

FRACTIONS: EASY AS PIE!

Grade Level: 4th Grade

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Length of Unit: 7 lessons

I. ABSTRACT

This unit, "Fractions: Easy as Pie!" is intended to teach every content skill in the *Core Knowledge Sequence* by using developmental, practice, and problem-solving activities. The fraction activities will include concrete, pictorial, and symbolic methods of utilizing fraction circles. Once the basic concepts in each lesson are introduced, teachers are encouraged to supplement the lessons with the textbook or other resources as needed. In this way teachers are allowed flexibility, as they may want to spend several days on one lesson objective.

II. OVERVIEW

A. Concept Objective:

1. The students will use fraction circles to create fractions and solve problems concretely, pictorially, and symbolically.
2. The students will practice writing skills by keeping a Math journal with daily writing assignments.

B. Content from the *Core Knowledge Sequence*

1. Recognize fractions to one-twelfth
2. Identify numerator and denominator
3. Write mixed numbers, and change improper fractions to mixed numbers
4. Recognize equivalent fractions
5. Put fractions in lowest terms
6. Rename fractions with unlike denominators to fractions with common denominators
7. Compare fractions with like and unlike denominators, using the signs $<$, $>$, and $=$
8. Solve problems in the form of $2/3 = ?/12$

C. Skill Objectives:

1. The students will identify the fractions represented by the shaded part of a given shape or picture that represents a fraction (halves through twelfths).
2. The students will identify equivalent fractions and mixed numbers.
3. The students will rename improper fractions as mixed numbers and vice versa.
4. The students will compare fractions or mixed numbers through twelfths.
5. The students will order a series of fractions and/or mixed numbers from least to greatest or vice versa.
6. The students will find the sum of two fractions or mixed numbers with like denominators without regrouping.
7. The students will solve real-world problems, the solution of which requires a basic understanding of fractions.

III. BACKGROUND KNOWLEDGE

A. For Teachers:

1. Hirsch Jr., E. D. *What Your Fourth Grader Needs to Know*. Core Publications, Inc., 1992. 0-385-31260-1.

B. For Students:

1. Addition
2. Subtraction
3. Multiplication
4. Division with remainders

5. Patterning

IV. RESOURCES

- A. Any fraction resources can be utilized to supplement this unit.

V. LESSONS

Lesson One: Introduction to Fractions

A. *Daily Objectives:*

1. Concept Objectives:
 - a. The students will use fraction circles to create fractions and solve problems concretely, pictorially, and symbolically.
 - b. The students will practice writing skills by keeping a daily Math journal.
2. Lesson Content:
 - a. The students will recognize that fractions are part of a whole number.
3. Skill Objectives:
 - a. The students will construct fractions in halves, thirds, fourths, sixths, eighths, and twelfths.
 - b. The students will explain what the numerator and the denominator in a written fraction represent.

B. *Materials:*

1. Fraction circles of different colors for each student (white-whole, orange-halves, yellow thirds, green-fourths, blue-sixths, red-eighths, purple-twelfths) *Note: pieces are not labeled $\frac{1}{4}$, etc., to allow natural discovery

C. *Key Vocabulary:*

1. Fraction: Equal parts to a whole, derived from a Latin word meaning "to break"
2. Numerator: the top number of a fraction that tells the number of equal parts compared to the number of equal parts in a whole
3. Denominator: the bottom number of a fraction that tells the number of equal parts in the whole
4. Whole number: a complete amount lacking no part, member, or element

D. *Procedures/Activities:*

1. Ask the students if they were really hungry, would they want a $\frac{1}{4}$ -pound hamburger from McDonald's or a $\frac{1}{3}$ pound hamburger from Burger King if the hamburgers were the same price. Discuss their answers and explanations for their choices.
2. Have the students take out a sheet of paper and draw a picture of what the white circle looks like. Tell them that a fraction is part of a whole. Explain that the numerator is the top number, and the denominator is the bottom number in a fraction. Explain that the numerator is the individual pieces of one color and the denominator is the number of the same color pieces that make up the whole circle. Use the orange halves to illustrate this.
3. Have the students manipulate the orange parts to make the whole. Ask them to draw a picture of what the orange parts look like when they make the whole. Next to the picture ask them to write the fraction for one part of the whole, and the fraction for all parts of the whole.
4. Follow the same procedure as #3 with each color in this order: yellow, green, blue, red, and purple.
5. Ask the students to discuss in small groups and answer the following questions on paper: "What patterns do you see for the fractions under each piece?" and "What patterns do you see for all of the fractions that make up the whole?" Discuss these questions as a class after the small groups have had time to discuss.

E. *Assessment/Evaluation:*

1. The students will write a paragraph in their Math journal answering the following

- question with a detailed explanation as to their reasoning: "If you were really hungry, and I offered you a choice between $\frac{1}{2}$ of a pizza or $\frac{1}{12}$ of a pizza, which one would you choose? Why?"
2. The students will draw pictures and shade $\frac{1}{2}$ of a pizza and $\frac{1}{12}$ of a pizza. They should label each pizza with the fraction.
 3. The students will create and write a story problem for a friend to solve using fractional parts on a sheet of paper. They will trade papers and solve.

Lesson Two: Ordering and Comparing Fractions

A. *Daily Objectives:*

1. Concept Objectives:
 - a. The students will use fraction circles to create fractions and solve problems concretely, pictorially, and symbolically.
 - b. The students will practice writing skills by keeping a daily Math journal.
2. Lesson Content:
 - a. The students will order and compare fractions.
3. Skill Objectives:
 - a. The students will show the fractions $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{8}$, and $\frac{1}{12}$ in order from least to greatest concretely, pictorially, and symbolically.
 - b. The students will compare fractions symbolically using $>$, $<$, and $=$.

B. *Materials:*

1. Fraction circles (one piece of each color used in Lesson One)
2. White construction paper 12"X18"
3. Glue
4. Scissors

C. *Key Vocabulary:*

1. Order: to arrange numbers from least to greatest or from greatest to least
2. Compare: to decide which of two numbers is greater

D. *Procedures/Activities:*

1. Begin by discussing previous lesson about $\frac{1}{2}$ of a pizza being compared with $\frac{1}{12}$ of a pizza. Have the students discuss in small groups which choice they made regarding the question about being really hungry. Ask a student to summarize this activity orally for the class.
2. The students should cut their construction paper in half lengthwise. They should glue the pieces together, end to end, to create a 6"X34" strip.
3. While the glue is drying, have the students manipulate and arrange the different colors of fractional parts in order from the smallest piece to the largest piece. (They may have to spread out in the room to allow themselves plenty of work space.)
4. After the students have arranged the pieces in order, they need to trace and label each piece on the construction paper from least to greatest.
5. Review the concepts and symbolic representation for greater than, less than, and equal. As a practice activity, list some fractions on the board for the students to compare on paper using the symbols $>$, $<$, and $=$. Circulate while students perform practice problems to make sure that everyone understands.
6. Ask the students to discuss and answer the following questions in small groups: "How could you prove that $\frac{1}{3}$ is less than $\frac{1}{2}$?" and "What patterns do you see for the fractions under each piece?" Discuss these questions as a class after the small groups have had some time to discuss.

E. *Assessment/Evaluation:*

1. The students will compare fractions and write the $>$, $<$, or $=$ for 10 problems with "1" as the numerator.

2. The students will write a summary paragraph in the Math journal explaining how they know which symbol to use when comparing fractions.
3. The students will make fractions with numerators greater than "1" with same color fraction circle pieces and compare them with other colors. An example would be to compare two yellow pieces (thirds) with three green pieces (fourths). They will write the fractions with the proper "sign" on paper ($2/3 < 3/4$). They should also write this comparison in a complete sentence. (Two thirds is less than three fourths.)

Lesson Three: Equivalent Fractions

A. Daily Objectives:

1. Concept Objectives:
 - a. The students will use fraction circles to create fractions and solve problems concretely, pictorially, and symbolically.
 - b. The students will practice writing skills by keeping a Math journal.
2. Lesson Content:
 - a. Equivalent fractions
3. Skill Objectives:
 - a. The students will show equivalent fractions concretely, pictorially, and symbolically.

B. Materials:

1. Fraction circles for each student

C. Key Vocabulary:

1. Equivalent: equal value

D. Procedures/Activities:

1. Begin by writing the word "equivalent" on the board and asking the students if it looks like any word that they have ever seen before. After discussing the idea that it looks like the word "equal" and what the word "equal" means, explain that "equivalent" means the pieces are the same size and shape, ONLY the pieces are cut up differently.
2. Review previous lesson about what the fraction looks like for halves, thirds, fourths, sixths, eighths, and twelfths when the fraction equals one whole circle. Review that "one whole" equals $2/2$, $3/3$, $4/4$, etc.
3. Have the students arrange their fraction pieces by color. They need to have an orange stack, a yellow stack, and so on. Once they have done this with all the colors, ask them to take the orange $1/2$ piece and draw what it looks like on paper. Ask the students to manipulate the colors to equal the same exact amount as this piece.
4. As the students discover combinations of the SAME color that equal the $1/2$ piece, ask them to draw on paper what it looks like. Ask them to label their drawings with the fraction.
5. Ask the students to discuss and answer the following questions in small groups: "What patterns do you see when you look at equivalent fractions?" "How are these equivalent fractions alike?" "How are these equivalent fractions different?" "What are some other fractions that are equivalent to $1/2$?" Discuss these questions as a class after the small groups have had time to discuss.

E. Assessment/Evaluation:

1. The students will list three equivalent fractions for $1/4$ using fraction circles. They will be asked to think about the patterns that they noticed in the previous activity and list three MORE equivalent fractions for $1/4$. (They will not have the manipulatives for this part of the assignment).
2. The students will write a short paragraph in their Math journals explaining how many fractions that they think there are which are equivalent to $1/4$ and their reasoning for their answer.

Lesson Four: Finding an Unknown Numerator or Denominator

A. Daily Objectives:

1. Concept Objectives:
 - a. The students will use fraction circles to create fractions and solve problems concretely, pictorially, and symbolically.
 - b. The students will practice writing skills by keeping a daily Math journal.
2. Lesson Content:
 - a. Finding unknown numerators or denominators
3. Skill Objectives:
 - a. The students will find unknown numerators and denominators in fractions concretely, pictorially, and symbolically.

B. Materials:

1. Fraction circles for each student

C. Key Vocabulary:

1. None

D. Procedures/Activities:

1. Begin today's lesson by reviewing previous lesson on equivalent fractions. Discuss different combinations that were found to be equivalent to $\frac{1}{4}$.
2. Take an example that was mentioned (for example, $\frac{1}{4}$ is equivalent to $\frac{2}{8}$) and write it on the board with the numerator missing in the second fraction ($\frac{1}{4} = \frac{?}{8}$). Ask the question, "How could we find out what this numerator is if it isn't shown?"
3. Allow the students time to manipulate their fraction pieces to determine how many red (eighths) pieces it takes to equal one green piece (fourths). Once they have determined that it takes two red pieces to equal one green piece, ask them to draw a picture of the problem and label it with the fractions.
4. Write this problem on the board: $\frac{1}{4} = \frac{3}{?}$. Have the students take the fraction piece that they know in this problem ($\frac{1}{4}$) and try different colors of 3 to determine which color it takes to be equivalent to $\frac{1}{4}$. Once the students determine that it takes three of the purple pieces (twelfths) to equal $\frac{1}{4}$, ask them to draw a picture of the problem and label it with the fractions.
5. The students should discuss and answer the following questions in small groups: "What patterns do you notice when you determine the unknown numerator or denominator with the fraction circles?" and "What patterns do you notice when you look at the fractions written on paper?" Discuss these questions as a class after the small groups have had time to discuss.

E. Assessment/Evaluation:

1. The students will write a paragraph in their Math journal explaining how they determined an unknown numerator or denominator using the term "equivalent" appropriately somewhere in their paragraph.
2. The students will use their fraction circles and a sheet of paper to create and write 3 problems involving an unknown numerator or denominator. They will trade papers with a friend and solve each other's problems.

Lesson Five: Adding Fractions with Like Denominators and Putting Fractions in Lowest Terms

A. Daily Objectives:

1. Concept Objectives:
 - a. The students will use fraction circles to create fractions and solve problems concretely, pictorially, and symbolically.
 - b. The students will practice writing skills by keeping a daily Math journal.
2. Lesson Content:

- a. Adding fractions with like denominators
 - b. Putting fractions in lowest terms
3. Skill Objectives:
- a. The students will add fractions with like denominators concretely, pictorially, and symbolically.
 - b. The students will demonstrate their ability to "simplify" fractions into lowest terms.
- B. *Materials:*
1. Fraction circles for each student
 2. 100 pennies
- C. *Key Vocabulary:*
1. Simplify: process of renaming a fraction through division into lowest terms
- D. *Procedures/Activities:*
1. Begin by sharing a story about needing a dollar for school. "My mother gave me 100 pennies when I told her that I needed a dollar." Model for the students by showing them how I look with 100 pennies in my pocket. Dramatize how heavy my pockets are by stooping, holding my hand on my aching back as I walk, etc.
 2. Ask the students, "How could I simplify my life?" (Explain what I mean by that. I want to make my life easier, or more simple.) As the students offer suggestions, write them on the board. (Possible suggestions: I could TRADE my 100 pennies for 10 dimes, 20 nickels, or 4 quarters.)
 3. Discuss the suggestions. Ask the question, "Of the possibilities listed on the board, which one would simplify my life the most?" (TRADING my 100 pennies for 4 quarters). Make sure that the students mention that the amount is the same, because I still have the dollar that I need for school. Dramatize how much better I feel carrying my dollar now that I have "simplified" my life. *Note: Do not use the term "reduce" when referring to putting fractions in lowest terms. This term implies "getting smaller", and may confuse students.
 4. Write the following fraction problem on the board: $1/4 + 1/4 = ?$. Ask the question, "What does addition mean?" (joining sets). Have the students manipulate the fraction pieces to join $1/4$ and $1/4$. Ask the question, "When you pushed the colors together, did they change colors?" (No). Have the students draw a picture and label the pieces with the fractions, as well as write the problem with the answer.
 5. Ask the students what they got as the answer ($2/4$). Ask the question, "Can I TRADE these 2 pieces for something that is the same size, only has fewer pieces?" (The students should discover that $1/2$ would be the same amount, only in fewer pieces.) Explain that I have "simplified" the fraction when I trade for fewer pieces that would equal the same amount.
 6. Ask the students to discuss and answer the following questions in small groups: "What do you notice about the numerator when you add fractions with like denominators?" "What do you notice about the denominator when you add fractions with like denominators?" "What is the "rule" for adding fractions with like denominators?" and "What does the term "simplify" mean when talking about fractions?" Discuss these questions as a class after the small groups have had time to discuss.
- E. *Assessment/Evaluation:*
1. The students will create an addition problem with fractions that have the same denominator in their Math journals. They should come up with a problem that has not been used in class. They should draw a picture of what the fractions look like, label the parts, and simplify their answer in lowest terms. They should write a paragraph explaining the process.

Lesson Six: Adding Fractions with Unlike Denominators

A. Daily Objectives:

1. Concept Objectives:
 - a. The students will use fraction circles to create fractions and solve problems concretely, pictorially, and symbolically.
 - b. The students will practice writing skills by keeping a daily Math journal.
2. Lesson Content:
 - a. The students will add fractions with unlike denominators.
3. Skill Objectives:
 - a. The students will add fractions with unlike denominators concretely, pictorially, and symbolically by renaming the fractions.

B. Materials:

1. Fractions circles for each student

C. Key Vocabulary:

1. Rename: writing equivalent fractions by multiplying each part of the fraction by the same number
2. Common denominator: renaming fractions as fractions with same-sized denominators

D. Procedures/Activities:

1. Review previous lesson about adding fractions with like denominators. Explain that a like denominator is the same thing as a common denominator. Tell the students that denominators that are alike have something in common. Show examples on the board.
2. Ask the students what addition means. After discussing that addition means joining, ask how we could add fractions with different denominators like $\frac{1}{4} + \frac{1}{2}$. They will probably say that we would join a green piece (fourths) with an orange piece (halves). Ask whether we could trade either of these pieces for colors that matched. (The students should see that they could trade the orange piece for two green pieces, and the colors would match.)
3. Explain that in order to add fractions with unlike denominators, we must rename $\frac{1}{2}$ as $\frac{2}{4}$, so that our denominators would be the same, or common, as the fraction to which we are adding.
4. Have the students draw a picture of the problem and label the pieces with the fractions, as well as write the answer. Ask the students what they got for an answer. ($\frac{3}{4}$)
5. Have the students discuss and answer the following questions in small groups: "Could you trade the three green pieces in for something that is the same size, only has fewer pieces?" (No) and "What does that mean?" (The answer is already in lowest terms and cannot be "simplified".) Also ask, "What is the "rule" for adding fractions with unlike denominators?" Discuss these questions as a class after the small groups have had time to discuss.

E. Assessment/Evaluation:

1. The students will analyze the "rule" for adding fractions with unlike denominators in a paragraph in their journals and explain how and why the process works.

Lesson Seven: Changing Improper Fractions to Mixed Numbers

A. Daily Objectives:

1. Concept Objectives:
 - a. The students will use fraction circles to create fractions and solve problems concretely, pictorially, and symbolically.
 - b. The students will practice writing skills by keeping a daily Math journal.
2. Lesson Content:
 - a. The students will change improper fractions to mixed numbers.
3. Skill Objectives:

- a. The students will write mixed numbers and improper fractions.
 - b. The students will change improper fractions to mixed numbers.
- B. *Materials:*
- 1. Fraction circles for each student (2 sets)
- C. *Key Vocabulary:*
- 1. Mixed number: a number that has a whole-number part and a fractional part
 - 2. Improper fraction: a fraction in which the numerator is greater than or equal to the denominator
- D. *Procedures/Activities:*
- 1. Review previous lesson about adding fractions with unlike denominators, and what had to be done to carry out the operation. Write the following problem on the board: $1/2 + 3/4 = ?$. Remind the students that these fractions do not have a common denominator, so they must be renamed so that they have a common denominator. Ask the students what they would trade so that the colors would match. (The orange piece would be traded for two green pieces so that the colors would match.)
 - 2. Have the students draw a picture of the problem before and after the trade. Have them label the fraction for each piece. Ask them what they got for the answer. (There is a whole circle, and one piece of green left over.)
 - 3. Explain that when this happens you can write your answer as a mixed number. Explain that a mixed number has a whole number and a fraction "mixed" together. Ask them what the answer of this problem would be written as a mixed number. ($1 - 1/4$)
 - 4. Explain that there is another way to express the answer. Ask the students if they did not list the answer as a mixed number and listed it as a fraction instead, what it would be. ($5/4$). Ask what they notice about the numerator in this fraction. (The numerator is larger than the denominator.) Explain that this is an example of an improper fraction. Explain that improper fractions are fractions that have a numerator that is larger than the denominator.
 - 5. Write the problem $1/2 + 2/2 = ?$ on the board. Have the students manipulate their fraction pieces to form the answer as $3/2$. Ask them what $3/2$ is. (An improper fraction). Have the students draw a picture of $3/2$ joined together. Ask what this improper fraction would be if it were expressed as a mixed number. ($1 - 1/2$).
 - 6. Have the students discuss and answer the following questions in small groups: "How are improper fractions and mixed numbers alike?" and "How are improper fractions and mixed numbers unlike any fractions we have studied so far?" Discuss these questions as a class after the small groups have had some time to discuss.
- E. *Assessment/Evaluation:*
- 1. The students will write an entertaining story using addition of fractions that would add up to more than one whole number. In their story the main character should be presented with the problem of the fractions whose sum is more than 1. At the end of the story, the student should explain how the main character solved the problem.
 - 2. Present fractions with unlike denominators in which both fractions would have to be changed to have the same (common) denominator in order to get the sum. Give the students addition problems with sums greater than 1 in which the answer would need to be "simplified".

VI. CULMINATING ACTIVITY

- A. A letter will go home before our culminating activity asking the parents to volunteer to host and supervise a group of 3-4 students in a cooking lesson at their home. The students will work in small groups, follow the directions in a recipe, and make a pie. Each individual student will complete a worksheet answering questions as to their part of the assignment. (Individuals need to have performed at least one function involving fractions. See

Handouts/Student Worksheets section of this unit.) Each group will be assigned a specific content skill (from Sequence page 101) and asked to create a short presentation for the entire class at school illustrating that skill--using their pie. The students may combine with another group if two pies are needed to illustrate the concept (as in mixed numbers and improper fractions). At the end of the presentations the class will enjoy a pie party.

VII. HANDOUTS/WORKSHEET

A. PIE ASSIGNMENT

VIII. BIBLIOGRAPHY

- A. Hirsch Jr., E. D. Core Publications, Inc., 1992. 0-385-31260-1. *What Your Fourth Grader Needs to Know*.

Appendix A: **PIE ASSIGNMENT**

1. Write a paragraph describing exactly what you did in making the group pie.
2. Explain what your part of the overall effort was that involved fractions when you made the pie.
3. What does your fraction mean?
4. What is your group's goal in your presentation to the class?
5. Write a paragraph explaining how your group will accomplish this goal in your presentation. What will your role be in the presentation?