COMMON CORE MATH 8 – UNIT 1

Using Rational Numbers in Finding the Distance between Two Points and Properties of Integer Exponents and Square Root to Represent Solution to Equations

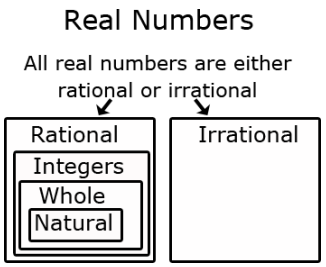
Critical Area: Students will understand informally the rational and irrational numbers and use rational numbers approximation of irrational numbers. Students will use rational numbers to determine an unknown side in triangles. They apply the Pythagorean Theorem to find distances between points on the coordinate plane, to find lengths, and to analyze polygons. Students use radicals and integers when they apply the Pythagorean Theorem in real word.

CLUSTER	COMMON CORE STATE STANDARDS
Understand and apply the Pythagorean Theorem.	**8.G.6** Explain a proof of the Pythagorean Theorem and its converse. 8.G.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real world and mathematical problems in two and three dimensions. 8.G.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
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.,π^2). *For example, by truncating the decimal expansion of* $\sqrt{2}$*, show that* $\sqrt{2}$ *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 $\sqrt{2}$ is irrational. 8.EE.3 Use numbers expressed in the form of a single digit times an integer

CLUSTER	COMMON CORE STATE STANDARDS
	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 reasoning 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://ime.math.arizona.edu/progressions/#committee. CDE Progress to Algebra K-8 www.cde.ca.gov/be/cc/cd/documents/updateditem12catt3.doc

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS	KEY VOCABULARY
• Students apply real world problem using Pythagorean Theorem. • 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.	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?	Approximate Benchmark Converse Cube root, cubic root Equation Equivalent Estimate, Exponent Expression Hypotenuse Integer Irrational Pythagorean Theorem Radical Rational

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS	KEY VOCABULARY
	How can you investigate the relationships between rational and irrational numbers?	Scientific notation Side, length, distance Square root

RESOURCES	INSTRUCTIONAL STRATEGIES	ASSESSMENT
Mathematics Assessment Project 8.G.6, 8.G.7: The Pythagorean Theorem: Square Areas 8.NS.1, 8.NS.2: MAP Concept Lesson, "Repeating Decimals," **Illustrative Mathematics** 8EE.1: Extending the Definition of Exponents," **LAUSD Adopted Textbooks and Programs** • Houghton Mifflin Harcourt, 2014 Go Math! • McGraw-Hill, 2014, California Math, Courses 1-3 • College Preparatory Mathematics, 2013 Core Connections, Courses 1-3 • Pearson, 2013, Common Core System of Courses	• Introduce the proof of the Pythagorean Theorem 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.  • Students can approximate square roots by iterative processes. Have students to recognize that $\sqrt{5}$ falls between $2^2 = 4$ and $3^2 = 9$. The value will be closer to 2 than to 3. • For 8.EE 1 and 2, have students experience different	**Formative Assessments** SBAC - http://www.smarterbalanced.org/ ITEM #'S 42906 8 NS1-2, 8 EE 1-2 SBAC Sample Items: • 8 G 7 MAT.08.CR.1.0000G.H.002 • 8 G 8 MAT.08.SR.1.0000G.H.143 • 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 • 8 G 7: CR 5: Jane's TV **Mathematics Assessment Project** 8 NS, 8 EE, Short Novice Assessment Tasks 8 EE: Summative Assessment Tasks: "100 People" **LAUSD Periodic Assessments** District assessments are under development. More information to come soon. **State Assessments** California will be administering the SMARTER Balance Assessment as the end of course for grades 3-8 and 11. There is no assessment for Algebra 1. The 11th grade assessment will include ítems from Algebra 1, Geometry, and Algebra 2 standards. For examples, visit the SMARTER Balance Assessment at: http://www.smarterbalanced.org/

RESOURCES	INSTRUCTIONAL STRATEGIES	ASSESSMENT
	examples such as: $\frac{4^3}{4^7} = 4^{3-7} = 4^{-4} = \frac{1}{4^4} = \frac{1}{256}$ • Have students match cards with a given fractional exponents and their solutions. $3^2 = 9$ and $\sqrt{9} = \pm 3$ $\left(\frac{1}{3}\right)^3 = \left(\frac{1^3}{3^3}\right) = \frac{1}{27}$ and $\sqrt[3]{\frac{1}{27}} = \frac{\sqrt[3]{1}}{\sqrt[3]{27}} = \frac{1}{3}$ • Have students convert decimal forms to scientific notation and apply rules of exponents to simplify expressions. Have them use calculators or spreadsheets, to recognize scientific notation and output of 2.45E+23 is 2.45 x 1023 and 3.5E-4 is 3.5 x 10-4.	Sample Smarter Balanced Items: http://sampleitems.smarterbalanced.org/itempreview/sbac/index.htm 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

LANGUAGE GOALS

- 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 provide concluding statements related to sides of the triangle using a concluding statement.
  Example Stem: In conclusion, if side A is ____ and side B is ____, the length of the side C is ____ because _____.
- Students will explain how the mathematical relationship of the sides of a triangle applies in real life, using subordinate conjunctions.
  Example Stem: This idea relates to real life in that _____.
- 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_____.

Mathematics Assessment Project
8.EE: Solving Real-Life Problems: Baseball Jerseys
8.EE.4: Estimating Length Using Scientific Notation

DIFFERENTIATION 🕮		
FRONT LOADING	ACCELERATION	INTERVENTION
Expressions and Equations: • 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 estimate very large or very small quantities	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=conceptRational and Irrational Numbers 2, Concept Lesson http://map.mathshell.org/materials/lessons.php?taskid=434&subpage=concept	• 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 representation activity for rational exponents to allow students to discuss and refine their understanding of exponential and radical notation

References:

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