

MAKING SENSE OF FRACTIONS

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In Indiana state standards have placed high priority on fraction concepts across the elementary grade levels. Whole number concepts such as the relationships between tens and ones, rounding numbers, utilizing estimation skills, and decomposing large numbers are frequent topics covered in classrooms. Yet, number sense doesn't stop with whole numbers. Fractions, decimals, and percents are numbers, too! It may seem odd to pair geometry standards in kindergarten through second grade with number sense standards in Grades 3-6; however, the kindergarten, first, and second grade standards of partitioning shapes is a precursor for work with fractions in Grades 3-6. In those grades, students build on this knowledge to conceptualize fractions as part of a whole or part of a set, understand the concept of equivalence, and extend this knowledge into mixed numbers, decimals, and percents.

KINDERGARTEN - GRADE 1

Compose simple geometric shapes to form larger shapes (e.g., create a rectangle composed of two triangles). (K.G.4)

Partition circles and rectangles into two and four equal parts; describe the parts using the words halves, fourths, and quarters; and use the phrases half of, fourth of, and quarter of. Describe the whole as two of, or four of, the parts. Understand for partitioning circles and rectangles into two and four equal parts that decomposing into equal parts creates smaller parts. (1.G.4)

Unpacking the Standards

In kindergarten we want children exploring shapes as much as possible including how to build shapes from others. When we put two squares together, what shape do we get? What happens when we put two rectangles together? This is a wonderful precursor to first grade where they start thinking about the concept of partitioning. We want children in first grade to understand they can take a circle or rectangle and partition it into two or four equal parts. When we do this, we have created two smaller shapes within one larger shape.

Considerations for Lessons and Assessment

There are several manipulatives that can be used to teach these concepts such as pattern blocks, power polygons, and tangrams. Time for exploration and play will provide opportunities for students to explore the concept of building shapes from other shapes as well as partitioning shapes into equal parts. Formative assessment can be done by way of observation and conversation between the teacher and student as well as tracings and drawings.

GRADE 2

Partition circles and rectangles into two, three, or four equal parts; describe the shares using the words halves, thirds, half of, a third of, etc.; and describe the whole as two halves, three thirds, four fourths. Recognize that equal parts of identical wholes need not have the same shape. (2.G.5.)

Unpacking the Standard

Prior to second grade, students are asked to partition shapes into halves and fourths while understanding that each piece is a half or a fourth of the shape. The second-grade standard extends this knowledge by including thirds, and asking students to recognize the whole shape as two halves, three thirds, or four fourths. Additionally, the same shape can be partitioned into equal parts in multiple ways.

Considerations for Lessons and Assessment

This video shows teachers how to use activities such as drawing, cutting, and folding shapes; utilizing common classroom manipulatives; and drawing on students' familiarity with objects around their homes, schools, and communities. Several assessments are also highlighted in the video. Assessments evaluate knowledge children bring from first grade as teachers build on students' strengths in moving toward the second-grade standard. End-of-unit assessments ensure that students meet all aspects of the standard including partitioning shapes into equal pieces and partitioning shapes into equal parts in a variety of ways.

GRADE 3

Understand a fraction, $\frac{1}{b}$, as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction, $\frac{a}{b}$, as the quantity formed by a parts of size $\frac{1}{b}$. [In Grade 3, limit denominators of fractions to 2, 3, 4, 6, 8.] (3.NS.3)

Unpacking the Standard

In second grade students learn how to equally partition shapes and understand that when partitioned, whole consists of two halves, three thirds, or four fourths. In third grade partitioning shapes into six and eight equal parts is included. Further, students must understand that each part is $\frac{1}{b}$ of that shape (e.g. when a shape is divided into four parts, each part is $\frac{1}{4}$). Students must also understand that multiple equally partitioned pieces within a shape represent a out of b parts (e.g., a shape equally partitioned into four pieces with three shaded in has $\frac{3}{4}$ shaded).

Considerations for Lessons and Assessment

This video builds off of what students completed in second grade. Students will draw, cut, and fold shapes. However, they will move into exploring sixths and eighths. They will compare and contrast shapes that are partitioned and labeled differently while also using manipulatives to recognize more than one part of the whole. Formative and summative assessments ask students to equally partition shapes in a variety of ways and identify more than one part of the whole.

GRADE 4

Express whole numbers as fractions and recognize fractions that are equivalent to whole numbers. Name and write mixed numbers using objects or pictures. Name and write mixed numbers as improper fractions using objects or pictures. (4.NS.3)

Unpacking the Standard

In this fourth-grade standard, students begin to develop an understanding of turning a fraction into a whole or mixed number. Students are introduced to the difference between concepts such as $4/4 = 1$ and $4/1 = 4$. After that, students use this knowledge to build understandings of mixed numbers as well as what it means when the numerator is greater than the denominator in a given fraction.

Considerations for Lessons and Assessment

In this video, manipulatives are used to explore the relationship between whole numbers and fractions. As well, lessons build from the use of drawing, cutting, and folding shapes to the introduction of mixed numbers. Assessments ask students to explain the difference between a fraction and a mixed number while representing each through words, pictures, and manipulatives.

GRADE 5

Explain different interpretations of fractions, including: as parts of a whole, parts of a set, and division of whole numbers by whole numbers. (5.NS.2)

Unpacking the Standard

This standard provides the first opportunity for students to develop an understanding that one whole isn't always represented by one standalone item. One whole can also be a set of something (e.g. a group of people, a pile of markers, a deck of cards). This establishes the idea that parts of a set can be represented in fraction form. The standard builds on work done in fourth grade by continuing to explore fractions where the numerator is greater than the denominator (also known as an improper fraction). Division is used to assist students in converting these fractions into whole numbers (e.g. $8/2 = 4$; $36/4 = 9$).

Considerations for Lessons and Assessment

Drawing upon the work done in fourth grade with pictures and manipulatives, this video shows how this standard transitions students to the use of division as a way to think about fractions. Further, it demonstrates how manipulatives, items from home, and survey data allow students to develop an understanding of fractions. This is done while reminding students that fractions can represent part of a whole as well as part of a set. Formative and summative assessments will ask students to explain the difference between fractional representations, rename numbers in both whole number and fraction form, and explain how fractions are a representation of division.

Know commonly used fractions (halves, thirds, fourths, fifths, eighths, tenths) and their decimal and percent equivalents. Convert between any two representations (fractions, decimals, percents) of positive rational numbers without the use of a calculator. (6.NS.4)

Unpacking the Standard

In sixth grade we want students to fully understand that any fraction can also be represented as a decimal and as a percent. For example, we want students to understand that $\frac{1}{2}$ is the same as .50 and 50%. With this knowledge, they will be able to determine which representation of the number is best used in different situations—for both context and computation.

Considerations for Lessons and Assessment

Manipulatives that are commonly used for this standard include fraction bars and circles, and bars or circles that show decimal and percent equivalents. However, we can also use number lines, clocks, money, pattern blocks, and power polygons to help demonstrate various representations. Providing multiple opportunities for students to connect to the different number representations will help students make sense of these numbers as they begin to use them in computational situations as well as in the world around them. Opportunities for assessment include observations and conversations as well as formative assessment opportunities to represent the numbers in multiple ways.

ADDITIONAL RESOURCES

Empson, S. B. & Levi, L. (2011). *Extending children's mathematics: Fractions and decimals*. Heinemann.

Fosnot, C. T. & Dolk, M. (2002). *Young mathematicians at work: Fractions, decimals, and percents*. Heinemann.

Partnership for Inquiry Learning (n.d.). <http://partnershipforinquirylearning.org>.