Theme: **Suggested Days of Instruction: 45 days**

Ohio Learning Standards

NUMBER AND OPERATIONS: FRACTIONS (F)

Extend understanding of fraction equivalence and ordering.

1. Explain why a fraction a/b is equivalent to a fraction (n x a)/(n x 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.
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 ½. 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.

Build fractions from unit fractions by applying and extending previous understanding of operations on whole numbers.

3. Understand a fraction a/b with a > 1 as a sum of fractions 1/b.
   a. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.
   b. Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. *Example: 3/8 = 1/8 + 1/8 + 1/8; 3/8 = 1/ 8 + 2/8; 2 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8.*
   c. Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction.
   d. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem.
4. Apply and extend previous understanding of multiplication to multiply a fraction by a whole number.
   a. Understand a fraction a/b as a multiple of 1/b. *For example, use a visual fraction model to represent 5/4 as the product 5 x ((1/4), recording the conclusion by the equation 5/4 = 5 x (1/4).*
   b. Understand a multiple of q/b as a multiple of 1/b, and use this understanding to multiply a fraction by a whole number. *For example, use a visual fraction model to express 3 x (2/5) as 6 x (1/5). Recognizing this product as 6/5. (In general, n x (a/b) = (n x a)/b.)*
   c. Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem. *For example, if each person at a party will eat 3/8 of a pound of roast beef, & there will be 5 people at the party, how many pounds of roast beef will be needed? Between what two whole numbers does your answer lie?*

Understand decimal notation for fractions, and compare decimal fractions.

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. *For example, express 3/10 as 30/100 and add 3/10 + 4/100 = 34/100.*

MEASUREMENT AND DATA (MD)

Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.

1. Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; Lb., l, ml; hr., min., sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft. is 12 times as long as 1 in. Express the length of a 4ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 2), (2, 24), (3, 36).*
2. Use the four operations to solve word problems involving distances, intervals of time, liquid, volumes, masses of objects, and money, including problems involving simple fractions or decimals, and in terms of a smaller unit. Represent measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.
3. Apply the area and perimeter formulas for rectangles in real world and mathematical problems. *For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.*

Represent and interpret data.

4. Make a line plot to display a data set of measurements in fractions of a unit (1/2, ¼, 1/8). Solve problems involving addition and subtraction of fractions by using information presented in line plots.

Commentary:

Fourth graders extend understanding from third grade experiences, composing fractions from unit: fractions and decomposing fractions into unit fractions, and apply this understanding to add and subtract fractions with like denominators. They begin with visual models and progress to making generalizations for addition and subtraction fractions with like denominators. They compare fractions that refer to the same whole using a variety of strategies. Using visual models and making connections to whole number multiplication supports students as they begin to explore multiplying a whole number times a fraction. In Grade 4, denominators are limited to 2, 3, 4, 5, 6, 8, 10, 12, and 100. Students build equivalent fractions with denominators of 10 and 100 and connect that work to decimal notation for tenths and hundredths.

Cluster A:

Fourth graders continue to work with equivalence beginning with models and using those models to generalize a pattern and eventually a rule for finding equivalent fractions. They justify their reasoning using pictures numbers and words. In Grade 3 students compared fractions with like numerators or like denominators reinforcing the important comparison concept that fractions must refer to the same whole.

Commentary

Standards for Mathematical Practice

SFMP 2. Use quantitative reasoning.

SFMP 3. Construct viable arguments and critique the reasoning of others.

SFMP 4. Model with Mathematics.

SFMP 5. Use appropriate tools strategically.

SFMP 7. Look for and make use of structure.

SFMP 8. Look for and express regularity in repeated reasoning.

Fourth graders extend their understanding of equivalent fractions reasoning with visual models. They look for patterns both physical (when I double the number of pieces in the whole pizza, I double the number of pieces that I ate.) and think about these patterns in terms of the meaning of the numerator and the denominator. Providing experiences with appropriate visual models will help students to develop understanding rather than just following a rule that has no meaning. Through finding and discussing patterns students construct mathematical arguments to explain their thinking as they build sets of equivalent fractions. All of this work supports the fundamental structure of fractional numbers that is critical to all future work with fractions in this domain.

Cluster B

Fourth graders continue to develop understanding of fractions as numbers composed of unit fractions (for examples, ¾ = ¼ + 1/4 + ¼). They also extend their understanding that fractions greater than 1 can be expressed as mixed numbers (for example, 12/5 = 5/5 + 5/5 + 2/5 =

2 2/5). They connect their understanding of addition and subtraction of whole numbers as adding to/joining and taking apart/separating to fraction contexts using fractions with like denominator. They begin with visual representations, including area models, fraction strips, and number lines and connect these representations to written equations.

First experiences with multiplication of a fraction by a whole number begin with connecting the meaning of multiplication of whole numbers to multiplication of a fraction by a whole number (for example, 5 X ¼ means 5 groups of ¼) using visual representations. Following many experiences modeling multiplication with unit fractions by whole numbers, students continue to work with other fractions. They solve problems by modeling using area models, fraction strips, and number lines and explain their reasoning to others.

Commentary continued

Standard for Mathematical Practices

SFMP 1. Make sense of problems and persevere in solving them.

SFMP 2. Use quantitative reasoning.

SFMP 3. Construct viable arguments and critique the reasoning of others.

SFMP 4. Model with Mathematics.

SFMP 5. Use appropriate tools strategically.

SFMP 6. Attend to precision.

SFMP 7. Look for and make use of structure.

SFMP 8. Look for and express regularity in repeated reasoning.

Students extend their work with unit fractions to composing and decomposing non-unit fractions. In doing so, they reason about fractions as numbers (quantitatively) and understand that fractions, like whole numbers, represent a "count" of something. The main difference is the "something" includes part of a whole. Problem solving contexts reinforce the meaning of addition and subtraction, presenting opportunities for students to relate previous work with addition and subtraction situations with whole numbers to adding ad subtracting fractions. They use models including area models, fraction strips and number lines and connect those visual models to written equations when they are ready. They build on previous understandings of the meaning of the numerator and denominator (precision) to see the structure of addition and subtraction and explain what is happening when they add and subtract fractions (for example, why they add or subtract numerators but keep the same denominator).

Cluster C:

As students continue to work with fractions, they make explicit connections between building equivalent fractions with tenths, and hundredths. They use decimal notations as another way to write these numerical values and build an understanding of tenths and hundredths as an extension of the place value system to numbers less than 2. They compare decimals using physical models. Models for this cluster include base-ten blocks and the number line.

Commentary continued

Standard for Mathematical Practices

SFMP 1. Make sense of problems and persevere in solving them.

SFMP 2. Use quantitative reasoning.

SFMP 3. Construct viable arguments and critique the reasoning of others.

SFMP 4. Model with Mathematics.

SFMP 5. Use appropriate tools strategically.

SFMP 6. Attend to precision.

SFMP 7. Look for and make use of structure.

SFMP 8. Look for and express regularity in repeated reasoning.

As fourth graders begin to explore decimal notation for a special group of fractions (those with denominators that are powers of 10) and connect decimal numbers to previous experiences with place value, they should have opportunities to find and share examples of where they see decimals used in their everyday life (money, sports statistics). They connect their experiences with equivalent fractions to work with a specific group of fractions, those with denominators that are powers of 10 (tenths and hundredths). They extend their previous work with the structure of our place value system to write these special fractions as decimals, explaining the value of tenths and hundredths as related to the ones place and one whole.

Measurement and Data

Fourth graders will focus their learning on understanding the relationship between units within one system of measurement. Emphasis will be placed on solving problems involving distances, intervals of time, liquid volumes, masses of objects, money, and area and perimeter. Students will also learn to use a protractor to measure angles and will interpret data using line plots they created.

Cluster A: Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.

Grade 4 Overview

Fourth graders will focus their learning on understanding the relationship between units within one system of measurement. Emphasis will be placed on solving word problems involving distances, inters of time, liquid volumes, masses of objects, money and area and perimeter.

Standards for Mathematical Practice

SFMP 1. Make sense of problems and persevere in solving them.

Students will solve problems involving measurement and the conversion of measurements from a larger unit to a smaller unit.

SFMP 2. Reason abstractly and quantitatively.

Students will recognize angle measure as additive.

SFMP 3. Construct viable arguments and critique the reasoning of others.

Students will construct and critique arguments relating to relative size of measurement units with everyday objects.

SFMP 4. Model with mathematics.

Students will construct line plots to display data of measurements in fractions of a unit.

SFMP 5. Use appropriate tolls strategically.

Students will select and use rulers, balances, graduated cylinders, angle rulers, and protractors to measure.

SFMP 6. Attend to precision.

Students will specify units of measure and state the meaning of the symbols used.

Cluster B: Represent and interpret data.

Grade 4 Overview

This cluster is about creating line plots to display a data set of objects measured in fractional units of 1/2, ¼, and 1/8. Students will solve problems using the data they collected.

SFMP 2. Reason abstractly and quantitatively.

Students will attend to the meaning of the measured objects and plots on the number line.

SFMP 4. Model with mathematics.

Students will use line plots to display data of objects measured in fractional units.

SFMP 5. Use appropriate tools strategically.

Students will use a ruler to measure objects to the nearest 1/8, ¼, and ½ inch.

SFMP 6. Attend to precision.

Students will attend to precision with specific vocabulary to describe and analyze data of objects measured and displayed on line plots.

Instructional Resources
Text: Math Expressions Common Core Assessment Guide

Unit 5: Measurement (Sections: 5.1-5.8)
- Converting Measurements
- Perimeter and Area

Unit 6: Fraction Concepts and Operations (Sections 6.1-6.10)
- Fractions with Like Denominators
- Mixed Numbers with Like Denominators
- Multiply Fractions and Whole Numbers

Unit 7: Fractions and Decimals (Sections 7.1-7.7)
- Comparing Fractions
- Equivalent Fractions

Differentiated Instruction Activities

Pages: 457, 465, 473, 479, 487, 495, 501, 507, 521, 531, 539, 549, 557, 565, 573, 579, 585, 591, 603, 613, 619, 627, 635, 645 and 651

Think Central Resources: www.thinkcentral.com
Below Level-Soar to Success, On Level-Mega Math, Challenge-Destination Math

Materials:

Unit 5: Activity Cards; math journals; meter strips; metric cards; scissors; metric mass uit cards; balance scale; quart/liter bottle of liquid; various classroom objects; analog clock; index cards; make a yard; calculator customary liquid cards; small objects to weight; grid

Assessments
Source: Math Expressions: Common Core Assessment Guide

Unit 5: Quick quiz 1 and 2, Unit 5 Assessment Form A and Unit 5 Assessment Form B

Unit 6: Quick Quiz 1, 2 and 3; Unit 6 Assessment Form A and Unit 6 Assessment Form B

Unit 7: Quick Quiz 1 and 2

Materials Continued

paper; stringing perimeter; units of perimeter and Area; Math Boards; centimeter grid paper

Unit 6: Activity Cards; Math journals; index cards; fraction strips (1 per person); number cubes (1,2,3,4,6,8); scissors; clear plastic container; small items (e.g. centimeter cubes, marbles); fraction cards; blank number cubes with stickers; colored pencils; erasers; number cubes (1-6) small identical containers; inch cubes

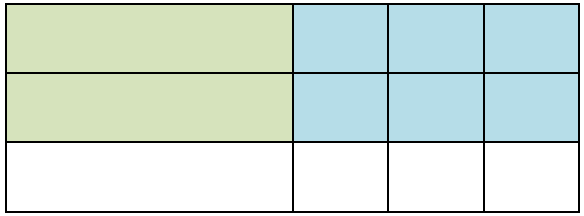
Unit 7: Activity Cards: Math journals; number cubes labeled 1 – 6 (1 pair per student); fraction strips; measuring lengths; inch ruler; centimeter grid paper; scissors; play money; spinner A; paper clip; multiplication table rows and equivalent; fraction box; game cards index cards

Addressing Student Misconceptions and Common Errors

4.NF.1

Students who use addition or subtraction instead of multiplication to develop sets of equivalent fractions need additional experiences with visual representations including fraction bars, areas models, and the number line. Explanations of why one multiples or divides to find an equivalent fraction should begin with visual representations and eventually connect to the rule/algorithm.

Addressing Student Misconceptions and Common Errors cont.



2/3 2X3= 6

3X3= 9

If I triple the number of pieces in the whole, that triples the number of pieces in my count.

4.NF.2

It is important for students to use reasoning and numbers sense to compare fractions and justify their thinking. Students who forget that the larger the number in the denominator, the smaller the pieces, may base their comparison on incorrect notations. These students need additional practice with concrete models and making connections to the written numeral. When comparing fractions, students must consider the size of the whole. One-half of a large box of popcorn is greater than ½ of a small box of popcorn. Take time to provide a variety of experiences for students to make sense of these important concepts.

4.NF 3.

Although students may be able to decompose a fraction into unit fractions (that is 4/5 = 1/5 + 1/5 + 1/5 +1/5 +1/5), when given the unit fraction to compose into a fraction, they may think they need to add denominators as well as numerators. This misconception can be avoided by giving students multiple opportunities with various concrete models, pictures, and the number line and making explicit connections to written equations.

4.NF 3a.

Students need not actually add or subtract fractions at this point, although many of them will be ready. Students who struggle with identifying a situation as an addition situation or a subtraction situation need more experience solving problems that require addition or subtraction. Modeling such situations using fraction pieces will help them to relate these operations to previous work with whole numbers.

Addressing Student Misconceptions and Common Errors cont.

4NF 3b.

Although this work may seem obvious to some students, it is important to take the time to build the concept because it lays the foundation for addition and subtracting fractions. Students who see functions as composed of smaller parts develop the understanding that when they add or subtract fractions, the numerator describes the count of pieces and the denominator describes the piece. Carefully developing this concept now will avoid misconceptions many students have when adding two fractions with unlike denominators.

4 NF 3 d.

Watch for students who may add or subtract denominators when adding and subtracting fractions. Those students need additional

concrete experiences and specific questions about whether their answer is reasonable. For example, if a student adds 2/3 +3/3 and get a sum of 5/6,

4.NF 5

Remember that at this point students are not expected to develop an algorithm for adding fractions with unlike denominators. This is an import opportunity for students to think about and explore situations in which adding two fractions with unlike denominators necessitates finding a common denominator, and why. Students who add numerators and denominators need more explicit experiences with models and to talk about why the denominator needs to be the same. Experiences should also focus on why they do not add denominators when adding fractions. Reinforcing the meaning of the numerator as the count of the number of piece and denominator as a descriptor telling the number of pieces in the whole supports future experiences adding fractions with unlike denominators in Grade 5.

4.MD 1.

Some students misunderstand that the larger the unit, the smaller the number you get when you measure. Students may incorrectly thing that larger units will give larger measures. To correct this common misconception, provide addition experiences for students to measure the same object with two different measuring units, such as rulers and yardsticks. Help students learning that it takes fewer yardsticks to measure a hallway than it takes rulers.

4. MD 2.

Some students may have difficulty converting a word problem into the necessary mathematical form needed to solve the problem. To address this, teachers need to provide multiple experiences with measurement problems on an ongoing basis.

Addressing Student Misconceptions and Common Errors cont.

4. MD 3

Some fourth graders may be confused when given a rectangle with only two of the side lengths shown or a problem situation with only two of the side lengths provided. The students may add only the dimensions shown to find that perimeter. To avoid this misconception, have students with the dimension on the other side of the rectangle.

Students are often confused between the concepts of perimeter and area. The formulas fourth graders learn must be developed through experience not just memorization. To address this, provide additional experiences for students to discover both area and perimeter. Help students notice that the formula for area is $l \times w = a$. The answer for are a will always be in square units. The formula for perimeter can be $2l + 2w = p$, and the answer will always be in linear units.

4.MD. 4.

Some students may not know what measurement to use if the object measures between 1/8 and ¼ inch. To address this, help students understand that measuring is approximate and items will not exactly measure to 1/8, ¼, ½ or one whole inch. Another error occurs when students use whole number names when counting fractional parts on a number line. To address this, remind students that the fraction name should be used instead. For example, if two-eights is displayed on the line plot three times, then there would be six-eighths.

Source: The Common Core Mathematics Companion: The Standards Decoded (What They Say, What They Mean, How to Teach Them)
Authors: Ruth Harbin Miles and Lois A. Williams, 2016 NCTM