Unit 3 - *Quadratic Equations and Complex Numbers*

Overview

Students will understand what a radical is and how to simplify and combine in order to solve quadratics that are not factorable. Students will learn a variety of ways to solve quadratic equations and then will be challenged to choose the most efficient method for solving a given equation. Students can visualize the solutions of quadratic equations through graphing (e.g., min, max, transformations, complex roots). Completing the squares is used as an introduction to the equation of circles to further understanding of transformations. Students will demonstrate their efficiency through the solving of application problems.

21st Century Capacities: Collective Intelligence

Stage 1 - Desired Results

ESTABLISHED GOALS/ STANDARDS

MP 1 Make sense of problems and persevere in solving them
MP3 Construct viable arguments and critique the reasoning of others
MP4 Model with Mathematics
MP7 Look for and make use of structure
MP8 Look for and express regularity in repeated reasoning

N.CN.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.
N.CN.2 Use the relation $i^2 = $ -1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
N.CN.3(+) Find the conjugate of a complex number; use conjugates of a complex number to find moduli and quotients of complex numbers.
N.CN.7 Solve quadratic equations with real coefficients

Transfer:

Students will be able to independently use their learning in new situations to...
1. Manipulate equations and expressions to create order and establish relationships. (Analyzing)
2. Draw conclusions about graphs, shapes, equations, or objects. (Analyzing)
3. Make sense of a problem, initiate a plan, execute it, and evaluate the reasonableness of the solution (Analyzing).
4. Work respectfully and responsibly with others, exchanging and evaluating ideas to achieve a common objective (Collective Intelligence)

Meaning:

UNDERSTANDINGS: *Students will understand that:*	ESSENTIAL QUESTIONS: *Students will explore and address these recurring questions:*
1. Mathematicians examine relationships to discern a pattern, generalization, or structure.	A. How does my knowledge of the pattern predict future outcomes?
2. Mathematicians use models to represent and make meaning of quantitative relationships in procedural and real world problems.	B. How do I use my knowledge of quadratic equations to model a real world problem?
3. Mathematicians analyze change and make predictions in various contexts.	C. Is there another way to represent this?

	Acquisition:	
that have complex solutions. N.CN.8 (+) Extend polynomial identities to the complex numbers. For example, rewrite $x^2 + 4$ as $(x + 2i)(x - 2i)$. N.CN.9 (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials. F.BF.3 See unit 1 A.SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression[*] A.SSE.3a Factor a quadratic expression to reveal zeros of the function it defines. A.SSE.3b Complete the square in a quadratic expression to reveal the maximum value of the function it defines. A.REI.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous roots may arise. A.REI.4 Solve quadratic equations in one variable. A.REI.4b Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b. F.IF.7a Graph linear and quadratic functions and show intercepts, maxima, and minima. A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*	*Students will know…* 1. $i = \sqrt{-1}$ 2. $a + bi$ form of a complex number 3. There are several ways to solve a quadratic equation: factoring, completing the square, quadratic formula 4. How to interpret a quadratic graph, including the vertex, minimum, and maximum, domain and range, zeros. 5. Vocabulary: complex number, imaginary unit, conjugates, zeros,	*Students will be skilled at…* 1. Simplifying radical expressions including those with a negative number under the radical 2. Simplifying expressions with radicals by multiplying , dividing, adding and subtracting 3. Writing equations in standard form or vertex form 4. Finding the axis of symmetry 5. Finding zeros 6. Finding the number of solutions 7. Identifying real and imaginary components of complex numbers 8. Combining (add, subtract, multiply, and divide) complex numbers 9. Solving quadratic equations by factoring, completing the square, and the quadratic formula 10. Graphing quadratic functions 11. Transforming quadratic functions 12. Applying quadratic equations to model