The Doorbell Rang

After reading *The Doorbell Rang* by Pat Hutchins, students explore fractional representations for a set of cookies. Students communicate their thinking through discussion, writing, and modeling.

Levels

- Grades 3 through 5

Topics

- Interpreting fractions in context
- Fraction models
- Unit fractions
- Benchmark fractions
- Fraction equivalence
- Adding with like denominators
- Multiplying whole numbers and fractions
- Adding with unlike denominators

Goals

- Students will be able to explain the meaning of numerator and denominator.
- Students will be able to order unit fractions and place them along a number line.
- Students will be able to correctly determine fractions of a set.
- Students will be able to identify equivalent fractions using common unit fractions.
- Students will be able to add fractions with common denominators.
- Students will understand that multiplying a fraction by a whole number can be understood as repeated addition.
- Students will begin to explore addition with unlike denominators and use estimation of sums.

Prerequisite Knowledge

- Students should recognize that fractions represent parts of a whole. Students should recognize and work with the benchmark fraction 1/2.

Preparation Time up to 1 hour

Activity Time five 30 to 60 minute lessons.

Materials

- a copy of "The Doorbell Rang" by Pat Hutchins
- chart paper
- a blank number line from 0 to 1 (approximately 2 meters long)
- bags of cookie cereal with 12 pieces (one for each student)
- counters (24 per student)
- sheets of manila paper (1 per student)
- copies of activity handouts (1 set per student)

Authors Cheryl A. Nix and Amanda Katharine Serenevy

Additional Resources

- illuminations.nctm.org/activities (requires access to computers)
  - Equivalent Fractions: number line and area models
  - Fraction Models: length, area, and set models
  - Fraction Game: number line model
- Illuminations.nctm.org/lessons
  - Fractional Clothesline: number line
  - A Meter of Candy: set model
- www.nsa.gov/academia
  - select MEPP
  - select Concept Development Units/Elementary/Fractions "Flying Through Fractions"

Lesson 1: Unit Fractions with a Set Model and Number Line

Read aloud *The Doorbell Rang* by Pat Hutchins. After the first page, ask students "How many cookies are on the plate?". Ask students "How many cookies will Victoria and Sam each have if they *shared them equally*?". State that there is one plate of cookies being shared by two people.

When the doorbell rings, have students anticipate what is about to happen. When Tom and Hannah arrive, ask students what happens to the cookies. State that there is one plate of cookies being shared by four people. Students may begin to talk about how each person has fewer cookies to eat.

Continue this each time "the doorbell rings".

After the book is read, hand out the manila paper to each student. Make sure the number line is on the board and have chart paper ready.

Hand out the bags of "cookies". If using cereal, tell students they need to wait to eat them until the activity is complete. Ask students to determine what $\frac{1}{2}$ of the bag of cookies would be. Students should use their cookies to help them. Have students share their ideas with a partner. When students are ready, write $\frac{1}{2}$ of 12 cookies is _____ cookies. Have students share the results.

Discuss what the fraction $\frac{1}{2}$ means in this situation. Lead students to recognize that the denominator tells how many groups the batch will be divided into (2 groups in this case), and that the numerator tells how many groups will be given to Victoria (1 of the groups in this case). It may be helpful to hold up the picture from the book that demonstrates this idea.

Continue this with $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{12}$.

Have these fractions written on 3×5 cards and invite students to place them along the number line between 0 and 1. Ask students "Which fraction is the smallest? Which fraction is the largest?" Have students explain why $\frac{1}{4}$ would be smaller than $\frac{1}{2}$ even though 4 is larger than 2.

Hand out Activity 1 and allow students to enjoy their treat as they complete the tasks on the page.

Lesson 2: Addition with Like Denominators and Creating Equivalent Fractions

Have a large chart of the students' fraction table ready for the class. Have the number line from lesson 1 on the board.

Have students work with a partner to share their writing and their pictures from day 1.

Hand out Activity 2 and ask students to write as many fractions as they remember (or can reconstruct) from lesson 1. Call on students to supply fractions and numbers of cookies for the classroom chart.

Using the manila paper and markers, crayons, or pencils, have students draw a picture that would show $\frac{1}{3}$ of the batch of cookies. Discuss the results and write this fraction on a 3×5 card and have students decide where to place this fraction on the number line.

Ask students how their picture would change if they wanted to know how much $\frac{2}{3}$ of the 12 cookies would be. Have students share their thinking. Lead students to the understanding that they are adding $\frac{1}{3} + \frac{1}{3}$ and that they are looking for 2 of the 3 equal groups. If Victoria gets to eat $\frac{2}{3}$ of the batch of cookies, how many cookies would she get? What if she gets $\frac{3}{3}$ of the cookies? Add these fractions to the chart.

Have students continue this for the other fractions. For example: $\frac{2}{4}$, $\frac{3}{4}$, $\frac{3}{6}$, $\frac{4}{6}$, $\frac{6}{12}$. (Note: Have counters available for students to use to help them find these fractions.) Have students write addition sentences, using unit fractions, for each of these fractions. Place these fractions along the number line and discuss the idea of *equivalent fractions*.

Lesson 3: Equivalent Fractions

Review lesson 2 by asking students to give an example of a fraction equivalent to $\frac{1}{2}$. Discuss why these fractions are equivalent. Answers may include their location on the number line and that they represent the same number of cookies.

Using a picture, have students show $\frac{5}{6}$ of the set of 12 cookies. Have students write the addition sentences with like denominators that would equal this fraction. Addition sentences could be $\frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6}$ or $\frac{1}{6} + \frac{4}{6}$, etc.

Have students work with a partner to find a fraction equivalent to this number. Encourage students to consider the number line and their list of fractions on the table as well as their addition sentences. Have students share their thinking when they discover that $\frac{10}{12}$ is equivalent.

Have students place all new fractions onto the table.

Give each pair of students 24 counters. Hand out Activity 3. Have students work on their own to complete the tasks and find equivalent fractions and write addition sentences. When done, have students compare results with a partner.

Discuss the results as a class.

Lesson 4: Multiplication of Whole Numbers and Fractions

Place this addition sentence on the board: $6 + 6 + 6 + 6 = 24$. Ask students if there would be another way to find this solution. Accept all reasonable ideas, but be sure to lead students to the multiplication sentence $4 \times 6 = 24$.

Place this addition sentence on a chart: $\frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} =$

Have students give the solution. Discuss the idea that adding a number five times means the same as multiplying by 5. Write "Each of the 5 children were given $\frac{1}{6}$ of the batch of cookies" and ask students

what fraction of the cookies the children ate. Lead students to understand that the solution is $\frac{5}{6}$, and then write $5 \times \frac{1}{6} = \frac{5}{6}$.

Write "Each of the 3 children were given $\frac{1}{4}$ of the batch of 12 cookies. How many cookies did the 3 children eat?" (Solution: 9 cookies)

Have students work with a partner to think about an addition and a multiplication sentence for this problem and the correct solution.

Have students work in teams of 3 or 4 to create at least four questions. Provide manila paper and markers. Teams should write the problems on one side of the paper and the addition and multiplication sentences on the back. Students can work with a batch of 12 cookies or with a batch of 24 cookies. (Note: have counters available for student use.)

Hang the problems around the room or have teams exchange problems.

Teams should compare their work with the solutions on the back of the paper.

Circulate the room as teams work to clarify any confusion.

Lesson 5: Addition with Unlike Denominators

Ask students to think about and then discuss the following question: "If Mary took $\frac{1}{2}$ of the batch of 12 cookies and Andre took $\frac{1}{3}$ of the batch of 12 cookies, how many cookies did they take? What fraction of the batch did they eat altogether?" (Solution is 10 cookies which is $\frac{5}{6}$ of the batch.)

Before students find the solution, have students look at the number line and estimate the fraction. Have them use 0, $\frac{1}{2}$, and 1 as benchmarks. Ask them "What number will be closest to the sum?" Have students share their reasoning and accept all answers that correctly explain why the sum should be close to one whole. It is important for them to practice estimation in order to become familiar with reasonable solutions.

Have students find the number of cookies and the fraction of the whole batch. Students may draw pictures, use objects or use the table of fractions from earlier lessons. Have students share their results with partners and explain their reasoning.

Hand out "cookie sheets" (pieces of manila paper), and Activity 4. Have students work in teams to find solutions.

Note: Allow students to invent their own strategies.

Lesson 6: Finding Common Denominators

During Lesson 5, some students may have come developed the strategy of adding fractions by changing them to equivalent fractions with the same denominator. If so, have these students discuss this idea with the class. If not, pose this question: "I wanted to keep $\frac{1}{3}$ of a batch of cookies and you wanted to keep $\frac{1}{6}$ of

the batch of 12 cookies. What fraction of the cookies will we take?" Have students estimate the solution using the number line. Invite students to write the fraction addition problem and then ask them to find the solution using strategies they did in the lesson before. After students find that the solution is $\frac{3}{6}$, ask this question: "How can we change these fractions so it's really easy to add them, like we did before when the denominators were the same?" Have the fraction table chart posted prior to this question and allow students time to think about the question and discuss ideas with a partner.

Students should notice that $\frac{1}{3}$ is equivalent to $\frac{2}{6}$ and so the problem could be changed to $\frac{2}{6} + \frac{1}{6}$ which is $\frac{3}{6}$. Have students use this strategy with the work from the prior lesson and verify that they are able to find the correct sums.

Have students work with a partner to create their own questions using a batch of 24 cookies. Each team should try to write two questions on manila paper. On separate paper, the solution should be given with pictures and with numbers.

Have students hang their solutions behind their problems, and have students take a problem solving "journey" around the classroom.

The Doorbell Rang by Pat Hutchins: Activity 1

1. Victoria and Sam each want to have $\frac{1}{2}$ of the batch of cookies. How many cookies will they each have? *Draw a picture and explain the answer in words.*

2. Victoria wants $\frac{1}{2}$ of the batch of cookies. In this situation, what does the denominator 2 mean?

3. Victoria wants $\frac{1}{2}$ of the batch of cookies. In this situation, what does the numerator 1 mean?

4. When Hannah and Tom arrive, what fraction of the cookies will each child have if they share them equally? *Draw a picture to show how they will share the batch of 12 cookies.*

5. When Peter and his little brother arrive, there are now 6 children sharing the batch of cookies. *Draw a picture to show that they each have* $\frac{1}{6}$ *of the cookies.*

Activity 2

Write the fractions you find and the number of cookies in the table

Fractions of one batch of 12	Number of cookies

Fractions of one batch of 12	Number of cookies

The Doorbell Rang by Pat Hutchins: Activity 3

Grandma arrived with 24 cookies! Find the number of cookies for each fraction below if one batch has 24 cookies instead of 12. Use counters or pictures to help you.

1.

fraction	number of cookies
$\frac{1}{2}$	
$\frac{1}{3}$	
$\frac{1}{4}$	
$\frac{1}{6}$	
$\frac{1}{8}$	
$\frac{1}{12}$	

2. Write addition sentences for each fraction below and then add these fractions to the table.

   (a) $\frac{3}{4}$

   (b) $\frac{3}{6}$

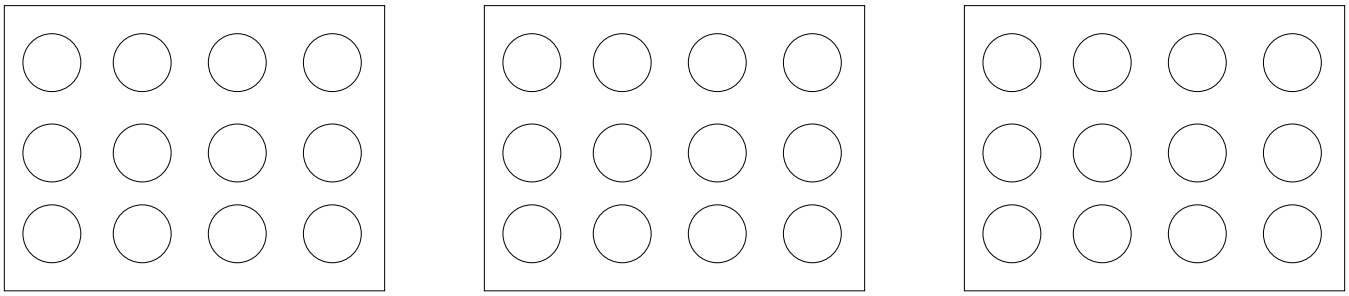
   (c) $\frac{4}{8}$

   (d) $\frac{3}{12}$

3. What *equivalent fractions* did you find?

The Doorbell Rang by Pat Hutchins: Activity 4

Use counters or these cookie sheets to help you answer the questions.



1. Sam took one third of the cookies on a sheet and Thomas took one fourth of them.

   (a) How many cookies did they take all together?

   (b) What fraction of the cookies on the sheet did they take?

   (c) What fraction of the cookies were left?

2. Joy asked for one sixth of the cookies on one sheet. Simon asked for seven twelfths of the cookies on a sheet.

   (a) How many cookies did they take all together?

   (b) What fraction of the cookies on the sheet did they take?

   (c) What fraction of the cookies were left?

3. Victoria wanted one third of the cookies on a sheet. Peter wanted one sixth of the cookies on the sheet.

   (a) How many cookies did they take all together?

   (b) What fraction of the cookies on a sheet did they take?

   (c) What fraction of the cookies were left?

The Doorbell Rang by Pat Hutchins: Activity 1
KEY

1. Victoria and Sam each want to have $\frac{1}{2}$ of the batch of cookies. How many cookies will they each have? *Draw a picture and explain the answer in words.*

PICTURE SHOULD SHOW TWO EQUAL GROUPS OF SIX.

2. Victoria wants $\frac{1}{2}$ of the batch of cookies. In this situation, what does the denominator 2 mean?

   THE BATCH OF COOKIES IS DIVIDED INTO TWO EQUAL GROUPS

3. Victoria wants $\frac{1}{2}$ of the batch of cookies. In this situation, what does the numerator 1 mean?

   VICTORIA WANTS ONE OF THE EQUAL GROUPS.

4. When Hannah and Tom arrive, what fraction of the cookies will each child have if they share them equally? *Draw a picture to show how they will share the batch of 12 cookies.*

PICTURE SHOULD SHOW THAT THERE ARE 4 EQUAL GROUPS OF 3. THE FRACTION IS $\frac{1}{4}$.

5. When Peter and his little brother arrive, there are now 6 children sharing the batch of cookies. *Draw a picture to show that they each have $\frac{1}{6}$ of the cookies.*

PICTURE SHOULD SHOW 6 EQUAL GROUPS OF 2.

Activity 2
KEY

Write the fractions you find and the number of cookies in the table

ANSWERS MAY VARY

Fractions of one batch of 12	Number of cookies
$\frac{1}{2}$	6
$\frac{2}{2}$	12
$\frac{1}{3}$	4
$\frac{2}{3}$	8
$\frac{3}{3}$	12

Fractions of one batch of 12	Number of cookies
$\frac{1}{4}$	3
$\frac{2}{4}$	6
$\frac{3}{4}$	9
$\frac{4}{4}$	12
$\frac{1}{6}$	2
$\frac{2}{6}$	4
$\frac{3}{6}$	6
$\frac{4}{6}$	8
$\frac{5}{6}$	10
$\frac{6}{6}$	12
$\frac{1}{12}$	1
$\frac{2}{12}$	2
$\frac{4}{12}$	4
$\frac{6}{12}$	6
$\frac{10}{12}$	10

The Doorbell Rang by Pat Hutchins: Activity 3
KEY

Grandma arrived with 24 cookies! Find the number of cookies for each fraction below if one batch has 24 cookies instead of 12. Use counters or pictures to help you.

1.

fraction	number of cookies
$\frac{1}{2}$	**12**
$\frac{1}{3}$	**8**
$\frac{1}{4}$	**6**
$\frac{1}{6}$	**4**
$\frac{1}{8}$	**3**
$\frac{1}{12}$	**2**

2. Write addition sentences for each fraction below and then add these fractions to the table.
ANSWERS VARY

(a) $\frac{3}{4} = \mathbf{\frac{1}{4} + \frac{1}{4} + \frac{1}{4}}$

(b) $\frac{3}{6} = \mathbf{\frac{1}{6} + \frac{1}{6} + \frac{1}{6}}$

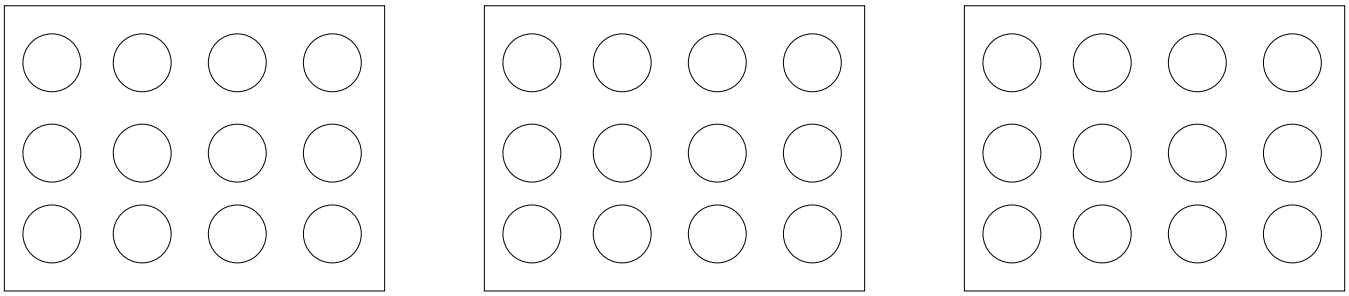
(c) $\frac{4}{8} = \mathbf{\frac{2}{8} + \frac{2}{8}}$

(d) $\frac{3}{12} = \mathbf{\frac{1}{12} + \frac{2}{12}}$

3. What *equivalent fractions* did you find?
ANSWERS VARY
$\mathbf{\frac{1}{2} = \frac{3}{6} = \frac{4}{8}}$; $\mathbf{\frac{1}{4} = \frac{3}{12}}$

The Doorbell Rang by Pat Hutchins: Activity 4
KEY

Use counters or these cookie sheets to help you answer the questions.



1. Sam took one third of the cookies on a sheet and Thomas took one fourth of them.

   (a) How many cookies did they take all together? **7**

   (b) What fraction of the cookies on the sheet did they take? $\mathbf{\frac{7}{12}}$

   (c) What fraction of the cookies were left? $\mathbf{\frac{5}{12}}$

2. Joy asked for one sixth of the cookies on one sheet. Simon asked for seven twelfths of the cookies on a sheet.

   (a) How many cookies did they take all together? **9**

   (b) What fraction of the cookies on the sheet did they take? $\mathbf{\frac{9}{12}}$ **OR** $\mathbf{\frac{3}{4}}$

   (c) What fraction of the cookies were left? $\mathbf{\frac{3}{12}}$ **OR** $\mathbf{\frac{1}{4}}$

3. Victoria wanted one third of the cookies on a sheet. Peter wanted one sixth of the cookies on the sheet.

   (a) How many cookies did they take all together? **6**

   (b) What fraction of the cookies on a sheet did they take? $\mathbf{\frac{6}{12}}$ **OR** $\mathbf{\frac{1}{2}}$

   (c) What fraction of the cookies were left? $\mathbf{\frac{6}{12}}$ **OR** $\mathbf{\frac{1}{2}}$