Fractions

"Cut my pizza into four pieces... no way I could eat eight."

Understand numbers, ways of representing numbers, relationships among numbers, and number systems.

Grades Pre-K-2
• Understand and represent commonly used fractions, such as 1/4, 1/3, and 1/2.

Grades 3-5
• Develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as divisions of whole numbers.
• Use models, benchmarks, and equivalent forms to judge the size of fractions.

Grades 3-5 continued
• Recognize and generate equivalent forms of commonly used fractions, decimals, and percents.
• Explore numbers less than 0 by extending the number line and through familiar applications.
• Develop and use strategies to estimate computations involving fractions and decimals in situations relevant to students’ experience.
• Use visual models, benchmarks, and equivalent forms to add and subtract commonly used fractions and decimals.

Developing Fraction Concepts and Number Sense
• Initial work with fractions should begin with natural activities children experience, ex. sharing.
• Represent fractions using words, a variety of models, diagrams and symbols and make connections among various representations.
• Manipulative models should be used throughout the middle years.
• Give other names for numbers and justify the procedures used to generate equivalent forms.

Model of Fractions

Model of Representation

Spoken or written words: "one-half"
Written Symbol: \( \frac{1}{2} \)
Real-world situations: Mary slid a pizza into eight pieces and then Mary ate one-half the pizza. How many pieces are left?

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Picture: A pizza divided into eight equal parts, with four parts shaded.
Manipulative materials: Eight circular pieces of cardboard, some of which are shaded to represent one-half.
Fraction Names

- Fraction words should be used without the symbols.
- Fraction symbols should be introduced when students understand the meaning of the terms one-half, one-third, one-fourth, one-fifth.
- Fractions should be written with a horizontal bar called a VINCULUM.
- DO NOT USE a slanted bar.

Developing Fraction Concepts and Number Sense

- Describe the relative magnitude of numbers by comparing them to common benchmarks, giving simple estimates, ordering a set of numbers and finding a number between two numbers.
- Equivalence is another key concept associated with fractions. It relates to the various ways that show equal shares.
- Developing the meaning of half.
- Cutting in half means that we show two parts that are the same amount.
  - The parts are the same size.
  - When a figure has been cut in half, each part is half the shape, a half or one-half.

Developing Fraction Concepts

Fractions can be interpreted from several perspectives:
- Part-whole of region (area model)
- Measure (number line model)
- Set (group model)
- Ratio (relationship between sets)
- Division (fractions denote division consequently decimals)

The Part-Whole of Region (Area) Model

- The Region Model should be learned before the model of “parts of a set”
- The whole can be a region (an object to be shared or an area to be divided)
- Fractional parts may have the same area but might not necessarily be congruent.
- Regular geometric regions are good fraction models
  - Fraction Circles
  - Rectangular Strips

Measurement Model

Linear Model
- Number line
- Tape
- Ribbon
- Strips of Paper
- Fractions Bars
- Cuisenaire Rods

Set Model

- In fractional parts of a set, the whole becomes a given number of objects rather than a region.
  - “How many?” is a whole-number answer.
  - “How much?” and “What part?” have fraction number answers.
Ratio Model

• A fraction such as \( \frac{2}{3} \) can also represent a ratio, which means that two elements of one set are present for every three elements of another set.

• The order of the words in the final question set the order or position of the numbers. (What is the ratio of circles to squares?)

Division Model

• Fractions denote division of one set by the other.

• A fraction such as \( \frac{1}{2} \) also represents division.

\[
\frac{1}{2} \quad 2 \div 1 \quad 1 \div 2
\]

Developing Comparisons

• Compare by representing fractions concretely and pictorially before symbolically.
• Relative Size of Fractions
  • Improper Fractions
  • Mixed Numbers
• Understanding Equivalent Fractions
• Fractions can be expressed in different ways
  • Equivalent=equal value
• Renaming fractions

Developing Fraction Computation

Before beginning fraction computation students must:
• Understand fraction concepts
• Be able to compare fractions
• Develop number sense about fractions
• Recognize equivalence
• Understand the meaning of operations on whole numbers
Operations with Fractions

- Addition and Subtraction
  - Needs a common name
  - Denominator
  - Multiple
  - Model with manipulatives
  - Accompanied with verbal description
  - Followed with written steps
- Multiplication and Division

Fraction Addition

Add $\frac{1}{2} + \frac{1}{2} = \frac{2}{2}$

- Add the numerators and keep the common denominator.
- Combine the two grey halves to make one whole.

Fraction Subtraction

You have 3 out of 4 parts and take away one of the three parts. How many do you have left?

$\frac{3}{4} - \frac{1}{4} = \frac{2}{4}$

- When you subtract again you need common denominators.
- Then subtract the numerators and keep the common denominator.

Fraction Multiplication

Draw two congruent rectangles and show each fraction.

$\frac{1}{5} \times \frac{1}{2} = \frac{1}{10}$

Then draw a third rectangle congruent to the others and shade $\frac{1}{5}$ of $\frac{1}{2}$ of the rectangle as shown.

The part where the shading intersects shows the answer.

$\frac{1}{5} \times \frac{1}{2} = \frac{1}{10}$

Resources

- Fraction Fun by David Adler
- Pizza Counting by Christina Dobson
- Fraction Action by Loreen Leedy
- Gator Pie by Louise Mathews
- Skittles Riddles Math by Barbara McGrath
- How Many Ways Can You Cut a Pie? by Jane Moncure
- Give Me Half by Stuart Murphy
- The Hershey’s Milk Chocolate Fractions Book by Jerry Pallotta
- Apple Fractions by Jerry Pallotta

Internet Resources

- Visual Fractions: [www.visualfractions.com](http://www.visualfractions.com)
- Fun with Fractions Unit: [http://illuminations.nctm.org/index_o.aspx?id=113](http://illuminations.nctm.org/index_o.aspx?id=113)
- Fraction Bars: [http://arcytech.org/java/fractions](http://arcytech.org/java/fractions)
- Fraction Bingo: [http://www.fractionbars.com/WorkshopActivities/5_BarsBingo.html](http://www.fractionbars.com/WorkshopActivities/5_BarsBingo.html)
- Fun with Fractions Unit: [http://illuminations.nctm.org/index_o.aspx?id=113](http://illuminations.nctm.org/index_o.aspx?id=113)
- Fraction Bingo: [http://www.fractionbars.com/WorkshopActivities/5_BarsBingo.html](http://www.fractionbars.com/WorkshopActivities/5_BarsBingo.html)
- Fraction Games: [http://www.fractionbars.com/ArticleFrac.html](http://www.fractionbars.com/ArticleFrac.html)