Practice Task – Dividing with Unit Fractions

STANDARDS FOR MATHEMATICAL CONTENT

MCC5.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. *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.*

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.*

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 1/2 lb of chocolate equally? How many 1/3-cup servings are in 2 cups of raisins?*

[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**

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

ESSENTIAL QUESTIONS

- What does dividing a unit fraction by a whole number look like?
- What does dividing a whole number by a unit fraction look like?
- How can we model dividing a unit fraction by a whole number with manipulatives and diagrams?
- How can we model dividing a whole number by a unit fraction using manipulatives and diagrams?

MATERIALS

- Reasoning with Fractions Task
- Accessible manipulatives
- Grid Paper

GROUPING

Pair/Individual

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Comments:

This task was developed to give students an opportunity to make sense of division with fractional divisors and dividends. This task is meant to involve students in a deeper investigation of the concept of division in the context of unit fractions.
Students should be allowed to draw representations of their thinking. Using grid paper may facilitate this, but is not necessary. Students may wish to use other representations based on their own understandings. Creating these representations allows them to "talk through" their process which in turn enables students the opportunity to attend to precision as they explain and reason mathematically.

BACKGROUND KNOWLEDGE

Students engaging in this task should be familiar with multiple fraction models, including but not limited to, fraction strips and circle fraction pieces, as well as less traditional fractional models such as color tiles, colored beads, and pattern blocks. The problems in this task were adapted from problems found in Teaching Student Centered Mathematics, volume 2, by John A. Van de Walle and LouAnn H. Lovin.

Teacher Notes:

Before beginning this task, have a computation discussion with your students using the following computations. It is important for students to have plenty of quiet think time for each individual computation is presented. Likewise, after the quiet think time, students should share their strategies before moving to the next problem.

What does it mean when you see the computation 16 ÷ 2?
What do you think when you see the computation 16 ÷ ½?
What do you think of when you see the computation ¼ ÷ 6?

Part I

Introduce the task. Make sure students understand the context of the task and what they are expected to do. Allow students to share ideas about the task with the group. Make sure students have materials necessary for investigating this task.

The problem here is not just to find answers to problems, but to explain why some of the quotients are larger than the divisor and dividend and some are smaller. Evidence must be presented for each using mathematical representations, words, and numbers.

Allow students to work in pairs to answer the questions posed.

Listen to student thinking and provide support with thought provoking questions such as those below.

Students may use several strategies to solve this problem.

Some students may use 1 inch color tiles to create the whole, but may run into trouble dividing by a unit fraction. It is possible for students to use these manipulatives by assigning a fractional length to each tile. For example, students may decide that the length of each tile represents ¼, rather than 1. This presents its own challenges, but the struggle is where the learning happens.

Other students may use grid paper in the same manner presented above. A variety of grid sizes may be useful for this task.

FORMATIVE ASSESSMENT QUESTIONS

- *How can you tell that your answer is correct?*
- *How does this explain what is happening here? Show me your thinking.*
- *What kind of representation will you use to show your thinking?*
- *Did you develop a shortcut to find your answers?*
- *Did you identify any patterns or rules? Explain what you have found!*

After enough time has been devoted to the task, bring pairs of students together to share in groups of 4 to 6 students. As students share, listen for different explanations and look for different representations.

When students have finished the sharing, come back to the large group and begin the closing of the lesson. The goal of this closing is to help students make connections about areas of rectangles with fractional dimensions. Help students reach this goal, not by telling, but by asking thought provoking questions about the work.

Questions for Teacher Reflection

- How did my students engage in the 8 mathematical practices today?
- How effective was I in creating an environment where meaningful learning could take place?
- How effective was my questioning today? Did I question too little or say too much?
- Were manipulatives made accessible for students to work through the task?
- One positive thing about today's lesson and one thing you will change.

DIFFERENTIATION

- **Extension**

Students should work on contextual problems such as those found in Teaching Student Centered Mathematics, by John Van de Walle, pgs 172-177. Possible student representations are also presented in these pages. The problems in this section go beyond what Common Core GPS require of 5th grade students, but it is worth a look. The fractions in the division problems presented can easily be changed to unit fractions without sacrificing the quality of the context. Likewise the mixed numbers can easily be changed to whole numbers.

- **Intervention**

Students requiring intervention should also use contextual problems such as those found in Teaching Student Centered Mathematics, by John Van de Walle, pgs 172-177. Students should talk their way through the problems with teacher support and questioning. The problems in this section go beyond what Common Core GPS require of 5th grade students, but it is worth a look. The fractions in the division problems presented can easily be changed to unit fractions without sacrificing the quality of the context. Likewise the mixed numbers can easily be changed to whole numbers.

Technology

http://www.learner.org/courses/learningmath/number/session9/part_a/area_division.html *This resource is for teacher understanding.* This is another lesson about division of fractions. This is where students will be in sixth grade, but this is a great resource to build teacher understanding of fraction division.

http://www.k-5mathteachingresources.com/ this site offers simple contextual problems to use to extend and support students in their understanding of fraction computation and all problems are correlated to CCSS.

Practice Task - Dividing with Unit Fractions

1. The pizza slices served at Connor's Pizza Palace are ¼ of a whole pizza. There are three pizzas ready to be served. 14 children come in for lunch. Is there enough pizza for every child? Show your mathematical thinking.

2. I am building a patio. Each section of my patio requires 1/3 of a cubic yard of concrete. The concrete truck holds 2 cubic yards of concrete. How many sections can I make with the concrete in the truck? Show your mathematical thinking.

3. You have just bought 6 pints of Ben & Jerry's ice cream for a party you are having. If you serve each of your guests 1/3 of a pint of ice cream, how many guests can you serve? Show your mathematical thinking.

4. Lura has 4 yards of material. She is making clothes for her American Girl dolls. Each dress requires 1/6 yards of material. How many dresses will she be able to make from the material she has? Show your mathematical thinking.