7th 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 6 FLUENCIES	
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 sea level, 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
6.NS.6a	Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., –(–3) = 3, and that 0 is its own opposite.
6.NS.7c	Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. For example, for an account balance of –30 dollars, write |–30| = 30 to describe the size of the debt in dollars.

GRADE 7 NUMBER SENSE	
7.NS.1	Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram. a. Describe situations in which opposite quantities combine to make 0. For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged. b. Understand p + q as the number located a distance |q| from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts. c. Understand subtraction of rational numbers as adding the additive inverse $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts. d. Apply properties of operations as strategies to add and subtract rational numbers.
7.NS.A.2	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as $(-1)(-1) = 1$ and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts. b, Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then $-(p/q) = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real-world contexts. c. Apply properties of operations as strategies to multiply and divide rational numbers. d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.
7.NS.A.3	Solve real-world and mathematical problems involving the four operations with rational numbers.

Model Curriculum Student Learning Objectives

SLO	Description
1	Describe a model, on a horizontal and vertical number line, real-world situations in which rational numbers are combined.
2	Apply the additive inverse property to subtraction problems and develop the argument that the distance between two points is the absolute value of the difference between their coordinates.
3	Explain why a divisor cannot be zero and why division of integers results in a rational number.
4	Model the multiplication and division of signed numbers using real-world contexts, such as taking multiple steps backwards.
5	Convert a rational number to a decimal using long division and explain in oral or written language why the decimal is either a terminating or repeating decimal.
6	Apply properties of operations as strategies to add, subtract, multiply, and divide rational numbers.
7	Solve mathematical and real-world problems involving addition, subtraction, multiplication, and division of rational numbers.

Connections to the Mathematical Practices

1	Make sense of problems and persevere in solving them
	- explain and demonstrate rational number operations by using symbols, visuals, words, and real life contexts - demonstrate perseverance while using a variety of strategies (number lines, manipulatives, drawings, etc.)
2	Reason abstractly and quantitatively
	- demonstrate quantitative reasoning by representing and solving real world situations using visuals, numbers, and symbols - Demonstrate abstract reasoning by translating numerical sentences into real world situations
3	Construct viable arguments and critique the reasoning of others
	- discuss rules for operations with rational numbers using appropriate terminology and tools/visuals - apply properties to support their arguments and constructively critique the reasoning of others while supporting their own position -
4	Model with mathematics
	- model understanding of rational number operations using tools such as algebra tiles, counters, visual, and number lines and connect these models to solve problems involving real-world situations
5	Use appropriate tools strategically
	- demonstrate their ability to select and use the most appropriate tool (paper/pencil, manipulatives, and calculators) while solving problems with rational numbers
6	Attend to precision
	- demonstrate precision by using correct terminology and symbols and labeling units correctly - use precision in calculation by checking the reasonableness of their answers and making adjustments accordingly
7	Look for and make use of structure
	- look for structure in positive and negative rational numbers when they place them appropriately on the number line - use structure in calculation when considering the position of numbers on the number line - Recognize the problem solving structures of word problems and use this awareness to aid in solving
8	Look for and express regularity in repeated reasoning
	- use manipulatives to explore the patterns of operations with rational numbers - use patterns to develop algorithms - use algorithms to solve problems with a variety of problem solving structures

Vocabulary

Term	Definition
Additive Inverse	Two numbers whose sum is 0 are additive inverses of one another. Example: ¾ and ¾ are additive inverse of one another because ¾ + (-3/4) = (-3/4) + ¾ = 0
Multiplicative Inverse	Two numbers whose product is 1 are multiplicative inverses of one another. Example: ¾ and 4/3 are multiplicative inverses of one another because ¾ - 4/3 = 4/3 * ¾ = 1
Absolute Value	The distance between a number and zero on the number line. The symbol for absolute value is shown in this equation $\|-8\| = 8$
Integers	A number expressible in the form a or –a for some whole number a. The set of whole numbers and their opposites {…, -3, -2, -1, 0, 1, 2, 3 … }
Long Division	Standard procedure suitable for dividing simple or complex multi-digit numbers. It breaks down a division problem into a series of easier steps.
Natural Numbers	The set of numbers {1, 2, 3, 4, …}. Natural numbers are also called counting numbers
Negative Numbers	The set of numbers less than zero
Opposite Numbers	Two different numbers that have the same absolute value. Example: 4 and -4 are opposite numbers because both have an absolute value of 4
Positive Numbers	The set of numbers greater than zero.
Rational Numbers	The set of numbers that can be written in the form a/b where a and b are integers and b ≠ 0.
Repeating Decimal	A decimal number in which a digit or group of digits repeats without end.
Terminating Decimal	A decimal number that contains a finite number of digits
Zero Pair	Pair of numbers whose sum is zero

Potential Student Misconceptions

- When subtracting numbers with positive and negative values, students often subtract the two numbers and use the sign of the larger number in their answer rather than realize they are actually moving up or down the number line depending on the signs of the numbers. They also become very confused when subtracting a negative and often add the numbers and make the answer negative or subtract the numbers and make the answer negative.

- Another common mistake occurs when students attempt to apply the rules for multiplying and dividing numbers to adding and subtracting. For example, if they are subtracting two negative numbers they subtract the numbers and make the answer positive. Similarly, when subtracting a negative and positive value, they subtract the two numbers make the answer negative.

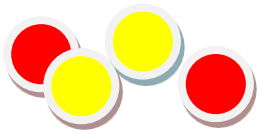
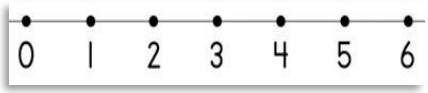
- Students will frequently forget the direction to move when adding on a number line. It is advisable to start with smaller numbers that they are familiar with before giving problems with larger numbers or with fractions, or decimals.

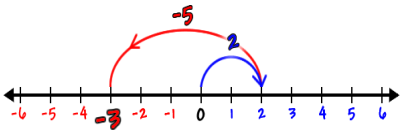
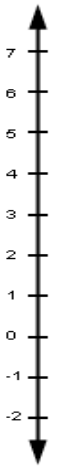
- When interpreting a negative mixed number, the students frequently assume that the whole number part is negative and the fraction part is positive instead of considering the whole mixed number as negative, both the whole number and the fraction part
  Just as students are taught that 23 means 20 + 3, and that 2 ¾ means 2 + ¾, teachers should explicitly explain what -2 ¾ means. They should lead the students to understand that it means (-2 + -3/4) and not (-2 + ¾).

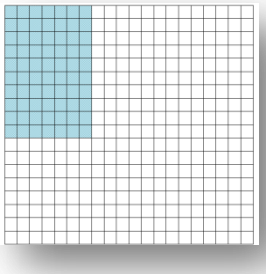
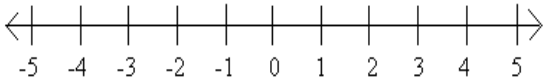
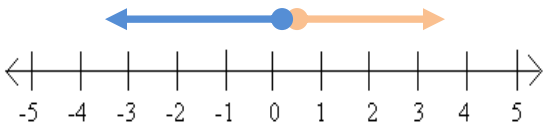
- Students often make the mistake of assuming that signed numbers mean only integers. They should be exposed to exercises that include signed fractions and decimals to curb this mistake.

- When dealing with addition and subtraction rules, students often make the mistake of changing the sign of the first number instead of leaving it as it is and then changing the subtraction sign and changing the second number to its additive inverse. Students should spend more time working on addition and subtraction using the number line so that they may have a strong foundation and understanding of the reason that subtraction changes to addition and the second number is changed to its additive inverse

Teaching Multiple Representations

CONCRETE REPRESENTATIONS	
• **2-color coin counters to represent negatives and positives**	
• **Number Lines**	
• **Thermometers and other equally partitioned tools**	
• **Rectangular Strips**	

PICTORIAL REPRESENTATIONS	
• **Number Lines (Horizontal)**	
	Figure 3 - Vertical Number Line
• **Number Lines (Vertical)**	
• **Bar/Fraction Models**	

• **100's Grid**	
• **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**  **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** 
ABSTRACT REPRESENTATIONS	
• Applying Properties of Numbers; p – q = p + (-q); p - -q = p + q • Applying Properties of Numbers • Applying the standard algorithms for addition, subtraction, multiplication, and division • Symbolic Representations	

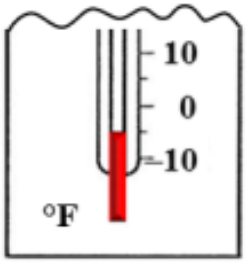
Pacing Guide

Activity	Common Core Standards/SLO	Estimated Time
Review of 6th Grade	6.NS.5; 6.NS.6a; 6.NS.7c	7 days
Accentuate the Negative (CMP3) Investigation 1	7.NS.A.1; 7.NS.A.1a; 7.NS.A.2; 7.NS.A.3; 7.EE.B.4b *SLO* 1, 2, 7	3 days
Accentuate the Negative (CMP3) Investigation 2	7.NS.A.1; 7.NS.A.1b; 7.NS.A.1c; 7.NS.A.2; 7.NS.A.3 *SLO* 1, 2, 6, 7	3 days
Accentuate the Negative (CMP3) Investigation 3	7.NS.A.2; 7.NS.A.2a; 7.NS.A.2b; 7.NS.A.2c; 7.NS.A.3 *SLO* 3, 4, 5, 6, 7	3 days
Accentuate the Negative (CMP3) Investigation 4	7.NS.A.1; 7.NS.A.1d; 7.NS.A.2; 7.NS.A.2a; 7.NS.A.2d; 7.NS.A.3 *SLO* 1, 4, 6, 7	3 days
Assessment Check 1	7.NS.1	1 day
Stretching and Shrinking (CMP3) Investigation 1	7.RP.A.2; 7.RP.A.2a; 7.G.A.1 *SLO* 7	2 days
Stretching and Shrinking (CMP3) Investigation 2	7.RP.A.2; 7.RP.A.2a; 7.RP.A.2b; 7.G.A.1 *SLO* 7	2 days
Stretching and Shrinking (CMP3) Investigation 3	7.RP.A.2; 7.RP.A.2b; 7.RP.A.3; 7.G.A.1; 7.G.A.2 *SLO* 7	3 days
Stretching and Shrinking (CMP3) Investigation 4	7.RP.A.2; 7.RP.A.2a; 7.EE.B.4; 7.NS.A.3; 7.G.1 *SLO* 7	3 days
Assessment Check 2	7.NS.2; 7.NS.3	1 day
Unit Review/Task/Project	7.NS.1; 7.NS.2; 7.NS.3	2 days
Unit 1 Assessment	7.NS.1; 7.NS.2; 7.NS.3	1-2 days (October 24/25)

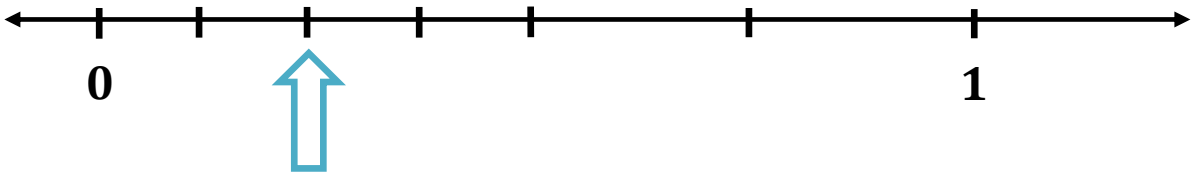
Assessment Checks

Assessment Check 1

1. What temperature would be 15° more than the temperature shown on the thermometer below?



2. Determine the number indicated on the number line below.



3. Jim's cell phone bill is automatically deducting $32 from his bank account every month. How much will the deductions total for the year?

a. -32
b. -44
c. -364
d. -384

4. A submarine was situated 450 feet below sea level. If it descends 300 feet, what is its new position?

5. In the Sahara Desert one day it was 136°F. In the Gobi Desert a temperature of -50°F was recorded. What is the difference between these two temperatures?

6. Mario walked $\frac{3}{4}$ mile to school and he walked back home. Then he walked $\frac{2}{3}$ miles to the store and back home. How far did Mario walk altogether?

Assessment Check 2

1. Let ♦ = -6, find the value of the following expressions:

5 • ♦	-5 • ♦	5 • (-♦)	5 • |♦|

2. When a diver is underwater, he is breathing air at a higher pressure than usual. If he stays too deep for too long, the high pressure of the air causes some of it to dissolve in his blood. Then, if he ascends too quickly, the air will "un-dissolve" and make bubbles in his blood, a very painful experience called "the bends." The US Navy has established time limits for how long a diver can stay at certain depths before he is in danger of the Bends.

To determine the amount of time (in seconds) a diver can safely remain under water, we use the equation:

$$Time = -6.1 \bullet depth + 750$$

If a diver is at a depth of 120 feet, how long can he safely remain under water before he is in danger of the Bends?

3. A speedboat can travel at a rate of 40 miles per hour. At this rate, what is the distance that the speedboat will travel in 6 minutes?

4. A bottle contains 0.375 liters of juice. Which of the following is another way to express 0.375?
   a. 3/75
   b. 3/8
   c. 37/50
   d. 3/4

Extensions

Online Resources

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

http://www.ixl.com/math/grade-7
- Interactive, visually appealing fluency practice site that is objective descriptive

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

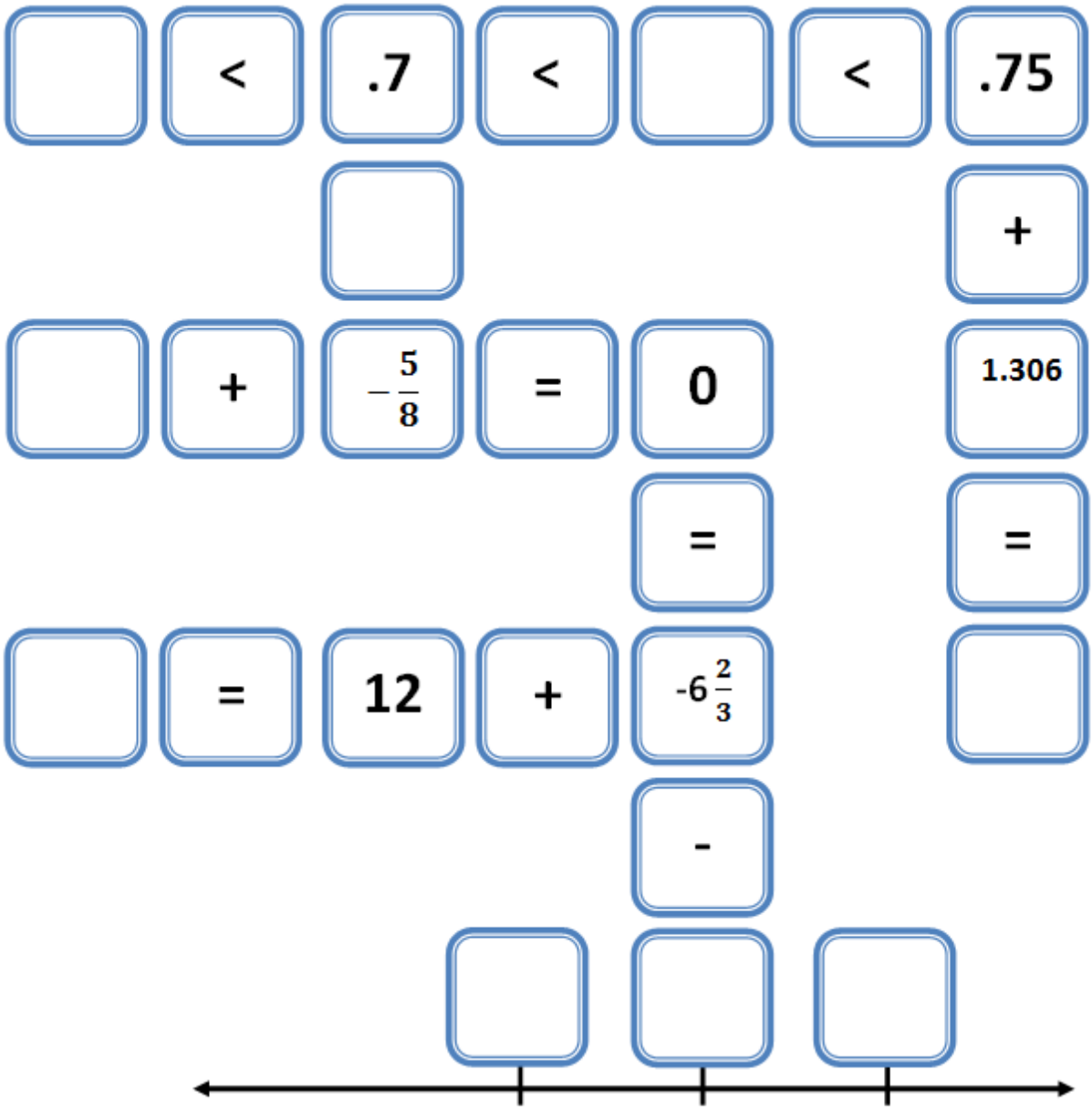
https://www.khanacademy.org/math/arithmetic/decimals/decimal_to_fraction/e/converting_fractions_to_decimals
- Interactive, tracks student points, objective descriptive videos, allows for hints

http://www.doe.k12.de.us/assessment/files/Math_Grade_7.pdf
- Common Core aligned assessment questions, including Next Generation Assessment Prototypes

Assessment Resources

7.NS.1 Summative Task

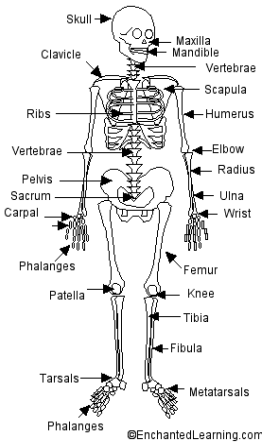
Replace each blank square in the bubble chart with a rational number or symbol that makes each number sentence true.



7.NS.2a-b Summative Task

FORENSIC SCIENCE

When a skeleton is found, a forensic scientist uses the lengths of certain bones to calculate the height of the living person. The bones that are used are the femur (F), the tibia (T), the humerus (H), and the radius (R). When the length of one of these bones is known, one of the following formulas is used to determine the height. All measurements are in inches. Find the approximate height of a female skeleton that has a humerus that measures 12inches.



MALE	FEMALE
Height = 2.2•F + 27	Height = 2.3•F + 24
Height = 2.4•T + 32	Height = 2.5•T + 29
Height = 3 •H + 29	Height = 3.1•H + 26
Height = 3.7•R + 32	Height = 3.9•R + 29

TEMPERATURE

To convert between degrees Celsius (C) to degrees Fahrenheit (F), we use the equation F = 9/5 (C+32). Calculate the temperature in Fahrenheit given C= -7°.

7.NS.2c-d Summative Task

Aiden needs to buy food for his dog Dusty. The Pet Emporium (TPE) has a 30-lb bag of Dusty's favorite brand on sale for $19.95, while Woofs'R'Us (WRU) has a 40-lb bag of Dusty's favorite brand on sale for $24.95.

- Which food package should Aiden buy if he wants to get the better deal on Dusty's favorite brand?
- How much would his savings be if he purchased 3 bags of the less expensive brand?