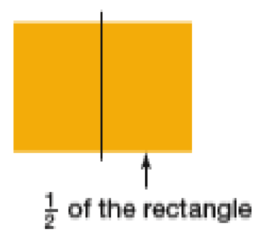
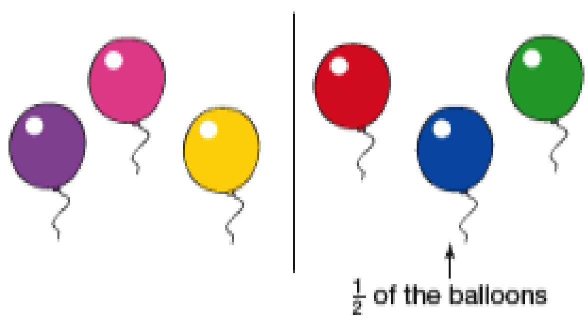
Math Content by Strand[1]

Fractions (Grade 2)/Rational Numbers (Grades 3-5)

Grade 2

Second graders develop an understanding of what fractions are and how they can be used to name quantities. They learn that fractions are quantities that are equal parts of a whole whether the whole is a single object or a set of objects. Students work with 1/2, 1/3, 1/4, 2/3, 2/4, and 3/4 of single objects such as blocks, rectangles, squares and flags. They work with 1/2, 1/3, and ¼ of sets of objects such as balloons, sandwiches and other objects shared among a group of people.





Students learn how fractions are expressed in words—one half, two thirds—and represented using numbers—for example, 1/2, 2/3. They learn that the denominator represents the number of equal parts in the whole and that the numerator represents the number of the equal parts being considered, though they are not expected to use the words *denominator* and *numerator* when describing fractions. Students also learn the notation for mixed numbers through dividing sets. For example, if two girls share three sandwiches, each girl gets 1 1/2 sandwiches.

[1] This document applies to the 2nd edition of *Investigations* (2008, 2012). See http://investigations.terc.edu/CCSS/ for changes when implementing *Investigations and the Common Core Standards*.

Emphases

What Fractions Are

- Understanding fractions as equal parts of a whole
- Using terms and notation

Benchmarks

- Identify 1/2, 1/3, and 1/4 of a region
- Find 1/2 of a set of objects
- Recognize that a fraction divides the whole into *equal* parts

Grade 3

Students use a variety of contexts to understand, represent, and combine fractions. These include rectangles representing "brownies," hexagonal pattern block "cookies," and groups of objects.

Students work with halves, fourths, eighths, thirds, and sixths as they learn how fractions represent equal parts of a whole. They learn the meanings of the numerator and denominator of a fraction, so that when comparing unit fractions (fractions with a numerator of 1), they understand that the larger the denominator the smaller the part of the whole: 1/6 is smaller than ½ of the same whole. Students also gain experience with common equivalencies, for example, that 3/6 and 2/4 are both equal to 1/2. Using these equivalents in contexts, students find combinations of fractions that are equivalent to a whole or to another fraction. For example,

$$1/2 + 2/6 + 1/6 = 1$$
$$1/3 + 1/6 = 1/2$$

Students are introduced to decimal fractions (0.50 and 0.25), using the context of money, and gain familiarity with fraction and decimal equivalents involving halves and fourths.

Emphases

Rational Numbers

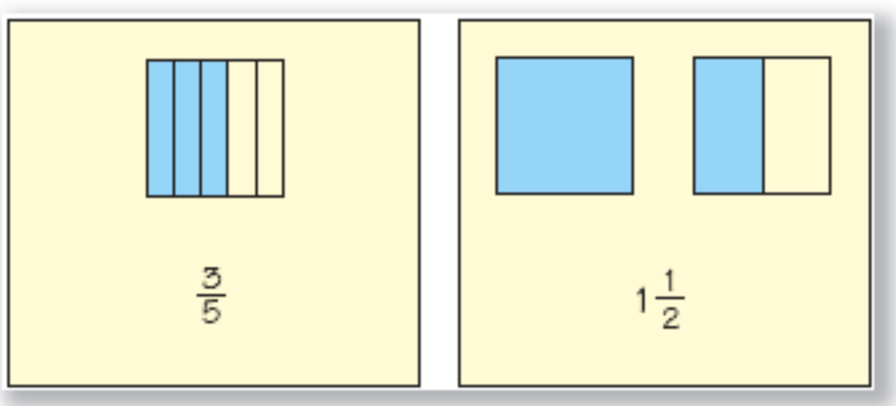
- Understanding the meaning of fractions (halves, fourths, eighths, thirds, sixths) and decimal fractions (0.50, 0.25) as equal parts of a whole (an object, an area, a set of objects)
- Using representations to combine fractions (halves, fourths, eighths, thirds, and sixths)

Benchmarks

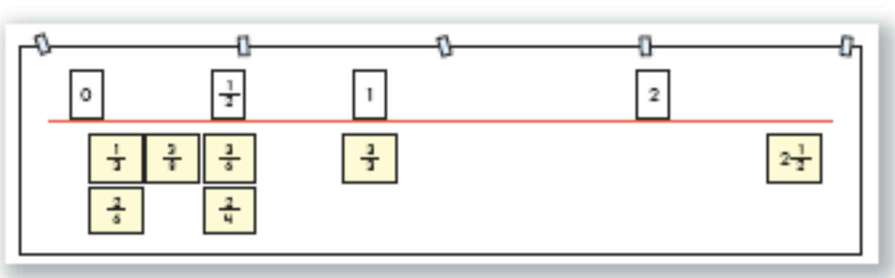
- Divide a single whole or a quantity into equal parts and name those parts as fractions or mixed numbers
- Identify equivalent fractions (e.g. $\frac{3}{6} = \frac{1}{2}$ and $\frac{1}{3} = \frac{2}{6}$)
- Find combinations of fractions that are equal to 1 and to other fractions (e.g. $\frac{3}{6} + \frac{1}{2} = 1$; $\frac{1}{6} + \frac{1}{6} = \frac{1}{3}$; and $\frac{1}{3} + \frac{1}{6} = \frac{1}{2}$)

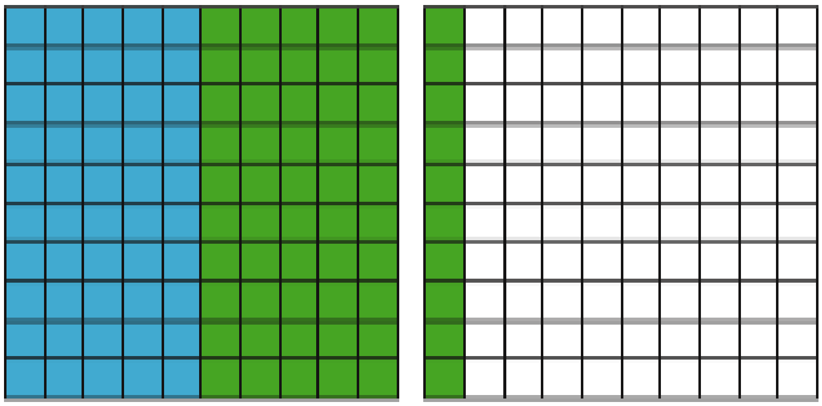
Grade 4

The major focus of the work on rational numbers in Grade 4 is on building students' understanding of the meaning, order, and equivalencies of fractions and decimals. Students continue to focus on the meaning of fractions as equal parts of a whole. They extend their images of equal parts to accommodate fractions that are greater than 1. Students work with fractions in the context of area (equal parts of a rectangle), as a group of things (e.g., a fractional part of the class), and on a number line. They work with fractions that represent halves, thirds, fourths, fifths, sixths, eighths, tenths, and twelfths.



Students are introduced to decimal fractions in tenths and hundredths as an extension of the place value system they have studied for whole numbers. They relate decimals to equivalent decimals and fractions (for example, when they represent 0.25 as part of a rectangle, they can see how it is equal to ¼ and to 2 ½ tenths). Students draw on their mental images of fractions and decimals and on their knowledge of fraction and decimal equivalencies and relationships to reason about fraction comparisons, to order fractions on a number line, and to add fractions and decimals using representations.





0.5 + 0.6 = 1.1 (one whole square and one tenth of the second square)

Emphases

Rational Numbers

- Understanding the meaning of fractions and decimal fractions
- Comparing the values of fractions and decimal fractions

Computation with Rational Numbers

- Using representations to add rational numbers

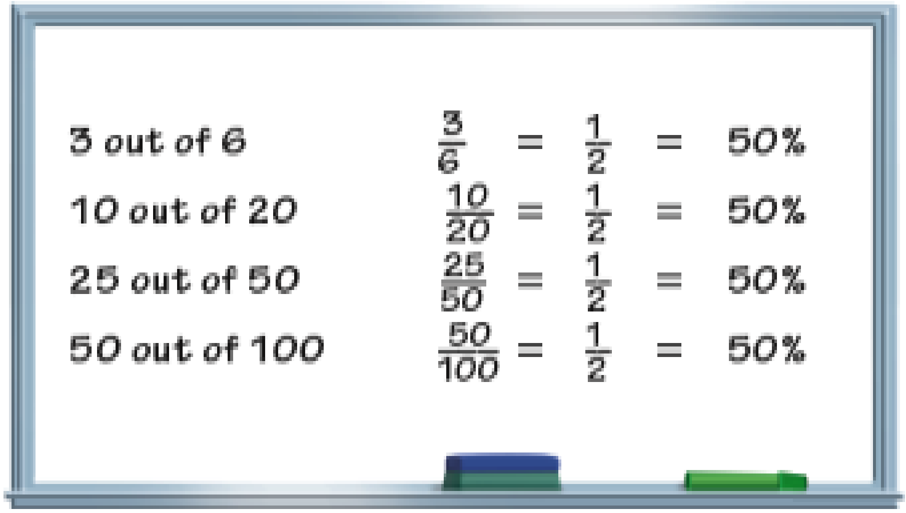
Benchmarks

- Identify fractional parts of an area
- Identify fractional parts of a group (of objects, people, etc.)
- Read, write, and interpret fraction notation
- Order fractions with like and unlike denominators
- Read, write, and interpret decimal fractions in tenths and hundredths

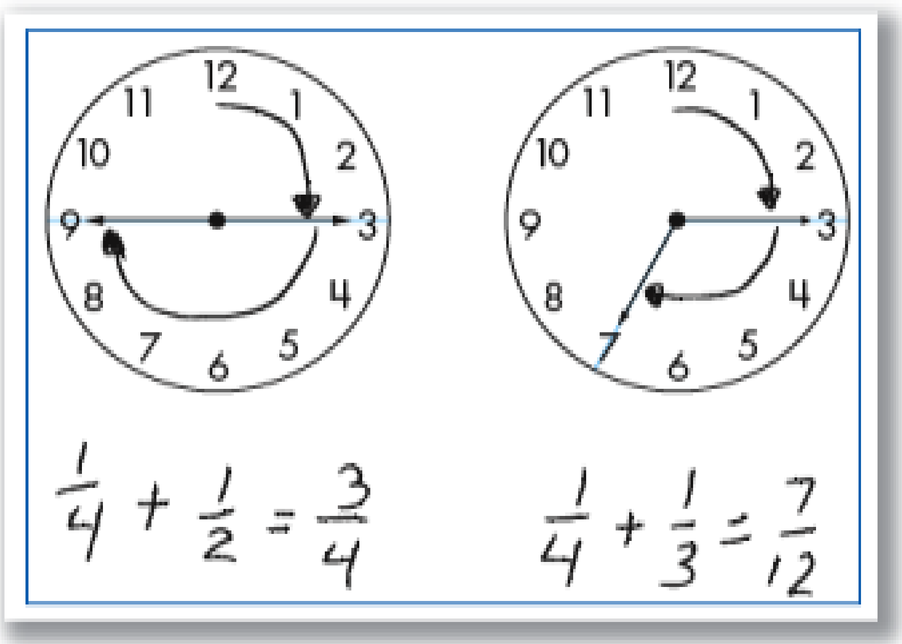
Grade 5

The major focus of the work on rational numbers in grade 5 is on understanding relationships among fractions, decimals, and percents. Students make comparisons and identify equivalent fractions, decimals, and percents, and they develop strategies for adding and subtracting fractions and decimals.

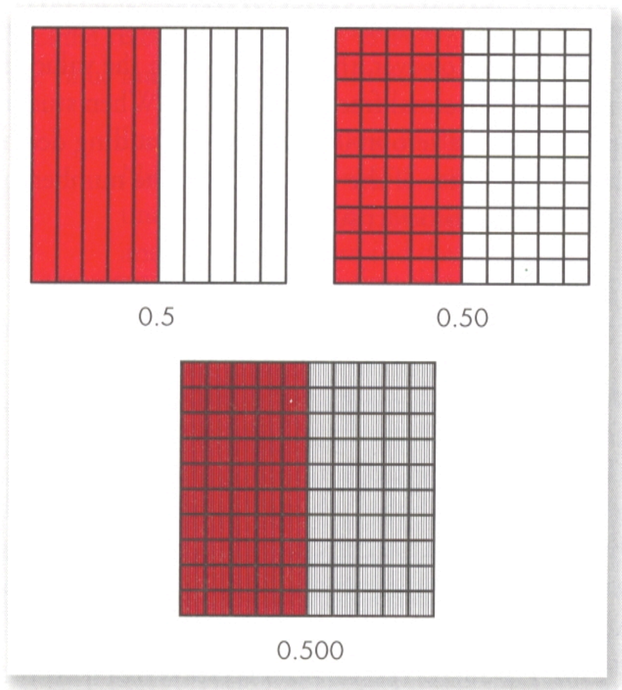
In a study of fractions and percents, students work with halves, thirds, fourths, fifths, sixths, eighths, tenths, and twelfths. They develop strategies for finding percent equivalents for these fractions so that they are able to move back and forth easily between fractions and percents and choose what is most helpful in solving a particular problem, such as finding percentages or fractions of a group.



Students use their knowledge of fraction equivalents, fraction-percent equivalents, the relationship of fractions to landmarks such as ½, 1, and 2, and other relationships to decide which of two fractions is greater. They carry out addition and subtraction of fractional amounts in ways that make sense to them by using representations such as rectangles, rotation on a clock, and the number line to visualize and reason about fraction equivalents and relationships.

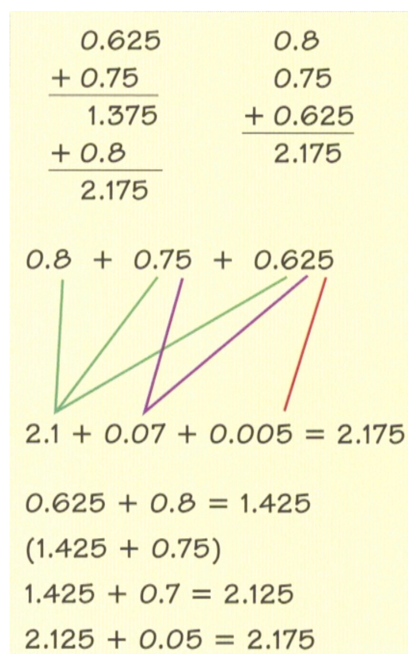


Students continue to develop their understanding of how decimal fractions represent quantities less than 1 and extend their work with decimals to thousandths. By representing tenths, hundredths, and thousandths on rectangular grids, students learn about the relationships among these numbers—for example, that one tenth is equivalent to ten hundredths and one hundredth is equivalent to ten thousandths—and how these numbers extend the place value structure of tens that they understand from their work with whole numbers.



Students extend their knowledge of fraction-decimal equivalents by studying how fractions represent division and carrying out that division to find an equivalent decimal.

They compare, order, and add decimal fractions (tenths, hundredths, and thousandths) by carefully identifying the place value of the digits in each number and using representations to visualize the quantities represented by these numbers.



Emphases

Rational Numbers

- Understanding the meaning of fractions and percents
- Comparing fractions
- Understanding the meaning of decimal fractions
- Comparing decimal fractions

Computation with Rational Numbers

- Adding and subtracting fractions
- Adding decimals

Benchmarks

- Use fraction-percent equivalents to solve problems about the percentage of a quantity
- Order fractions with like and unlike denominators
- Add fractions through reasoning about fraction equivalents and relationships
- Read, write, and interpret decimal fractions to thousandths
- Order decimals to the thousandths
- Add decimal fractions through reasoning about place value, equivalents, and representations