Gateway Regional School District

Atlas

Unit Plan

Extending Operations to Fractions

Chester / Littleville Elementary / Grade 4 / Mathematics

Week 9 - Week 13 | 5 Curriculum Developers | Last Updated: Mar 20, 2024 by LeBlanc, Deanna

Style Guide

What is the purpose of the unit? What are the major take-aways?

Standards

MA: Mathematics (2017)

MA: Grade 4

Number & Operations—Fractions

4.NF Extend understanding of fraction equivalence and ordering to fractions with denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100.
Show Details

- [x] 1. Explain why a fraction a/b is equivalent to a fraction (n × a)/(n × b) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions, including fractions greater than 1.
- [x] 2. Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.

4.NF Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers for fractions with denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100.

- [x] 3. Understand a fraction a/b with a > 1 as a sum of fractions 1/b.
- [x] 4. Apply and extend previous understandings of multiplication to multiply a fraction by a whole number.

4.NF Understand decimal notation for fractions, and compare decimal fractions.

- [x] 5. Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100. Show Details

Measurement & Data

4.MD Represent and interpret data.

- [x] 4. Make a line plot (dot plot) representation to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using information presented in line plots (dot plots). Show Details

Enduring Understandings

1. Equivalence and Scaling:
Students will understand that fractions can represent the same value even when they have different numerators and denominators. This concept is built on the idea that multiplying the numerator and denominator by the same number (scaling) creates an equivalent fraction. Understanding equivalence is essential for working with

Essential Questions

1. Equivalence and Visual Models:
- How can we show that two different-looking fractions are actually the same value?
- What does it mean for two fractions to be equivalent, and how can multiplying the numerator and denominator by the same number help us find equivalent fractions?

fractions in various contexts and is fundamental to recognizing how fractions can be simplified or expanded to facilitate operations such as addition, subtraction, comparison, and understanding fractions greater than one.

2. Comparative Reasoning:
Students will understand that comparing fractions requires a common frame of reference, which can be achieved by finding common denominators or common numerators. Using benchmark fractions, such as 1/2, as well as visual models, students learn to compare the size of fractions and express these comparisons using the symbols >, =, or <. This understanding is crucial when ordering fractions, assessing the reasonableness of answers, and applying fractions to real-world situations.

3. The Nature of Fractions Greater Than One:
Students will recognize that a fraction with a numerator greater than the denominator is equivalent to a whole number plus a proper fraction, exemplifying the concept of fractions as a sum of unit fractions. This understanding helps students in decomposing fractions, making connections to mixed numbers, and establishing a foundation for addition and subtraction of fractions.

4. Multiplication beyond Whole Numbers:
Students will understand that the principles of multiplication they have learned with whole numbers extend to multiplying fractions by whole numbers. This extends their understanding of multiplication as repeated addition and lays the groundwork for future learning about the multiplication of two fractions and the scaling of quantities.

5. Relating Denominators:
Students will comprehend that fractions with related denominators, such as 10 and 100, can be used to express the same fractional quantities in different forms. Through exploring the relationship between these denominators, students develop the ability to convert between them and add fractions with these denominators. This concept prepares students for working with decimal equivalents and understanding the base-ten system's role in our number system.

- Why do equivalent fractions have the same value even though they may consist of a different number of pieces?

2. Comparing Fractions:
- How can we compare fractions that have different numerators and denominators?
- What strategies can we use to determine which of two fractions is larger or if they are equal?
- How does using benchmark fractions like 1/2 help us compare other fractions, and why must the fractions refer to the same whole when comparing them?

3. Fractions Greater Than One:
- How can we represent a fraction as a sum of smaller fractions, especially when the numerator is greater than the denominator?
- What does it mean when a fraction has a numerator that is larger than the denominator?

4. Multiplication of Fractions by Whole Numbers:
- How can we use multiplication to find the product of a fraction and a whole number?
- What does it look like when we multiply a fraction by a whole number, and how can we use visual models to represent this?

5. Fractions with Denominators of 10 and 100:
- How can we show that a fraction with a denominator of 10 is equivalent to a fraction with a denominator of 100?
- What is the relationship between fractions that have denominators of 10 and 100, and how do we use this relationship to add such fractions?
- When adding fractions with denominators of 10 and 100, how is finding an equivalent fraction helpful?

Content

In this unit, students deepen their understanding of how fractions can be composed and decomposed, and learn about operations on fractions.
In grade 3, students partitioned a whole into equal parts and identified one of the parts as a unit fraction. They learned that non-unit fractions and whole numbers are composed of unit fractions. They used visual fraction models, including tape diagrams and number lines, to represent and compare fractions. In a previous unit, students extended that work and reasoned about fraction equivalence.
Here, students multiply fractions by whole numbers, add and subtract fractions with the same denominator, and add tenths and hundredths. They rely on familiar concepts and representations to do so. For instance, students had represented multiplication on a tape diagram, with equal-size groups and a whole number in each group. Here, they use a tape diagram that shows a fraction in each group.

Skills

Section A Goals
- Recognize that $n \times (a/b) = (n \times a)/b$.
- Represent and explain that a fraction a/b is a multiple of $1/b$, namely $a \times (1/b)$.
- Represent and solve problems involving multiplication of a fraction by a whole number.

Section B Goals
- Create and analyze line plots that display measurement data in fractions of a unit (18,14,1218,14,12).
- Represent and solve problems that involve the addition and subtraction of fractions and mixed numbers, including measurements presented in line plots.
- Use various strategies to add and subtract fractions and mixed numbers with like denominators.

Section C Goals
- Reason about equivalence to add tenths and hundredths.

- Reason about equivalence to solve problems involving addition and subtraction of fractions and mixed numbers.

In earlier grades, students used number lines to represent addition and subtraction of whole numbers. Here, they use number lines to represent the decomposition of fractions into sums, and to reason about addition and subtraction of fractions with the same denominator, including mixed numbers.

Students then apply these skills in the context of measurement and data. They analyze line plots showing fractional lengths and find sums and differences to answer questions about the data.
Lastly, students use fraction equivalence to find sums of tenths and hundredths.

Throughout the unit

The warm-up activities in this unit allow students to revisit and apply skills learned in previous grades, as well as to practice skills and develop the concepts learned in the unit.
Number Talks that involve multiplication encourage students to use familiar facts and structure in expressions to mentally find the values of related products. For example, the Number Talk in lesson 10 prompts students to notice and generalize patterns in the multiplication of a fraction and a whole number. In the last Number Talk, students revisit the associative property with whole numbers in preparation to strategically add tenths and hundredths when there are three or more addends.
The True or False activities encourage students to look for structure to determine if two expressions are equivalent, rather than to evaluate each expression. Students use their understanding of equal groups of fractions, fraction decomposition, and equivalent fractions to reason about the truth of equations.

How will you gauge student learning?

Assessments

4.3 End-of-Unit Assessment | Summative | Written Test

Grade4-3-End-of-Unit-Assessment-assessment.pdf

12 State Standards Assessed

How will students learn?

Learning Activities

Section A:
In this section, students extend their earlier understanding of multiplication as equal groups of whole numbers of objects to now include equal groups of fractional pieces.

Students begin by reasoning about groups containing unit fractions. Later, they also reason about groups of non-unit fractions and write expressions to represent the quantities.
Later, students reason with diagrams and equations. Through repeated reasoning, they see regularity in the product of a whole number and a fraction (MP8). The numerator in the resulting fraction is the product of the whole number and the numerator of the fractional factor, and the denominator is the same as in the fractional factor.

These diagrams also help students see that some fractions can be represented by more than one multiplication expression.

By circling the diagram in various ways, students can visualize the different combinations of groups, understand their equivalence, and observe the associative property of multiplication. In doing this work, students practice looking for and making use of structure (MP7).
Students then solve problems that involve fraction multiplication, using diagrams and equations to show their reasoning. These diagrams will also be useful in later grades, when students make sense of fractions as quotients.

Section B:
In this section, students learn to add and subtract fractions by decomposing them into sums of smaller fractions, writing equivalent fractions, and using number lines to support their reasoning.
Students begin by thinking about a fraction as a sum of unit fractions with the same denominator and then as a sum of other smaller fractions. They represent different ways to decompose a fraction by drawing “jumps” on number lines and writing different equations.

Working with number lines helps students see that a fraction greater than 1 can be decomposed into a whole number and a fraction, and then be expressed as a mixed number. This can in turn help us add and subtract fractions with the same denominator.
Later in the section, students organize fractional length measurements on line plots. They apply their ability to interpret line plots and to add and subtract fractions to solve problems about measurement data.

Section C:
In this section, students apply their understanding of fraction equivalence to add tenths and hundredths.
In the previous unit, students learned that 1/10=10/100. They use this reasoning to add tenths and hundredths by generating equivalent fractions. They also apply what they learned in the previous section to strategically use decomposition and the associative and commutative properties to add three or more tenths and hundredths, including mixed numbers.
This section ends with an optional lesson that allows students to apply what they have learned about multiplication, addition, and subtraction of fractions and mixed numbers to solve a design problem.

Differentiated Instruction

Technology Integration

21st Century Skills

Positive Behavior

CASEL

Collaborative for Academic, Social, and Emotional Learning

Resources

Teacher Notes and Reflections

Two optional lessons