trapezoid. A trapezoid is a quadrilateral with *exactly* one pair of parallel sides.

This standard also calls for students to classify quadrilaterals into a hierarchy based on the relationship between shapes based on attributes.

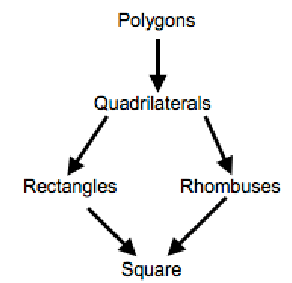
Checking for Understanding

Questions that might be posed to students include:

- A parallelogram has 4 sides with both sets of opposite sides parallel. What types of quadrilaterals are parallelograms?
- All rectangles have 4 right angles. Squares have 4 right angles so they are also rectangles. True or False?
- A trapezoid has 2 sides parallel so it must be a parallelogram. True or False?

Create a Hierarchy Diagram using the following terms:

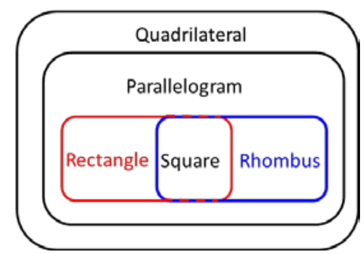
polygons – a closed plane figure formed from line segments that meet only at their endpoints.
quadrilaterals - a four-sided polygon.
rectangles - a quadrilateral with two pairs of equal, parallel sides and four right angles.
rhombus – a parallelogram with all four sides equal in length.
square – a parallelogram with four equal sides and four right angles.



(Sample student response)

Create a Hierarchy Diagram using the following terms:

quadrilateral – a four-sided polygon.
parallelogram – a quadrilateral with two pairs of parallel and congruent sides.
rectangle – a quadrilateral with two pairs of equal, parallel sides and four right angles.
rhombus – a parallelogram with all four sides equal in length.
square – a parallelogram with four equal sides and four right angles.



(Sample student response)

Return to Standards