Unit #2: The Number System

Content Area: **Mathematics**
Course(s):
Time Period: **November**
Length: **1**
Status: **Published**

Unit Overview

In this unit students will be turning decimal expansions into fractions and deepening their understanding of the meaning of decimal expansions. This sets a firm foundation for understanding irrational numbers. Students will learn that the square roots of perfect squares are rational numbers, and that the square roots of non-perfect squares, such as $\sqrt{2}$ or $\sqrt{7}$, are examples of irrational numbers. Students will understand the value of square roots and cube roots. Students will also be learning how to work with and simplify exponents, including scientific notation.

Enduring Understandings

- Algebraic and numeric procedures are interconnected and build on one another to produce a coherent whole.
- Every number has a decimal expansion.
- Properties of operations with whole and rational nu mbers also apply to all real numbers.
- The value of any real number can be represented in relation to other real numbers such as with decimal s converted to fractions, scientific notation and numbers written with exponents.

Essential Questions

- How is the universal nature of properties applied t o real numbers?
- Why are quantities represented in multiple ways?

Student Learning Objectives (SLOs)

- Apply the properties of integer exponents to simplify and write equivalent numerical expressions.
- Compare rational and irrational numbers to demonstrate that the decimal expansion of irrational numbers do not repeat; show that every rational number has a decimal expansion which eventually repeats and covert such decimals into rational numbers.
- In real-world problem solving situations choose units of appropriate size for measurement of very small and very large quantities.
- Perform operations using numbers expressed in scientific notation, including problems where both decimals and scientific notation are used (interpret scientific notation generated when technology has been used for calculations).
- Use rational numbers to approximate and locate irrational numbers on a number line and estimate the value of expressions involving irrational numbers.
- Use scientific notation to estimate and express the values of very large or very small numbers and compare their values (how many times larger/smaller is one than the other).

Standards/Indicators

MA.8.NS	The Number System
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.8.NS.A	Know that there are numbers that are not rational, and approximate them by rational numbers.
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.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.8.EE.A	Work with radicals and integer exponents.
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.K-12.6	Attend to precision.
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-12.7	Look for and make use of structure.
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-12.8	Look for and express regularity in repeated reasoning.

Lesson Titles

- Approximating Square Roots
- Classifying Numbers
- Operations with numbers in scientific notation
- Properties of integer exponents
- Repeating and Terminating Decimals
- Simplifying Expressions
- Writing numbers in scientific notation

Career Readiness, Life Literacies & Key Skills

WRK.K-12.P.1	Act as a responsible and contributing community members and employee.

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.
WRK.K-12.P.9	Work productively in teams while using cultural/global competence.

Inter-Disciplinary Connections

- History - Evolution of Numbers
- LAL - Vocabulary
- Science - Expansion of Universe; Size of Universe
- Science - Look into Plant Cells

LA.L.8.4.D	Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).
SCI.7-8.5.1.8.B	Students master the conceptual, mathematical, physical, and computational tools that need to be applied when constructing and evaluating claims.
SCI.7-8.5.3.8.A	Living organisms are composed of cellular units (structures) that carry out functions required for life. Cellular units are composed of molecules, which also carry out biological functions.
SOC.6.1.8	U.S. History: America in the World: All students will acquire the knowledge and skills to think analytically about how past and present interactions of people, cultures, and the environment shape the American heritage. Such knowledge and skills enable students to make informed decisions that reflect fundamental rights and core democratic values as productive citizens in local, national, and global communities.
SOC.6.2.8	World History/Global Studies: All students will acquire the knowledge and skills to think analytically and systematically about how past interactions of people, cultures, and the environment affect issues across time and cultures. Such knowledge and skills enable students to make informed decisions as socially and ethically responsible world citizens in the 21st century.

Anticipatory Set

- Current Events
- Mathematics History
- Relate to prior knowledge
- Video clips

Instructional Strategies, Learning Activities, and Levels of Blooms/DOK

- SWBAT apply the properties of integer exponents to genera te equivalent numerical expressions
- SWBAT choose appropriate units of measurements for a give n number in scientific notation.
- SWBAT convert a decimal expansion which repeats eventually into a rational number.
- SWBAT distinguish between rational and irrational numbers.

- SWBAT estimate very large or very small quantities using a single digit times a power of ten.
- SWBAT express how much larger one number expressed as a s ingle digit times a power of ten is than another in the context of the situation.
- SWBAT express numbers in scientific notation.
- SWBAT find rational approximations of irrational numbers.
- SWBAT interpret scientific notation that has been generat ed by technology.
- SWBAT multiply and divide monomials.
- SWBAT perform operations with numbers expressed in scient ific notation and a mix of scientific notation and decimal notation.
- SWBAT use rational approximations of irrational numbers t o compare the size of irrational numbers, locate them approximately on a number line, and esti mate the value of expressions.

Modifications

ELL Modifications

Content specific:

vocabulary important for ELL students to understand include: Fraction, numerator/denominator, greatest/least, absolute value, signs, negative, opposite, improper fraction, mixed number, inverse

- Collaboration with ELL Teacher
- Frontload information in native language
- Graphic organizers
- Modification plan
- Strategy groups
- Teacher conferences
- Using videos, illustrations, pictures, and drawings to explain or clarification

IEP & 504 Modifications

- Anticipate where needs will be
- Assign a peer to help keep student on task
- Break tests down in smaller increments
- Graphic organizer for remembering integer rules.
- Increase one-to-one time
- Modifications & accommodations as listed in the student's IEP
- Modified or reduced assignments

- Personal handout for remembering integer rules (can be taped to desk).
- Position student near helping peer or have quick access to teacher
- Prioritize tasks
- Provide completed examples for practice work and homework.
- Reduce length of assignment for different mode of delivery
- Think in concrete terms and provide hands-on-tasks
- Working contract between you and student at risk

G&T Modifications

- Allow order of operation problems to contain multiple sets of parenthesis (including parenthesis inside of parenthesis).
- Evaluating expressions containing more rational numbers.
- Fraction/Decimal problems involving order of operations.

Formative Assessment

- Exit Question - Scientific Notation
- Exit Tickets - Classify numbers
- Graphic Organizer
- Group Work
- Guided Practice
- Hand Signals
- Independent Practice - Classify numbers
- Math Puzzles - Crossmatic
- Observation
- Open-ended question - order numbers
- Oral Questioning
- Quick Quizzes - previous day's lesson
- Quick quizzes -Cumulative Questions
- Senteo
- Think-Pair-Share
- Written Work

Summative Assessment

- K Chart: Scientific Notation https://docs.google.com/document/d/12LkHRP5S53CayIzYrQgnGEAOU6lbCd8L_nuFxx7ncvA/edit
- Marking Period Assessment
- Project Based Assessment - Represent real world numbers in scientific notation

- Quiz - rational/irrational numbers
- Quiz - scientific notation
- Self-Assessment
- Test - Classifying and ordering numbers

Benchmark Assessments

Skills-based assessment- math practice

Alternative Assessments

Performance tasks
Project-based assignments
Problem-based assignments
Presentations

Resources & Materials

- Glencoe Pre-Algebra - Chapter 5
- Number Lines

Technology

- Brain Pop - Scientific Notation https://classroom.google.com/c/MTY4MDI5NzY0OFpa
- Calculator
- estimate square roots http://www.mathopolis.com/games/estimate-sqroot.php
- PMI - Number System
- Project Link https://docs.google.com/document/d/1luZuB9s_6i-_f-oNapexZt9DKqqyYA7X-olYY11hfuY/edit
- Scientific Notation https://docs.google.com/document/d/12LkHRP5S53CayIzYrQgnGEAOU6lbCd8L_nuFxx7ncvA/edit
- Secrets of the Universe http://micro.magnet.fsu.edu/primer/java/scienceopticsu/powersof10/
- SmartBoard

TECH.8.1.8	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.2.8	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they

relate to the individual, global society, and the environment.