**Unit Abstract:**

Brief paragraph overview

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| **Overarching Question:**  How can I manipulate numbers into different forms and why is it important?  |
|  | **This Unit:** general subtopics |  |
| **Questions to Focus Assessment and Instruction:*** How can numbers be expressed in multiple ways?
* Why do we classify numbers?
* How can you determine if a number is rational?
* How are rational and irrational numbers different?
* How can you estimate the square root of a non-perfect square?
* How are properties of exponents used to evaluate and simplify expressions?
* How are negative and positive exponents related?
* How do you write numbers in scientific notation?
* Why would you use scientific notation?
* How does the relationship between squares and square roots and cubes and cube roots help us solve problems?
 | **Standards for Mathematical Practice**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.  |
| **Academic Vocabulary***(5-8 most important content specific vocabulary words)* | Irrational numbersScientific notationDecimal expansionSquare rootCubic rootPerfect squarePerfect cube |  |  |

| **Standards** | **Learning Targets** *(including relevant practice standards)* | **Explanations and Examples\*** | **Assured Experiences** *(common assessments and learning activities)* |
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| **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.** * 1. **Describe situations in which opposite quantities combine to make 0.**
	2. **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.**
	3. **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.**
	4. **Apply properties of operations as strategies to add and subtract rational numbers.**
 | Students will…. |  From state document | * common assessment
* learning activity:
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| **Standards** | **Learning Targets** *(including relevant practice standards)* | **Explanations and Examples\*** | **Assured Experiences** *(common assessments and learning activities)* |
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| **7.NS.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.** * 1. **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.**
	2. **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.**
	3. **Apply properties of operations as strategies to multiply and divide rational numbers.**
	4. **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.**
 | Students will…. |  From state document | * common assessment
* learning activity:
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| **Standards** | **Learning Targets** *(including relevant practice standards)* | **Explanations and Examples\*** | **Assured Experiences** *(common assessments and learning activities)* |
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| 7.NS.3 Solve real-world and mathematical problems involving the four operations with rational numbers. (Computations with rational numbers extend the rules for manipulating fractions to complex fractions.) | Students will…. |  From state document | * common assessment
* learning activity:
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| **Standards** | **Learning Targets** *(including relevant practice standards)* | **Explanations and Examples\*** | **Assured Experiences** *(common assessments and learning activities)* |
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| **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.****MP7 Look for and make use of structure** | Students will determine the differences between rational and irrational numbers.Students will classify numbers into groups: real, rational, integer, whole, natural, irrational.Students will express numbers in multiple ways.Students will convert repeating decimals into fractions/ratios made up of integers. Students will convert fractions/ratios made up of integers into repeating decimals.  | **8.NS.1.** Students can use graphic organizers to show the relationship between the subsets of the real number system.  | * common assessment
* learning activity:

**Jig Saw** (Frayer Model)Scientific Notation, decimal expansion, rational number, irrational number, square roots, perfect squares, cube roots and perfect cube 2-3 people per group each doing own Frayer modelRe-group so that all vocab words are together in a larger group (as many as 3 larger groups)Students share out and select groups favorite Frayer representation of the vocabulary word. Winners get vocab crown Bingo using the words : rational, irrational, integers, whole, natural, square roots, cube roots (introduced when giving examples of rational and irrational numbers)Classifying Rational and Irrational Numbers<http://map.mathshell.org/download.php?fileid=1710>  |

| **Standards** | **Learning Targets** *(including relevant practice standards)* | **Explanations and Examples\*** | **Assured Experiences** *(common assessments and learning activities)* |
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| 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., √2). *For example, by truncating the decimal expansion of* √*2, show that* √*2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*MP6 Attend to precision. | Students will estimate the value of an irrational number to the nearest hundredth.Students will locate irrational numbers on a number line.Students will compare the size of irrational numbers. | Students can approximate square roots by iterative processes. Examples: • Approximate the value of √5 to the nearest hundredth.Solution: Students start with a rough estimate based upon perfect squares. √5 falls between 2 and 3 because 5 falls between 22 = 4 and 32 = 9. The value will be closer to 2 than to 3. Students continue the iterative process with the tenths place value. √5 falls between 2.2 and 2.3 because 5 falls between 2.22 = 4.84 and 2.32 = 5.29. The value is closer to 2.2. Further iteration shows that the value of √5 is between 2.23 and 2.24 since 2.232 is 4.9729 and 2.242 is 5.0176. • Compare √2 and √3 by estimating their values, plotting them on a number line, and making comparative statements. Solution: Statements for the comparison could include: √2 is approximately 0.3 less than √3 √2 is between the whole numbers 1 and 2 √3 is between 1.7 and 1.8 | * common assessment
* learning activity:
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| **Standards** | **Learning Targets** *(including relevant practice standards)* | **Explanations and Examples\*** | **Assured Experiences** *(common assessments and learning activities)* |
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| **8.EE.1. Know and apply the properties of integer exponents to generate equivalent numerical expressions.** *For example, 32 × 3–5 = 3–3 = 1/33 = 1/27.***MP6 Attend to precision.** **MP7 Look for and make use of structure** | Students will use properties to create equivalent expressions.Students will use these properties:* Multiply and divide with the same base
* Exponent raised to another power
* Raise a product to a power

Students will convert negative exponents to positive exponents and vice versa. Students will identify the value of any number raised to the zero power.Students will determine whether or not any of the properties are able to be applied. |  8.EE.1. Examples: * $\frac{4^{3}}{5^{2}}$ = $\frac{64}{25}$
* $\frac{4^{3}}{4^{7}}$ = 43-7 = 4-4 = $\frac{1}{256}$
* $\frac{4^{-3}}{5^{2}}$ = 4-3 × $\frac{1}{5^{2}}$ = $\frac{1}{4^{3}} ×$ $\frac{1}{ 5^{2}}$ = $\frac{1}{64}$ $×$ $\frac{1}{25}$ = $\frac{1}{16,000}$
 | * common assessment
* learning activity:

Discovering the Rules of Exponents<http://www.mrc.stlmath.com/pdf/allpdf/discexp.pdf> Applying Properties of Exponents<http://map.mathshell.org/download.php?fileid=1668>  |

| **Standards** | **Learning Targets** *(including relevant practice standards)* | **Explanations and Examples\*** | **Assured Experiences** *(common assessments and learning activities)* |
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| 8.EE.2Use 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.**MP6 Attend to precision.** **MP7 Look for and make use of structure** | Students will calculate square roots and cube roots.Students will solve equations with square roots and cube roots.Students will describe how square/cube root and squaring/cubing are opposite operations. |  EX: Find $\frac{\sqrt{49}}{\sqrt{36}}$ | * common assessment
* learning activity:

Square Roots (Add Cube Roots)<http://www.math.uakron.edu/amc/PreAlgebraAlgebra/PreAlgAlgOld/SquareRoots.pdf>  |

| **Standards** | **Learning Targets** *(including relevant practice standards)* | **Explanations and Examples\*** | **Assured Experiences** *(common assessments and learning activities)* |
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| **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 × 108 and the population of the world as 7 × 109, and determine that the world population is more than 20 times larger.* | Students will simplify quantities using the product and quotient rules for powers of 10. Students will compare numbers with powers and determine how many times one is bigger or smaller than another.  |   | * common assessment
* learning activity:
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| **Standards** | **Learning Targets** *(including relevant practice standards)* | **Explanations and Examples\*** | **Assured Experiences** *(common assessments and learning activities)* |
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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.**MP4 Model with mathematics.**  | Students will use scientific notation to represent very small and very large numbers. Students will change from scientific notation to standard notation and vice versa. Students will add, subtract, multiply, and divide numbers expressed in scientific notation. Students will use a scientific calculator to represent scientific notation. Students will choose units of appropriate size for measurements using scientific notation.  |  Students can convert decimal forms to scientific notation and apply rules of exponents to simplify expressions. In working with calculators or spreadsheets, it is important that students recognize scientific notation. Students should recognize that the output of 2.45E+23 is 2.45 x 1023 and 3.5E-4 is 3.5 x 10-4. Students enter scientific notation using E or EE (scientific notation), \* (multiplication), and ^ (exponent) symbols.  | * common assessment
* learning activity:

Estimating Length Using Scientific Notation<http://map.mathshell.org/download.php?fileid=1664> Giantburgers<https://www.illustrativemathematics.org/content-standards/tasks/113> Work with science to develop interdisciplinary learning activity.  |

**Instructional resources** (including manipulatives, literature connections, professional resources)

8.NS.1

8.NS.2

* Use of calculator

8.EE.1

8.EE.2

8.EE.3

8.EE.4

* Use of calculator
* Pennies to Heaven <https://www.illustrativemathematics.org/content-standards/tasks/1291>
* Ants vs Humans <https://www.illustrativemathematics.org/content-standards/tasks/823>

Dan Meyer’s Live Binder

<http://www.livebinders.com/play/play_or_edit?id=330579>

Online Activities based on Standards

<http://mathsnacks.com/>

Name **ALL** the irrational number(s) listed below? Explain in complete sentences how you determined your answer.



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