Intro to Algebra II

[Implement start year (2013-2014)]

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Unit #5 Quadratic Functions

Stage 1 – Desired Results

Established Goals

2009 NJCCC Standard(s), Strand(s)/CPI #
(http://www.nj.gov/education/cccs/2009/final.htm)

Common Core Curriculum Standards for Math and English
(http://www.corestandards.org/)

The Real Number System N-RN: 3
- Use properties of rational and irrational numbers

The Complex Number System N-CN: 1, 2, 7
- Perform arithmetic operations with complex numbers
- Use complex numbers in polynomial identities and equations

Seeing Structure in Expressions A-SSE: 1, 2, 3a,b,
- Interpret the structure of expressions
- Write expressions in equivalent forms to solve problems

Arithmetic with Polynomials and Rational Expressions A-APR: 2, 3,
- Understand the relationship between zeros and factors of polynomials

Reasoning with Equations and Inequalities A-REI: 4, 10

21st Century Skills

Learning and Innovation Skills:
_X__ Creativity and Innovation
_X__ Critical Thinking and Problem Solving
_X__ Communication and Collaboration

Information, Media and Technology Skills:
___ Information Literacy
___ Media Literacy
_X__ ICT (Information, Communications and Technology) Literacy

Life and Career Skills:
_X__ Flexibility and Adaptability
_X__ Initiative and Self-Direction
_X__ Social and Cross-Cultural Skills
_X__ Productivity and Accountability
_X__ Leadership and Responsibility

• Solve equations and inequalities in one variable
• Represent and solve equations and inequalities graphically
 	
Interpreting Functions F-IF: 4, 7c, 8a
   • Interpret functions that arise in applications in terms of the context
   • Analyze functions using different representations	

Enduring Understandings:
Students will understand that . . .
 	
EU 1
Radical Expressions and Equations can be can be transformed into equivalent forms.
 	
EU 2
Arithmetic operations can be applied to complex numbers.
	Essential Questions:
	
	EU 1
	   • What is the most efficient use of mathematical operations to simplify radical expressions? (including rationalizing)
	   • What is the most efficient use of mathematical operations to solve radical equations?
	
	EU 2
	   • Why does the complex number system exist and when is it used?
	   • What is the most efficient use of mathematical operations to simply and solve complex expressions (including rationalizing, without using complex conjugates)
	
	EU 3
	   • What is the relationship between zeros and the graph of a quadratic function and its factors?
	   • What characteristics of a quadratic equation determine the best solution process?

EU 3 The solutions of quadratic functions can be found by graphing, factoring, the square root principle, completing the square, and the quadratic formula	
Knowledge: Students will know . . . **EU 1** • the characteristics and properties of radicals • how to simplify radicals using perfect squares as factors of the radicand • equations can be transformed and balanced by using inverse operations **EU 2** • the characteristics and properties of imaginary and complex numbers **EU 3** • the relationship between roots, zeros, x-intercepts, and solutions • how to determine if a solution is correct or incorrect • there are multiple ways to solve a quadratic which yield the same solution (factoring, the square root principle, completing the square, quadratic formula, and graphing)	**Skills:** Students will be able to . . . **EU 1** • simplify radical expressions of all types (including rationalization, with and without variables) • solve equations using opposite operations **EU 2** • simplify expressions and solve equations involving complex numbers by adding, subtracting, multiplying and dividing • simplifying powers of i **EU 3** • graph quadratic functions (using Nspire) • determine roots of a quadratic equation and their relationship to the x-intercepts of a graph • solve quadratic equations multiple ways and be able to verify solutions

Stage 2 – Assessment Evidence

Recommended Performance Tasks: EU1, EU3

It is the responsibility of the mayor of the town to design a fireworks display for the town's Fourth of July evening festivities. To make the best display, it is necessary for the fireworks to explode when they are at the top of their trajectory. The fireworks are shot from ground level. A list of fireworks and formulas that are needed to complete the display will be given. The town committee needs to know how long it will take for the projectile to reach the top of its trajectory so that the timing mechanism can be set. Determine the graph of each shell that is chosen. State the maximum height of each shell and the time it took to achieve that value. Given $500, create a program that lasts one minute that will keep the crowd's interest. A presentation will be given displaying the graph and justifying your display.

Other Recommended Evidence: *Tests, Quizzes, Prompts, Self-assessment, Observations, Dialogues, etc.*

- Tests/quizzes on simplifying and solving radical and complex expressions and equations.
- Tests/quizzes on solving quadratic function using multiple methods
- "Ticket to leave" at the end of simplifying radicals, multiplying complex numbers, solving quadratic functions using all methods
- Other teacher-graded evaluation; such as hw, do-now, classwork etc.
- Class discussions on the most efficient method of solving a quadratic equation.
- Observations and discussions on the use of all solution methods.
- Questioning on the relationship between solutions of a quadratic and its graphical representation.

Stage 3 – Learning Plan

Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: *Consider the WHERETO elements. Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.*

Activities:

- Activity #1
  Exercises where students simplify and solve radical expressions and equations (A)

- Activity #2
  Simplify perfect square radicals and powers of *i* to assist in understanding rationalization (M)

- Activity #3
  Brainstorm real-world applications where quadratic models could be used to represent real world situations.   (M/T)

- Activity #4
  Solve one quadratic function using multiple methods to highlight that they all produce the same solution.   (A/M)

- Activity #5
  http://education.ti.com/calculators/timathnspired/US/Activities/Detail?id=11889&sa=5022&t=5035
  The above is a link to a TI-Nspire activity entitled **Zeros of a Quadratic Function** (A/M)

- Activity #6
  Explore the connection between solutions of a quadratic and its visual representation. Writing assignment on prompt: Can you use this as a means of checking solutions? (A/M)

The following is the suggested sequence of learning activities for the Intro to Algebra II (Level 3) class and should comprise 46 school days:

- YWBAT simplify radical expressions (square root only). (A)
- YWBAT perform operations with radical expressions; multiply, divide. (A)
- YWBAT add, subtract, and multiply radical expressions. (A)
- Activity #1: Simplify Radical Expressions. (A)
- YWBAT rationalize radical expressions (conjugate optional). (A)
- YWBAT simplify, add, subtract, multiply, and divide complex numbers. (A)
- YWBAT simplify powers of *i*. (A)
- Activity #2: Simplifying Perfect Square Radicals and Powers of *i*. (M)
- YWBAT solve quadratic functions by factoring. (A)
- Activity #5: TI-Nspire Activity (A/M)
- YWBAT solve quadratic functions using the square root property. (A)
- YWBAT solve quadratic functions by completing the square. (A)
- YWBAT solve quadratic functions using the quadratic formula. (A)
- Activity #3: Brainstorm Real-World Applications. (M/T)
- Activity #4: Solve One Quadratic Functions Using Multiple Methods (A/M)
- YWBAT recognize and utilize characteristics of quadratic functions; up/down, intercepts. (A)
- Activity #6: Exploring Connections. (A/M)