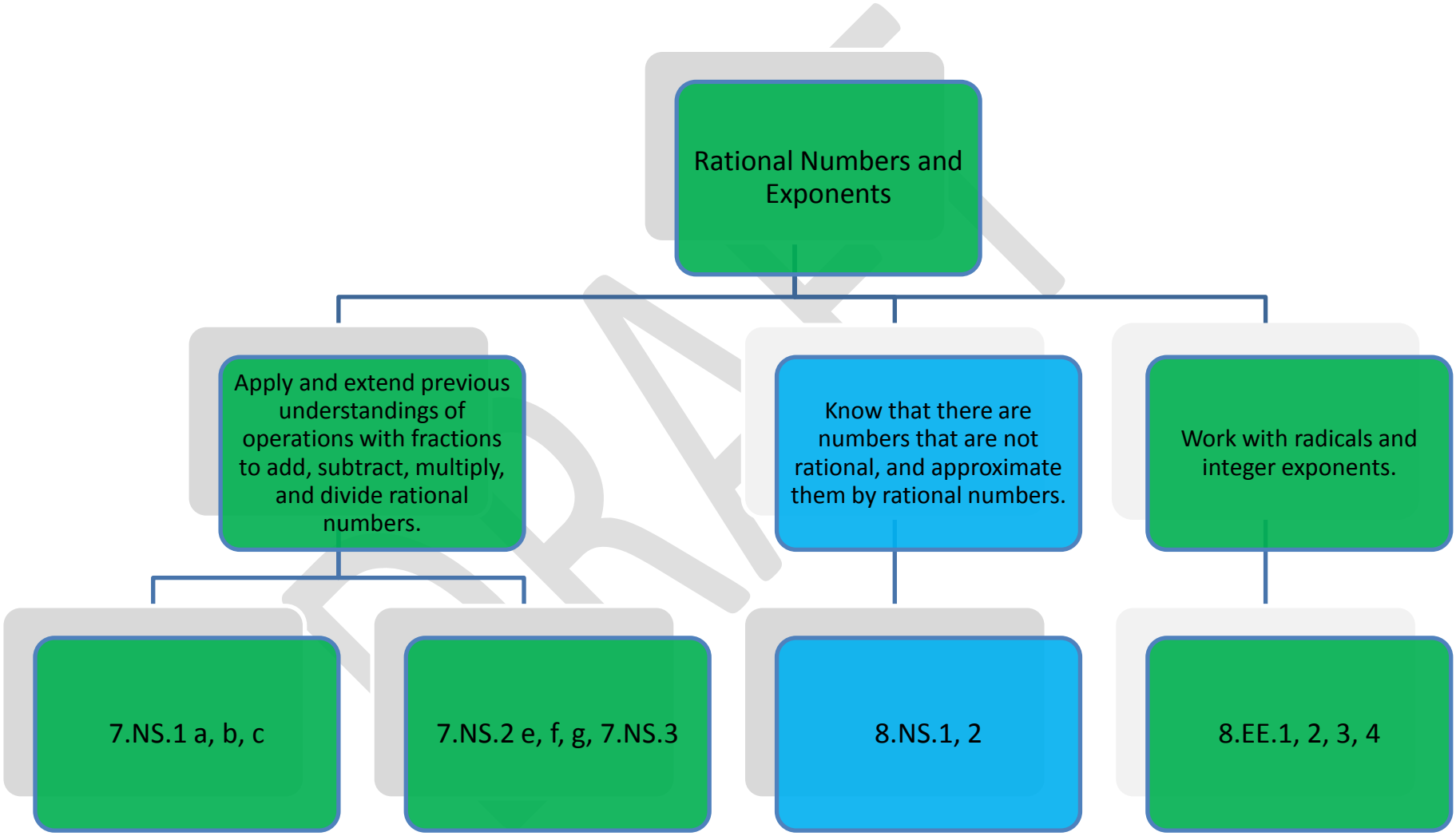
Accelerated Grade 7

Unit 1



Key: Major Clusters; Supporting Clusters and Additional Clusters

Accelerated Grade 7 – UNIT 1
Rational Numbers and Exponents

Students develop a unified understanding of number, recognizing fractions, decimals (that have a finite or a repeating decimal representation), and percents as different representations of rational numbers. Students extend addition, subtraction, multiplication, and division to all rational numbers, maintaining the properties of operations and the relationships between addition and subtraction, and multiplication and division. By applying these properties, and by viewing negative numbers in terms of everyday contexts (e.g., amounts owed or temperatures below zero), students explain and interpret the rules for adding, subtracting, multiplying, and dividing with negative numbers. They use the arithmetic of rational numbers as they formulate expressions and equations in one variable and use these equations to solve problems. They extend their mastery of the properties of operations to develop an understanding of integer exponents, and to work with numbers written in scientific notation

CLUSTERS	COMMON CORE STATE STANDARDS
Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.	**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 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.2** Apply and extend previous understanding of multiplication and division and of fractions to multiply and divide rational numbers. e. 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. f. 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. g. Apply properties of operations as strategies to multiply and divide rational numbers. h. Convert a rational number to a decimal using long division; know that the decimal from of a rational number terminates in 0s or eventually repeats. **7.NS.3** Solve real-world and mathematical problems involving the four operations with rational numbers.
Know that there are numbers that are not rational, and approximate them by rational numbers.	**8.NS.1**. Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number. **8.NS.2.** Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g.,). *For example, by truncating the decimal expansion of √ , show that √ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*
Work with radicals and integer exponents.	**8.EE.1** Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example,* $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$. **8.EE.2** Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational. **8.EE.3** Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as* 3×10^8 *and the population of the world as* 7×10^9*, and determine that the world population is more than 20 times larger.* **8.EE.4** Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

MATHEMATICAL PRACTICES	LEARNING PROGRESSIONS
1. Make sense of problems and persevere in solving them. **2. Reason abstractly and quantitatively.** **3. Construct viable arguments and critique the arguments of others.** **4. Model with mathematics.** **5. Use appropriate tools strategically.** **6. Attend to precision.** **7. Look for and make use of structure.** 8. **Look for and express regularity in repeated reasoning.**	http://commoncoretools.files.wordpress.com/2012/02/ccss_progression_nf_35_2011_08_12.pdf This cluster builds upon the understandings of rational numbers in Grade 6: • quantities can be shown using + or – as having opposite directions or values, • points on a number line show distance and direction, • opposite signs of numbers indicate locations on opposite sides of 0 on the number line, • the opposite of an opposite is the number itself, • the absolute value of a rational number is its distance from 0 on the number line, • the absolute value is the magnitude for a positive or negative quantity, and • locating and comparing locations on a coordinate grid by using negative and positive numbers. Learning now moves to exploring and ultimately formalizing rules for operations (addition, subtraction, multiplication and division) with integers. Using both contextual and numerical problems, students should explore what happens when negatives and positives are combined. Number lines present a visual image for students to explore and record addition and subtraction results. Students should be able to give contextual examples of integer operations, write and solve equations for real- world problems and explain how the properties of operations apply. Real-world situations could include: profit/loss, money, weight, sea level, debit/credit, football yardage, etc. http://ime.math.arizona.edu/progressions/#committee. CDE Progress to Algebra continuum K-8 www.**cde**.ca.gov/be/cc/**cd**/documents/updateditem12catt3.doc

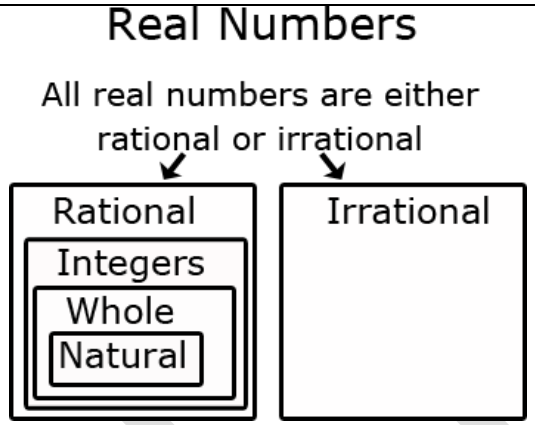
[1] **Major Clusters – area of intensive focus where students need fluent understanding and application of the core concepts.**

[2] **Supporting/Additional Clusters – designed to support and strengthen areas of major emphasis/expose students to other subjects.**

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS	KEY VOCABULARY
• Computation with positive and negative numbers is often necessary to determine relationships between quantities. • Models, diagrams, manipulatives, number lines, and patterns are useful in developing and remembering algorithms for computing with positive and negative numbers. • Properties of real numbers hold for all rational numbers. • Positive and negative numbers are often used to solve problems in everyday life. • Students approximate irrational numbers using their understanding of square and cube roots. • Students extend their understanding of the number system by investigating the relationship between the sides of a right triangle. • Students create equivalent expressions using integer exponents. • Students apply their understanding of exponents to express and compare numbers. • Students understand irrational numbers and when to use them in solving problems.	• When should we use additive inverse or multiplicative inverse? • How do we use a number line to show addition and subtraction of rational numbers? • What is the result of (what happens when) adding a number and its inverse or multiplying a number and its inverse? • How is the identity related to its inverses? • What is the relationship between addition and subtraction? • What is the relationship between multiplication and division? • How are the operations applied in real-world contexts? • How do the properties of operation help us compute with rational numbers? • Is it always true that multiplying a negative factor by a positive factor always produces a negative product? • How are rational and irrational numbers related? • How can lengths and distances be expressed – exactly or approximately – using understanding of square roots? • What real world problems does the Pythagorean Theorem allow us to solve? • How do we determine whether two expressions involving exponents are equivalent? • How can we express very small or very large numbers using exponential (scientific) notation? • How can you investigate the relationships between rational and irrational numbers?	• absolute Value • additive Inverse • approximate • associative Property • benchmark • commutative Property • converse • cube root, cubic root • distance • distributive Property • divisor • equation • equivalent • estimate • exponent • expression • factor • hypotenuse • integer • integers • irrational • length • multiplicative Inverse • opposite • product • Pythagorean Theorem • quotient • radical • rational • rational Numbers • repeating Decimal • scientific notation • side • square root • terminating decimal

		• zero Pair

RESOURCES	INSTRUCTIONAL STRATEGIES	ASSESSMENT
NLVM http://nlvm.usu.edu **NCTM Illuminations activities** 7.NS.3 Comparing Freezing Points http://www.illustrativemathematics.org/illustrations/314 7.NS.1a Distances on the Number Line 2 http://www.illustrativemathematics.org/illustrations/310 7.NS.3 Operations on the number line http://www.illustrativemathematics.org/illustrations/46 **California Draft Mathematics Framework:** http://www.cde.ca.gov/be/cc/cd/draftmathfwchapters.asp . **LAUSD Adopted Textbooks:** **California Mathematics: Concepts Skills and Problem Solving, Glencoe McGraw-Hill** 2.1 Rational Numbers 2.3 Multiplying Positive and Negative Fractions 2.4 Dividing Positive and Negative Fractions 2.5 Adding and Subtracting Like Fractions 2.6 Adding and Subtracting Unlike Fractions **California Math: Course 2 - McDougal Littell** 2.1 Simplifying Fractions 2.2 Comparing Fractions and Mixed Numbers 2.3 Adding and Subtracting Fractions 2.4 Using a Common Denominator 2.5 Multiplying Fractions 2.6 Dividing Fractions 2.7 Rational Numbers in Decimal Form 8.NS.1, 8.NS.2: MAP Concept Lesson, "Repeating Decimals," http://map.mathshell.org/materials/lessons.php?taskid=421&subpage=concept	• Number line model for operation with integers • Use of chips model (positive/negative numbers) for creating 0-pairs. • Use a foldable for integer rules. • Show that $\|a+b\| \neq \|a\| + \|b\|$ • Introduce this concept using a concrete model such as manipulative or have students draw a right triangle with sides 3, 4, and 5 units. Then have them draw a square of the above dimensions at each side of the right triangle. • Have students verify, using a model, that the sum of the squares of the legs is equal to the square of the hypotenuse in a right triangle. • Students should also understand that if the sum of the squares of the 2 smaller legs of a triangle is equal to the square of the third leg, then the triangle is a right triangle. • Engage students to have authentic experiences and exploration which would enable them to use the Pythagorean Theorem to solve problems. • Students can use graphic organizers to show the relationship between the subsets of the real number system.	SBAC - http://www.smarterbalanced.org/ Item #'s Items: 2959, 43022, 43023, 43026, 43047, 43053 SBAC - http://www.smarterbalanced.org/ ITEM #'S 42906 8 NS1-2, 8 EE 1-2 SBAC Sample Items: 8 EE 1 MAT.08.SR.1.000EE.B.203 8 EE 2 MAT.08.TE.1.000EE.B.144 MAT.08.TE.1.000EE.B.323 SBAC Content Specs: http://www.smarterbalanced.org/wordpress/wp-content/uploads/2011/12/Math-Content-Specifications.pdf 8 G 7: CR 5: Jane's TV PARCC MAP Center 8 NS, 8 EE, MAP Center, Short Novice Assessment Tasks, http://map.mathshell.org/materials/tasks.php?taskid=398#task3

8EE.1: Illustrative Mathematics, “Extending the Definition of Exponents,” http://s3.amazonaws.com/illustrativemathematics/illustration_pdfs/000/000/395/original/illustrative_mathematics_395.pdf?1343857080 **Engage New York**: Grade 8 Module 1 Integer Exponents and Scientific Notation	 • Students can approximate square roots by iterative processes. Have students to recognize that falls between $2^2 = 4$ and $3^2 = 9$. The value will be closer to 2 than to 3.	98 8 EE: MAP Center, Summative Assessment Tasks: “100 People” http://map.mathshell.org/materials/download.php?fileid=1046

LANGUAGE GOALS

Students will describe situations in which opposite quantities will combine to make 0 or 1.
Example: To add -5 and 5, I_____. The resulting sum will be_____, because _____.

Students will explain how they will use the properties of operations to compute with rational numbers.
Example: In performing operations with rational numbers, I will _____.

Students will create/write real-world problems representing operations with rational numbers.
Example: If the temperature is 40^0F in the morning and increases by 10^0 F by noon, the new temperature will be_____.

Students will summarize the steps in approximating irrational numbers using the square and cube roots.
Example Stem: Irrational numbers are _____. An example of an irrational number is _____. It is an irrational number because _____)

Students will use comparative adjectives to compare, explain and justify solutions.
(i.e. This exponent is greater than _____ because _____)

Students will compare and contrast rational and irrational numbers.
Example: The difference between a rational and irrational number is_____.

PERFORMANCE TASKS

MATHEMATICS ASSESSMENTS PROJECT
7. NS.1 and 7.NS.3 Using Positive and Negative Numbers in Context
http://map.mathshell.org/materials/lessons.php?taskid=453#task453

7NS.2 and 7.NS.3 Increasing and Decreasing Quantities by a Percent
http://map.mathshell.org/materials/lessons.php?taskid=210#task210
8.EE: MAP Center Concept Lesson, "Solving Real-Life Problems: Baseball Jerseys,"
http://map.mathshell.org/materials/download.php?fileid=1265
8.EE.4: MAP Center Concept Lesson, "Estimating Length Using Scientific Notation,"
http://map.mathshell.org/materials/lessons.php?taskid=414&subpage=concept

DIFFERENTIATION 🕮		
FRONT LOADING	ACCELERATION	INTERVENTION
• Have students construct number lines and show how they would get zero by determining how many points they would move from point 3 to 6 and back. • Use the amount they owe their friend to show that when they pay the debt, that there will be zero amount left. • Explain absolute value by using the distant they travel to school each way (to and fro). That distance is always positive. • Introduce integer concept using chips, manipulatives, number line or modeling virtually. • Students have an understanding of whole number powers of 10 with exponential notation. • Students have an understanding of the meaning of multiplication and further develop whole number power of 10 to	• Show students on a number line that the absolute value of a and absolute value of b will equal the magnitude of |a| and |b| |a| + |b| = a + b • Have students prove the following: Are there any rectangles whose area and perimeter have the same numerical value? • Can you write 1/2 as the sum of two "unit fractions"? 1⁄2= 1/a + 1/b. • Have students write multiplication problem or fraction division problem that can be modeled using area or linear model. • Provide students with opportunities to be recognized for their previous knowledge and to be allowed to avoid redundant learning by being encouraged to learn the sophisticated and advanced information and skills of the curriculum or related curriculums at their own rate. This also includes the opportunity for students to make personal meaning of the lesson. For example: **Expressions and Equations:** Students apply their math knowledge of scientific notation and choose appropriate size for measurements depending on quantity to determine such thing as measuring the volume of air a person breaths in a day, week, year, and lifetime given a rate. Bridging from 8 NS 1, 8 NS 2 to the related HS N-RNL Rational and Irrational Numbers 1, Concept Lesson http://map.mathshell.org/materials/lessons.php?taskid=424&subpage=concept Rational and Irrational Numbers 2, Concept Lesson http://map.mathshell.org/materials/lessons.php?taskid=434&subpage=concept	• Use manipulative to reteach integers such as using red and blue chips. • Provide number line strips to pairs of students and give them different integer problems. • Show students how to solve problems involving fractions with unlike denominators using a picture. Have them solve it using numbers and words. • Use Algebra tiles and fraction bars to reinforce learning. • Small teacher to student ratio discussion – have students observe a micro-organism and discuss such things as area, volume and rate but on a much smaller scale, thus having a need for exponential notation. • Emphasize think-pair-share. • Provide multiple

estimate very large or very small quantities.		representation activity for rational exponents to allow students to discuss and refine their understanding of exponential and radical notation.

References:

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10. The University of Arizona. (2011-12). Progressions Documents for the Common Core Math Standards. Retrieved from http://ime.math.arizona.edu/progressions.