

**Standard- New Jersey Student Learning Standards: N-RN, A-SSE, A-APR, F-IF, F-BF, F-LE
Number Theory and the Real Number System (Chapter 5)****Strand****N-RN: The Real Number System****Extend the properties of exponents to rational exponents.**

1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.
2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Use properties of rational and irrational numbers.

3. Explain why 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.

A-SSE: Seeing Structure in Expressions**Interpret the structure of expressions.**

1. Interpret expressions that represent a quantity in terms of its context.
 - a. Interpret parts of an expression, such as terms, factors, and coefficients.
 - b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1 + r)^n$ as the product of P and a factor not depending on P .*
2. Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.*

Write expressions in equivalent forms to solve problems

4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*

A-APR: Arithmetic with Polynomials and Rational Expressions**Use polynomial identities to solve problems.**

1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

Use polynomial identities to solve problems.

7. (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

F-IF: Interpreting Functions

Understand the concept of a function and use function notation

3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ for $n \geq 1$.*

F-BF: Building Functions

Build a function that models a relationship between two quantities

1. Write a function that describes a relationship between two quantities*
 - a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.*

F-LE: Linear and Exponential Models*

Construct and compare linear and exponential models and solve problems

2. Construct linear and exponential functions, including arithmetic and geometric-sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

Curriculum aligned with: 2009 New Jersey Core Curriculum Content Standards for 21st Century Skills (9.1 A-F)

21st Century Theme: Global Awareness , Financial, economic, business and entrepreneurial literacy x, Civic literacy , Health literacy Environmental Literacy

21st Century Skills: Critical Thinking & Problem Solving X, Creativity and Innovation , Collaboration, Teamwork and Leadership , Cross-Cultural Understanding and Interpersonal Communications Communication and Media Fluency , Accountability, Productivity and Ethics

Interdisciplinary Connection: Math=MA, English=ELA, Science=SCI, Social Studies=SS, Physical Education=PE, Art=ART, Music=MU, Technology=TECH, World Language=WL, Business = BU

Essential Questions	Enduring Understandings	Activities, Investigation, and Student Experiences
<ol style="list-style-type: none"> 1. What is the difference between prime and composite numbers? 2. How do you simplify expressions? 3. How do you work with rational numbers? 	<p><i>Students will understand....</i></p> <ul style="list-style-type: none"> ● Number Theory ● The Integers ● The Rational Numbers ● The Irrational Numbers ● Real Numbers and Their Properties 	<p style="text-align: center;">Task 1:</p> <p style="text-align: center;">Write the first five terms of an arithmetic sequence with first term 2 and common difference of 8.</p> <p style="text-align: center;">Answer:</p> <p style="text-align: center;">The first term is 2. The second term is $2 + 8$, or 10. The third term is $10 + 8$, or 18. The fourth term is $18 + 8$, or 26. The fifth term is $26 + 8$, or 34. Thus, the first five terms of the sequence are 2, 10, 18, 26, 34.</p>

<p>4. How do you work with irrational numbers?</p> <p>5. What are the properties of the real number system?</p> <p>6. What are the different rules of exponents?</p> <p>7. How do you identify and solve problems involving arithmetic sequences?</p> <p>8. How do you identify and solve problems involving geometric sequences?</p> <p>9. How do you identify and solve problems involving fibonacci sequences?</p>	<ul style="list-style-type: none"> ● Rules of Exponents and Scientific Notation ● Arithmetic and Geometric Sequences ● Fibonacci Sequence 	<p style="text-align: center;">Task 2:</p> <p>Write the first five terms of the geometric sequence whose first term is 4 and whose common ratio is 5.</p> <p style="text-align: center;">Answer:</p> <p>The first term is 4. The second term, found by multiplying the first term by 5, is 4 x 5, or 20. The third term is 20 x 5, or 100. The fourth term is 100 x 5, or 500. The fifth term is 500 x 5, or 2500. Thus, the first five terms of the geometric sequence are 4, 20, 100, 500, 2500</p> <p style="text-align: center;">Task 3:MU</p> <p>A musical composition is described as follows. Explain why this piece is based on the golden ration.</p>											
<p>Content Statements</p>	<p>Cumulative Progress Indicators</p>	<table border="1" style="width: 100%; text-align: center;"> <tr> <td>34 Measures</td> <td>55 Measures</td> <td>21 Measures</td> <td>34 Measures</td> </tr> <tr> <td>Theme</td> <td>Fast, Loud</td> <td>Slow</td> <td>Repeat of theme</td> </tr> </table> <p style="text-align: center;">Answer:</p> <p>The ratio the second to the first, and the fourth to the third measures estimates the golden ratio.</p>				34 Measures	55 Measures	21 Measures	34 Measures	Theme	Fast, Loud	Slow	Repeat of theme
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<p><i>Students will know...</i></p> <ul style="list-style-type: none">• Classify natural numbers as prime or composite.• Understand the rules of divisibility.<ul style="list-style-type: none">• Write the prime factorization of a natural number.• Determine the greatest common divisor of a group of natural numbers.• Understand the nature of prime numbers.<ul style="list-style-type: none">• Simplify expressions.<ul style="list-style-type: none">• Work with rational numbers.• Understand irrational numbers.• Simplify, add, subtract, multiply and divide radicals.• Rationalize denominators.<ul style="list-style-type: none">• Real numbers• Evaluate expressions using the rules of exponents.• Write numbers using scientific notation.<ul style="list-style-type: none">• Identify and solve problems involving arithmetic and geometric sequences.	<ul style="list-style-type: none">• Tests<ul style="list-style-type: none">• Quizzes• Practice problems for homework• Workbook pages• Worksheets	<p>Modifications and/or Accommodations:</p> <ul style="list-style-type: none">• Special Education: 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.• English Language Learners: Extend time requirements, preferred seating, positive reinforcement, check often for understanding/review, oral/visual directions/prompts when necessary, supplemental materials including use of online bilingual dictionary, and modified assessment and/or rubric.• Students at Risk of School Failure: Deliver instruction utilizing varied learning styles including audio, visual, and tactile/kinesthetic, provide individual instruction as needed, modify assessments and/or rubrics, repeat instructions as needed.• Gifted Students: 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 talent development opportunities <p>Spot Light On: <i>Use random response strategies.</i></p>
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<ul style="list-style-type: none"> • Fibonacci sequence. 	
Desired Results	
<ul style="list-style-type: none"> • Number Theory • The Integers • The Rational Numbers • The Irrational Numbers • Real Numbers and Their Properties • Rules of Exponents and Scientific Notation • Arithmetic and Geometric Sequences • Fibonacci Sequence 	
Standards for Mathematical Practices	
<ol style="list-style-type: none"> 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. 	
Teacher Resources	

Discrete Mathematics Unit 2 – Number Theory and the Real Number System

5 - 10 Days

Established 14-15

Revised 20-21

Revised August 2023

	<p>Mymathlab.com http://achievethecore.org https://learnzillion.com https://www.khanacademy.org/ https://www.desmos.com/ http://www.ixl.com</p>
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LGBT and Disabilities Law: *N.J.S.A. 18A:35-4.35*

Darla K. Anderson -

The mission is to ensure that every student is able to see themselves in our rich and diverse history.

Social and Emotional Learning: Competencies	Social and Emotional Learning: Sub-Competencies
<p>Self-Awareness Social Awareness Self-Management Relationship Skills Responsible Decision-Making</p>	<ul style="list-style-type: none"> ● 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. ● Recognize the skills needed to establish and achieve personal and educational goals. ● Utilize positive communication and social skills to interact effectively with others. ● Develop, implement, and model effective problem solving and critical thinking skills.

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