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

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.

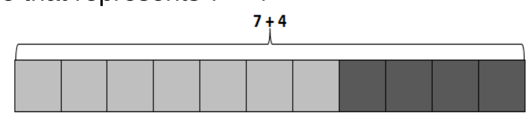
Checking for Understanding

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.

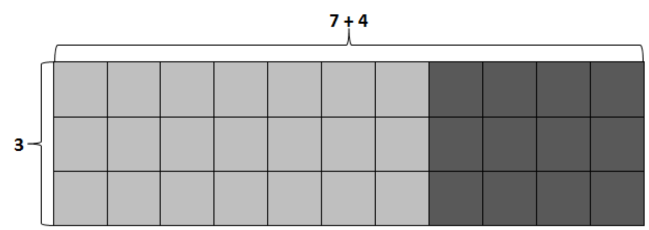
Adapted from Illustrative Mathematics (www.illustrativemathematics.org)

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

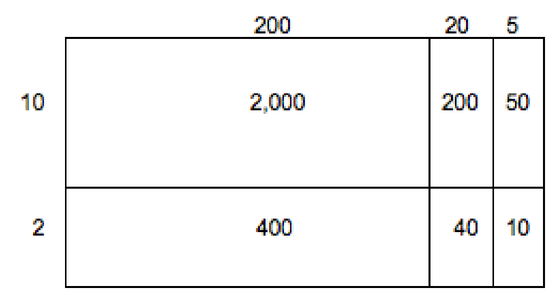
There are 225 dozen cookies in the bakery. How many cookies are there?

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:



$$\begin{array}{r} 2{,}000 \\ 400 \\ 200 \\ 40 \\ 50 \\ \underline{+\ \ 10} \\ 2{,}700 \end{array}$$

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

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.

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.*

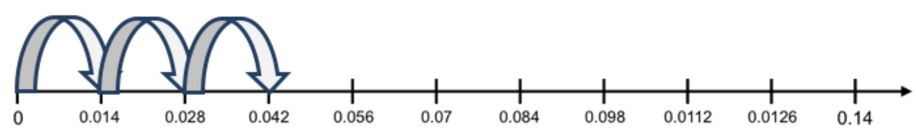
Student B

- *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:

<u>Number Line Model</u>



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.

<u>Using the Distributive Property</u>

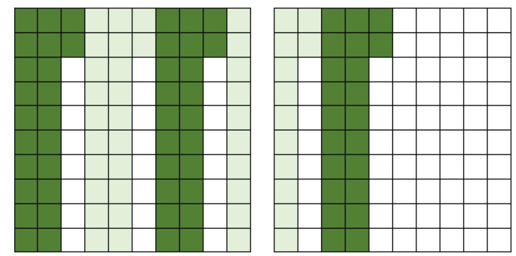
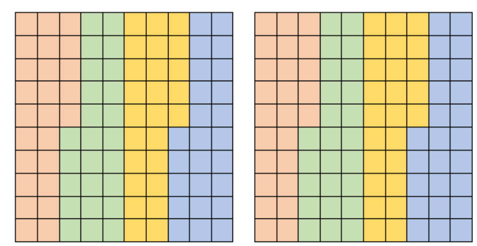
0.3 x 0.14 = 0.3 x (0.1 + 0.04)

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 $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. Sarah will need 8 bags for her trail mix.*

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

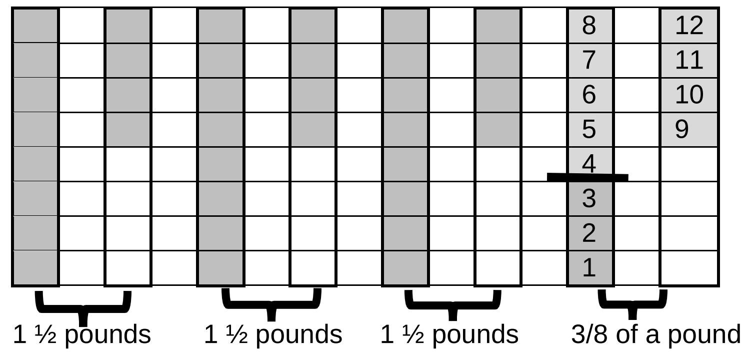
This standard extends students' work of multiplication from earlier grades. In fourth grade, students worked with recognizing that a fraction such as 3/4 can be represented as 3 pieces that are each one-fourth (3 x (1/4)) and multiplied fractions less than one by whole numbers.

This standard references both the multiplication of a fraction by a whole number and the multiplication of two fractions, including mixed numbers, with 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

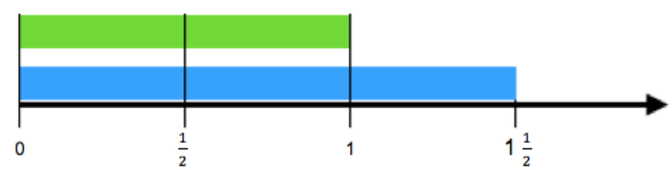
Use area and length models to multiply two fractions, with the denominators 2,3, and 4.

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 1 ½ = 12/8 so when I divided the 12/8 into fourths ¼ was 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.

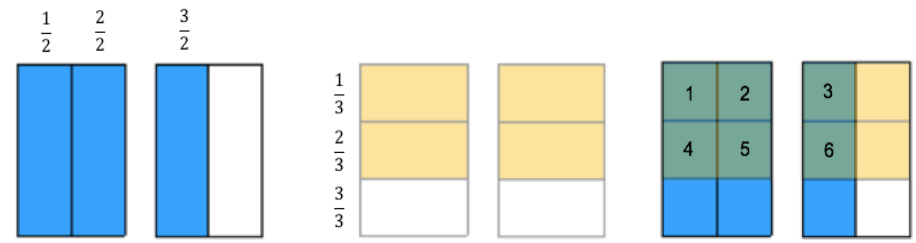
- Use area and length models to multiply two fractions, with the denominators 2, 3, 4.
- Explain why multiplying a given number by a fraction greater than 1 results in a product greater than the given number and when multiplying a given number by a fraction less than 1 results in a product smaller than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

Clarification

Checking for Understanding

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.

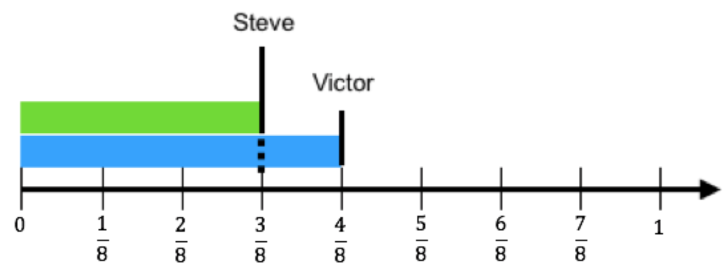
Sonya is multiplying 2/3 * 3/2. She tells Susan that her product will be greater than 2/3. Is Sonya correct? Model the problem and explain why Sonya is correct or not.



*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.

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

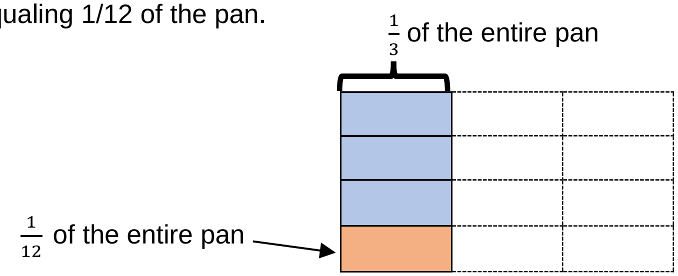
While students are working on NC.5.NF.7, this is the first time that students are dividing with fractions. In fourth grade students divided whole numbers, and multiplied a whole number by a fraction. The concept *unit fraction* is a fraction that has a one as the numerator. Students should be able to 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.

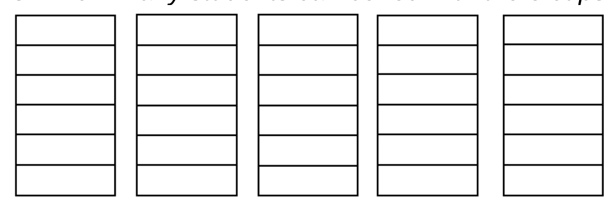


Whole Number Divided by a Unit Fraction:

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:

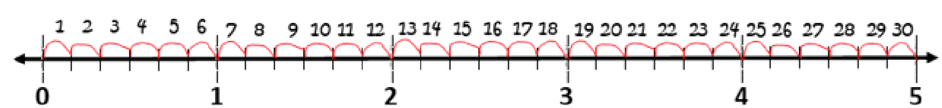
There are 5 cups of goldfish on the counter. Each student receives 1/6 of a cup of goldfish. How many students can be fed with the 5 cups of goldfish?



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

Measurement and Data

<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 a conversion chart and will convert measurements within the same system of measurement in the context of multi-step, real-world problems. Student will work with customary and standard 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 hours?
How many seconds are in 5 hours?
How many seconds are in a day?
<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