Marking Period	Unit Title	Recommended Instructional Days
1	**Real Numbers, Exponents, and Scientific Notation**	**23 - 28 days**

Domain

Strand:

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.

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). 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.

8.EE.A.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example,* $3^2 \times 3^{-5} = 3^{-3} = \frac{1}{3^3} = \frac{1}{27}$.

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 $\sqrt{2}$ is irrational.

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. *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.*

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.

Key:

Major Cluster **Supporting Cluster** **Additional Cluster**

Progress Indicator: ◊ Tests ◊ Homework / Classwork ◊ Projects ◊ Formative assessments ◊ Summative assessments

Mathematical Practices:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reason 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.

Recommended Activities, Investigations, Interdisciplinary Connections, and/or Student Experiences to Explore NJSLS-CLKS within Unit

Essential Questions:

Module 1:

How do you rewrite rational numbers and decimals?
How do you take square roots and cube roots?
How can the value of an irrational number be approximated?
How are sets of real numbers related?
Where do you see irrational values in the real-world?
How can you describe relationships between sets of real numbers?
How do you order a set of real numbers?

Module 2:

How can you develop and use the properties of integer exponents?
How can expressions with integer exponents be simplified?
What do the Zero Exponent and Negative Exponent Properties mean?
How can you use scientific notation to express very large quantities?

How can you use scientific notation to express very small quantities?
In what kinds of situations would it be useful to express a value using scientific notation?
How do you add, subtract, multiply, and divide using scientific notation?
What are some advantages to performing operations with numbers in scientific notation rather than standard notation? Disadvantages?

Essential Understandings:

Module 1:
All real numbers can be organized based on their characteristics.
All real numbers are either rational or irrational, and irrational values can be approximated.

Module 2:
Expressions can be simplified based on exponent rules.
Scientific notation can be used to express, estimate, and calculate values.

Vocabulary:

- rational number
- terminating decimal
- repeating decimal
- square root
- principal square root
- perfect square
- cube root
- perfect cube
- irrational numbers
- real numbers
- scientific notation

**Encourage students to practice using the unit vocabulary as they talk and write about mathematics. Understanding vocabulary will aid their understanding of the concepts.*

Suggested Activity Descriptions:

- Search for "In Search of Perfect Squares" on the Illuminations website for a hands-on exploration of perfect squares and the relationship between the area of a square and its side length.
- Display a list of rational and irrational values on the board before teaching the lesson and have students predict and record which numbers they think are irrational. Then, come back to the list at the conclusion of the lesson to compare their predictions with their learning.
- Display a large image of a graphic organizer for the sets of real numbers on the board. Then, have students write a real number on a sticky note. They can then give their sticky note to a classmate to place in the correct section of the graphic organizer.
- Give students an index card with a value written on it (fraction, decimal, square root, integer, etc.) and have them order themselves in a line.

This could be done within small groups or as an entire class.

- GoMATH Lesson 1.3 Root-O Game (GoMATH TB pages 26A - 26B)
- Display a very large or small value (ex. The distance from earth to the moon is 15,130,000,000,000 inches) and have students volunteer to try to read the value aloud. Then, discuss when scientific notation can be helpful.
- GoMATH Unit 1 Review Project: THE LARGE AND THE SMALL OF IT

◊Suggested Sample Tasks:

Activity Description: Zoo Keeper
Interdisciplinary Connections: Life Science
Content: From Molecules to Organisms: Structures and Processes

Nate and Elena participate in the "Keeper for a Day" program at the zoo, where they learn about the job of a zoo keeper and help with some of the responsibilities.

Nate weighs and measures several animals in the "Mouse House", recording the data in a table.

Animal	Treeshrew	Chinchilla
Weight (lb)	$0.\overline{4}$	$1.\overline{2}$
Length (in.)	$5.\overline{3}$	$10.08\overline{3}$

Part A:
The computer database only allows Nate to enter fractions. Complete the table to show how Nate should enter the data.

Part B:
Nate says that repeating decimals are rational numbers. Is Nate correct? Explain.

KEY:

Part A:

Animal	Treeshrew	Chinchilla
Weight (lb)	$\frac{4}{9}$	$1\frac{2}{9}$
Length (in.)	$5\frac{1}{3}$	$10\frac{1}{12}$

Part B

Yes; Sample answer: The decimal expansion does repeat, so each repeating decimal can be written as the ratio of two integers.

Activity Description: 100 People
Interdisciplinary Connections: Earth and Space Sciences
Content: Earth and Human Activity

There are approximately seven billion (7×10^9) people in the world. In the 1990s, researchers calculated that if there were just 100 people in the world:

- there would be 20 children
- 25 people would not have food and shelter
- 17 people would speak Chinese
- 8 would speak English

In this task, you are asked to estimate the real numbers, given that there are approximately seven billion people in the world.

1a. What fraction of people in the world do not have food and shelter?
1b. How many people in the world do not have food and shelter?

2. How many more people in the world speak Chinese than speak English?

3. Approximately 3×10^8 people live in the USA. In the world of 100 people, how many would live in the USA?

KEY:

Questions 1a and 1b
A quarter or 1/4 or 25%
1.75 billion or 1,750,000,000

Question 2
630 million or 630,000,000

Question 3
4 to nearest whole number

Interdisciplinary Connections:
Science:
1. Light travels at a speed of $3.0 \cdot 10^7$ m/s. How can you use this information to calculate the time in seconds it takes for light from Proxima Centauri to reach Earth. How many seconds does it take? Write your answer in scientific notation.
2. Paleontology: Use the table for problems 16–21. Write the estimated weight of each dinosaur in scientific notation. (See corresponding table and questions.) (GoMATH page 43)
3. Entomology: A tropical species of mite named Archegozetes longisetosus is the record holder for the strongest insect in the world. It can lift up to 1.182×10^3 times its own weight. (See corresponding questions.) (GoMATH page 43)

Social Studies:
1. Connecting to Everyday Life: Discuss examples of the uses of very large numbers with which students are familiar from a variety of subjects and areas of everyday life. From social studies, students might suggest populations; from economics, annual salaries; and from science, distances between the planets. Sample Facts: The average distance from the Earth to the moon is 240,000 miles. In 2010, the population of California was about 37,250,000. The annual salary of the president of the United States is $400,000. (GoMATH TE page T39A)
2. Math History: There is a famous irrational number called Euler's number, symbolized with an e. Like π, its decimal form never ends or repeats. The first few digits of e are 2.7182818284. (See corresponding questions.) (GoMATH page 26)

Language Arts:
1. Vocabulary Preview Activity, GoMATH pg. 2
2. Reading Startup Activities on GoMATH pages 5 and 31.

***Grade 8 Math/Science Connection**
Marking Period: 1
Science Module: K
Math Module(s): 1
Topics that Overlaps: Forces and Square Roots
Wave Performance Task page 8 of 9
Science Aspects: Hand-On Lab: Analyzing forces acting on falling objects/ Hands on Lab:Investigating falling objects: air resistance (unit 1, lesson 2) Design a parachute that will slow the fall of an object.
Skills: Recording data, graphing, measurement, air resistance, forces, engineering design
Math Aspects: Piggybacking off of the science activity, give students various parachute areas (include squares as well as circles). Have them work backwards to find the side length or radius of each parachute using square roots. Students may round to the nearest hundredth. You can

then extend the activity by having students order the lengths from least to greatest.
Skills: Finding side lengths of squares and radii of circles given areas (using square roots), ordering rational numbers

Spot Light On: Sally Ride

Social and Emotional Learning: ***Competencies***	**Social and Emotional Learning:** ***Sub-Competencies***
SEL Competencies: • Self-Awareness • Social Awareness • Self-Management • Relationship Skills • Responsible Decision-Making	• Recognizing the importance of self-confidence in handling daily tasks and challenges. • Demonstrate an awareness of the expectations for social interactions in a variety of ways. • Demonstrate an understanding of the need for mutual respect when viewpoints differ. • Identify and apply ways to persevere through alternative methods to achieve goals. • Utilize positive communication and social skills to interact effectively with others. •Develop, implement, and model effective problem solving and critical thinking skills.
Assessments (Formative) ***To show evidence of meeting the standard/s, students will successfully engage within:***	**Assessments (Summative)** ***To show evidence of meeting the standard/s, students will successfully complete:***
Formative Assessments: • Teacher Observations • Exit Tickets • Quizzes • Self Assessments • Math Journals • Homework/Classwork • Teacher created assessments	**Benchmarks & Summative Assessments:** • Chapter/Unit Assessments • Standardized Tests • District Assessments • Project-based Assessments

Differentiated Student Access to Content:
Teaching and Learning *Resources/Materials*

Core Resources	**Alternate Core Resources** ***IEP/504/At-Risk/ESL***	**ELL Core Resources**	**Gifted & Talented Core Resources**
Go Math Workbook, IXL, Personal Math Trainer, Math on the Spot Videos, My HRW, Khan Academy,	Reteaching worksheets, Skill building workbook, Math manipulatives, Leveled practice	Dictionary for native language, Video tutorial in native language, Success for English Learners worksheets,	ST Math Challenge Objectives, G&T tasks, Enrichment worksheets, Art of Problem

Illustrative Mathematics, Learn360, TeacherTube, BrainPOP, Freckle, LearnZillion, MobyMax, 60 minutes of weekly ST Math, Edulastic, Achieve the Core, Desmos	worksheets	GoMATH Leveled Strategies for English Learners, GoMATH Linguistic Support	Solving, Leveled assessments, GoMATH Teaching for Depth, GoMATH Extend-the-Math Activity, Math Olympiad

Supplemental Resources

Technology:
• Chromebooks • Scientific/Graphing Calculators (upper grades only) • Online math manipulatives
Other:
• Google Classroom, Google Meets, Schoology, Interactive Workbooks • Illustrative Mathematics • insidemathematics.org • National Library of Virtual Manipulatives

Differentiated Student Access to Content:
Recommended *Strategies & Techniques*

Core Resources	**Alternate Core Resources** ***IEP/504/At-Risk/ESL***	**ELL Core Resources**	**Gifted & Talented Core**
Deliver instruction utilizing varied learning styles including audio, visual, and tactile/kinesthetic, provide individual instruction as needed, modify assessments and/or rubrics.	Utilize a multi-sensory (VAKT) approach during instruction, provide alternate presentations of skills by varying the method (repetition, simple explanations, additional examples, modeling, etc.), modify test content and/or format, allow students to retake test for additional credit, provide additional times and preferential seating as needed, review, restate and repeat directions, provide study guides, and/or break assignments into segments of shorter tasks.	Extend time requirements, preferred seating, positive reinforcement, check often for understanding/review, oral/visual directions/prompts when necessary, supplemental materials including use of an online bilingual dictionary, and modified assessment and/or rubric.	Create an enhanced set of introductory activities, integrate active teaching/learning opportunities, incorporate authentic components, propose interest-based extension activities, and connect student to related content.

NJSLS CAREER READINESS, LIFE LITERACIES & KEY SKILLS	**Disciplinary Concept(s):** Critical Thinking and Problem Solving	
	Core Ideas:	An essential aspect of problem solving is being able to self-reflect on why possible solutions for solving problems were or were not successful.
	Performance Expectation/s:	9.4.8.CT.3: Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.
	Career Readiness, Life Literacies, & Key Skills Practices	
	Act as a responsible and contributing community member and employee. **Attend to financial well-being.** **Consider the environmental, social and economic impacts of decisions.** **Demonstrate creativity and innovation.** **Utilize critical thinking to make sense of problems and persevere in solving them.** **Model integrity, ethical leadership and effective management.** **Plan education and career paths aligned to personal goals.** **Use technology to enhance productivity, increase collaboration and communicate effectively.** **Work productively in teams while using cultural/global competence.**	

New Jersey Legislative Statutes and Administrative Code (place an "X" before each law/statute if/when present within the curriculum map)											
	Amistad Law: *N.J.S.A. 18A 52:16A-88*		Holocaust Law: *N.J.S.A. 18A:35-28*	**X**	LGBT and Disabilities Law: *N.J.S.A. 18A:35-4.35*	**X**	Diversity & Inclusion: *N.J.S.A. 18A:35-4.36a*		Standards in Action: *Climate Change*