



Grade 7 Pre-Algebra - Unit G - Beyond Rational Numbers

Unit Focus

This unit focuses exclusively on topics that come from grade 8 math standards. Students begin by 'discovering' the rules for working with expressions with exponents. This work continues as we work with scientific notation. Students learn that expressing very large or small numbers in scientific notation can make computation with those numbers much more manageable. Along with becoming fluent with converting between standard and scientific notation, students solve problems that involve any of the four operations and scientific notation. Finally, the students learn about irrational numbers, especially estimating their values, so they are prepared to use them while working with the Pythagorean Theorem in both two and three dimensional space

Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
Common Core Mathematics: 8 - 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. (CCSS.MATH.CONTENT.8.NS.A.1) - 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 $\sqrt{2}$, 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. (CCSS.MATH.CONTENT.8.NS.A.2) - Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = (1/3)^3 = 1/27$. (CCSS.MATH.CONTENT.8.EE.A.1) - 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. (CCSS.MATH.CONTENT.8.EE.A.2) - 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. (CCSS.MATH.CONTENT.8.EE.A.3)	<i>Students will be able to independently use their learning to...</i> T1 Demonstrate fluency with mathematical computations and definitions. T2 Identify and generalize patterns and structure in numbers, expressions, data and objects.	
	Meaning	
	Understanding(s)	Essential Question(s)
	<i>Students will understand that...</i> U1 Mathematicians see patterns to make generalizations about structures and relationships. U2 Mathematicians use their knowledge from patterns and structures to apply efficient strategies to solve a problem.	<i>Students will keep considering...</i> Q1 What generalizations can be made from this pattern? Q2 How can we apply knowledge of a pattern to similar problems? Q3 is a way of expressing the recurring pattern?
	Acquisition of Knowledge and Skill	
	Knowledge	Skill(s)
	<i>Students will know...</i> K1 Vocabulary: exponent, base (of an exponent), reciprocal, scientific notation, square root, cube root, irrational number, rational number, Pythagorean Theorem, hypotenuse, legs (of a right triangle), cube root, repeating decimal, terminating decimal.	<i>Students will be skilled at...</i> S1 using exponent rules to simplify expressions. S2 converting between numbers in standard notation and scientific notation.

Stage 1: Desired Results - Key Understandings

- 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 (CCSS.MATH.CONTENT.8.EE.A.4)
- Explain a proof of the Pythagorean Theorem and its converse. (CCSS.MATH.CONTENT.8.G.B.6)
- Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. (CCSS.MATH.CONTENT.8.G.B.7)
- Apply the Pythagorean Theorem to find the distance between two points in a coordinate system. (CCSS.MATH.CONTENT.8.G.B.8)
- Attend to precision. (CCSS.MATH.MP.6)
- Look for and make use of structure. (CCSS.MATH.MP.7)

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Analyzing: Examining information/data/ evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)

K2 the rule for multiplying number with exponents and like bases and why that rule works.

K3 the rule for dividing numbers with exponents and like bases and why that rule works.

K4 the rule for raising a power to power and why that rule works.

K5 that any number to the power of zero is 1.

K6 the meaning of a negative exponent.

K7 how exponent rules extend to expression involving negative exponents.

K8 the rule for combining numbers with the same exponent but different bases and why that rule works.

K9 the attributes of a number written in scientific notation.

K10 why equations with x^3 or x have just one solution and why equations with x^2 have two solutions.

K11 the Pythagorean Theorem and its converse.

S3 'fixing' numbers that are multiplied by a power of ten so they are in scientific notation.

S4 simplify expressions involving scientific notation and any of the four operations (multiplying, dividing, adding, subtracting)

S5 using scientific notation to solve application problems.

S6 classifying a number as rational or irrational.

S7 estimating square roots and cube roots.

S8 estimating expressions with square roots and cube roots.

S9 solving simple equations involving x^2 or x^3 .

S10 using the Pythagorean Theorem to solve triangles.

S11 determining if a triangle is right by using the converse of the Pythagorean Theorem.

S12 finding the distance between two points using the Pythagorean Theorem.

S13 applying the Pythagorean Theorem to three dimensional objects.