Unit 3: Rational Expressions, Real and Imaginary Numbers

Content Area: **Mathematics**
Course(s): **Algebra 2H**
Time Period: **November**
Length: **5 weeks**
Status: **Published**

Unit Overview

- • Represent and analyze mathematical situations using radicals
- • Understand numbers, ways of representing numbers, relationships among numbers and number systems
- • Understand the real number system and imaginary numbers

Enduring Understandings

- • Negatives under an even indexed radical are not part of the real number system and that imaginary numbers were invented to combat the natural phenomenon of a negative under a radical
- • Real and imaginary numbers comprise the complex number system.
- • Regardless of the method used, the answer will always come out the same
- • There are three possible variations on solutions to a quadratic equation as it applies to the real number system and the complex number system
- Solutions to quadratic equations include real and imaginary numbers

Essential Questions

- In what situations do we find it necessary to invent or discover something?
- Why is using a radical important instead of an approximation in real-life situations?
- Why would you have to use imaginary numbers?

Student Learning Objectives

- SWBAT add and subtract rational expressions
- SWBAT add, subtract, multiply, and divide complex numbers
- SWBAT find roots of real numbers
- SWBAT multiply and divide rational expressions
- SWBAT simplify complex fractions
- SWBAT simplify expressions involving radicals
- SWBAT simplify expressions involving sums of radicals
- SWBAT simplify expressions involving the exponent zero and negative integral exponents

- SWBAT Simplify products and quotients of binomials that contain radicals
- SWBAT simplify quotients using the law of exponents
- SWBAT simplify rational algebraic expressions
- SWBAT solve and use fractional equations
- SWBAT solve equations containing radicals
- SWBAT use the number i to simplify square roots of negative numbers

Lesson Titles

- Adding and Subtracting Radical Expressions
- Adding and Subtracting Rational Expressions
- Finding the Roots of Real Numbers
- Imaginary and Complex Numbers
- Multiplying and Dividing Rational Expressions
- Simplifying Complex Fractions
- Simplifying Expressions with Radicals
- Simplifying Expressions with Radicals
- Simplifying Expressions with Zero and Negative Exponents
- Simplifying Products and Quotients that Contain Radicals
- Simplifying Rational Algebraic Expressions
- Solving Fractional Equations
- Solving Radical Equations

Standards

MA.A-APR.C	Use polynomial identities to solve problems
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-APR.D.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.
MA.A-CED	Creating Equations

Indicators

MA.N-RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.
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.N-CN.A.3	Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.
MA.N-CN.B.4	Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.
MA.N-CN.B.5	Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation.
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-APR.D.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.

Career Readiness, Life Literacies & Key Skills

TECH.9.4.2.CI.1	Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2).
TECH.9.4.2.CI.2	Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a).
TECH.9.4.2.CT.3	Use a variety of types of thinking to solve problems (e.g., inductive, deductive).
TECH.9.4.2.DC.3	Explain how to be safe online and follow safe practices when using the internet (e.g., 8.1.2.NI.3, 8.1.2.NI.4).
TECH.9.4.2.TL.2	Create a document using a word processing application.
TECH.9.4.2.TL.3	Enter information into a spreadsheet and sort the information.

Inter-Disciplinary Connections

LA.RST.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
LA.W.9-10.6	Use technology, including the Internet, to produce, share, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
9-12.HS-ETS1-4.5	Using Mathematics and Computational Thinking

Instructional Strategies/Learning Activities/Levels of Blooms

- ch. 5 test
- Group students in groups of 3

- Instruct students to divide up the cards evenly between their group
- intro. conjugates with radicals
- Intro. Distributing Radicals
- Intro. dividing radicals
- Intro. Fractional coefficients
- intro. rationalizing radicals
- Intro. Simplifying expressions with sums and differences with radicals
- Intro. simplifying expressions with zero and negative exponents.
- Intro. simplifying rational expressions.
- Intro. Solving Equations involving fractional coefficients.
- Intro. solving inequalities involving fractional coefficients.
- Intro. sums and differences of rational expressions with unlike denominators.
- Intro. Writing Equations with radicals
- Review quiz
- review simplifying rational expressions.
- review solutions of the problems.
- Review test
- Assessment
- Discovery of zero exponent and negative exponents pattern
- Each student will solve the problems on their own
- Independent practice of 15 problems.
- Intro. Complex Fractions
- intro. Dividing Monomials
- Intro. dividing rational expressions.
- Intro. Laws of exponents when dividing same b
- Intro. Multiplying Binomials with radicals
- intro. multiplying radicals
- Intro. Multiplying rational Expressions
- intro. negative exponents.
- Intro. problem-solving with radicals.
- Intro. rationalizing using conjugates.
- Intro. simplifying expressions involving radicals.
- Intro. Simplifying Rational Expressions involving multiplication and Division.
- Intro. Solving complex Fractions
- Intro. solving functions that involve complex fractions.
- Intro. Sums and Differences of Radicals
- Intro. Sums and differences of rational expressions with like denominators.
- Pass out 12 index cards with example problems on them to each group
- Review Anticipatory Set

- review game
- review hmwk
- Review Multiplying Monomials
- review simplifying expressions containing negative and zero exponents.
- The group members will check the others work
- They will hand in the solutions to the problems as a group

Modifications

ELL Modifications

- Assess ELL students continuously using formative assessment methods
- Be flexible with time frames and deadlines
- During Delsea One - one on one with a student who speaks the same language
- Intentional scheduling/grouping with student/teacher who speaks the same language if possible
- Khan Academy offers lesson in several languages https://es.khanacademy.org/
- Offer resources for specific topics in primary language (Youtube web resources)
- Repeat, reword, clarify
- Use google translator, especially for application problems
- Using technology, such as but not limited to: graphing calculator and desmos

IEP & 504 Modifications

- Allowing co-teaching with general education and special education teachers in the same classroom so that the special education teacher can re-teach students with special needs in a different way in a smaller group (pulled to the side)
- For assessments - allowing student to correct mistakes or answer wrong questions correctly for additional credit if failed the first test (another way to re-teach material)
- For assessments - rewording questions so that there are not higher level vocabulary within the question (you are testing for understanding of the content not the ability to understand the question)
- For assessments - students could use calculator and/or other math tools (x grids, chips, ect)
- If not in a co-teaching setting allowing time in the schedule for a special education teacher to consult with general education teachers on what specifically can be modified or how to paraphrase things in a different way specific to that lesson
- Khan Academy offers extra practice and examples in all areas. https://www.khanacademy.org/
- Modeling and showing lots of examples
- Non-verbal redirection of behaviors
- Providing study guides that don't lead the student to study too much extraneous information (less unnecessary details)/scaffolded study guides

- Scaffolded notes
- Speaking to students privately when redirecting behaviors
- Videos that offer extra practice and examples in all areas are posted on google classroom and taken from: mathispower4u

G & T Modifications

- Ask students' higher level questions that require students to look into causes, experiences, and facts to draw a conclusion or make connections to other areas of learning.
- Determine where students' interests lie and capitalize on their inquisitiveness. (Is there a Invite students to explore different points of view on a topic of study and compare the two.
- Employ differentiated curriculum to keep interest high.
- Encourage students to explore concepts in depth and encourage independent studies or investigations.
- Encourage students to make transformations- use a common task or item in a different way.
- Invite students to explore different points of view on a topic of study and compare the two.
- Khan Academy offers extra practice and examples in all areas. https://www.khanacademy.org/
- Math- provide additional rigorous challenge problems for advanced students
- Refrain from having them complete more work in the same manner.
- Specific career they are interested in? How would this apply to their interest?)
- Videos that offer extra practice and examples in all areas are posted on google classroom and taken from: mathispower4u

At Risk Modifications

- Keep contact with parents/guardians and guidance counselor about progress
- Refer to Organizational Management
- Require Delsea One Tutoring

Formative Assessment

- Anticipatory Set
- Closure
- Group work
- Guided Practice
- Partner activity
- Pass out of class
- Quiz on Complex Fractions
- Quiz on Imaginary and Complex Numbers
- Quiz on Laws of Exponents - Zero/Negative Exponents
- Quiz on Rational Expressions

- Quiz on Simplifying Radicals and Radical Operations
- Teacher Observation
- Warm Up

Summative Assessment

- Benchmark Assessment
- Marking Period Assessment
- Unit Test on Complex Numbers and Rational Expressions
- Unit Test on Radicals, Imaginary and Complex Numbers

Resources & Materials

- Algebra and Trigonometry Book 2
- Establish a set of general strategies for student independence and self-evaluation
- Evoke student participation from their seats and at the board
- Independent/Cooperative learning explorations
- Mathispower4u math videos
- Powerpoint lessons
- Smartboard lessons
- Teacher Generated Worksheets
- Use youtube videos to introduce/demonstrate concepts in real-life situations.

Technology

- Chromebooks
- Desmos
- Equatio
- Graphing Calculators
- MathXLforschool.com

TECH.8.1.12.A.CS1	Understand and use technology systems.
TECH.8.1.12.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.
TECH.8.2.12.A.CS3	The relationships among technologies and the connections between technology and other fields of study.