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

5th Grade Mathematics ● Unpacked Content

For the new Common Core State Standards that will be effective in all North Carolina schools in the 2012-13.

This document is designed to help North Carolina educators teach the Common Core (Standard Course of Study). NCDPI staff are continually updating and improving these tools to better serve teachers.

What is the purpose of this document?
To increase student achievement by ensuring educators understand specifically what the new standards mean a student must know, understand and be able to do.

What is in the document?
Descriptions of what each standard means a student will know, understand and be able to do. The "unpacking" of the standards done in this document is an effort to answer a simple question "What does this standard mean that a student must know and be able to do?" and to ensure the description is helpful, specific and comprehensive for educators.

How do I send Feedback?
We intend the explanations and examples in this document to be helpful and specific. That said, we believe that as this document is used, teachers and educators will find ways in which the unpacking can be improved and made ever more useful. 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://corestandards.org/the-standards

Mathematical Vocabulary is identified in bold print. These are words that student should know and be able to use in context.

Operations and Algebraic Thinking 5.0A

Common Core Cluster

Write and interpret numerical expressions.

Common Core Standard	Unpacking What do these standards mean a child will know and be able to do?
5.OA.1 Use **parentheses, brackets,** or **braces** in numerical **expressions**, and evaluate expressions with these symbols.	**5.OA.1** calls for students to evaluate expressions with parentheses ( ), brackets [ ] and braces { }. In upper levels of mathematics, evaluate means to substitute for a variable and simplify the expression. However at this level students are to only simplify the expressions because there are no variables. Example: Evaluate the expression 2{ 5[12 + 5(500 - 100) + 399]} Students should have experiences working with the order of first evaluating terms in parentheses, then brackets, and then braces. The first step would be to subtract 500 – 100 = 400. Then multiply 400 by 5 = 2,000. Inside the bracket, there is now [12 + 2,000 + 399]. That equals 2,411. Next multiply by the 5 outside of the bracket. 2,411 x 5 = 12,055. Next multiply by the 2 outside of the braces. 12,055 x 2= 24,110. Mathematically, there cannot be brackets or braces in a problem that does not have parentheses. Likewise, there cannot be braces in a problem that does not have both parentheses and brackets.
5.OA.2 Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. *For example, express the calculation "add 8 and 7, then multiply by 2" as 2 × (8 + 7). Recognize that 3 × (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product.*	**5.OA.2** refers to expressions. Expressions are a series of numbers and symbols (+, -, x, ÷) without an equals sign. Equations result when two expressions are set equal to each other (2 + 3 = 4 + 1). Example: 4(5 + 3) is an expression. When we compute 4(5 + 3) we are evaluating the expression. The expression equals 32. 4(5 + 3) = 32 is an equation. **5.OA.2** calls for students to verbally describe the relationship between expressions without actually calculating them. This standard calls for students 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.

	Example: Write an expression for the steps "double five and then add 26." Student *(2 x 5) + 26* Describe how the expression 5(10 x 10) relates to 10 x 10. Student 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).

Common Core Cluster

Analyze patterns and relationships.

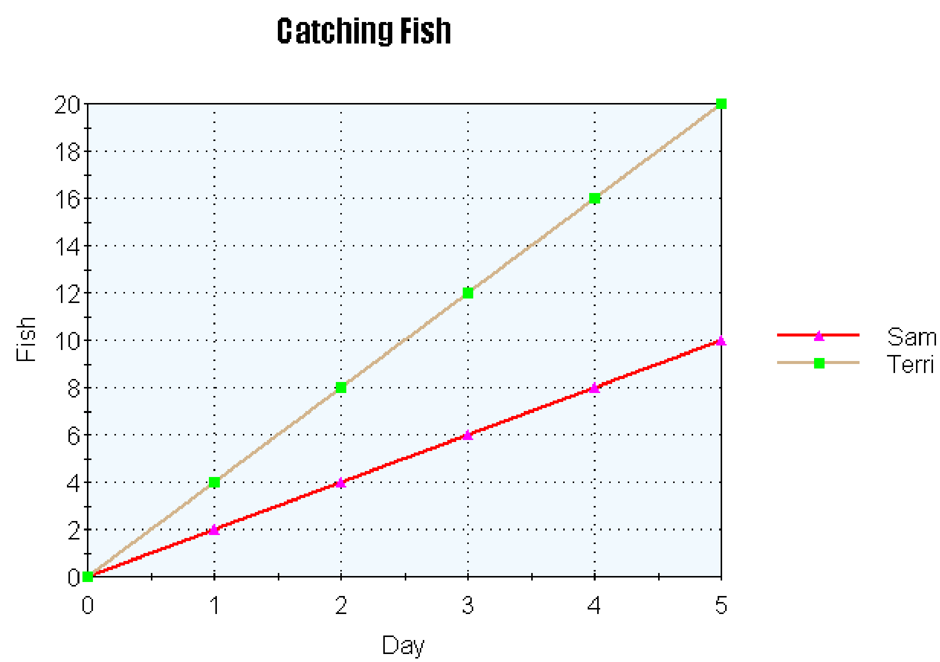
Common Core Standard	**Unpacking** What do these standards mean a child will know and be able to do?
5.OA.3 Generate two **numerical patterns** using two given **rules**. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the **ordered pairs** on a **coordinate plane**. *For example, given the rule "Add 3" and the starting number 0, and given the rule "Add 6" and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.*	**5.OA.3** 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 two numerical patterns. The graphs that are created should be line graphs to represent the pattern. This is a linear function which is why we get the straight lines. The Days are the independent variable, Fish are the dependent variables, and the constant rate is what the rule identifies in the table. Examples below:

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

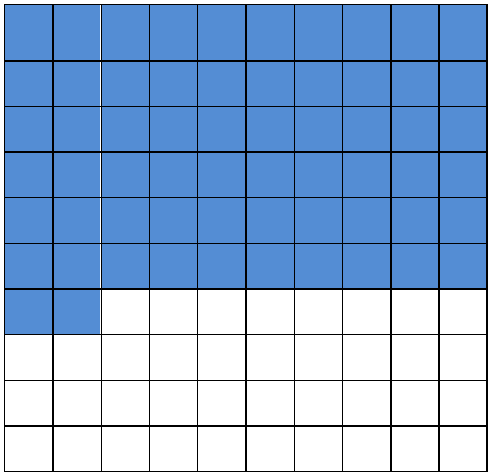
Days	Sam's Total Number of Fish	Terri's Total Number of Fish
0	0	0
1	2	4
2	4	8
3	6	12
4	8	16
5	10	20

Student
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.

Student
Plot the points on a coordinate plane and make a line graph, and then interpret the graph.
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.
Important to note as well that the lines become increasingly further apart. Identify apparent relationships between corresponding terms. Additional relationships: The two lines will never intersect; there will not be a day in which boys have the same total of fish, explain the relationship between the number of days that has passed and the number of fish a boy has (2n or 4n, n being the number of days).


Catching Fish
Fish
20
18
16
14
12
10
8
6
4
2
0
0
1
2
3
4
5
Day
Sam
Terri

Number and Operations in Base Ten	5.NBT
Common Core Cluster	
Understand the place value system.	
Common Core Standard	**Unpacking** What do these standards mean a child will know and be able to do?
5.NBT.1 Recognize 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.	**5.NBT.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 $1/10^{th}$ the size of the tens place. Example: The 2 in the number 542 is different from the value of the 2 in 324. The 2 in 542 represents 2 ones or 2, while the 2 in 324 represents 2 tens or 20. Since the 2 in 324 is one place to the left of the 2 in 542 the value of the 2 is 10 times greater. Meanwhile, the 4 in 542 represents 4 tens or 40 and the 4 in 324 represents 4 ones or 4. Since the 4 in 324 is one place to the right of the 4 in 542 the value of the 4 in the number 324 is $1/10^{th}$ of its value in the number 542. Note the pattern in our base ten number system; all places to the right continue to be divided by ten and that places to the left of a digit are multiplied by ten.
5.NBT.2 Explain patterns in the number of zeros of the **product** when multiplying a number by powers of 10, and explain patterns in the placement of the **decimal point** when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.	**5.NBT.2** includes multiplying by multiples of 10 and powers of 10, including 10^2 which is 10 x 10=100, and 10^3 which is 10 x 10 x 10=1,000. Students should have experiences working with connecting the pattern of the number of zeros in the product when you multiply by powers of 10. Example: $2.5 \times 10^3 = 2.5 \times (10 \times 10 \times 10) = 2.5 \times 1{,}000 = 2{,}500$ 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. $350 \div 10^3 = 350 \div 1{,}000 = 0.350 = 0.35$ 350/10 = 35, 35 /10 = 3.5 3.5 /10 =.0.35, or 350 x 1/10, 35 x 1/10, 3.5 x 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. Students need to be provided with opportunities to explore this concept and come to this understanding; this should not just be taught procedurally.

5.NBT.3 Read, write, and compare **decimals** to **thousandths.** a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., 347.392 = 3 × 100 + 4 × 10 + 7 × 1 + 3 × (1/10) + 9 x (1/100) + 2 x (1/1000) b. **Compare** two decimals to thousandths based on meanings of the digits in each place, using **>, =, and < symbols** to record the results of comparisons.	**5.NBT.3a** references expanded form of decimals with fractions included. 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.NBT.2 and deepen students' understanding of place value. **5.NBT.3b** comparing decimals builds on work from fourth grade.
5.NBT.4 Use place value understanding to **round** decimals to any place.	**5.NBT.4** refers to rounding. 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. **5.NBT.4** references rounding. Students should use benchmark numbers to support this work. Benchmarks are convenient numbers for comparing and rounding numbers. 0., 0.5, 1, 1.5 are examples of benchmark numbers. Which benchmark number is the best estimate of the shaded amount in the model below? Explain your thinking. 

Common Core Cluster

Perform operations with multi-digit whole numbers and with decimals to hundredths.

Students develop understanding of why division procedures work based on the meaning of base-ten numerals and properties of operations. They finalize fluency with multi-digit addition, subtraction, multiplication, and division. They apply their understandings of models for decimals, decimal notation, and properties of operations to add and subtract decimals to hundredths. They develop fluency in these computations, and make reasonable estimates of their results. Students use the relationship between decimals and fractions, as well as the relationship between finite decimals and whole numbers (i.e., a finite decimal multiplied by an appropriate power of 10 is a whole number), to understand and explain why the procedures for multiplying and dividing finite decimals make sense. They compute products and quotients of decimals to hundredths efficiently and accurately.

Common Core Standard	Unpacking What do these standards mean a child will know and be able to do?
5.NBT.5 Fluently multiply multi-digit whole numbers using the standard algorithm.	**5.NBT.5** refers to fluency which means accuracy (correct answer), efficiency (a reasonable amount of steps), and flexibility (using strategies such as the distributive property or breaking numbers apart also using strategies according to the numbers in the problem, 26 x 4 may lend itself to (25 x 4) + 4 where as another problem might lend itself to making an equivalent problem 32 x 4 = 64 x 8)). This standard builds upon students' work with multiplying numbers in Third and Fourth Grade. In Fourth Grade, students developed understanding of multiplication through using various strategies. While the standard algorithm is mentioned, alternative strategies are also appropriate to help students develop conceptual understanding. The size of the numbers should NOT exceed a three-digit factor by a two-digit factor. Examples of alternative strategies: There are 225 dozen cookies in the bakery. How many cookies are there? Student 1 225 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 2 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 3 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 a array model for 225 x 12…. 200 x 10, 200 x 2, 20 x 10, 20 x 2, 5 x 10, 5 x 2

225 x 12

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

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

5.NBT.6 Find whole-number **quotients** of whole numbers with up to four-digit **dividends** and two-digit **divisors,** using **strategies** based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using **equations, rectangular arrays,** and/or **area models.**

5.NBT.6 references various strategies for division. Division problems can include remainders. Even though this standard leads more towards computation, the connection to story contexts is critical. Make sure students are exposed to problems where the divisor is the number of groups and where the divisor is the size of the groups.

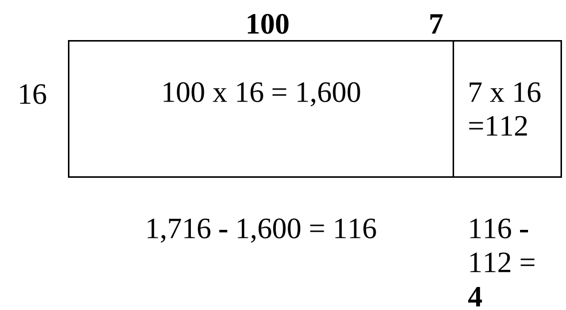
Properties – **rules about how numbers work**

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?

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 17 students.

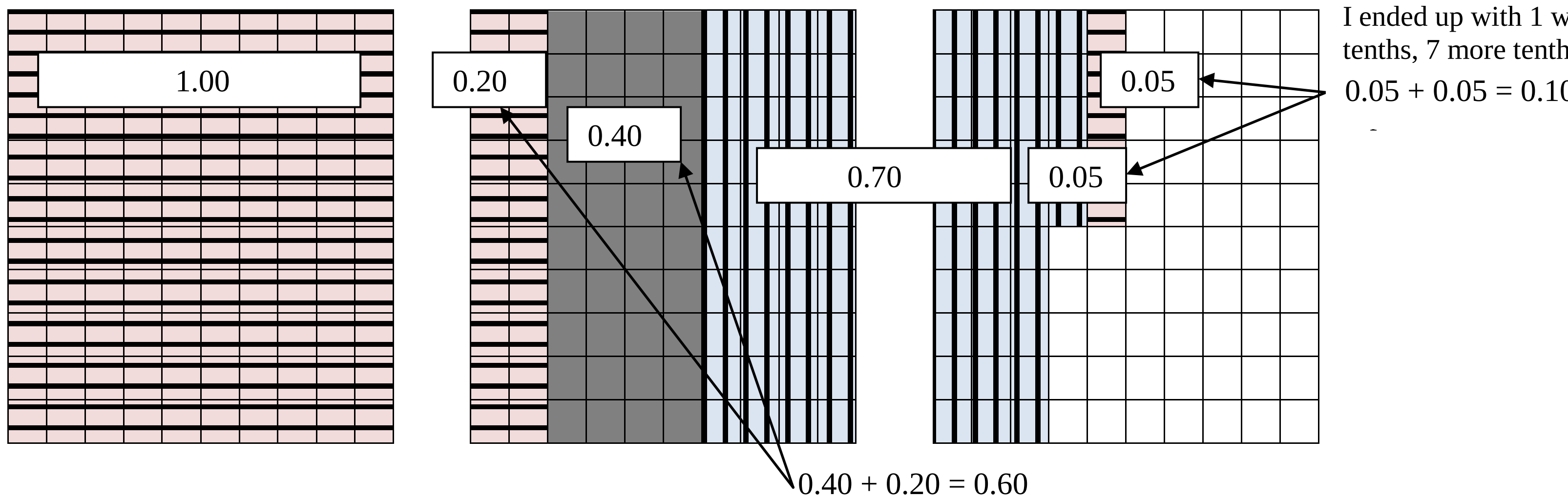
Student 2
1,716 divided by 16.
There are 100 16's in 1,716.
Ten groups of 16 is 160. That's too big.
Half of that is 80, which is 5 groups.
I know that 2 groups of 16's is 32.
I have 4 students left over.

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

	Student 3 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 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 R 4 
5.NBT.7 Add, subtract, multiply, and divide **decimals** to **hundredths**, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.	**5.NBT.7** 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 solely on the algorithm. The use of symbolic notations involves having students record the answers to computations (2.25 x 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.

Example:
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?

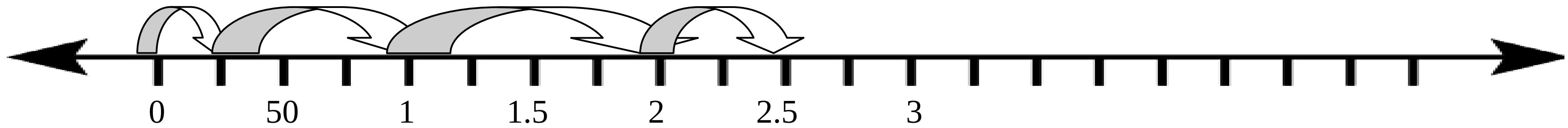
Student 1
1.25 + 0.40 + 0.75
First, I broke the numbers apart:
I broke 1.25 into 1.00 + 0.20 + 0.05
I left 0.40 like it was.
I broke 0.75 into 0.70 + 0.05
I combined my two 0.05s to get 0.10.
I combined 0.40 and 0.20 to get 0.60.
I added the 1 whole from 1.25.



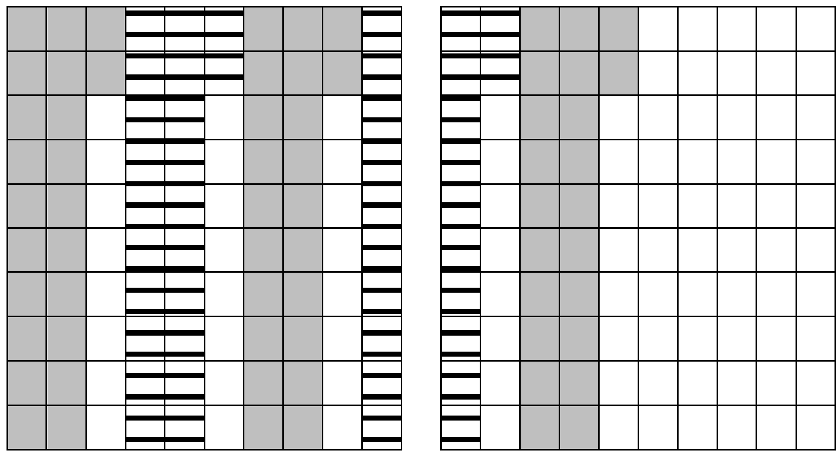
I ended up with 1 whole, 6 tenths, 7 more tenths and 1 ... ls 2.40

Student 2
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.

.25 + .75 + 1 + .40 = 2.40



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

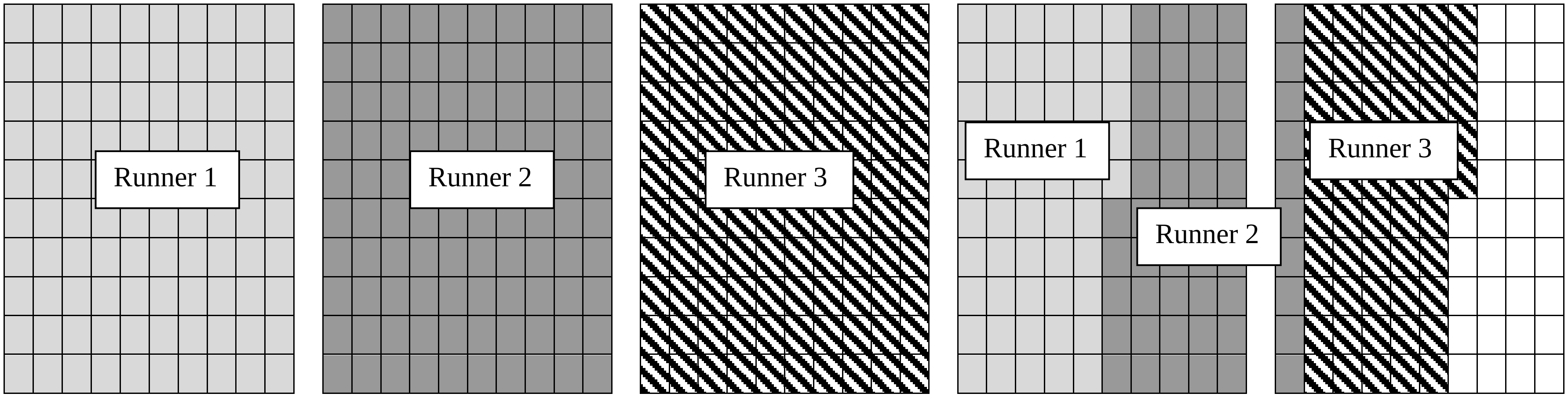


I estimate that the total cost will be a little more than a dollar. I know that 5 20's equal 100 and we have 5 22's.

I have 10 whole columns shaded and 10 individual boxes shaded. The 10 columns equal 1 whole. The 10 individual boxes equal 10 hundredths or 1 tenth. My answer is $1.10.

My estimate was a little more than a dollar, and my answer was $1.10. I was really close.

Example of Division:
A relay race lasts 4.65 miles. The relay team has 3 runners. If each runner goes the same distance, how far does each team member run? Make an estimate, find your actual answer, and then compare them.



My estimate is that each runner runs between 1 and 2 miles. If each runner went 2 miles, that would be a total of 6 miles which is too high. If each runner ran 1 mile, that would be 3 miles, which is too low.

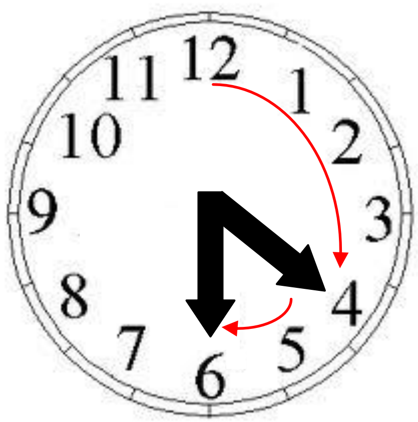
I used the 5 grids above to represent the 4.65 miles. I am going to use all of the first 4 grids and 65 of the squares in the 5th grid. I have to divide the 4 whole grids and the 65 squares into 3 equal groups. I labeled each of the first 3 grids for each runner, so I know that each team member ran at least 1 mile. I then have 1 whole grid and 65 squares to divide up. Each column represents one-tenth. If I give 5 columns to each runner, that means that each runner has run 1 whole mile and 5 tenths of a mile. Now, I have 15 squares left to divide up. Each runner gets 5 of those squares. So each runner ran 1 mile, 5 tenths and 5 hundredths of a mile. I can write that as 1.55 miles.

My answer is 1.55 and my estimate was between 1 and 2 miles. I was pretty close.

Number and Operation – Fractions 5.NF

Common Core Cluster

Use equivalent fractions as a strategy to add and subtract fractions.
Students apply their understanding of fractions and fraction models to represent the addition and subtraction of fractions with unlike denominators as equivalent calculations with like denominators. They develop fluency in calculating sums and differences of fractions, and make reasonable estimates of them.

Common Core Standard	Unpacking What do these standards mean a child will know and be able to do?
5.NF.1 Add and subtract fractions with **unlike denominators** (including **mixed numbers**) by replacing given fractions with **equivalent fractions** in such a way as to produce an **equivalent sum** or **difference** of fractions with like denominators. *For example, 2/3 + 5/4 = 8/12 + 15/12 = 23/12. (In general, a/b + c/d = (ad + bc)/bd.)*	**5.NF.1** builds on the work in Fourth Grade where students add fractions with like denominators. In Fifth Grade, the example provided in the standard has students find a common denominator by finding the product of both denominators. For 1/3 + 1/6, a common denominator is 18, which is the product of 3 and 6. This process should be introduced using visual fraction models (area models, number lines, etc.) to build understanding before moving into the standard algorithm. Example: Present students with the problem 1/3 + 1/6. Encourage students to use the clock face as a model for solving the problem. Have students share their approaches with the class and demonstrate their thinking using the clock model. 
5.NF.2 Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or	**5.NF.2** refers to number sense, which means students' understanding of fractions as numbers that lie between whole numbers on a number line. Number sense in fractions also includes moving between decimals and fractions to find equivalents, also being able to use reasoning such as 7/8 is greater than ¾ because 7/8 is missing only 1/8 and ¾ is missing ¼ so 7/8 is closer to a whole Also, students should use benchmark fractions to estimate and examine the reasonableness of their answers. Example here such as 5/8 is greater than 6/10 because 5/8 is 1/8

equations to represent the problem. Use **benchmark fractions** and **number sense** of fractions to **estimate mentally** and assess the **reasonableness** of answers. *For example, recognize an incorrect result 2/5 + 1/2 = 3/7, by observing that 3/7 < 1/2.*	larger than ½(4/8) and 6/10 is only 1/10 larger than ½ (5/10) Example: Your teacher gave you 1/7 of the bag of candy. She also gave your friend 1/3 of the bag of candy. If you and your friend combined your candy, what fraction of the bag would you have? Estimate your answer and then calculate. How reasonable was your estimate? Student 1 1/7 is really close to 0. 1/3 is larger than 1/7, but still less than 1/2. If we put them together we might get close to 1/2. 1/7 + 1/3= 3/21 + 7/21 = 10/21. The fraction does not simplify. I know that 10 is half of 20, so 10/21 is a little less than ½. Another example: 1/7 is close to 1/6 but less than 1/6, and 1/3 is equivalent to 2/6, so I have a little less than 3/6 or ½.

Common Core Cluster

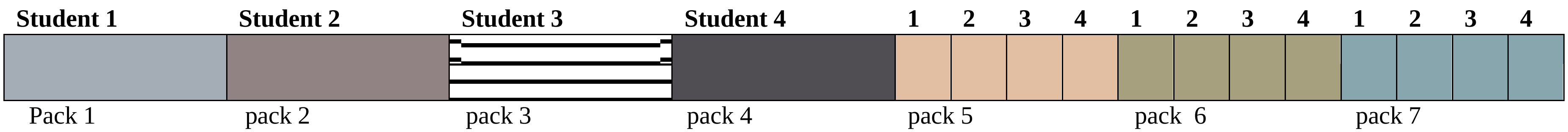
Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

Students also use the meaning of fractions, of multiplication and division, and the relationship between multiplication and division to understand and explain why the procedures for multiplying and dividing fractions make sense. (Note: this is limited to the case of dividing unit fractions by whole numbers and whole numbers by unit fractions.)

Common Core Standard	**Unpacking** What does this standards mean a child will know and be able to do?
5.NF.3 Interpret a fraction as division of the **numerator** by the **denominator** ($a/b = a \div b$). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem. *For example, interpret 3/4 as the result of dividing 3 by 4, noting*	**5.NF.3** calls for students to extend their work of partitioning a number line from Third and Fourth Grade. Students need ample experiences to explore the concept that a fraction is a way to represent the division of two quantities.

that 3/4 multiplied by 4 equals 3, and that when 3 wholes are shared equally among 4 people each person has a share of size 3/4. If 9 people want to share a 50-pound sack of rice equally by weight, how many pounds of rice should each person get? Between what two whole numbers does your answer lie?

Example:
Your teacher gives 7 packs of paper to your group of 4 students. If you share the paper equally, how much paper does each student get?

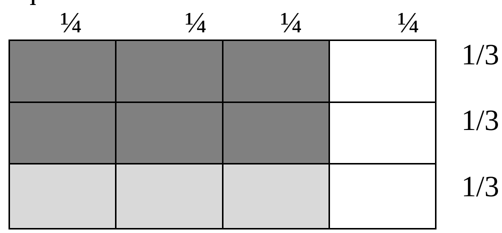


Each student receives 1 whole pack of paper and ¼ of the each of the 3 packs of paper. So each student gets 1 ¾ packs of paper.

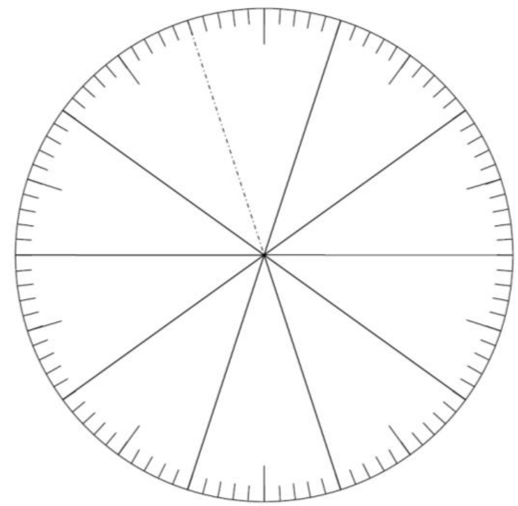
5.NF.4 Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. a. Interpret the product $(a/b) \times q$ as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations $a \times q \div b$. *For example, use a visual fraction model to show (2/3) × 4 = 8/3, and create a story context for this equation. Do the same with (2/3) × (4/5) = 8/15. (In general, (a/b) ×*	Students need to develop a fundamental understanding that the multiplication of a fraction by a whole number could be represented as repeated addition of a unit fraction (e.g., 2 x (1/4) = 1/4 + ¼ **5.NF.4** extends student's work of multiplication from earlier grades. In Fourth Grade, students worked with recognizing that a fraction such as 3/5 actually could be represented as 3 pieces that are each one-fifth (3 x (1/5)). In Fifth Grade, students are only multiplying fractions less than one. They are not multiplying mixed numbers until Sixth Grade. **5.NF.4a** 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: Three-fourths of the class is boys. Two-thirds of the boys are wearing tennis shoes. What fraction of the class are boys with tennis shoes? This question is asking what 2/3 of ¾ is, or what is 2/3 x ¾. What is 2/3 x ¾, in this case you have 2/3 groups of size ¾ (a way to think about it in terms of the language for whole numbers is 4 x 5 you have 4 groups of size 5. The array model is very transferable from whole number work and then to binomials.

(c/d) = ac/bd.)

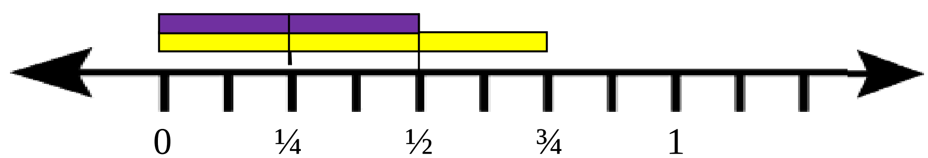
Student 1
I drew a rectangle to represent the whole class. The four columns represent the fourths of a class. I shaded 3 columns to represent the fraction that are boys. I then split the rectangle with horizontal lines into thirds. The dark area represents the fraction of the boys in the class wearing tennis shoes, which is 6 out of 12. That is 6/12, which equals 1/2.



Student 3
Fraction circle could be used to model student thinking.
First I shade the fraction circle to show the ¾ and then overlay with 2/3 of that?

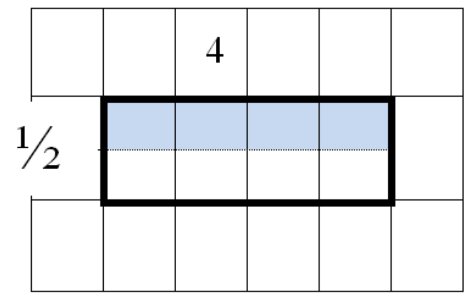


Student 2

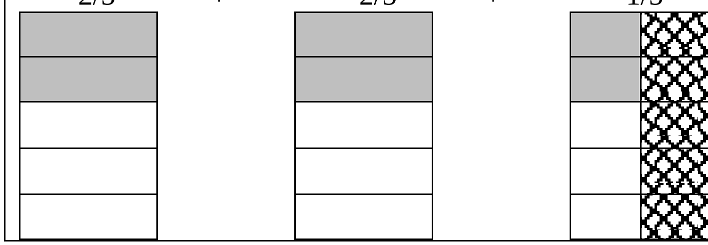


b. Find the **area** of a **rectangle** with **fractional side lengths** by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths.

5.NF.4b extends students' work with area. In Third Grade students determine the area of rectangles and composite rectangles. In Fourth Grade students continue this work. The Fifth Grade standard calls students to continue the process of covering (with tiles). Grids (see picture) below can be used to support this work.
Example:
The home builder needs to cover a small storage room floor with carpet. The storage room is 4 meters long and half of a meter wide. How much carpet do you need to cover the floor of the storage room? Use a grid to show your work and explain your answer.
In the grid below I shaded the top half of 4 boxes. When I added them together, I added ½ four times, which equals 2. I

Multiply fractional side lengths to find areas of **rectangles,** and represent fraction products as **rectangular areas**.	could also think about this with multiplication ½ x 4 is equal to 4/2 which is equal to 2. 
5.NF.5 Interpret multiplication as scaling (resizing), by: a. **Comparing** the size of a **product** to the size of one **factor** on the basis of the size of the other factor, without performing the indicated multiplication.	**5.NF.5a** calls for students to examine the magnitude of products in terms of the relationship between two types of problems. This extends the work with 5.OA.1. Example 1: Mrs. Jones teaches in a room that is 60 feet wide and 40 feet long. Mr. Thomas teaches in a room that is half as wide, but has the same length. How do the dimensions and area of Mr. Thomas' classroom compare to Mrs. Jones' room? Draw a picture to prove your answer. Example 2: How does the product of 225 x 60 compare to the product of 225 x 30? How do you know? Since 30 is half of 60, the product of 22 5x 60 will be double or twice as large as the product of 225 x 30.
b. Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given	**5.NF.5b** 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 and b) when multiplying by a fraction less the one, the number decreases. This standard should be explored and discussed while students are working with 5.NF.4, and should not be taught in isolation. Example: Mrs. Bennett is planting two flower beds. The first flower bed is 5 meters long and 6/5 meters wide. The second flower bed is 5 meters long and 5/6 meters 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.

<table>
<tr>
<td>number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence a/b = (n × a)/(n × b) to the effect of multiplying a/b by 1.</td>
<td></td>
</tr>
<tr>
<td>5.NF.6 Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.</td>
<td>5.NF.6 builds on all of the work done in this cluster. Students should be given ample opportunities to use various strategies to solve word problems involving the multiplication of a fraction by a mixed number. This standard could include fraction by a fraction, fraction by a mixed number or mixed number by a mixed number.
Example:
There are 2 ½ bus loads of students standing in the parking lot. The students are getting ready to go on a field trip. 2/5 of the students on each bus are girls. How many busses would it take to carry only the girls?

Student 1
I drew 3 grids and 1 grid represents 1 bus. I cut the third grid in half and I marked out the right half of the third grid, leaving 2 ½ grids. I then cut each grid into fifths, and shaded two-fifths of each grid to represent the number of girls. When I added up the shaded pieces, 2/5 of the 1st and 2nd bus were both shaded, and 1/5 of the last bus was shaded.
2/5 + 2/5 + 1/5 = 5/5 = 1 whole bus.


Student 2
2 ½ x 2/5=
I split the 2 ½ into 2 and ½
2 x 2/5 = 4/5
½ x 2/5 = 2/10
I then added 4/5 and 2/10. That equals 1 whole bus load.</td>
</tr>
<tr>
<td>5.NF.7 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.[1]
a. Interpret division of a unit fraction by a non-zero whole number, and compute such quotients.</td>
<td>5.NF.7 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 in the denominator. For example, the fraction 3/5 is 3 copies of the unit fraction 1/5. 1/5 + 1/5 + 1/5 = 3/5 = 1/5 x 3 or 3 x 1/5</td>
</tr>
</table>

For example, create a story context for (1/3) ÷ 4, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that (1/3) ÷ 4 = 1/12 because (1/12) × 4 = 1/3. [1] Students able to multiply fractions in general can develop strategies to divide fractions in general, by reasoning about the relationship between multiplication and division. But division of a fraction by a fraction is not a requirement at this grade.	

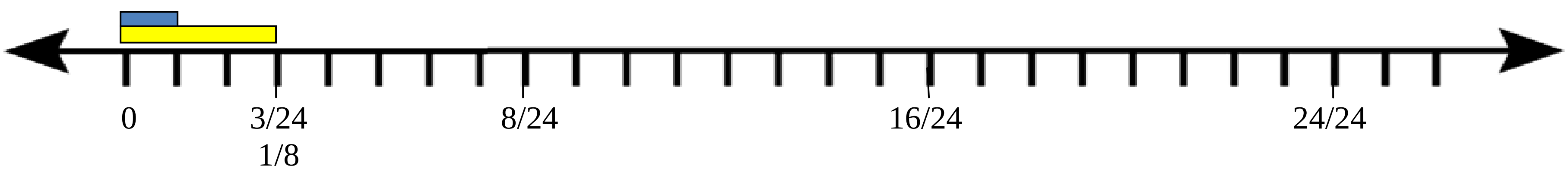
5.NF.7a asks students to work with story contexts where a unit fraction is divided by a non-zero whole number. Students should use various fraction models and reasoning about fractions.

Example:

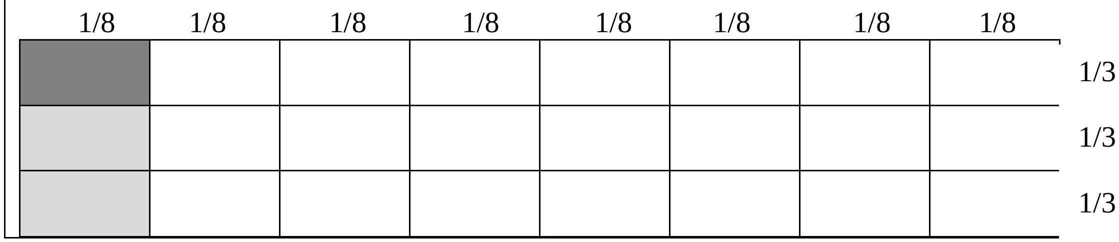
You have 1/8 of a bag of pens and you need to share them among 3 people. How much of the bag does each person get?

Student 1

Expression 1/ 8 ÷ 3



Student 2
I drew a rectangle and divided it into 8 columns to represent my 1/8. I shaded the first column. I then needed to divide the shaded region into 3 parts to represent sharing among 3 people. I shaded one-third of the first column even darker. The dark shade is 1/24 of the grid or 1/24 of the bag of pens.



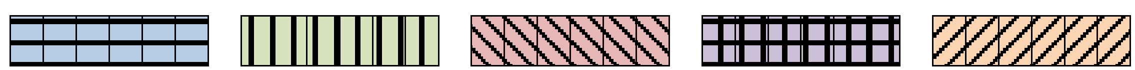
Student 3
1/8 of a bag of pens divided by 3 people. I know that my answer will be less than 1/8 since I'm sharing 1/8 into 3 groups. I multiplied 8 by 3 and got 24, so my answer is 1/24 of the bag of pens. I know that my answer is correct because (1/24) x 3 = 3/24 which equals 1/8.

b. Interpret division of a whole number by a unit fraction, and compute such **quotients.** *For example, create a story context for 4 ÷ (1/5), and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that 4 ÷ (1/5) = 20 because 20 × (1/5) = 4.*

5.NF.7b calls for students to create story contexts and visual fraction models for division situations where a whole number is being divided by a unit fraction.
Example:
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
The bowl holds 5 Liters of water. If we use a scoop that holds 1/6 of a Liter, how many scoops will we need in order to fill the entire bowl?

I created 5 boxes. Each box represents 1 Liter of water. I then divided each box into sixths to represent the size of the scoop. My answer is the number of small boxes, which is 30. That makes sense since 6 x 5 = 30.



1 = 1/6 + 1/6 + 1/6 + 1/6 + 1/6 a whole has 6/6 so five wholes would be 6/6 + 6/6 + 6/6 + 6/6 + 6/6 =30/6

c. Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and **equations** to represent the problem. *For example, how much chocolate will each person get if 3 people share ½ lb of chocolate equally? How many 1/3-cup servings are 2 cups of raisins?*	**5.NF.7c** extends students' work from other standards in 5.NF.7. Student should continue to use visual fraction models and reasoning to solve these real-world problems. Example: How many 1/3-cup servings are in 2 cups of raisins? Student I know that there are three 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 1/3 = 2 x 3 = 6 servings of raisins.

Measurement and Data 5.MD

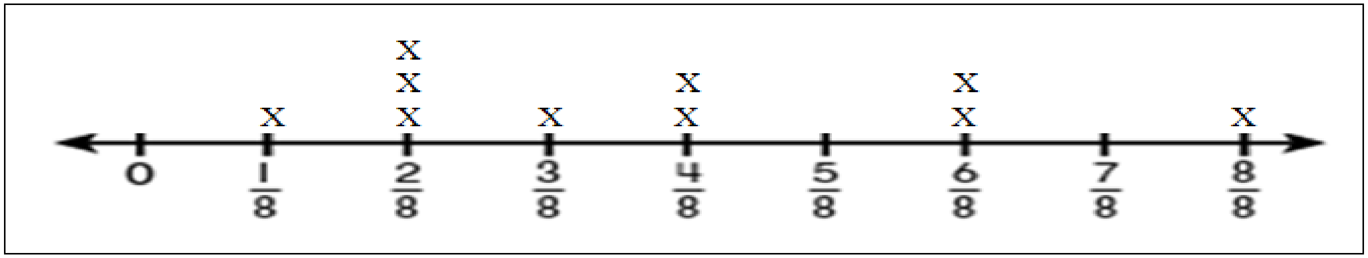
Common Core Cluster

Convert like measurement units within a given measurement system.

Common Core Standard	Unpacking What do these standards mean a child will know and be able to do?
5.MD.1 Convert among different-sized **standard measurement units** within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.	**5.MD.1** calls for students to convert measurements within the same system of measurement in the context of multi-step, real-world problems. Both customary and standard measurement systems are included; students worked with both metric and customary units of length in Second Grade. In Third Grade, students work with metric units of mass and liquid volume. In Fourth Grade, students work with both systems and begin conversions within systems in length, mass and volume. Students should explore how the base-ten system supports conversions within the metric system. Example: 100 cm = 1 meter. From previous grades: **relative size, liquid volume, mass, length, kilometer (km), meter (m), centimeter (cm), kilogram (kg), gram (g), liter (L), milliliter (mL), inch (in), foot (ft), yard (yd), mile (mi), ounce (oz), pound (lb), cup (c), pint (pt), quart (qt), gallon (gal), hour, minute, second**

Common Core Cluster

Represent and interpret data.

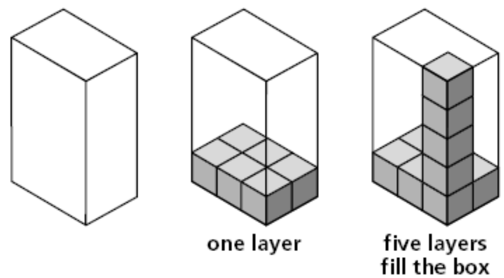
Common Core Standard	Unpacking What do these standards mean a child will know and be able to do?
5. MD.2 Make a **line plot** to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots. *For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally.*	**5.MD.2** This standard provides a context for students to work with fractions by measuring objects to one-eighth of a unit. This includes length, mass, and liquid volume. Students are making a line plot of this data and then adding and subtracting fractions based on data in the line plot. Example: Students measured objects in their desk to the nearest ½, ¼, or 1/8 of an inch then displayed data collected on a line plot. How many object measured ¼? ½? If you put all the objects together end to end what would be the total length of **all** the objects? 

Common Core Cluster

Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.

Students recognize volume as an attribute of three-dimensional space. They understand that volume can be measured by finding the total number of same-size units of volume required to fill the space without gaps or overlaps. They understand that a 1-unit by 1-unit by 1-unit cube is the standard unit for measuring volume. They select appropriate units, strategies, and tools for solving problems that involve estimating and measuring volume. They decompose three-dimensional shapes and find volumes of right rectangular prisms by viewing them as decomposed into layers of arrays of cubes. They measure necessary attributes of shapes in order to determine volumes to solve real world and mathematical problems.

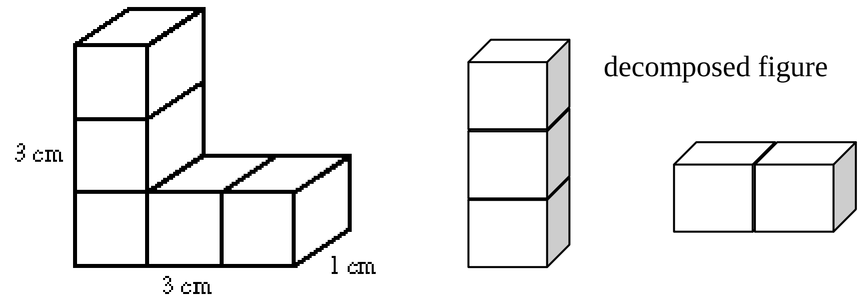
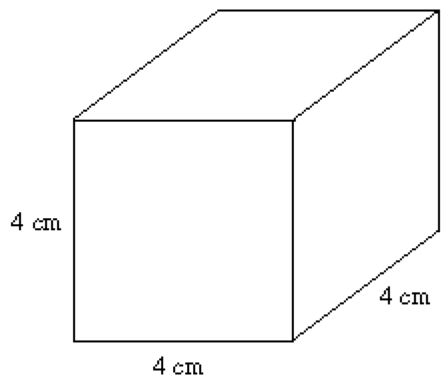
<table>
<tr><th>Common Core Standard</th><th>Unpacking
What do these standards mean a child will know and be able to do?</th></tr>
<tr><td>5. MD.3 Recognize volume as an attribute of solid figures and understand concepts of volume measurement.
a. A cube with side length 1 unit, called a “unit cube,” is said to have “one cubic unit” of volume, and can be used to measure volume.
b. A solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units.</td>
<td rowspan="3">5. MD.3, 5.MD.4, and 5. MD.5 represents the first time that students begin exploring the concept of volume. In Third Grade, students begin working with area and covering spaces. 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 (see picture below). Students should have ample experiences with concrete manipulatives before moving to pictorial representations.

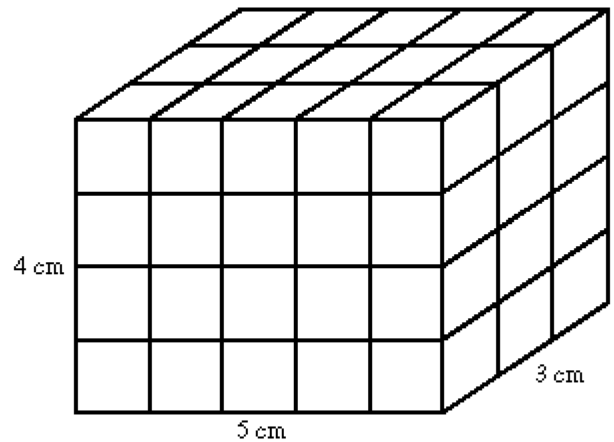


(3 x 2) represented by first layer
(3 x 2) x 5 represented by number of 3 x 2 layers
(3 x 2) + (3 x 2) + (3 x 2) + (3 x 2)+ (3 x 2) = 6 + 6 + 6 + 6 + 6 + 6 = 30
6 representing the size/area of one layer

5. MD.5a & b involves finding the volume of right rectangular prisms (see picture above). Students should have experiences to describe and reason about 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.

5.MD.5c calls for students to extend their work with the area of composite figures into the context of volume. Students should be given concrete experiences of breaking apart (decomposing) 3-dimensional figures into right rectangular prisms in order to find the volume of the entire 3-dimensional figure.</td></tr>
<tr><td>5. MD.4 Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.</td></tr>
<tr><td>5. MD.5 Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.
a. Find the volume of a right 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, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication.
b. Apply the formulas $V = l \times w \times h$ and $V = b \times h$ for rectangular prisms</td></tr>
</table>

to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real world and mathematical problems. c. Recognize volume as additive. Find volumes of solid figures **composed** of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real world problems.		Example:  Example: 

	Example: 

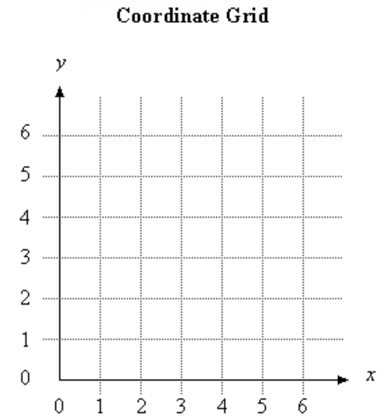
Geometry 5.G

Common Core Cluster

Graph points on the coordinate plane to solve real-world and mathematical problems.

Common Core Standard	Unpacking What do these standards mean a child will know and be able to do?
5.G.1 Use a pair of **perpendicular number lines**, called **axes,** to define a **coordinate system**, with the **intersection** of the lines (the **origin**) arranged to coincide with the 0 on each line and a given point in the plane located by using an **ordered pair** of numbers, called its **coordinates**. Understand that the first number indicates how far to travel from the	**5.G.1** and **5.G.2** deal with only the first quadrant (positive numbers) in the coordinate plane. Example: Connect these points in order on the coordinate grid below: (2, 2) (2, 4) (2, 6) (2, 8) (4, 5) (6, 8) (6, 6) (6, 4) and (6, 2).

<table>
<tr>
<td>origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).</td>
<td>
What letter is formed on the grid?

Solution: “M” is formed.


Example:
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?
solutions: trapezoid, line segments AB and DC are parallel, segments AD and DC are perpendicular

Example:
Emanuel draws a line segment from (1, 3) to (8, 10). He then draws a line segment from (0, 2) to (7, 9). If he wants to draw another line segment that is parallel to those two segments what points will he use?
</td>
</tr>
<tr>
<td>5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.</td>
<td>5.G.2 references real-world and mathematical problems, including the traveling from one point to another and identifying the coordinates of missing points in geometric figures, such as squares, rectangles, and parallelograms.</td>
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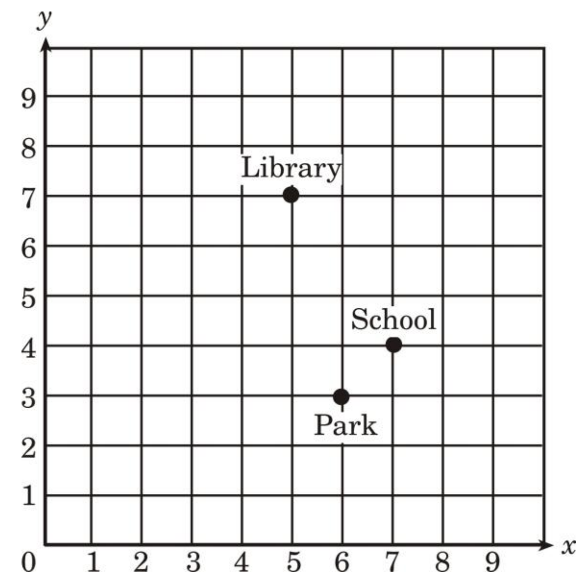
</table>

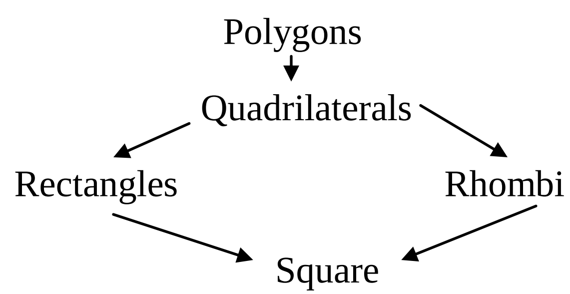
	Example: Using the coordinate grid, which ordered pair represents the location of the School? Explain a possible path from the school to the library. 

Common Core Cluster	
Classify two-dimensional figures into categories based on their properties.	
Common Core Standard	**Unpacking** What do these standards mean a child will know and be able to do?
5.G.3 Understand that **attributes** belonging to a **category** of two-dimensional figures also belong to all subcategories of that category. *For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.*	**5.G.3** calls for students to reason about the attributes (properties) of shapes. Student should have experiences discussing the property of shapes and reasoning. Example: Examine whether all quadrilaterals have right angles. Give examples and non-examples.
5.G.4 Classify two-dimensional figures in a **hierarchy** based on properties.	**5.G.4** this stand build on what was done in 4^{th} grade. Figures from previous grades: **polygon, rhombus/rhombi, rectangle, square, triangle, quadrilateral, pentagon, hexagon, cube, trapezoid, half/quarter circle, circle**

Example:
Create a Hierarchy Diagram using the following terms:

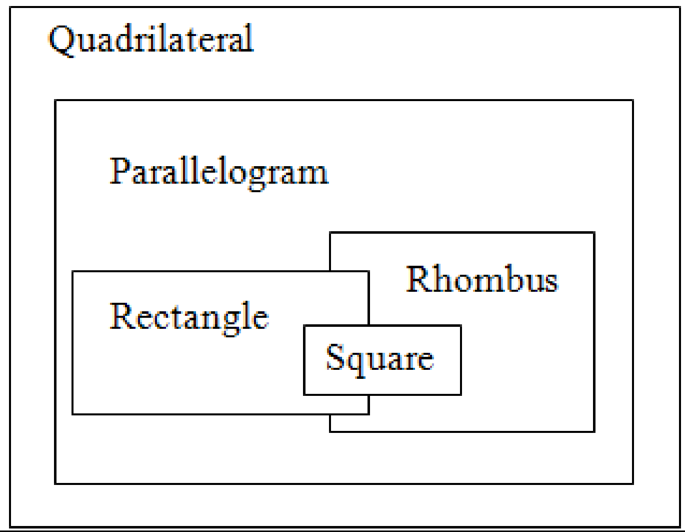
polygons – a closed plane figure formed from line segments that meet only at their endpoints.
quadrilaterals - a four-sided polygon.
rectangles - a quadrilateral with two pairs of congruent parallel sides and four right angles.
rhombi – a parallelogram with all four sides equal in length.
square – a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

Possible student solution:



quadrilateral – a four-sided polygon.
parallelogram – a quadrilateral with two pairs of parallel and congruent sides.
rectangle – 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:



Student 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?, and How many lines of symmetry does a regular polygon have?