# Real Numbers and Linear Equations

Content Area: **Math**
Course(s): **Math Grade 8**
Time Period: **MP1**
Length: **45**
Status: **Published**

## Unit Overview

| Unit Summary | Unit Rationale |
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| Students build on their understanding of real numbers in order to classify numbers as rational or irrational. Students understand that repeating and terminating decimals can be represented as an equivalent rational number in fraction form. Students will also understand the relationship between squares, square roots, cubes, and cube roots. Students recognize that irrational numbers do not have an exact decimal representation and can be approximated. Students will learn that irrational square roots can be approximated by using perfect squares and decimal approximations. Learning how to estimate very small and very large quantities using powers of 10 is a critical step in learning to compare these quantities. Recognizing how to write very small and very large numbers in scientific notation makes it possible to add, subtract, multiply and divide these numbers using less effort. Students will also understand that any nonzero number raised to the power of zero is equal to one. Students will use patterns to predict and understand integer exponent relationships. Lastly, students will learn the properties of exponents and how to use these properties to add, subtract, multiply, and divide exponential expressions. This unit also expands on student's understanding of the real number systems and solving equations. In this unit students will also use equation-solving methods they learned previously in order to solve a variety of equations that have either zero, one, or infinitely many solutions. They will incorporate their knowledge of the Distributive Property to solve multi-step equations. | Unit 1 builds students procedural skill and fluency related to real numbers and solving equations. In this unit students also develop conceptual understanding related to these topics. Being able to represent situations using real numbers is a transferable life skill. The skills and understandings developed in this unit will allow students to effectively analyze the world around them. Understanding real numbers and their applications are also foundational skills for upper level mathematics as well as real world situations. |

## NJSLS

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| 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., □²). |
| 8.NS.A.3 | Understand that the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. |
| 8.EE.A.1 | Know and apply the properties of integer exponents to generate equivalent numerical expressions. |
| 8.EE.A.2 | Use square root and cube root symbols to represent solutions to equations of the form □² = □ and □³ = □, where □ is a positive rational number. |
| 8.EE.A.2.a | Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational. |
| 8.EE.A.2.b | Simplify numerical radicals, limiting to square roots (i.e., nonperfect squares). |
| 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. |
| 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. |
| 8.EE.C.7.a | Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form □ = □, □ = □, or □ = □ results (where □ and □ are different numbers). |
| 8.EE.C.7.b | Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. |

## Standards for Mathematical Practice

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| 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 |

## Unit Focus

| Enduring Understandings | Essential Questions |
| --- | --- |
| • Repeating decimals can be represented as an equivalent rational number.<br>• Every real number is either a rational or irrational number.<br>• Rational and irrational numbers can be compared and ordered using decimal approximations.<br>• To find the square root of a number, find the factor whose square is equal to that number.<br>• To find a cube root, find the factor whose cube is equal to that number.<br>• Solve equations with squares by taking the square root of each side of the equation.<br>• Solve equations with cubes by taking the cube root of each side of the equation.<br>• The properties of exponents are used to simplify expressions by adding, subtracting, multiplying, or dividing either the base or the exponents.<br>• Any nonzero number raised to the power of zero is equal to one.<br>• Any nonzero number raised to a negative power is equal to its multiplicative reciprocal.<br>• An estimate of very small or very large numbers can be written as a single digit times a power of 10.<br>• Scientific notation is an efficient way to write very small or very large numbers.<br>• Combining like terms that are on one side of an equation makes it easier to solve for the variable by using inverse operations.<br>• To solve a linear equation that has variable terms on both sides of the equation, first use inverse operations to move all variables terms to one side of the equation and constant terms to the other. Then, isolate the variable.<br>• The Distributive Property is an important tool for simplifying expressions and combining like terms. | • What are real numbers and how are they used to solve problems?<br>• How can you write decimals as fractions?<br>• How is an irrational number different from a rational number?<br>• How can you compare and order rational and irrational numbers?<br>• How do you evaluate cube roots and square roots?<br>• How can you solve equations with squares and cubes?<br>• How do properties of integer exponents help you write equivalent expressions?<br>• When would you use a power of 10 to estimate a quantity?<br>• What is scientific notation and when, why and how is it used?<br>• How do you solve equations that contain like terms?<br>• How do you use inverse operations to solve equations with variables on both sides?<br>• How can you use the Distributive Property to solve multistep equations?<br>• Will a one-variable equation in one variable always have only one solution? |

## Instructional Focus

**Learning Targets**

Learners will be able to:

- Locate repeating decimals on a number line
- Write repeating decimals as fractions
- Classify a number as rational or irrational
- Understand the concepts of square roots and perfect squares
- Approximate square roots by using perfect squares
- Compare and order rational and irrational numbers
- Evaluate square roots and cube roots to solve problems
- Evaluate perfect squares and perfect cubes
- Solve equations involving perfect squares or cubes
- Solve equations involving imperfect squares or cubes
- Multiply and divide expressions with integer exponents
- Find the power of a power
- Simplify exponential expressions using the Zero Exponent Property and the Negative Exponent Property.
- Estimate and compare very large and very small quantities using powers of 10.
- Write very large and very small numbers in scientific notation
- Convert scientific notation to standard form
- Add, subtract, multiply, and divide numbers in scientific notation.
- Combine like terms
- Solve equations with like terms on one side of the equation
- Make sense of scenarios and represent them with equations
- Plan multiple solution pathways and choose one to find the solution
- Determine the number of solutions to an equation

**Prerequisite Skills**

- Integer Operations
- Rewriting expressions
- Evaluating expressions
- Parts of a power.
- Show proportional relationships among variables in a variety of ways.
- Identify the constant of proportionality.
- Identify variables to determine appropriate range.
- Understand the place value system.
- Simplify algebraic expressions.
- The subsets of rational numbers.

**Common Misconceptions**

- Students commonly misinterpret exponents as multiplication instead of repeated multiplication.
- It may be difficult for students to remember how to apply properties of exponents and that the square root of a number has 2 possible solutions.
- For Real Number Subgroups, students often think integers are irrational. Also, that the most restrictive subgroup is the only classification of a number.

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| • Often graph labels are interchanged. |

## Spiraling For Mastery

| Current Unit Content/Skills | Spiral Focus | Activity |
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| • Rational and Irrational Numbers<br>• Square roots and Cube Roots<br>• Integer Exponents and Scientific Notation<br>• Equations | • Rational Numbers and Integers (Grade 7)<br>• Rewriting an Expressions (Grade 7)<br>• Expressions (Grade 7) | • Math Diagnostic and Intervention System Activities |

## Assessment

| Formative Assessment | Summative Assessment |
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| • Homework<br>• Lesson Checks<br>• MathXL<br>• Quizzes<br>• Exit Tickets<br>• Lesson Reflections<br>• Performance Tasks | • Topic Tests (Common Assessments)<br>• Unit 1 Benchmark (Link-It) |

## Resources

| Key Resources | Supplemental Resources |
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| • Savvas EnVision Grade 8<br>• Pacing Guide | • IXL<br>• Delta Math<br>• Desmos<br>• Khan Academy<br>• Manuevering the Middle |

## Career Readiness, Life Literacies, and Key Skills

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| 9.4.8.CI.1 | Assess data gathered on varying perspectives on causes of climate change (e.g., cross-cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4). |
| 9.4.8.DC.7 | Collaborate within a digital community to create a digital artifact using strategies such as crowdsourcing or digital surveys. |
| 9.4.8.GCA.1 | Model how to navigate cultural differences with sensitivity and respect (e.g., 1.5.8.C1a). |
| 9.4.8.GCA.2 | Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal. |
| 9.4.8.IML.3 | Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping (e.g., 6.SP.B.4, 7.SP.B.8b). |
| 9.4.8.TL.1 | Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making. |
| 9.4.8.TL.6 | Collaborate to develop and publish work that provides perspectives on a real-world problem. |

## Interdisciplinary Connections

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| L.KL.8.2 | Use knowledge of language and its conventions when writing, speaking, reading, or listening. |
| L.KL.8.2.A | Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases. |
| L.VL.8.3 | Determine or clarify the meaning of unknown and multiple-meaning words or phrases based on grade 8 reading and content, including technical meanings, choosing flexibly from a range of strategies. |
| SL.PE.8.1 | Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly. |
| SL.PE.8.1.A | Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion. |
| SL.PE.8.1.B | Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed. |
| SL.PE.8.1.C | Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas. |
| SL.PE.8.1.D | Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented. |
| 6-8.MS-ETS1-3.4 | Analyzing and Interpreting Data |
| 6-8.MS-ETS1-3.ETS1.B.1 | There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. |
| 6-8.MS-ETS1-3.ETS1.B.2 | Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. |