Overview for Families

Mathematics in Context unit: ***Go Rational***

Mathematical strand: **Number**

The following pages will help you to understand the mathematics that your child is currently studying as well as the type of problems (s)he will solve in this unit.

Each page is divided into three parts:

- *Section Focus*
  Identifies the mathematical content of each section.

- *Learning Lines*
  Describes the mathematical flow of each section.

- *Learning Outcomes*
  Outlines what students should know and be able to do at the end of each section.

"From the very beginning of his education, the child should experience the joy of discovery."

Alfred North Whitehead

Go Rational

Section A Rational Numbers Revisited

Section Focus

Students use their knowledge of benchmark fractions and decimals to compare numbers in both forms. They informally and formally convert fractions to decimals and decimals to fractions. Students compute quotients using long division and calculators to find repeating and terminating decimals to determine if a number is considered rational. Students write numbers in expanded form to compare fractional notation to decimal notation. Finding a square root using a calculator is revisited informally in the context of finding a non-repeating decimal.

Learning Lines

Number Sense: Decimals

Comparing fractions and decimals in the context of a recipe and a liter bottle helps pre-assess students' recall of benchmark fractions. Students use such benchmark fractions as ½, ¼, 1/3, 1/10, and 1/5 to find decimal equivalents of other numbers. The expanded notation idea is connected to the context of money to develop students' understanding of decimals and the relationship between fractions and decimals. For example: \$6.51 can be written as 6 x \$1 + 5 x \$0.10 + 1 x \$0.01. Students may even write \$0.10 as one dime or 1/10 of a dollar. This knowledge can be used to change 0.40 into a fraction. Students can think \$0.40 is four dimes. One dime is 1/10 of a dollar, so four dimes is 4/10 of a dollar. To change fractions that are not related to benchmark fractions, the context of money is very helpful. For example to change 0.17 into a fraction: \$0.53 is 53 cents. One cent is 1/100 of a dollar, so 53 cents is 53/100 of a dollar. When using a calculator to convert fractions into decimals, students find that some decimal equivalents have a finite number of digits while others have an infinite number of digits. The latter are commonly referred to as repeating decimals. For example, 1/3 in decimal form is 0.333.... A repeating decimal is usually indicated with a horizontal line over the digits that repeat: 1/7= 0.142857142857142... = $0.\overline{142857}$

Strategies

Benchmark fractions such as ¼ = 0.25 are also used to show the connection with decimals in the context of money. When changing a decimal to a fraction, the ratio table serves as a model, for example, 0.125 = 1/8.

Learning Outcomes

Students are able to:

- convert fractions to decimals;
- convert repeating or terminating decimals to fractions;
- write a decimal number in expanded form using both decimals and fractions;
- identify a repeating decimal; and
- identify a rational number

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Section B Working with Fractions

Section Focus

Students create and use models to compute fractions with unlike denominators. They assess if a model can properly represent the specific problem. Number lines and ratio tables are revisited as tools to help find common denominators and the least common denominator. Ratio Tables can also be used to simplify fractions and to find equivalent fractions. The relationship between improper fractions and mixed numbers is formalized.

Learning Lines

Number Sense

The relationship between equivalent fractions and equivalent forms of fractions is made explicit in this section. The idea of finding a common denominator to add fractions is revisited. The idea of using common denominators that students are comfortable with is explored. For example, working with a clock face and the 60 minutes that make up an hour is used as a model for working with fractions that have a common denominator of 60. Students also explore when a model does not fit a specific situation. Students should be able to identify equivalent fractions and move easily between mixed numbers and improper fractions. These skills will come with practice.

Models

Clock Face Model

Students relate familiar fractions to parts of an hour using a clock face. For example 1/4 + 1/3 can be related to adding 15 minutes and 20 minutes. The resulting 25 parts of the hour can then be interpreted as 25/60 or 5/12.

Number Lines

Number lines support understanding of fractions in a couple of different ways. In this section, number lines are also used to find common denominators in addition problem.

Ratio Tables

Ratio tables are especially useful to support students operating with fractions. The idea of equivalent fractions can be shown with ratio tables. This skill is important for finding common denominators and as well as for reducing fractions to lowest terms.

part	3	6	9	12
whole	8	16	24	32

Learning Outcomes

Students will be able to:

- use math models to help compute fractions with unlike denominators;
- create a ratio table to find common denominators and equivalent fractions;
- identify the least common denominator;
- simplify fractions; and
- work with mixed numbers and improper fractions fluidly.

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Section C Fractions, Decimals, and Number Lines

Section Focus

Students create and use number lines as a model to help them add and subtract mixed numbers and decimals. Students are reintroduced to the empty number line model to make simple computations with decimals. Students also work to gain an understanding of the relationship between fractional and decimal representations of the same number.

Learning Lines

Mathematical Properties

In this section, the Additive Inverse Property and Commutative Property of Addition are informally incorporated into the use of the math models. By modeling on the number line, students can choose their starting point to illustrate that A + B = B + A.

Models

The *number line* model helps students develop a conceptual understanding of fractions as numbers.

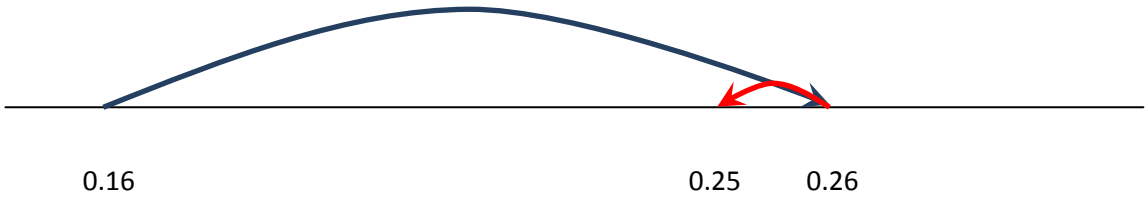
The *empty number line* is a tool that is based on the number line: the numbers are placed in the correct order but not necessarily to scale.

Decimals

In this section, students' understanding of place value and their ability to compare and order numbers with one and two decimals is revisited and further developed. A number line that appears to be a section of a ruler gives visual support for the decimal notation of tenths and hundredths.

A method for adding numbers uses an empty number line. By moving from one number to another in the fewest jumps and by jumping only 0.01 space, 0.1 space, 1 space, or 10 spaces at one time, students are learning to mentally add and subtract decimals. This method is known as the *compensation method*.

For example, to jump from 0.16 to 0.25 on the number line you can make a jump of 0.1 to 0.26 and then a jump of 0.01 back. So 0.25 – 0.16 = 0.09.



Learning Outcomes

Students will have further developed a conceptual understanding of fractions and decimals and the relationship between different but equivalent representations of the same number. They order fractions (improper fractions and mixed numbers) and decimals on a number line and use the number line as a model to add and subtract both fractions and decimals to the hundredth place. They compare different strategies for working with rational numbers.

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Section D Operations with Number Models

Section Focus

Students create a bar model to visualize the product of two fractions. They formalize a rule for multiplying fractions. They investigate different strategies to multiply decimals. Students create an area model to compute products of decimals and mixed numbers. Students are encouraged to convert between fraction and decimal equivalents depending on which representation makes sense to them in order to multiply rational numbers. They divide fractions and mixed numbers by finding equivalent division problems that are easier to understand and work with.

Learning Lines

Number Sense

Multiplication of fractions and decimals is developed using a variety of contexts and models. The connection between the use of the word "of" and multiplication of fractions is made clear. Students are encouraged to move between fractions and decimals to find the representation that makes sense to them and that they can use with understanding.

Division of whole numbers by fractions and division of mixed number fractions is presented using the method of finding equivalent division problems involving whole numbers. Proportional reasoning is developed in this context.

Models

The *bar model* is used to give meaning to finding a fraction of a fraction.

The *ratio table* supports multiplication of decimals in a context, and it is also used in the form of a T-chart to support understanding of problems involving division by a fraction. A T-chart is just a ratio table written top to bottom instead of left to right. The goal is to find an equivalent division problem involving whole numbers, which are easier to work with than are fractions.

The *area model* is used to support multiplication of fractions and decimals by showing geometrically the parts that make up the product. For example 5 ½ x 3 1/3 can be represented by the surface area of a rectangle having sides of (5 + ½) and (3 + 1/3).

The *number line* provides a model to support division of whole numbers by fractions.

Learning Outcomes

Students understand finding a fraction of a fraction to mean multiplication of the fractions. They compute products of decimals and mixed numbers using area models. Students convert fractions to decimal equivalents to multiply rational numbers. They divide fractions and decimals by finding equivalent division problems involving whole numbers. They work within contexts to support understanding.

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Section E Rational Numbers in Context

Section Focus

Students solve problems in real-world context and decide which model and number representation: ratios, fractions, decimals, and percents, they want to use. They apply their understanding of rational numbers by formulating and evaluating equations based on various contexts.

Learning Lines

Strategies

Throughout this unit students have developed a number of strategies for working with rational numbers in different representations. This section provides a variety of real-life contexts involving rational numbers for students to interpret, compute, and solve using the strategies that they have developed.

Models

The models that were introduced or revisited in this unit are available for students to use in this section. Students have had experiences with ratio tables, bar models, number lines, double number lines, T-charts, and the area model. Although all models are not applicable to all problems, students should be comfortable using a model that makes sense to them and will help them solve the problem.

Learning Outcomes

Students apply their understanding of the relationship between ratios, fractions, decimals, and percents. They choose their own strategy for solving problems involving numbers in different forms. They decide on which form of rational numbers--fractions, decimals, or ratios- they are most comfortable using based on the context of the problem. They formulate and apply equations to represent unknowns from real-world contexts such as measurement in cooking, trip distances, discounts on purchases, and baseball batting averages.