The Real Number System

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

Unit Overview

Unit Summary	Unit Rationale
This unit focuses on enhancing students' understanding of rational and irrational numbers, their properties, and their practical applications. Students will learn to distinguish between rational and irrational numbers and understand that every number has a decimal expansion, with rational numbers either terminating or repeating. They will practice converting repeating decimals to fractions and using rational approximations to compare and locate irrational numbers on a number line. The unit will also cover operations with rational numbers, including addition and subtraction, and representing these operations on number lines. Students will explore real-world contexts where opposite quantities combine to make zero, understand additive inverses, and calculate distances between rational numbers using absolute values.	Understanding rational and irrational numbers is essential for students as it lays the groundwork for advanced math concepts in high school. This unit helps students differentiate between rational and irrational numbers, recognize their properties, and represent them on a number line. By learning to convert repeating decimals to fractions and using rational approximations, students enhance their problem-solving abilities. This unit also highlights the practical applications of rational numbers in real-world contexts, such as financial transactions and temperature changes. Interactive activities and real-world problems make learning engaging and relevant, promoting deeper understanding and critical thinking.

NJSLS

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., $□^2$).
7.NS.A.1	Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.
7.NS.A.1.a	Describe situations in which opposite quantities combine to make 0.
7.NS.A.1.b	Understand □ + □ as the number located a distance |□| from □, in the positive or negative direction depending on whether □ is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.

7.NS.A.1.c	Understand subtraction of rational numbers as adding the additive inverse, □ – □ = □ + (– □). Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
7.NS.A.2	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
6.NS.C.5	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.
7.NS.A.2.d	Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.
6.NS.C.6	Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.
7.NS.A.3	Solve real-world and mathematical problems involving the four operations with rational numbers.
6.NS.C.7	Understand ordering and absolute value of rational numbers.
6.EE.A.2.c	Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations).
6.EE.A.3	Apply the properties of operations to generate equivalent expressions.

Standards for Mathematical Practice

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
• Numbers can be classified into different categories based on their properties. Rational numbers can be expressed as fractions, while irrational numbers cannot. • Every number can be represented in decimal form, and the decimal form of rational numbers either terminates or repeats, while	• What are the differences between rational and irrational numbers? • How can we determine if a number is rational or irrational? • How can we represent rational and irrational

that of irrational numbers does not. • Rational and irrational numbers can be located on a number line, and rational approximations can help us estimate the positions of irrational numbers. • Rational numbers can be added and subtracted, and these operations can be visualized on a number line. • Opposite quantities, when combined, result in zero. The additive inverse of a number is the number that, when added to the original number, results in zero. • The absolute value of a number represents its distance from zero on a number line, and this concept can be used to calculate the distance between any two rational numbers. • Knowledge of rational and irrational numbers can be applied to solve real-world problems, enhancing their practical understanding and utility.	numbers in decimal form? • How do we use the number line to compare and locate rational and irrational numbers? • How can we use rational approximations to understand irrational numbers better? • What happens when we add or subtract rational numbers, and how can we visualize these operations on a number line? • How do opposite quantities combine to make zero, and how can we find the additive inverse of a number? • What is absolute value, and how can it help us measure the distance between numbers? • How can our understanding of rational and irrational numbers help us solve real-world problems? • Why is it important to understand the properties of rational and irrational numbers in mathematics?

Instructional Focus

Learning Targets

- Identify whether a number is rational or irrational.
- Explain the difference between rational and irrational numbers.
- Recognize that every number has a decimal form.
- Convert repeating decimals into fractions.
- Use rational approximations to compare and locate irrational numbers on a number line.
- Add and subtract rational numbers and show these operations on a number line.
- Understand and explain how opposite quantities (like +5 and -5) combine to make zero.

- Find the additive inverse of a number and explain what it means.
- Calculate the distance between two rational numbers using absolute values.
- Apply my understanding of rational and irrational numbers to solve real-world problems.

Prerequisite Skills

- Recognize and understand whole numbers, fractions, and decimals.
- Perform basic arithmetic operations with whole numbers, fractions, and decimals.
- Simplify fractions and convert between improper fractions and mixed numbers.
- Compare and order fractions and decimals.
- Add, subtract, multiply, and divide decimals.
- Understand place value in decimal numbers.
- Identify and represent negative numbers on a number line.
- Perform basic arithmetic operations with negative numbers.
- Place and identify numbers on a number line.
- Understand the concept of distance on a number line.

Common Misconceptions

- Students may think that all decimals are irrational numbers. Clarify that only non-repeating, non-terminating decimals are irrational.
- Students might struggle to recognize repeating decimals and incorrectly classify them as irrational.
- Students may not realize that the numerator and denominator of a fraction must be integers for it to be classified as a rational number.
- Students might believe that any decimal that goes on forever is irrational. Explain that repeating decimals, which go on forever but in a repeating pattern, are actually rational.
- Some students might think that the square root of any number is irrational. Explain that only the square roots of non-perfect squares are irrational.
- Students may have difficulty comparing rational and irrational numbers or placing them accurately on a number line.
- Students might not understand that rational approximations (e.g., 3.14 for π) are not exact values but close estimates.
- Students may not grasp that opposite quantities, like +5 and -5, combine to make zero.

- Students may confuse absolute value with the original number, particularly if the original number is negative.
- Students might incorrectly calculate the distance between numbers on a number line, especially when involving negative numbers.
- Students may struggle to apply their understanding of rational and irrational numbers to real-world problems.

Spiraling For Mastery

Current Unit Content/Skills	Spiral Focus	Activity
• Define Each Set of Numbers • Exposure to Vocabulary • Classifying Numbers • Properties of Real Numbers • Order of Operations • Absolute Value • Operations with Integers • Understand the relationship between integers and their opposites • Apply Integers to Real World Context and Interpret Their Meaning • Operations with Rational Numbers • Understand the Connection Between Rational Numbers and Their Opposites • Recognize Real Numbers	• Revisit definitions in various contexts • Integrate vocabulary in various mathematical tasks and discussions • Present mixed sets of numbers in different forms • Apply properties in different operations and problem-solving situations • Use absolute value in various contexts, such as comparing numbers, solving equations, and interpreting real-world scenarios. • Integrate integer operations in multi-step problems and real-world applications, revisiting and reinforcing these skills regularly. • Use opposites in various contexts • Gradually increase the complexity and variety of	• iXL problems • iXL Diagnostic Assessment • Delta Math

as values on a number line • Utilize Absolute Value as a Means for Comparing Real Numbers	real-world contexts, ensuring students can interpret and solve problems accurately. • Use connection between rational numbers and their opposites in various contexts. • Incorporate number line activities in various mathematical tasks. • Apply the absolute value as a means for comparing real numbers in increasingly complex problems.	

Assessment

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

Resources

Key Resources	Supplemental Resources
EnVision 6th Grade EnVision 7th Grade EnVision 8th Grade Pacing Guide	iXL Delta Math ThatQuiz.org Desmos

	Khan Academy Teacher Made Worksheets

Career Readiness, Life Literacies, and Key Skills

9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
9.4.12.IML.1	Compare search browsers and recognize features that allow for filtering of information.
9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).
9.4.12.IML.7	Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJSLSA.W1, 7.1.AL.PRSNT.4).
9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
9.4.12.TL.4	Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).
9.1.12.FP.1	Create a clear long-term financial plan to ensure its alignment with your values.
9.1.12.PB.2	Prioritize financial decisions by considering alternatives and possible consequences.

Interdisciplinary Connections

2.2.12.N.1	Compare and contrast the nutritional trends, eating habits, body image, and the impact of marketing foods on adolescents and young adults nationally and worldwide.
9-12.HS-PS3-4.3.1	Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.