Algebra 2 Level 2 - Unit 3 - Quadratic Equations and Complex Numbers

Unit Focus

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.

Stage 1: Desired Results - Key Understandings

Standard(s)

Common Core
Mathematics: 9-12

- 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. (CCSS.MATH.CONTENT.HSN.CN.A.1)
- Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. (CCSS.MATH.CONTENT.HSN.CN.A.2)
- Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers. (CCSS.MATH.CONTENT.HSN.CN.A.3)
- Solve quadratic equations with real coefficients that have complex solutions. (CCSS.MATH.CONTENT.HSN.CN.C.7)
- Extend polynomial identities to the complex numbers. For example, rewrite $x^2 + 4$ as $(x + 2i)(x - 2i)$. (CCSS.MATH.CONTENT.HSN.CN.C.8)
- Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials. (CCSS.MATH.CONTENT.HSN.CN.C.9)
- Factor a quadratic expression to reveal the zeros of the function it defines. (CCSS.MATH.CONTENT.HSA.SSE.B.3.A)
- Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. (CCSS.MATH.CONTENT.HSA.SSE.B.3.B)
- 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. (CCSS.MATH.CONTENT.HSA.CED.A.1)

Transfer

Students will be able to independently use their learning to...
T1 manipulate equations/expressions or objects to create order and establish relationships.
T2 draw conclusions about graphs, shapes, equations, or objects.
T3 make sense of a problem, initiate a plan, execute it, and evaluate the reasonableness of the solution.
T4 work respectfully and responsibly with others, exchanging and evaluating ideas to achieve a common objective.

Meaning

Understanding(s)

Students will understand that...
U1 Mathematicians examine relationships to discern a pattern, generalizations, or structure.
U2 Mathematicians use models to represent and make meaning of quantitative relationships.
U3 Mathematicians analyze change and make predictions in various contexts.

Essential Question(s)

Students will keep considering...
Q1 How does my knowledge of the pattern predict future outcomes?
Q2 How do I use my knowledge of quadratic equations to model a real world problem?
Q3 Is there another way to represent this?

Acquisition of Knowledge and Skill

Knowledge

Students will know...
K1 $i = \sqrt{-1}$
K2 a + bi form of a complex number

Skill(s)

Students will be skilled at...
S1 simplifying radical expressions including those with a negative number under the radical

Stage 1: Desired Results - Key Understandings

• Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (CCSS.MATH.CONTENT.HSA.CED.A.2) • Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. (CCSS.MATH.CONTENT.HSA.REI.A.2) • 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 +/- bi for real numbers a and b. (CCSS.MATH.CONTENT.HSA.REI.B.4.B) • Graph linear and quadratic functions and show intercepts, maxima, and minima. (CCSS.MATH.CONTENT.HSF.IF.C.7.A) • Make sense of problems and persevere in solving them. (CCSS.MATH.MP.1) • Construct viable arguments and critique the reasoning of others. (CCSS.MATH.MP.3) • Model with mathematics. (CCSS.MATH.MP.4) • Look for and make use of structure. (CCSS.MATH.MP.7) • Look for and express regularity in repeated reasoning. (CCSS.MATH.MP.8) **Madison Public Schools Profile of a Graduate** • Analyzing: Examining information/data/ evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)	**K3** there are several ways to solve a quadratic equation: factoring, completing the square, quadratic formula **K4** How to interpret a quadratic graph, including the vertex, minimum, and maximum, domain and range, zeros. **K5** Vocabulary: complex number, imaginary unit, conjugates, zeros	**S2** simplifying expressions with radicals by multiplying, dividing, adding and subtracting **S3** writing equations in standard form or vertex form **S4** finding the axis of symmetry **S5** finding zeros **S6** finding the number of solutions **S7** identifying real and imaginary components of complex numbers **S8** combining (add, subtract, multiply, and divide) complex numbers **S9** solving quadratic equations by factoring, completing the square, and the quadratic formula **S10** graphing quadratic functions **S11** transforming quadratic functions **S12** applying quadratic equations to model