Common Core Math 8
Unit 1
Rational Numbers, Properties of Integer Exponents and Square Root

Geometry
- Understand and apply the Pythagorean Theorem
  - 8.G.6-8

The Number System
- Know that there are numbers that are not rational, and approx them by rational numbers
  - 8.NS.1
  - 8.NS.2

Expressions and Equations
- Work with radicals and integers
  - 8.EE.1-2
  - 8.EE.3-4

Key: Green = Major Clusters; Blue = Supporting Clusters; Yellow = Additional Clusters

LAUSD Secondary Math
March 17, 2015 Draft
## 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.

<table>
<thead>
<tr>
<th>CLUSTER</th>
<th>COMMON CORE STATE STANDARDS</th>
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<tbody>
<tr>
<td>Understand and apply the Pythagorean Theorem.</td>
<td><strong>8.G.6</strong> Explain a proof of the Pythagorean Theorem and its converse.</td>
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<tr>
<td>Know that there are numbers that are not rational, and approximate them by rational numbers.</td>
<td><strong>8.G.7</strong> Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real world and mathematical problems in two and three dimensions.</td>
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<td>Work with radicals and integer exponents.</td>
<td><strong>8.G.8</strong> Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.</td>
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<td><strong>8.NS.1</strong> 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.</td>
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<td><strong>8.NS.2</strong> 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., (\pi^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.</td>
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<td><strong>8.EE.1</strong> Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, (3^2 	imes 3^{-5} = 3^{-3} = 1/3^3 = 1/27)</td>
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<td><strong>8.EE.2</strong> 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.</td>
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<td><strong>8.EE.3</strong> 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...</td>
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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**

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.

**LEARNING PROGRESSIONS**

- [http://ime.math.arizona.edu/progressions/#committee](http://ime.math.arizona.edu/progressions/#committee)
- CDE Progress to Algebra K-8

**ENDURING UNDERSTANDINGS**

- 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.

<table>
<thead>
<tr>
<th>ESSENTIAL QUESTIONS</th>
<th>KEY VOCABULARY</th>
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<tbody>
<tr>
<td>How are rational and irrational numbers related?</td>
<td>Approximate</td>
</tr>
<tr>
<td>How can lengths and distances be expressed – exactly or approximately – using understanding of square roots?</td>
<td>Benchmark</td>
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<tr>
<td>What real world problems does the Pythagorean Theorem allow us to solve?</td>
<td>Converse</td>
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<tr>
<td>How do we determine whether two expressions involving exponents are equivalent?</td>
<td>Cube root, cubic root</td>
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<tr>
<td>How can we express very small or very large numbers using exponential (scientific) notation?</td>
<td>Equation</td>
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<td>How can you investigate the relationships between rational and irrational numbers?</td>
<td>Equivalent</td>
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<td>Estimate,</td>
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<td>Exponent</td>
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<td>Expression</td>
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<td>Hypotenuse</td>
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<td>Integer</td>
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<td></td>
<td>Irrational</td>
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<tr>
<td></td>
<td>Pythagorean Theorem</td>
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<tr>
<td></td>
<td>Radical</td>
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<tr>
<td></td>
<td>Rational</td>
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<td>Scientific notation</td>
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<td>Side, length, distance, Square root</td>
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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 and 3. The value will be closer to 2 than to 3.

- For 8.EE 1 and 2, have students experience different examples such as: $\frac{4}{3} = 4^{3} - 7 = 4^{-4} = \frac{1}{4^{3}} = \frac{1}{256}$

- Have students match cards with a given fractional exponents and their solutions.

Real Numbers
All real numbers are either rational or irrational

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- Have students match cards with a given fractional exponents and their solutions.

$3^{2} = 9$ and $\sqrt{9} = \pm 3$
RESOURCES | INSTRUCTIONAL STRATEGIES | ASSESSMENT
---|---|---

$\left(\frac{1}{3}\right)^{1/3} = \left(\frac{1/3}{3}\right) = \frac{1}{27}$ and $\sqrt[3]{\frac{1}{27}} = \frac{1}{3}$

- 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 $2.45\times10^{23}$ is $2.45 \times 10^{23}$ and $3.5\times10^{-4}$ is $3.5 \times 10^{-4}$.

http://sampleitems.smarterbalanced.org/itempreview/sbac/index.htm

SBAC Content Specs:
8 G 7: CR 5: Jane’s TV

**LANGUAGE GOALS** for low achieving, high achieving, students with disabilities and English Language Learners

- 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

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**DIFFERENTIATION**

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<tr>
<th>UDL/ FRONT LOADING</th>
<th>ACCELERATION</th>
<th>INTERVENTION</th>
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| **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 | Acceleration for high achieving students:
  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 | Intervention for low achieving students and students with disabilities:
  - 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 |
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 breathes in a day, week, year, and lifetime given a rate.


- 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: