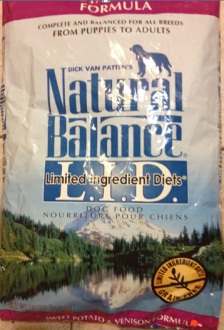
**Dividing Fractions**

This activity and the subsequent activities are designed to help students to structure their thinking so that they are afforded the opportunity to make sense of the idea of division of fractions. The goal of this collection of activities is to allow the division algorithm to emerge from quality thinking and reasoning about the mathematics needed to divide fractions. While students will engage in many (all?) of the Standards for Mathematical Practices, the primary practice that is the focus of these activities is Practice #8: Look for and express regularity in repeated reasoning. We hope that as a result of developing this, and the other, mathematical practices, division of fractions will become part of a well-connected network of understanding.

The activities in this series of lessons have just a few questions in each. However, each question will likely take much time and were designed to elicit much conversation, discussion, debate, explanation, etc. That is, students should be thinking deeply about what they are doing and why they are doing it. Teachers should be challenging students to explain what “it” means as students describe the methods they used to answer each question.

**Activity #1 – Focus on Proportional Reasoning**

Every morning when I wake up, I feed my two dogs, Tobie and Gracie. It seems like I am buying large bags of dog food so often that I wondered one morning…how many scoops of dog food do I deposit into their doggie dishes before running out of dog food?

I use a clear plastic cup (see picture) to scoop the dog food. I determined that it takes approximately 93 scoops (rounded to the nearest whole scoop) to exhaust the supply of dog food. I then need to go to the dog food store to buy a new 28 pound bag of food for Tobie and Gracie.

1. Draw a pair of line segments to represent the situation involving the number of scoops and the total amount of dog food in the bag. Label as much information on the segments as you can.

28 lbs

93 scoops

Imagine cutting the “scoops” line segment up into 93 equal parts. Also, imagine cutting the “pounds” line segment up into 93 equal parts.

93

93 scoops

93 scoops

2. If I cut the “scoops” line segment into \_\_\_\_\_\_\_\_\_\_\_\_\_ pieces, each piece represents

1

1/93

\_\_\_\_\_\_\_\_\_\_\_\_\_ copies of the total number of scoops or \_\_\_\_\_\_\_\_\_\_\_\_\_ scoops.

3. To keep the situation ***in proportion*** (you may want to discuss what this means), cut the

93

“pounds” line segment into \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_pieces where each piece represents

28/93

1/93

\_\_\_\_\_\_\_\_\_\_\_\_\_\_ copies of the total number of pounds of dog food or \_\_\_\_\_\_\_\_\_\_\_ pounds.

4. Represent, using fractions, the number of pounds of dog food that fit into one scoop. Explain how you know.

1. We are partitioning the 28 pounds into 93 equal parts. Therefore, we divide 28/93 to find how many pound of dog food in each scoop.

2. We need to find 1/93 copies of 28 pounds. That is, 1/93 \* 28 which is equivalent to 28/93.

3. Push the idea of scale factor.

**Activity 2 – The Dog Food Saga Continues**

In Activity 1, the number of scoops of dog food was rounded to the nearest whole number of scoops. In reality, it takes scoops before I run out of dog food and have to buy another 28 pound bag of dog food. As you respond to the items on this page, use fractions to represent all quantities.

1. Draw a pair of line segments to represent the situation involving the number of scoops and the total amount of dog food in the bag. Label as much information on the segments as you can.

92 3/4 scoops

28 lbs

Imagine cutting the “scoops” line segment up into equal parts. Also, imagine cutting the “pounds” line segment up into equal parts.



2. If I cut the “scoops” line segment into \_\_\_\_\_\_\_\_\_\_\_\_\_ pieces, each piece represents

1



\_\_\_\_\_\_\_\_\_\_\_\_\_ copies of the total number of scoops or \_\_\_\_\_\_\_\_\_\_\_\_\_ scoops.

3. To keep the situation ***in proportion*** (you may want to discuss what this means), cut the



“pounds” line segment into \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_pieces where each piece represents





\_\_\_\_\_\_\_\_\_\_\_\_\_\_ copies of the total number of pounds of dog food or \_\_\_\_\_\_\_\_\_\_\_ pounds.

4. Represent, using fractions, the number of pounds of dog food that fit into one scoop. Explain how you know. Simplify your result into a fraction of the form where *a* and *b* are whole numbers.

Answers will vary. Focus on meanings…focus on scale factor.

1.  Note that the idea of scaling and proportion are at the foundation of this response.

2. A student might observe that the denominator shows 371 copies of ¼ scoops (371(¼)). Using the idea of scale factor, they multiply numerator and denominator by 4 to scale up to full scoops - . That is, there are 112 pounds in 371 full scoops which is in proportion to 28 pounds in 371 quarter scoops. Then, students might express the number of pounds in just 1 scoop using the scale factor 1/371.



We can say that there are 112/371 pounds in one scoop of dog food. By the way…this is approximately 0.3 pounds per scoop.

**Activity 3 – Baking Cookies**

I love Cowboy Cookies. The recipe shown calls for cup of flour. At my house, measuring cups are hard to find and on the day I wanted to bake Cowboy Cookies, I could only find a cup measuring cup (see picture of my kitchen drawer). Describe how I can, as accurately as possible, measure cup of flour using only the cup measuring cup. Show and/or describe all reasoning needed to resolve the situation.



We need to determine how many 1/2 cups are in 2/3 cup. That is, how many copies of 1/2 are in 2/3? This is a division problem!



At this stage, students are encouraged to think about this using the idea of the scale factor.



There are 4/3 copies of 1/2 in 2/3. To make the cookies, 4/3 or 1 and 1/3 copies of 1/2 cup are required. That is, one would have to add 1 full ½ cup of flour plus an additional 1/3 of a full ½ cup.

Another strategy involving common denominators:



Students may think: how many 3/6 are in 4/6? With a multiplicative understanding of fraction, we have 3 copies of 1/6 and 4 copies of 1/6. So, we can think: how many copies of 3 are in 4?

**Activity 4 – Coffee Blends**

Some people like to create their own coffee blends by mixing together different kinds of freshly roasted and ground coffee beans. One website, www.thecaptainscoffee.com, recommends different blends for people to try. One such blend is shown.



Suppose a person has pounds of Ethiopian Harrar coffee that they wish to blend with Sumatran Mandeling (of which they have abundant supply). How many pounds of this blend can be made?

For every pound of the blended coffee, we will havelbs. of Sumatran Mandheling and lbs. of Ethiopian Harrar. The question becomes: how many lbs. are in pounds?



Note the idea of scaling. We can continue scaling:



We can make or pounds of coffee.