6th Grade Mathematics

Unit 1 Curriculum Map: September 9th – October 25th

ORANGE PUBLIC SCHOOLS

OFFICE OF CURRICULUM AND INSTRUCTION

OFFICE OF MATHEMATICS

Common Core Standards

REVIEW OF GRADE 5 FLUENCIES	
5.NBT.6	Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.
5.NBT.7	Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.
5.NF.7	Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (Note: Students able to multiply fractions in general can develop strategies to divide fractions in general, by reasoning about the relationship between multiplication and division. But division of a fraction by a fraction is not a requirement at this grade.)
	a. Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. For example, create a story context for (1/3) ÷ 4, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that (1/3) ÷ 4 = 1/12 because (1/12). 4 = 1/3.
	b. Interpret division of a whole number by a unit fraction, and compute such quotients. For example, create a story context for 4 ÷ (1/5), and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that 4 ÷ (1/5) = 20 because 20. (1/5) = 4.
	c. Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. For example, how much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 1/3-cup servings are in 2 cups of raisins?

GRADE 6 NUMBER SENSE	
6.NS.1	Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3.(In general, (a/b) ÷ (c/d) = ad/bc.) How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cupservings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?
6.NS.2	Fluently divide multi-digit numbers using the standard algorithm.
6.NS.3	Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.
6.NS.5	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g. temperature above/below zero, elevation above/below, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts explaining the meaning of 0 in each situation.

GRADE 6 RATIOS AND PROPORTIONS	
6.RP.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, “The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak.” “For every vote candidate A received, candidate C received nearly three votes.”
6.RP.2	Understand the concept of a unit rate a/b associated with a ratio a:b with b +/- 0, and use rate language in the context of a ratio relationship. For example, “This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is ¾ cup of flour for each cup of sugar.” “We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger.”
6.RP.3	Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. a. Make tables of equivalent ratios relating quantities with whole number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. b. Solve unit rate problems including those involving unit pricing and constant speed c. Find a percent of quantity as a rate per 100, (e.g. 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole given a part and the percent. d. Use ratio reasoning to convert measurement units, manipulate and transform units appropriately when multiplying or dividing quantities.

Model Curriculum Student Learning Objectives

SLO	Description
1	Compute quotients of fractions
2	Construct visual fraction models to represent quotients and explain the relationship between multiplication and division of fractions
3	Solve real-world problems involving quotients of fractions and interpret the solutions in the context given
4	Fluently add, subtract, multiply and divide multi-digit decimals and whole numbers using standard algorithms
5	Use positive and negative numbers to describe quantities in real-world situations
6	Explain the relationship of two quantities or measures of a given ratio and use ratio language to describe the relationship between the two quantities. For example, “The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak.” “For every vote candidate A received, candidate C received nearly three votes.”
7	Use rate language in the context of a ratio relationship to describe a unit rate a/b associated with a ratio a:b with $b \neq 0$. For example, “This recipe has a ratio of 3 cups f flour to 4 cups of sugar, so there is a ¾ cup of flour for each cup of sugar.” “We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger.”
8	Use ratio and rate reasoning to solve real world and mathematical problems which include making tables of equivalent ratios, solving unit rate problems, finding percent of a quantity as a rate per 100.
9	Use ratio and rate reasoning to convert measurement units (manipulate and transform units appropriately when multiplying or dividing quantities).

Connections to the Mathematical Practices

1	**Make sense of problems and persevere in solving them** - Make sense of real-world fraction and decimal problem situations by representing the context in tactile and/or virtual manipulatives, visual, or algebraic models - Understand the problem context in order to translate them into ratios/rates
2	**Reason abstractly and quantitatively** - Understand the relationship between two quantities in order to express them mathematically - Use ratio and rate notation as well as visual models and contexts to demonstrate reasoning - Apply the constructs of multiplication, division, addition, and subtraction of rational numbers to solve application problems
3	**Construct viable arguments and critique the reasoning of others** - Construct and critique arguments regarding the proportion of a whole as represented in the context of real-world situations - Explain why you do not always get a smaller number when dividing with fractions and decimals - Reason the steps in modeling division of fractions - Construct and critique arguments regarding appropriateness of representations given ratio and rate contexts, EX: does a tape diagram adequately represent a given ratio scenario
4	**Model with mathematics** - Model a problem situation symbolically (tables, expressions, or equations), visually (graphs or diagrams) and contextually to form real-world connections - Model real-world situations to show division of fractions
5	**Use appropriate tools strategically** - Use visual or concrete tools for division of fractions with understanding - Choose appropriate models for a given situation, including tables, expressions or equations, tape diagrams, number line models, etc.
6	**Attend to precision** - Use and interpret mathematical language to make sense of ratios and rates - Attend to the language of problems to determine appropriate representations and operations for solving real-world problems. - Attend to the precision of correct decimal placement used in real-world problems
7	**Look for and make use of structure** - Examine the relationship of rational numbers (positive decimal and fraction numbers) to the number line and the place value structure as related to multi-digit operations. - Use knowledge of problem solving structures to make sense of real world problems - Recognize patterns that exist in ratio tables, including both the additive and

	multiplicative properties - Use knowledge of the structures of word problems to make sense of real-world problems
8	Look for and express regularity in repeated reasoning
	- Utilize repeated reasoning by applying their knowledge of ratio, rate and problem solving structures to new contexts - Generalize the relationship between representations, understanding that all formats represent the same ratio or rate - Demonstrate repeated reasoning when dividing fractions by fractions and connect the inverse relationship to multiplication - Use repeated reasoning when solving real-world problems using rational numbers

Vocabulary

Term	Definition
Algorithm	a step-by-step solution to a problem
Difference	the amount left after one number is subtracted from another number
Distributive Property	The sum of two addends multiplied by a number equals the sum of the product of each addend and that number
Dividend	a number that is divided by another number
Divisor	a number by which another number is to be divided
Factor	When two or more integers are multiplied, each number is a factor of the product. “To factor” means to write the number or term as a product of its factor.
Measurement Model of Division	When we know the original amount and the size or measure of ONE part, we use measurement division to find the number of parts. Ex: 20 is how many groups of 4?
Minuend	the number that is to be subtracted from
Multiple	the product of a given whole number and an integer
Quotient	a number that is the result of division
Partitive Model of Division	When we know the original amount and the number of parts, we use partitive division to find the size of each part. Ex: 20 is 4 groups of what unit?
Reciprocal	two numbers whose product is 1. The reciprocal of a fraction can be found by inverting that fraction (switching the denominator and numerator)
Sum	the number you get by adding two or more numbers together
Subtrahend	the number that is to be subtracted
Product	a number that is the result of multiplication
Percent	a fraction or ratio in which the denominator is 100; a number compared to 100
Proportion	an equation which states that two ratios are equal
Rate	A comparison of two quantities that have different units of measure
Ratio	compares quantities that share a fixed, multiplicative relationship
Rational number	A number that can be written as a/b where a and b are integers, but b is not equal to 0
Tape Diagram	A thinking tool use to visually represent a mathematical problem and transform the words into an appropriate numerical operation. Tape diagrams are drawings that

	look like a segment of tape, used to illustrate number relationships. Also known as Singapore Strips, strip diagrams, bar models or graphs, fraction strips, or length models
Unit Ratio	are ratios written as some number to 1
Quantity	is an amount that can be counted or measured

Potential Student Misconceptions

- Students may believe that dividing by ½ is the same as dividing in half. Dividing by half means to find how many one-halves there are in a quantity, whereas, dividing in half means to take a quantity and split it into two equal parts. 7 ÷ ½ = 14 and 7 ÷ ½ ≠ 3½

- Students may understand that 1½ ÷ ¼ means, “How many fourths are in 1½?” So, they set out to count how many fourths (6). But in recording their answer, they can get confused as to what the 6 refers to and think it should be a fraction, and they record 6/4 when actually it is 6 groups of one-fourths, not 6 fourths

- As noted above, knowing what the unit is (the divisor) is critical and must be understood in giving the remainder. In the problem 3 3/8 ÷ 1/4, students are likely to count 4 fourths for each whole number (12 fourths) and one more for 2/8, but then not know what to do with the extra eights. It is important to be sure they understand the measurement concept of division. Ask, “How much of the next piece do you have?” Context can also help. In this case, if the problem was about pizza servings, there would be 13 full servings and ½ of the next serving.

- The most common error in adding fractions is to add both the numerators and the denominators. For example, one teacher asked her fifth graders if the following was correct: 3/8 + 2/8 = 5/16. A student correctly replied, “No because they are eighths. If you put them together, you will still have eighths. See, you can’t make them into sixteenths when you put them together. They are still eighths.”

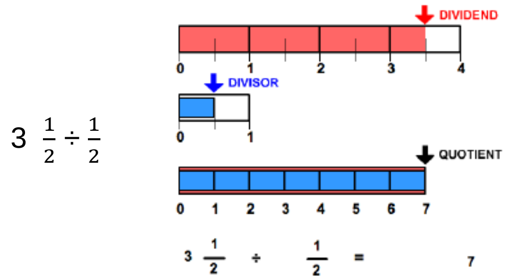
- Many students have trouble finding common denominators because they are not able to come up with common multiples of the denominators quickly. This skill requires having a good command of multiplication facts. Students benefit from knowing that any common denominator will work. Least common denominators are preferred because the computation is more manageable with smaller numbers, and there is less simplifying to do after adding or subtracting. Do not require least common multiples, support all common denominators, and through discussion students will see that finding the smallest multiple is more efficient.

- Often there is a misunderstanding that a percent is always a natural number less than or equal to 100. Provide examples of percent amounts that are greater than 100%, and percent amounts that are less than 1%.

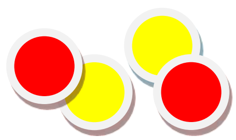
Teaching Multiple Representations

CONCRETE REPRESENTATIONS

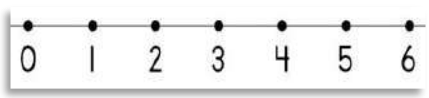
- Number Lines



- 2-color coin counters to represent negatives and positives



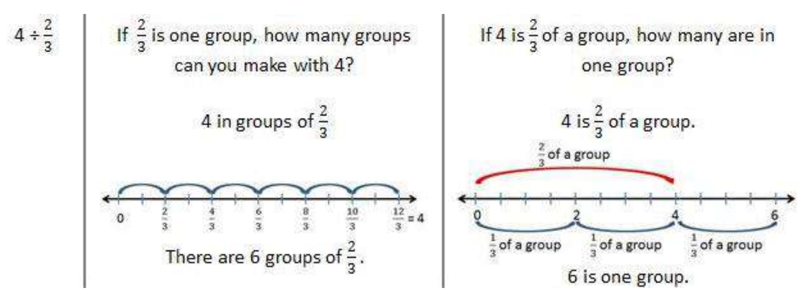
- Number Lines



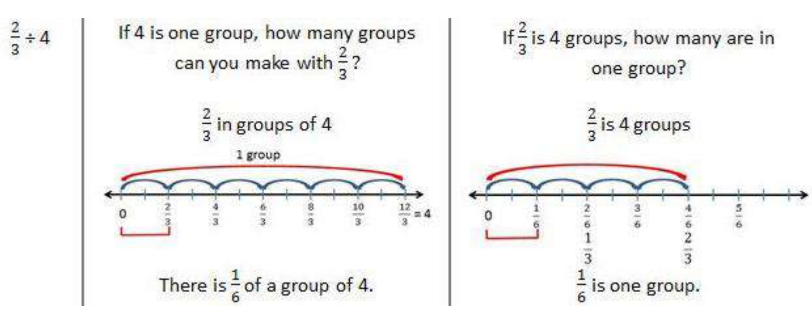
- Thermometers and other equally partitioned tools

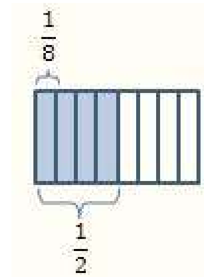
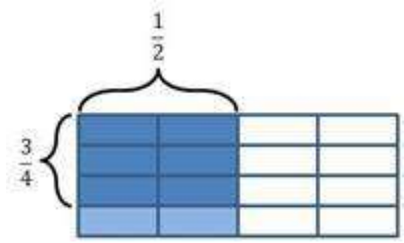
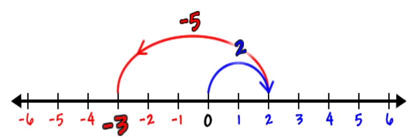
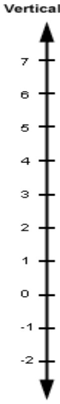
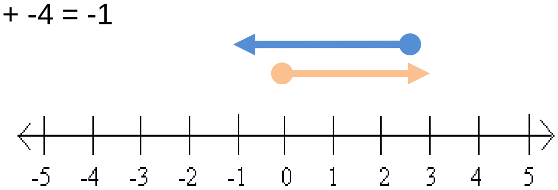
PICTORIAL REPRESENTATIONS

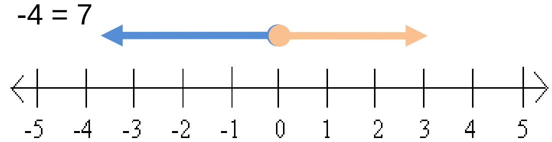
- Number Lines (Division Shown)



- Rectangular Area Models (Division & Multiplication Shown)



	$\frac{1}{2} \div \frac{1}{8}$  $\frac{3}{4}$ x $\frac{1}{2}$ 
• Number Lines (Horizontal) • Number Lines (Vertical)	 Figure 3 - Vertical Number Line 
• Distance / Vector Model	*Adding Integers* Addition is modeled as putting a second vector's tail at the first vector's head and finding where the second vector's head extends to. 3 + -4 = -1 

<table>
<tr><td></td><td>Subtracting Integers
Subtraction can be thought of as comparing the two vectors p, and q, by putting both tails together (starting each from zero) and asking the question: “How would one extend a vector from the head of p to the head of q?” The length and direction of that vector would be the result of the subtraction.
3 - -4 = 7

</td></tr>
<tr><td colspan="2">ABSTRACT REPRESENTATIONS</td></tr>
<tr><td colspan="2">• Applying the Operations
• Applying Properties of Numbers
• Applying the standard algorithms for addition, subtraction, multiplication, and division</td></tr>
<tr><td>• Applying Properties of Numbers</td><td>p – q = p + (-q)
p - -q = p + q</td></tr>
</table>

Pacing Guide

Activity	Common Core Standards/SLO	Estimated Time
Review of 5th Grade	5.NBT.6; 5.NBT.7; 5.NF.7	7 days
Let's Be Rational (CMP3) Investigation 1	6.NS.6; 6.NS.3; 6.NS.4 SLO 4	3 days
Let's Be Rational (CMP3) Investigation 2	6.NS.3; 6.NS.4 SLO 4	2 days
Let's Be Rational (CMP3) Investigation 3	6.NS.1; 6.NS.2; 6.NS.3; 6.NS.4 SLO 1, 2, 3, 4	3 days
Let's Be Rational (CMP3) Investigation 4	6.NS.1; 6.NS.3; 6.NS.4 SLO 1, 2, 3, 4	2 days
Assessment Check 1	6.NS.1; 6.NS.2; 6.NS.3	1 day
Comparing Bits and Pieces (CMP3) Investigation 1	6.RP.1; 6.RP.3; 6.NS.4 SLO 6, 8, 9	4 days
Comparing Bits and Pieces (CMP3) Investigation 2	6.RP.1; 6.RP.2; 6.RP.3; 6.NS.4 SLO 6, 7, 8, 9	2 days
Comparing Bits and Pieces (CMP3) Investigation 3	6.NS.3; 6.NS.4; 6.NS.5; 6.NS.6; 6.NS.7; 6.RP.1; 6.RP.3 SLO 4, 5, 6, 8, 9	4 days
Comparing Bits and Pieces (CMP3) Investigation 4	6.NS.2; 6.RP.1; 6.RP.3 SLO 4, 6, 7, 8	2 days
Assessment Check 2	6.RP.1; 6.RP.2; 6.RP.3; 6.NS.5	1 day
Unit 1 Assessment	6.NS.1; 6.NS.2; 6.NS.3; 6.NS.5; 6.RP.1; 6.RP.2; 6.RP.3	1-2 days (October 24/25)

Assessment Checks

Assessment Check 1

1. Andy wants to buy 3 1/3 cups of cashews. There is 5/6 cup of cashews in each package. How many packages of cashews should Andy buy?

2. One mug of hot chocolate uses 2/3 cup of cocoa powder. How many mugs can Nelli make with 3 cups of cocoa powder?
    a. Solve the problem by drawing a picture.
    b. Explain how you can see the answer to the problem in your picture.
    c. Which of the following multiplication or division equations represents this situation? Explain your reasoning.

    3 x 2/3 = _____ 3 ÷ 2/3 = _____ 2/3 ÷ 3 = _____

3. ½ of a gallon of milk is being poured in to smaller containers that each hold 1/3 of a gallon of milk. How many small containers can be filled?

4. 122 students were split into groups to go on vans for a class trip. If each van held 14 students then how many vans were needed? Was each van full? Give a graphic example of your answer.

5. Jerry has 3,572 Skittles stored in boxes. If there are 38 boxes, how many Skittles must go in each box?

6. Mila parked her car at a lot that charges $0.25 per every half hour. She parked at 10:30AM. How much will she owe at 1PM?

Assessment Check 2

1. The table below shows the 2009 population of Tennessee represented by different age groups.

Tennessee Population in 2009

Age Group	**Percent of Total Population**
0 to 4	7
5 to 18	17
19 to 64	63
65 and over	13

Based on this information, which ratio represents the percent of the total population who were in the 65 and over age group to the percent of the total population who were in the 0 to 18 age group in Tennessee in 2009?

a. 1:8 b. 1:5 c. 13:24 d. 13:17

2. Fill-in the chart comparing slices per pizza.

Slices		16	24	40		160
Pizza	1		3	5	10	20

3. Derek Jeter had 203 hits in 627 at bats last year.

a. To the nearest hundredth, how many at bats did Derek Jeter average before he would get a hit?

b. To calculate batting average you divide hits by at-bats (hits/at-bats). What was Jeter's batting average and how does it mathematically compare to his number of at-bats before he got a hit?

4. A farmer was selling corn to the market. He sold it by the ton (2000 lbs.)

a. If he sold 12 tons for $3600, then how much did one pound of corn cost the market?

b. After purchasing the corn, the market found that one ton of corn equaled 6000 ears of corn on average. How many ears per pound does that compute to?

5. Jack ran 4 miles in 45 minutes. Jill ran 7 miles in 64.5 minutes.

a. How many miles/hour did each person run?

b. Who ran faster? Explain how you know.

6. Kendall bought a vase that was priced at $450. In addition, she had to pay 3% sales tax. How much did she pay for the vase?

7. A submarine was situated 800 feet below sea level. If it ascends 250 feet, what is its new position?

8. One day in July, the temperature at ground level at the airport was 90°. A pilot reported the temperature at 10,000 feet was 50°. How much did the temperature drop per 1000 feet?

Extensions

Online Resources

http://www.illustrativemathematics.org/standards/k8
- Performance tasks, scoring guides

http://www.ixl.com/math/grade-6
- Interactive, visually appealing fluency practice site that is objective descriptive

https://www.khanacademy.org/math/arithmetic/fractions
- Interactive, tracks student points, objective descriptive videos, allows for hints

https://www.khanacademy.org/math/arithmetic/rates-and-ratios
- Interactive, tracks student points, objective descriptive videos, allows for hints

https://www.khanacademy.org/math/arithmetic/absolute-value
- Interactive, tracks student points, objective descriptive videos, allows for hints

http://www.doe.k12.de.us/assessment/files/Math_Grade_6.pdf
- Common Core aligned assessment questions, including Next Generation Assessment Prototypes

6.RP.1-3 Summative Task
1. John, Marie, and Will all ran for 6th grade class president. Of the 36 students, 16 voted for John, 12 for Marie, and 8 for Will. What was the ratio of votes for John to votes for Will? What was the ratio of votes for Marie to votes for Will? What was the ratio of votes for Marie to votes for John?
2. Because no one got half the votes, they had to have a run-off election. Marie dropped out and convinced all her voters to vote for Will. What is the new ratio of Will's votes to John's?
3. John and Will also ran for Middle School Council President. There are 90 students voting in middle school. If the ratio of Will's votes to John's votes remains the same as it was in part (b), how many more votes will Will get than John?

6.NS.1-3 Summative Task
Taylor and Anya live 67.5 miles apart. Taylor is a very consistent biker rider – she finds that her speed is always very close to 12.5 miles per hour. Anya rides more slowly than Taylor, but she is working out and so she is becoming a faster rider as the weeks go by.
1. How long would it take Taylor to ride the 67.5 miles?
2. If Anya rides at 5 miles per hour, how long will it take her to cover the same distance?
3. Sometimes on a Saturday, they ride their bikes toward each other's houses and meet somewhere in between. Make a table showing how far apart the two friends are after zero hours, one hour, two hours, three hours, and four hours.
4. After riding for 30 minutes, how far apart will the girls be from each other?
5. If the girls both start out at 8AM, at approximately what time will the two friends meet? Explain your thinking.

6.NS.5 Summative Task
Use the transaction register to answer the questions below.
A transaction register is used to record money deposits and withdrawals from a checking account. It shows how much more money Mandy, a college student, had in her account as well as the 4 checks she has written so far.

Check No.	Date	Description of Transaction	Payment	Deposit	Balance
	9/04	Allowance from parents		$500	$500
1	9/07	College bookstore – textbooks	$291		
2	9/13	Graphing calculator	$99		
3	9/16	Bus pass	$150		
4	9/24	Charlie's Pizza	$12		

1. Subtract each withdrawal to find the balance after each check was written. If Mandy spend more than $500, record that amount as a negative number.
2. Which check did Mandy write that made her account overdrawn?
3. Mandy called home and asked for a loan. On 9/26, her parents loaned her $500. Mandy didn't make any other deposits or withdrawals between 9/24 and 9/26. After depositing the check from her parents, what was the balance in her register?
4. After her parents let her borrow the $500 from Exercise 3, Mandy wants to spend $300 on clothes and $150 on decorations for her dorm room. Does she have enough money in the bank? Express her balance with an integer if she buys these items.