Unit 02: Poly, Rational, and Radical Relationships

Content Area: **Template**
Course(s):
Time Period: **Full Year**
Length: **FY**
Status: **Published**

Standards Alignment

New Jersey Student Learning Standards

MA.A-SSE	Seeing Structure in Expressions
LA.K-12.NJSLSA.R	Reading
MA.F-IF	Interpreting Functions
MA.A-SSE.A	Interpret the structure of expressions
	Key Ideas and Details
LA.K-12.NJSLSA.R1	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
MA.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
LA.K-12.NJSLSA.R2	Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
MA.A-SSE.A.1a	Interpret parts of an expression, such as terms, factors, and coefficients.
MA.A-SSE.A.1b	Interpret complicated expressions by viewing one or more of their parts as a single entity.
LA.K-12.NJSLSA.R3	Analyze how and why individuals, events, and ideas develop and interact over the course of a text.
	Craft and Structure
LA.K-12.NJSLSA.R4	Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
MA.A-SSE.B	Write expressions in equivalent forms to solve problems
LA.K-12.NJSLSA.R5	Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.
LA.K-12.NJSLSA.R6	Assess how point of view or purpose shapes the content and style of a text.
LA.K-12.NJSLSA.R7	Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
LA.K-12.NJSLSA.R8	Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
MA.N-CN	The Complex Number System
MA.F-IF.C	Analyze functions using different representations
MA.A-SSE.B.4	Derive and/or explain the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems.

MA.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
MA.N-CN.A	Perform arithmetic operations with complex numbers.
MA.N-CN.A.1	Know there is a complex number i such that i^2 = -1, and every complex number has the form $a + bi$ with a and b real.
MA.N-CN.A.2	Use the relation i^2 = -1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
MA.A-APR	Arithmetic with Polynomials and Rational Expressions
MA.F-IF.C.7c	Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
MA.A-APR.A	Perform arithmetic operations on polynomials
MA.A-APR.A.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.
LA.RST.11-12.1	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
MA.A-APR.B	Understand the relationship between zeros and factors of polynomials
LA.RST.11-12.2	Determine the central ideas, themes, or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
LA.RST.11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
MA.A-APR.B.2	Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x - a$ is $p(a)$, so $p(a)$ = 0 if and only if $(x - a)$ is a factor of $p(x)$.
MA.A-APR.B.3	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
MA.A-APR.C	Use polynomial identities to solve problems
LA.RST.11-12.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
LA.RST.11-12.5	Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
MA.N-CN.C	Use complex numbers in polynomial identities and equations.
MA.A-APR.C.4	Prove polynomial identities and use them to describe numerical relationships.
LA.RST.11-12.6	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.
MA.N-CN.C.7	Solve quadratic equations with real coefficients that have complex solutions.
LA.RST.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
LA.RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
MA.A-APR.D	Rewrite rational expressions
MA.A-APR.D.6	Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x)$ + $r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less

	than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.
MA.A-REI	Reasoning with Equations and Inequalities
MA.A-REI.A	Understand solving equations as a process of reasoning and explain the reasoning
MA.A-REI.A.2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
MA.A-REI.C	Solve systems of equations
MA.A-REI.C.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.

Integration of Career Readiness, Life Literacies and Key Skills

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP3	Attend to personal health and financial well-being.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP10	Plan education and career paths aligned to personal goals.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

Technology / Integration of Computer Science and Design Thinking

Interdisciplinary Connections: NJSLS for ELA, Social Studies, Science and/or Math Section

Integration of Diversity, Equity and Inclusion; Climate Change; Informational and Media LiteracyNew Section

see Crosswalks

21st Century Life and Careers

Stage I: Desired Results

Transfer/Overview/Rationale

Transfer / Overview / Rationale

Unit Rationale

The purpose of this unit…

Unit 1: Polynomial , Rational, and Radical Relationships

This unit develops the structural similarities between the system of polynomials and the system of integers. Students draw on analogies between polynomial arithmetic and base-ten computation, focusing on properties of operations, particularly the distributive property. Students connect multiplication of polynomials with multiplication of multi-digit integers, and division of polynomials with long division of integers. Students identify zeros of polynomials, including complex zeros of quadratic polynomials, and make connections between zeros of polynomials and solutions of polynomial equations. The unit culminates with the fundamental theorem of algebra. Rational numbers extend the arithmetic of integers by allowing division by all numbers except 0. Similarly, rational expressions extend the arithmetic of polynomials by allowing division by all polynomials except the zero polynomial. A central theme of this unit is that the arithmetic of rational expressions is governed by the same rules as the arithmetic of rational numbers.

Meaning

Essential Questions

- What is the purpose of learning different types of functions.
- Why do we like to analyze the zeros of a function?
- Why do we incorporate the usage of imaginary numbers describing zeros of functions?

Enduring Understanding/Indicators of Understanding

- Students will understand how to represent different applications using different functions at their disposal.
- Complex numbers are used to represent non-real solutions to quadratics. (also used in electrical engineering)
- Students will understand the importance of zeros of functions and how they relate to word problems.
- How to substitute variables for real life objects.

Acquisition (Student Learning Objectives)

Knowledge

Knowledge

Students will know…

- Know there is a complex number i such that $i^2 = -1$, and every complex number has the form a + bi with a and b real.
- 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 $(x^2 - y^2)(x^2 + y^2)$.
- 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.
- Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x – a) is a factor of p(x).
- Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.
- Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system.

- Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

Skills

Skills

Student will be skilled at …

- Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
- Solve quadratic equations with real coefficients that have complex solutions.
- Interpret parts of an expression, such as terms, factors, and coefficients.
- 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.
- 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.
- Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
- Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
- Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

Stage 3: Learning Plan

Resource and Mentor Texts

Resources and Mentor Texts

Mcdougal - Algebra 2 Textbook (green)

Pearson - www.pearsonsuccess.com

login: CommonCore2012 Password:pearsonmath

McGraw-Hill - Algebra 2 TextbookL

Formative Assessment Strategies

Formative Assessment Strategies

Homework

Labs

Projects

Class Participation

Classwork

Quizzes

Tests

Learning Activities/Unit of Study

Learning Activities/Unit of Study

All Sections numbers reference our green Algebra 2 McDougal-Littell Textbook

Factoring

Day 1 - 5.2 Solve Quadratics by Factoring

Day 2 - 5.2 Day 2

Day 3 - 5.2 Day 3

Day 4 - 5.3 Square Roots/ Radicals Review

Day 5 - 5.3 Day 2

Day 6 - 5.3 Day 3

Day 7 - Review

Day 8 - 5.2 - 5.3 Assessment

Complex Numbers

Day 1 - 5.4 Complex Numbers, simplifying expressions

Day 2 - 5.4 Adding/Subtraction, Multiplying complex numbers

Day 3 - 5.4 Division of complex numbers

Day 4 - 5.4 Review

Day 5 - Quiz on 5.4

Polynomial Functions

Day 1 - 6.3 Adding/Subtracting Polynomials

Day 2 - 6.3 Day 2

Day 3 - 6.3 Day 3

Day 4 - 6.4 Factor Polynomials

Day 5 - 6.4 Day 2

Day 6 - 6.4 Day 3

Day 7 - End Behavior (Find extra material)

Day 8 - 6.5 Long Division/Remainder Theorem

Day 9 - 6.5 Synthetic Division

Day 10 - 6.5 Day 3

Day 11 - Review

Day 12 - 6.3 - 6.5 Assessment

Rational Zeros

Day 1 - 6.6 Finding Rational Zeros

Day 2 - 6.6 Day 2

Day 3 - 6.6 Day 3

Day 4 - 7.1 nth Roots, Rational Expressions

Day 5 - 7.1 Day 2

Day 6 - 7.1 Day 3

Day 7 - 7.6 Solving Radical Equations

Day 8 - 7.6 Extraneous Solutions

Day 9 - 7.6 Day 3

Day 10 - Review

Day 11 - 6.6, 7.1, 7.6 Assessment

Log and "e"

Day 1 - 8.3 "e"

Day 2 - 8.3 Day 2

Day 3 - 8.3 Day 3

Day 4 - 8.4 Logs

Day 5 - 8.4 Day 2

Day 6 - 8.4 Day 3

Day 7 - 8.5 Properties of Logs

Day 8 - 8.5 Day 2

Day 9 - 8.5 Day 3

Day 10 - Review

Day 11 - e and Logs Assessment

Rational Expressions

Day 1 - 9.4 Multiplication/Division of Rational Expressions

Day 2 - 9.4 Day 2

Day 3 - 9.4 Day 3

Day 4 - 9.5 Addition/Subtraction of Rational Expressions

Day 5 - 9.5 Day 2

Day 6 - 9.5 Day 3

Day 7 - 9.6 Solving Rational Equations

Day 8 - 9.6 Day 2

Day 9 - 9.6 Day 3

Day 10 - Review

Day 11 - 9.4 - 9.6 Assessment

Unit 1: Review

Day 1 - Review

Day 2 - Review

Day 3 - Unit 1: Polynomials, Radicals, Rationals Test

61/75 Allotted Days - Add in projects, labs, ETC

Modifications and/or Accommodations

Suggested Modifications (ELL, Sp. Ed, GIfted, At-risk of Failure)

English Language Learners

Native language support: The teacher provides auditory or written content to students in their native language.

Adjusted Speech: The teacher changes speech patterns to increase student comprehension. This could include facing the students, paraphrasing, clearly indicating the most important ideas, and speaking more slowly.

Visuals: The teacher uses graphics, pictures, visuals, and manipulatives. This helps ELL students better understand and comprehend the subjects at hand.

Front-Loading Vocabulary: The teacher front loads vocabulary. This means providing students with a list of important vocabulary words they will need to know for a book, lesson, etc. prior to the lesson being taught. Including pictures to go with the vocabulary words is also very beneficial for the students.

Special Education Students

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Oral Reading: The teacher will read work orally to students. Class work such as tests and literature circles may need to be read aloud to the student.

Timers: The teacher will use timers as an instructional tool. The use of timers is beneficial for students who have trouble completing tasks. Timers can be helpful so the student is aware of how much time they have to complete an assignment.

Students with 504 Plans

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Gifted & Talented Strategies

Extensions/Enrichments: Teachers will provide gifted and talented students with extension/enrichment projects. Students will be challenged to further their understanding, to apply acquired knowledge, and/or to produce something in reference to acquired knowledge.

Modify/Change Activities: Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project work is necessary for those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

Students at Risk of School Failure

Directions or Instructions: Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

Peer Support: Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

Alternate or Modified Assignments: Always ask yourself, "How can I modify this assignment to ensure the students at risk are able to complete it?" Sometimes you'll simplify the task, reduce the length of the assignment or allow for a different mode of delivery. For instance, many students may hand something in, the at-risk student may jot notes and give you the information verbally. Or, it just may be that you will need to assign an alternate assignment.

Increase One to One Time: When other students are working, always touch base with your students at risk and find out if they're on track or needing some additional support. A few minutes here and there will go a long way to intervene as the need presents itself.

Contracts: It helps to have a working contract between you and your students at risk. This helps prioritize the tasks that need to be done and ensure completion happens. Each day write down what needs to be completed, as the tasks are done, provide a checkmark or happy face. The goal of using contracts is to eventually have the student come to you for completion sign-offs.

Hands On: As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them. A child may have to listen to a story being read instead of reading it him/herself.

Tests/Assessments: Tests can be done orally if need be. Break tests down in smaller increments by having a portion of the test in the morning, another portion after lunch and the final part the next day.

Seating: Seat students near a helping peer or with quick access to the teacher. Those with hearing

or sight issues need to be close to the instruction which often means near the front.