

# Rational Number Project

<b>Fraction Operations and Initial Decimal Ideas</b> <b>Lesson 25: Overview</b>	<b>Materials</b> <ul style="list-style-type: none"><li>• Student Pages A - D</li></ul>
Students draw pictures to solve measurement division story problems. Students explain their solution strategies. Story problems involve whole numbers divided by a fraction $< 1$ ; mixed numbers divided by a fraction $< 1$ ; fraction $< 1$ divided by another fraction $< 1$ . All answers are whole numbers.	

## Teaching Actions

### Warm Up

Draw a picture of a number line and use it to solve  $\frac{2}{3} \times \frac{1}{4}$ . Be ready to explain your thinking.

### Large Group Work

1. Present this story problem using whole numbers:

Addis works as a baker. She bought 50 pounds of flour. It is easier to use if she repackages the flour into smaller containers. Each container holds 5 pounds of flour. How many containers can she make with the 50 pounds of flour?

2. Ask: What do you imagine when solving this problem? What question are you answering? [How many 5's in 50?] What number sentence represents the action in this story problem? [ $50 \div 5 = 10$ ]
3. Repeat for this example and ask students what picture might be used to solve the problem.

You have 12 pounds of peanuts. You package them into 3-pound bags. How many bags?

## Comments

Consider these last 4 lessons on fraction division as a problem solving opportunity for students. Students are not directly taught how to divide fractions but are asked to solve division story problems using pictures. Students use their understanding of the part-whole model for fractions and the role of the unit to construct their own strategy for solving division tasks.

The measurement model is being used to develop fraction division. In measurement division the amount in each group is known as well as the total amount. What students are finding is the number of groups.

In the first example students should imagine constructing 5-pound containers; they are finding out "How many 5 pounds in 50 pounds? This is the question we want students to consider when dividing 3 pounds into groups of  $\frac{1}{3}$  pounds. "How many  $\frac{1}{3}$  pounds in 3 pounds?"

## Teaching Actions

### Small Group/Partner Work

4. Explain that each pair of students will receive 3 problems to solve. These are on Student Pages A and B. Students are to draw a picture to model each problem. (These problems are all whole numbers divided by a fraction with a whole number answer).

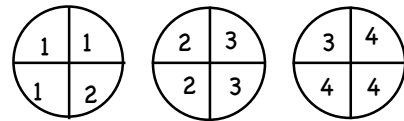
### Large Group Work

5. After giving students 10 - 15 minutes to solve the problems, call the group back together. Call on students to explain how to draw pictures to solve each problem.
6. When the presentations are done, look at the pictures of each solution and ask:
  - How are the solutions strategies similar?
  - What question were you answering in each one?
  - What type of number was each answer?
7. Step back and ask:
  - What number sentence matches each problem?
  - Is it addition, subtraction, multiplication or division?
  - How do you know?
  - In what way are these problems similar to the first problem of the day?
  - How are they different?

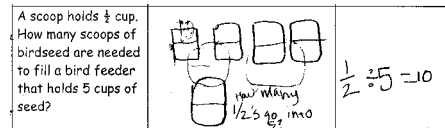
## Comments

As students work in groups move among the groups asking students to explain how the fraction circles help them solve the problem.

Identify students to present their solutions to the whole group. Look for students who solved the problem by portioning the whole number part into fractional parts. See example below: See Teacher Notes for Lesson 25 for examples of students' work on these problems.



Most students will solve the problem by drawing a picture to show the amount to be partitioned first. Consider this student's solution to a homework problem. She drew 5 rectangles to represent the 5 cups. Then she partitioned the 5 units into halves and ask: How many  $\frac{1}{2}$ 's go into 5?



The following student drew a different picture. He used a repeated addition idea of adding up  $\frac{1}{2}$ 's to reach 5. In both cases the students determined the answer to be 10 scoops. But we did notice students who drew a picture showing repeated addition often made mistakes counting up. During student presentations we did move students to use the strategy of drawing the picture of the amount to

## Teaching Actions

8. Say: Let's record the division sentence under each picture. [Also record the question: How many \_ are in \_?]
9. Ask students to look at the picture for problem 1. Comment on how the students partitioned the 3 whole circles into fourths to see more easily how many  $\frac{3}{4}$ 's cups of birdseed could be taken from 3 cups. Record as:  $3 \div \frac{3}{4} = 4$  and  $\frac{12}{4} \div \frac{3}{4} = 4$ .
10. Note that students might write the division sentence incorrectly. In the examples at the right, students wrote  $\frac{1}{2} \div 5$  instead of  $5 \div \frac{1}{2}$ .
11. Repeat for the other problems. (See Additional Notes to the Teacher for lesson 25 for examples of students' pictures to solve division problems).

## Small Group/Partner Work

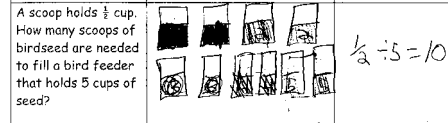
12. Send students back to work in their groups on Student Pages C and D. Direct students to use pictures to solve each problem.

## Wrap Up

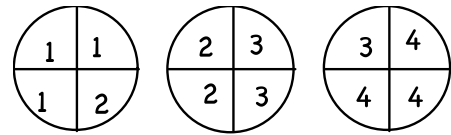
13. Share again in large group; draw pictures, write number sentence; rewrite the number sentence to show the whole being divided into fractional parts.

## Comments

be shared first. Notice in problem set II we encourage this strategy by providing students with the pictures.



How many  $\frac{3}{4}$ 's in 3?

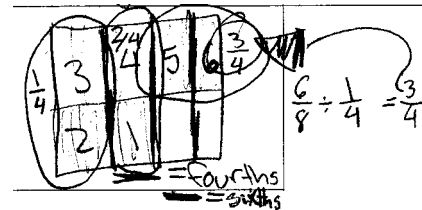


$$3 \div \frac{3}{4} = 4$$

$$\frac{12}{4} \div \frac{3}{4} = 4$$

At this point you are just making the observation that the picture could also be recorded in its equivalent form with same denominators.

A common error is noted in this student's work. Instead of stating the answer as 3 the student writes  $\frac{3}{4}$ .



The problems on Student Pages C and D are fractions divided by fractions. The answer is still a whole number. In the next lesson, students solve problems where the answer involves a fraction.

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**Teaching Actions****Comments**

14. End the lesson with this problem:  $1\frac{1}{2} \div \frac{1}{4}$

15. Ask: What question should you think of to find the answer? [How many  $\frac{1}{4}$ 's are there in  $1\frac{1}{2}$ ? What picture can you draw to solve the problem? What other number sentence can describe the picture?

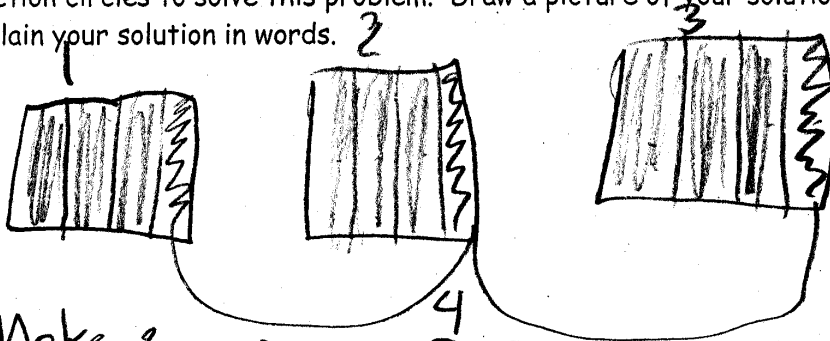
**Translations:**

- Real life to pictures to verbal
- Real life to pictures to symbols
- Pictures to symbols to symbols

**Additional Teacher Notes**  
**Lesson 25**

Students were creative in how they solved division story problems even though they received limited instruction initially on how to solve these problems. Students drew pictures of circles, rectangles and number lines. They intuitively understood to change the picture so they could count out fractional amounts. Examples from students' work are shown below.

1) A scoop holds  $\frac{3}{4}$  cup. How many scoops of birdseed are needed to fill a bird feeder that holds 3 cups of birdseed? Show how to use pictures of fraction circles to solve this problem. Draw a picture of your solution below. Explain your solution in words.

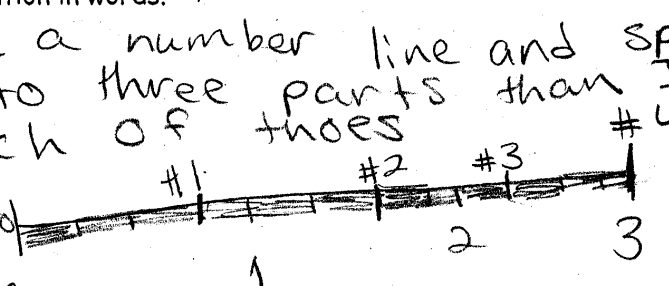


Make 3 groups of  $\frac{3}{4}$  and there are 3 sets with  $\frac{1}{4}$  left in each group so  $3 \times \frac{1}{4} = \frac{3}{4}$  so there are 4 sets of  $\frac{3}{4}$ .

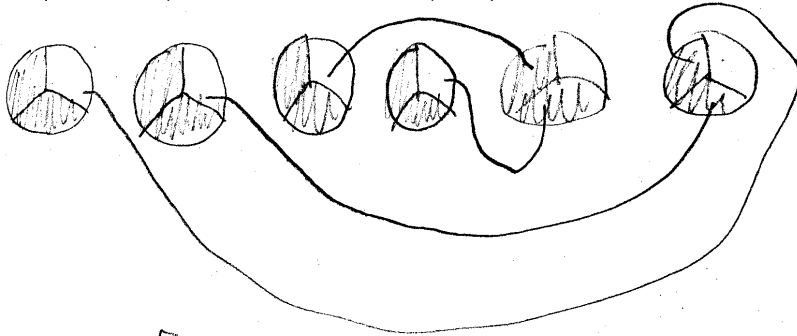
1) A scoop holds  $\frac{3}{4}$  cup. How many scoops of birdseed are needed to fill a bird feeder that holds 3 cups of birdseed? Show how to use pictures of fraction circles to solve this problem. Draw a picture of your solution below. Explain your solution in words.

I made a number line and split it into three parts then I cut each of those parts into fourths.

Then I made one fourth. I kept doing this and figured out there was 4 scoops.

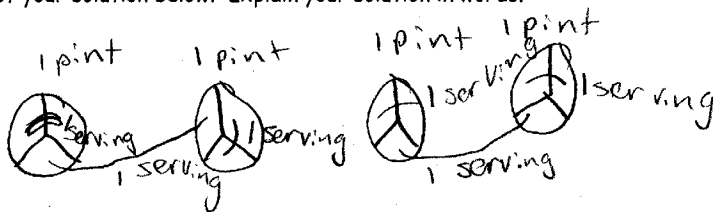


2) You bought 4 pints of ice cream from Ben and Jerry's for your party. You plan on serving each friend about  $\frac{2}{3}$  of a pint. How many servings can you dish out? Show how to use pictures of fraction circles to solve this problem. Draw a picture of your solution below. Explain your solution in words.



6 servings  
 because you can have  $4\frac{2}{3}$  so  
 start out with because  $\frac{2}{3}$  is  
 less than 1, so if you  
 make 2 more  $\frac{2}{3}$  you can fill in  $\frac{4}{3}$   
 the  $\frac{4}{3}$  missing with the other 3.

2) You bought 4 pints of ice cream from Ben and Jerry's for your party. You plan on serving each friend about  $\frac{2}{3}$  of a pint. How many servings can you dish out? Show how to use pictures of fraction circles to solve this problem. Draw a picture of your solution below. Explain your solution in words.

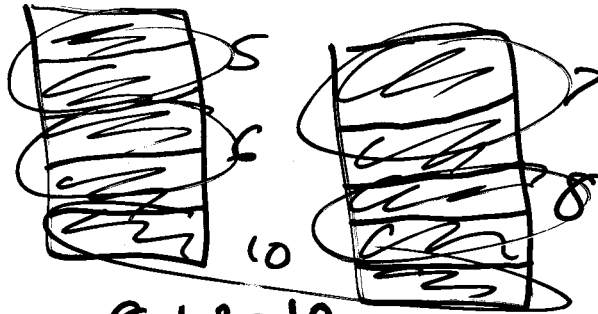


I made four fraction circles  
 each for 1 pint. Then I split  
 it into thirds. I counted out  
 the servings and there are 6.

You have 4 cups of lemonade concentrate. If you mix  $\frac{2}{5}$  of a cup of concentrate with a gallon of water to make a pitcher of lemonade how many pitchers can you make with 4 cups of concentrate?

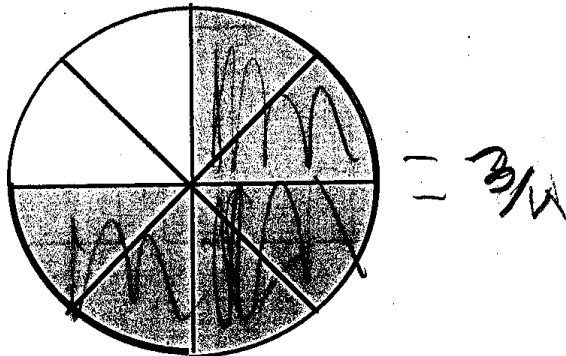
$$4 \div \frac{2}{5} = ?$$

$$\frac{20}{3} \div \frac{2}{5} = 10$$



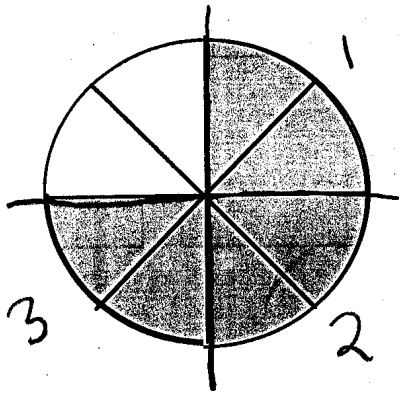
$$8 + 2 = 10$$

2) What if Kia only had  $\frac{5}{8}$  of a pound of peppermint candies and she makes small bags, each about  $\frac{1}{4}$  of a pound. How many small bags of candies can she make?

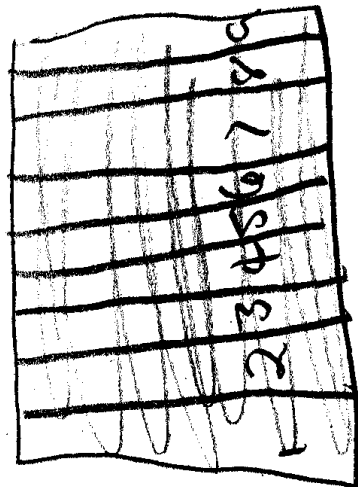
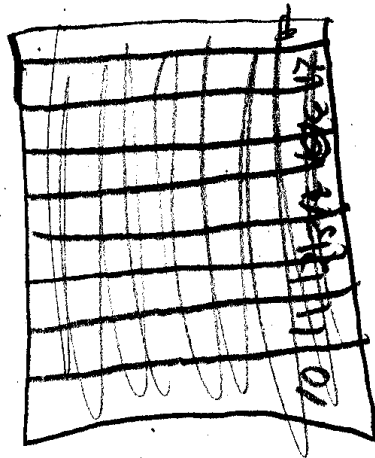


2) What if Kia only had  $\frac{6}{8}$  of a pound of peppermint candies and she makes small bags, each about  $\frac{1}{4}$  of a pound. How many small bags of candies can she make?

she can make 3 small bags of peppermint candies

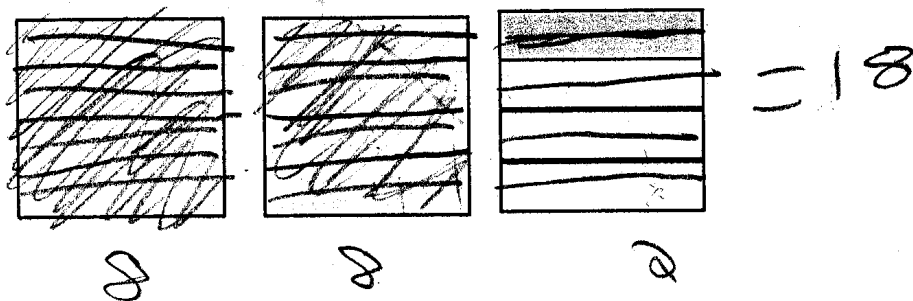


4) Show the fraction  $2\frac{1}{3}$ . How many  $\frac{1}{9}$ 's are in that amount? Draw a picture to solve this problem. Use a rectangle as the unit.



~~20~~  $\frac{1}{9}$  are in  $2\frac{1}{3}$

1) Kia has  $2\frac{1}{4}$  pounds of peppermint candies. She wants to put them in small bags, each about  $\frac{1}{8}$  of a pound. How many small bags of candies can she make?



Draw a picture of a number line  
and use it to solve  $\frac{2}{3} \times \frac{1}{4}$ . Be ready  
to explain your thinking.



- 3) You have 4 cups of lemonade concentrate. If you mix  $\frac{2}{5}$  of a cup of the concentrate with a gallon of water you make a pitcher of lemonade. How many pitchers of lemonade can you make with those 4 cups of concentrate? Show how to use pictures to solve this problem. Draw a picture of your solution below. Explain your solution in words.

Questions to ponder:

1. How are the solution strategies you used to solve each problem similar?
2. What type of number was each answer?

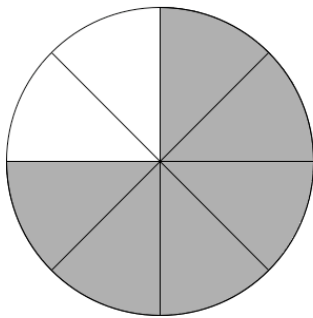
**Problem Set II**

Use the pictures to solve each problem.

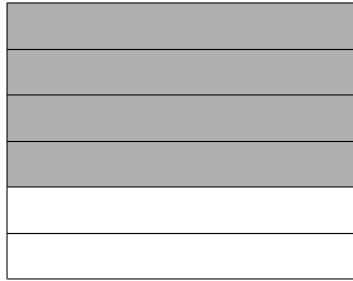
- 1) Kia has  $2\frac{1}{4}$  pounds of peppermint candies. She wants to put them in small bags, each about  $\frac{1}{8}$  of a pound. How many small bags of candies can she make?



- 2) What if Kia only had  $\frac{6}{8}$  of a pound of peppermint candies and she makes small bags, each about  $\frac{1}{4}$  of a pound. How many small bags of candies can she make?



- 3) You have  $\frac{4}{6}$  of a cup of lemonade concentrate. If you mix  $\frac{1}{3}$  of a cup of the concentrate with a quart of water you make a small pitcher of lemonade. How many pitchers of lemonade can you make?



- 4) Show the fraction  $2\frac{1}{3}$ . How many  $\frac{1}{9}$ 's are in that amount?  
Draw a picture to solve this problem. Use a rectangle as the unit.

## Post Lesson Reflection

Lesson \_\_\_\_\_

1) Number of class periods allocated to this lesson: \_\_\_\_\_

2) Student Pages used: \_\_\_\_\_

3) Adaptations made to lesson: (For example: added extra examples, eliminated certain problems, changed fractions used)

4) Adaptations made on Student Pages:

5) To improve the lesson I suggest: