03 - Exponents, Scientific Notation, and Real Numbers

Content Area: **Math**
Course(s):
Time Period: **Full Year**
Length: **4.5 weeks**
Status: **Published**

General Overview, Course Description or Course Philosophy

Pre-Algebra 7A units were created and organized in line with the areas of focus as identified by the New Jersey Student Learning Standards. Each unit consists of standards that are considered major content along with standards that are supporting and/or additional content. The expectation is that students will have many opportunities to develop fluency with rational number arithmetic and solving multi-step problems (including those involving positive and negative rational numbers and word problems leading to one variable equations) throughout the school year. This course prepares students to take Algebra 1 in Grade 8 by addressing a combination of Grade 7 and Grade 8 standards in one school year.

In this unit, students will draw on their knowledge of exponents to develop understanding of the properties of exponents and scientific notation. They will use this understanding to build fluency with simplifying algebraic expressions involving powers and computing with scientific notation. Students will also draw on their knowledge of the set of rational numbers to develop understanding of the set of real numbers. They will use this understanding to build fluency with determining if numbers are rational or irrational, finding roots of perfect squares and cubes, and estimating roots of numbers. They will apply their fluency to solve multi-step real-world problems.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Essential Questions:

- Why do we classify numbers?
- Why does one need to distinguish between rational and irrational numbers?
- How does one locate irrational numbers on a number line?
- How are square roots and cube roots of numbers related to their geometric representations?
- How can the values of square roots be estimated?
- How can the values of cube roots be estimated?
- How are numbers that can be represented as fractions (rational numbers) related to numbers that cannot be represented as fractions (irrational numbers)?
- How can rational numbers be written as fractions and as terminating decimals or

repeating decimals?
- How do you represent irrational numbers that cannot be written as fractions?
- What is the square root of a whole number that is not a perfect square called?
- How can you find the location of irrational numbers on a number line?
- How can properties of rational and irrational numbers be used?
- Why are exponents useful when working with very large or very small numbers?

Enduring Understandings:

- All numbers, rational and irrational, have a location on a number line.
- Every number has a decimal expansion.
- Every rational number has a decimal expansion that terminates or eventually repeats.
- A number in the form a/b means a is divided by b.
- Every irrational square root can be estimated by its location between two rational square roots, e.g., √7 is between √4 and √9
- The set of real numbers is comprised of the set of rational numbers and the set of irrational numbers. Decimals that neither repeat nor terminate are called irrational numbers.
- Irrational numbers can be located on a number line, and worked with in the same way as with rational numbers.

CONTENT AREA STANDARDS

7.NS

A. Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers

7.EE

A. Use properties of operations to generate equivalent expressions

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.8.NS.A.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.

MA.K-12.2	Reason abstractly and quantitatively.
MA.8.NS.A.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).
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.8.EE.A.1	Know and apply the properties of integer exponents to generate equivalent numerical expressions.
MA.K-12.5	Use appropriate tools strategically.
MA.8.EE.A.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.
MA.8.EE.A.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.
MA.K-12.6	Attend to precision.
MA.8.EE.A.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.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

9.1.8.PB.6: Construct a budget to save for short-term, long term, and charitable goals. There are strategies to decrease and manage expenses. 9.1.8.PB.7: Brainstorm techniques that will help decrease expenses including comparison shopping, negotiating, and day-to-day expense management.

LA.K-12.NJSLSA.R1	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
LA.K-12.NJSLSA.SL1	Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
LA.K-12.NJSLSA.SL4	Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.
CS.K-12.3	Recognizing and Defining Computational Problems
CS.K-12.5	Creating Computational Artifacts
CS.K-12.6	Testing and Refining Computational Artifacts
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate

effectively.

STUDENT LEARNING TARGETS

Declarative Knowledge

Students will understand:

- understand the Law of Exponents
- understand that numbers that are not rational are called irrational
- understand that every number has a decimal expansion
- understand that know that the square root of 2 is irrational

Procedural Knowledge

Students will be able to:

- write and evaluate expressions involving powers and exponents.
- use the Law of Exponents to simplify expressions involving products and quotients of monomials.
- use the Law of Exponents to find powers of monomials.
- simplify expressions that have zero and negative exponents.
- use scientific notation to write large and small numbers.
- compute with numbers written in scientific notation.
- locate irrational numbers on a number line diagram.
- use rational approximations of irrational numbers to compare the size of irrational numbers.
- evaluate square roots of small perfect squares and cube roots of small perfect cubes.
- compare and order numbers in the real number system

EVIDENCE OF LEARNING

Alternate Assessments

- Portfolios
- Verbal Assessment (instead of written)
- Multiple choice
- Modified Rubrics
- Performance Based Assessments

Benchmark Assessments

- BOY Diagnostic Snapshot Assessment
- MP1 Quarterly Assessment
- MP2 Quarterly Assessment
- MP3 Quarterly Assessment
- MP4 Quarterly Assessment
- EOY Diagnostic Snapshot Assessment

Formative Assessments

- Delta Math Assignments
- Do Now Check ins
- Formative Assessments - exit tickets, student-friendly proficiency scales, skill checklists

Summative Assessments

- Summative Assessment
- OnCourse Assessments
- Teacher created assessments (both test generator and teacher generated questions)
- Delta Math - Teacher generated assessments

RESOURCES (Instructional, Supplemental, Intervention Materials)

Instructional Materials:

- Reveal Math Accelerated - Exponents, Scientific Notation, and Real Numbers Numbers (Modules 4 & 5) (Online link - teacher and student resources)

Supplemental/Intervention Materials:

- Delta Math
- Khan Academy
- NCTM Illuminations
- Illustrative Math
- Illustrative Math Tasks

INTERDISCIPLINARY CONNECTIONS

- Architecture and construction
- Computer and information systems
- Agriculture
- Art

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.