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 2018-19 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 at feedback@dpi.state.nc.us 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 http://www.ncpublicschools.org/curriculum/mathematics/scos/.

Standards for Mathematical Practice

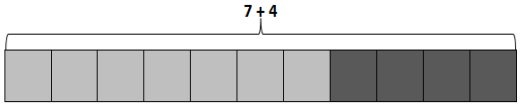
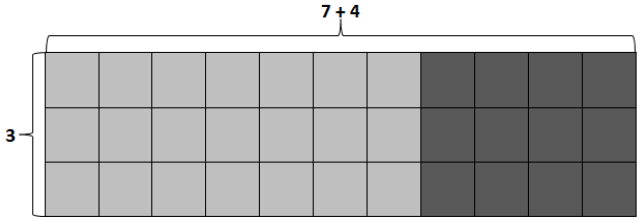
Practice	Explanation and Example
1. Make sense of problems and persevere in solving them.	Mathematically proficient students in grade 5 should solve problems by applying their understanding of operations with whole numbers, decimals, and fractions including mixed numbers. They solve problems related 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	**Checking for Understanding**
This standard calls for students to verbally describe the relationship between expressions without actually calculating them. Students will also need to apply their reasoning of the four operations as well as place value while describing the relationship between numbers. The standard does not include the use of variables, only numbers and signs for operations.	Write an expression for the number of points Eric has at the end of the game. Do not evaluate the expression. The expression should keep track of what happens in each step listed below. • John is playing a video game. At a certain point in the game, he has 32,700 points. Then, the following events happen, in order: • He earns 1760 additional points. • He loses 4890 points. • The game ends, and his score doubles. • John's sister Erica plays the same game. When she is finished playing, her score is given by the expression: 4(31,500 + 2560) – 8760. • Describe a sequence of events that might have led to Erica earning this score. *Adapted from Illustrative Mathematics (www.illustrativemathematics.org)* 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.*

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	Checking for Understanding
	 *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).*

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.

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	Student B	Student C
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*	*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.*	*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:

	200	20	5
10	2,000	200	50
2	400	40	10

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.

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 + 6 + 1 = 107 teams
Those other 4 students can just hang out

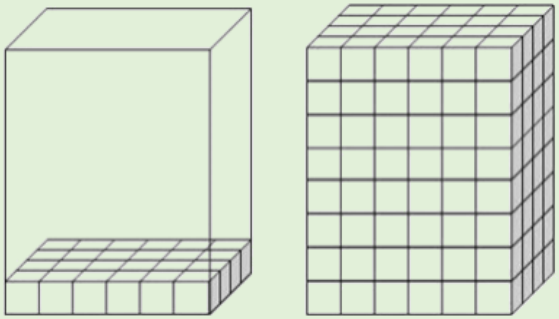
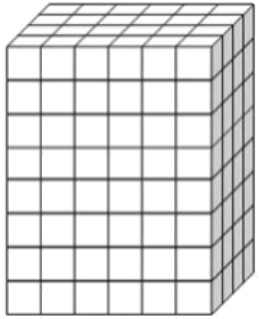
Student D

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

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	**Checking for Understanding**
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. 	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.

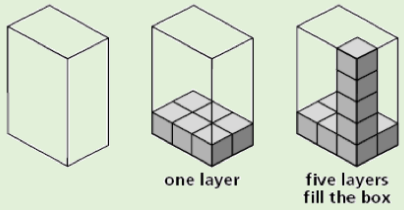
NC.5.MD.5 Relate volume to the operations of multiplication and addition.

- 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:

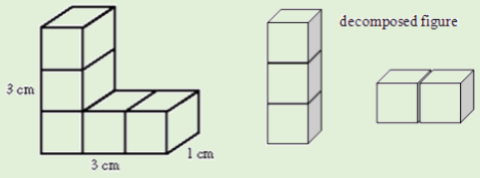


(3 x 2) represented by first layer
(3 x 2) x 5 represented by number of 3 x 2 layers
(l x w) x h = V
B x h = V

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:



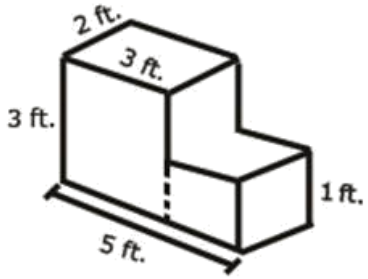
Checking for Understanding

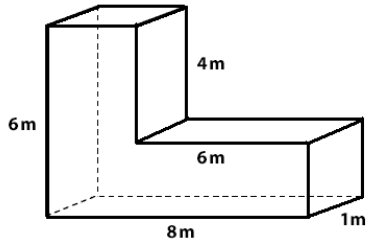
Given 24 cubes, build as many different rectangular prisms as possible and record the dimensions.

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

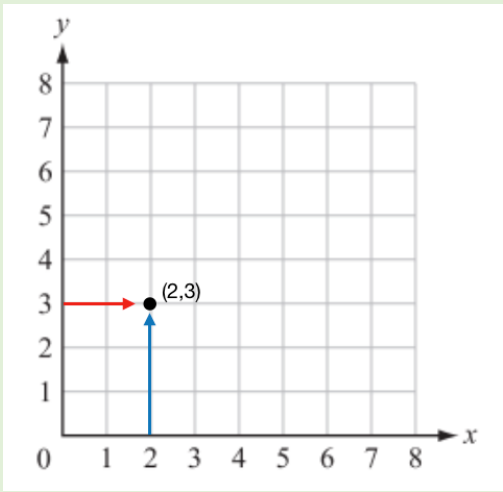
Understand the coordinate plane.
NC.5.G.1 Graph points in the first quadrant of a coordinate plane, and identify and interpret the *x* and *y* coordinates to solve problems.

Clarification

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.

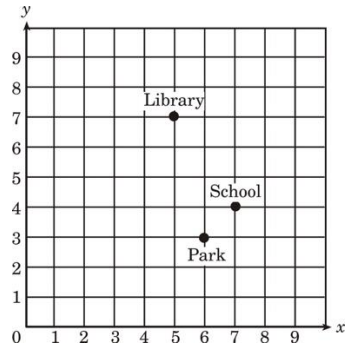


Checking for Understanding

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.

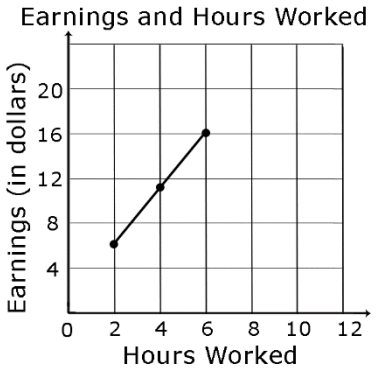
1. What geometric figure is formed? What attributes did you use to identify it?
2. What line segments in this figure are parallel?
3. What line segments in this figure are perpendicular?

(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.

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



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.

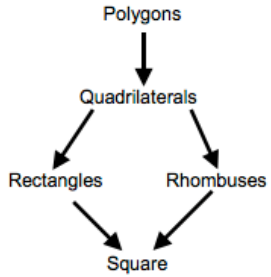
Checking for Understanding

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:

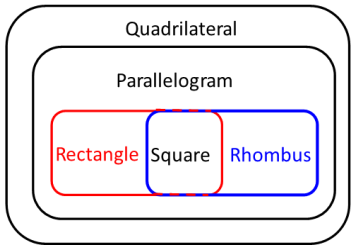
polygons – a closed plane figure formed from line segments that meet only at their endpoints.
quadrilaterals - a four-sided polygon.
r**ectangles** - a quadrilateral with two pairs of equal, parallel sides and four right angles.
rhombus – a parallelogram with all four sides equal in length.
square –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