Math
Unit 2
Parts of a Whole

- How do we represent parts of a whole using words, numbers, and symbols?
- What strategies can we use to solve problems with parts of a whole?

UBD-Unit Plan[1]

[1] Adapted from *Understanding by Design, Unit Design Planning Template* (Wiggins/McTighe, 2005). Each unit plan is designed for 6-8 weeks of instruction, depending on student levels and length and frequency of class periods. The unit is mapped out in more detailed in the Unit Guide.

OVERVIEW[2]

Introduction

Unit 2 builds off of students' work with place value in Unit 1 to help them develop their understanding of quantities less than a whole. In this unit, students will explore the concepts behind rational numbers using a context all people are familiar with—food.

By leveraging the concept of purchasing and preparing food, students will learn how to compare and order fractions, decimals, and percents, as well as perform operations with fractions and decimals. The activities in this unit are designed to help students develop multiple models for constructing these important concepts, such as the number line, area models, and ratio tables. Through hands-on, concrete activities with familiar types of drinks like tea, students will be able to develop a strong conceptual understanding of ratio and proportion.

In a traditional course sequences, the concepts explored in Unit 2 take several years to develop. The activities in the unit are intended to give students a broad conceptual overview of topics that also allows them to develop the vocabulary to formalize their existing knowledge and intuitions about the mathematics.

[2] This is a summary of the unit. The sections on the following pages describe the unit in more detail.

STAGE 1 – DESIRED RESULTS							
Unit Targets[3]	**SET 1**	**SET 2**	**SET 3**	**SET 4**	**SET 5**	**SET 6**	**SET 7**
I can **identify amounts less than one whole**. (3.NF.A.1[4])	X	X	X	X	X	X	X
I can **determine the number of equal** and **individual parts** within a fraction. (3.NF.A.1)	X	X	X			X	X
I can **identify a fractional part out of a whole**. I can **create one whole** using various fractions. (3.NF.A.1)	X	X	X				X
I can **compare fractions with numerators of one** and **with numerators greater than one**. (3.NF.A.3.D, 3.NF.A.2)		X	X				
I can **recognize when two fractions are equivalent** when they are the same size. (3.NF.A.3.A)		X	X				
I can **recognize when two fractions are equivalent** when they are the same point on a number line. (3.NF.A.3.A, 4.NF.A.1)		X					
I can **create a table of equivalent ratios** and **discover patterns** in the numerators and denominators. (4.NF.A.1)		X				X	X
I can **add and subtract fractions with like and unlike denominators** using manipulatives and by creating equivalent fractions. I can **write my answer in lowest terms**. (4.NF.B.3.A, 5.NF.A.1)			X				X
I can **use fraction models to multiply fractions by a whole number** and **show that multiplication of fractions is the same as repeated addition**. (CCSS Content Standard 4.NF.4)			X				X
I can **compute quotients of whole numbers and fractions divided by fractions**. (5.NF.B.7.B, 6.NS.A.1)			X				X
I can **solve real-world problems involving fractions** with all four operations. (5.NF.A.2, 5.NF.B.6, 5.NF.B.7.C)			X				X
I can **use decimal notations for fractions with denominators of 10 and 100**. I can **read and write decimals to thousandths**. (4.NF.C.6, 5.NBT.A.3.A)				X	X		X
I can **use decimal numbers** to solve problems involving money. (2.MD.C.8)					X	X	X
I can **compare two decimal numbers to thousandths** based on the value of the digit in each place. (5.NBT.A.3.B)				X	X		

[3] Only targets new to this unit are included here.
[4] Unless otherwise stated, the standards listed here are all CCSS.MATH.CONTENT standards.

STAGE 1 – DESIRED RESULTS							
Unit Targets[3]	**SET 1**	**SET 2**	**SET 3**	**SET 4**	**SET 5**	**SET 6**	**SET 7**
I can **use what I know about place value and models to add and subtract decimals**. (5.NBT.7)					X		
I can **use decimal models to show that multiplication of decimals is the same as repeated addition** and that **the quotient of a decimal and whole number is the same as repeated subtraction**. (5.NBT.B.7)					X		
I can **solve real-world problems involving decimals** with all four operations. (5.NBT.B.7)					X		X
I can **find a percent of a number** as a rate per 100. (6.RP.A.3.C)						X	X
I can **convert a fraction to a decimal to a percent**. (4.NF.C.6)					X	X	X
I can **identify equivalent fractions, decimals and percents** using models. (4.NF.C.6)					X	X	X
I can **demonstrate how ratios compare two quantities**. (6.RP.1)						X	X
I can **understand a proportion as two equivalent ratios** and **can determine if two ratios form a proportion**. (7.RP.A.2.A)						X	X
I can **solve a proportion problem with a missing term** and **use proportional reasoning to solve word problems** involving percents. (6.RP.A.3)						X	X
I can **identify relative sizes of measurement** in a recipe. (4.MD.A.1)							X
I can **use what I know about ratios and proportions** to solve a real-world problem. (6.RP.A.3)						X	X
I can **work on a challenging problem and not give up**. (MP 1)	X	X	X	X	X	X	X
I can **think about numbers in many different ways, use what I already know about math** to solve problems, and **use a strategy that I used to solve another math problem**. (MP 2, MP 7, MP 8)	X	X	X	X	X	X	X
I can **show my work**, **explain how I got my answers, and check my work** to make sure my calculations are correct. (MP 3, MP 6)	X	X	X	X	X	X	X
I can **use math symbols, numbers, tools, pictures, drawings, and objects** to solve a problem. (MP 4, MP 5)	X	X	X	X	X	X	X

Essential Questions & Enduring Understandings

Students will understand that ...

How do we represent parts of a whole using words, numbers, and symbols?

We can represent parts of a whole as fractions, decimals, or percents, since they are all equivalent ways to represent the same value. Fractions can be represented in more than one way. There are an infinite number of ways to represent a fractional amount of a given value (we can create infinite equivalent fractions).

What strategies can we use to solve problems with parts of a whole?

There are various strategies that can be used to solve problems involving parts of a whole. First, we can use what we know about the properties of numbers to help us reason through problems. We can also use our knowledge that fractions, decimals, and percents can be represented interchangeably to help us. We can convert between the three forms to make computations easier based on the type of problem we're working on, and we can use ratio tables, number lines, and diagrams to help us solve problems.

UNIT AT A GLANCE		
SET	**GUIDING QUESTIONS & KNOWLEDGE** *Students will know that ...*	**SKILLS** *Students will be able to ...*
1 3 lessons	**How can we represent amounts less than one whole?** *A fraction can be used to represent a number that is less than one whole. Fractions describe relationships (ratio of part to whole), so knowing the size or amount of the whole matters. Understand that fractional parts must be equal-sized. The number of equal parts tell how many make a whole.*	• identify a fraction as a ratio, quotient, and as a means to describe the part-to-whole relationship • identify fractions given how many parts are in the whole • identify the numerator and a denominator in a fraction and what it represents • create fractions that represent one whole
2 5 lessons	**How can we tell if two fractions are equivalent?** **What strategies can we use to compare fractions?** *Benchmark fractions can be used as landmarks to help compare and order fractions. Fractions are quantities that we can represent as points between whole numbers on a number line, and can be represented in an infinite number of ways.*	• identify if two fractions are equivalent • create equivalent fractions using a variety of strategies (visual fraction models, ratio tables, algorithms) • represent fractions on a number line • compare unit and non-unit fractions using number lines, concrete and visual models, and benchmark fractions • understand that as the denominator in a fraction increases, the size of the equal parts decreases

3 7 lessons	**What strategies and math tools can we use to solve problems with fractions?** *Fractions can be added or subtracted using like-sized parts (equivalent fractions). When multiplying or dividing fractions, we may get a product/quotient that is bigger than, smaller than, or equal to the original number. Concrete and visual models, algorithms, and calculators are some strategies that we can use to solve problems.*	• add and subtract fractions with like and unlike denominators using visual models, algorithms, and calculators • multiply a fraction by a whole number and by a fraction using visual models, algorithms, and calculators • divide a fraction by a whole number and by a fraction using visual models, algorithms, and calculators • develop calculator fluency to perform fraction operations and check solutions • use a variety of strategies to solve real-world fraction problems with all four operations
4 3 lessons	**How do we represent a part out of a whole as a fraction and a decimal?** **What strategies can we use to compare decimals?** *Place value determines the value of the decimal. Any decimal can be written as an equivalent fraction that has the same value. Decimals are quantities that can be represented as points between whole numbers on a number line.*	• represent a part-to-whole relationship as a fraction and as an equivalent decimal • read and write decimal numbers and state their equivalent decimal fraction • use U.S. bills and coins to represent decimal numbers • compare and order decimal numbers using concrete models and number lines
5 5 lessons	**What strategies and math tools can we use to solve problems with decimals?** *When multiplying or dividing decimals, we may get a product/quotient that is bigger than, smaller than, or equal to the original number. Concrete and visual models, algorithms, and calculators are some strategies that we can use to solve problems.*	• use a variety of strategies to add and subtract decimals • use a variety of strategies to multiply a decimal by a whole number and a decimal by a decimal • use a variety of strategies to divide a decimal by a whole number • develop calculator fluency to perform decimal operations and check solutions • use a variety of strategies to solve real-world problems involving decimals with all four operations

6 9 lessons	**How do we represent a part out of a whole as a ratio and a percent?** **How do we solve problems with ratios, proportions, and percents?** *Ratios can be expressed as fractions, but ratios and fractions do not have identical meaning. Ratios describe relationships between two quantities (part-to-part comparison) while fractions describe relationships between a part and a whole Two ratios form a proportion if they are equivalent ratios. Percents are amounts out of 100. Every percent can be written as an equivalent fraction and equivalent decimal.*	• construct ratios from word problems, models, and pictures • determine whether two ratios form a proportion • understand a percent as another part to whole ratio comparing a number to 100 • represent a part-to-whole relationship as a fraction, decimal, and percent • use a variety of strategies to solve real-world problems involving proportional relationships and percents
7 3 lessons	**How do we use knowledge of fractions, decimals, and percents to help us in everyday life?** *Knowledge of fractions, decimals, and percents is a useful and necessary tool to help navigate everyday scenarios, such as shopping, budgeting, and preparing food.*	• apply concepts of operations with fractions, ratios, and proportional relationships to solve an authentic task • adjust a recipe to feed more or less people (double, half, etc.) • determine a total cost or budget needed to create a recipe for a given amount of people • explain and justify their solutions to a real-world problem

STAGE 2 – ASSESSMENT EVIDENCE	
Major Assessments	
Beginning Assessment On Demand[5] - Individual	**Pre-Unit Diagnostic Assessment** (3.NF.A.1, 3.NF.A.3, 4.NF.A.1, 4.NF.B.3, 4.NF.B.4, 4.NF.C.6, 5.NBT.A.3, 6.RP.A.1, 7.RPA.2.A) At the start of Set 1, students should complete a constructed response format diagnostic test. The purpose of this assessment is to help teachers determine students' entry points into the curriculum as well to ascertain any misconceptions or potential areas of struggle for students. *(Note: This assessment is not provided in materials; teachers will need to create this.)*
Mid-Unit Assessment On Demand - Individual	**Mid-Unit Assessment** (3.NF.A.1, 3.NF.A.3, 4.NF.A.1, 4.NF.A.2, 4.NF.B.3.A, 5.NF.A.1, 4.NF.B.4, 5.NF.B.7.B, 5.NF.B.6) The mid-unit assessment is intended to be a formative assessment to gauge student progress at the midpoint of the unit. To reduce the cognitive demand on students, we suggest that students be allowed to use calculators during this assessment, as well as manipulatives or number lines to assist them in performing operations. Multiple choice is introduced for the first time in this assessment. This is intentional to help introduce students to multiple-choice testing format that they will encounter on standardized tests.
Performance Task[6] Over Time - Collaborative	**"My Favorite Recipe" Performance Task** Over the course of Set 7, students will use an original family recipe to create various recipes for a specific number of people. They will also plan a budget to purchase the ingredients by creating a grocery shopping list and finding the total cost.
Final Assessment On Demand - Individual	**Final Assessment** (3.NF.A.1, 3.NF.A.3.D, 3.NF.A.3.B, 4.NF.C.6, 5.NBT.A.3.A, 5.NBT.B.7) Students will complete the final multiple-choice and constructed-response exam at the end of Set 7. This exam is in similar format to the Mid-Unit Assessment. It is designed to both help teachers ascertain the progress students have made since the Beginning Assessment, as well as to provide an additional measure to determine what extent the students have met the learning targets of the unit.

[5] On Demand refers to an assessment completed in one sitting, without teacher support.

[6] See the Performance Task Description and Student Model for more details on this assessment.

STAGE 3 – LEARNING PLAN	
SET 1	**How can we represent amounts less than one whole?**
1	Getting a Fair Share
2	Part of a Whole
3	Representing Fractions
SET 2	**How can we tell if two fractions are equivalent? What strategies can we use to compare fractions?**
4	Comparing Unit Fractions
5	Comparing Fractions: Fraction Line-Up
6	Equivalent Fractions: Part 1
7	Equivalent Fractions: Part 2
8	Using a Ratio Table to Make Equivalent Fractions
SET 3	**What strategies and math tools can we use to solve problems with fractions?**
9	Adding and Subtracting Fractions with Like Denominators
10	Adding and Subtracting Fractions with Unlike Denominators
11	Multiplying a Whole Number by a Fraction
12	Finding the Product of Two Fractions
13	Dividing Fractions
14	Dividing Fractions by Fractions
15	Problem Solving with Fractions
SET 4	**How do we represent a part out of whole as a fraction and a decimal? What strategies can we use to compare decimals?**
16	Decimal Place Value
17	Decimals and Money: Way to Make a Dollar
18	Comparing and Ordering Decimals
SET 5	**What strategies and math tools can we use to solve problems with decimals?**
19	Decimal Addition
20	Decimal Subtraction
21	Decimal Multiplication
22	Decimal Division
23	Problem Solving with Decimals
SET 6	**How do we represent a part out of a whole as a ratio and a percent? How do we solve problems with ratios, proportions, and percents?**
24	Introducing Percent
25	Fractions, Decimals, and Percents
26	Fraction, Decimal, and Percent Equivalence
27	Introduction to Ratios
28	Ratio Relationships
29	Introduction to Proportionality
30	Proportional Relationships
31	Solving Problems with Proportions
32	Solving Problems with Proportions and Percents

SET 7	How do we use knowledge of fractions, decimals, and percents to help us in everyday life?
33	Launching the Task
34	Exploring Solutions to the Task
35	Exploring Solutions to the Task Part 2