UbD Algebra 2 - Complex Numbers and Rational Exponents

Time Frame: 19 Lessons	Unit 3: Complex Numbers and Rational Exponents	Course Name: Algebra 2

Stage 1: Desired Results

Established Goal(s)

Standards Addressed:

HSF-BF.A.1
Write a function that describes a relationship between two quantities.
HSF-BF.A.1.b
Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.
HSF-BF.B.3
Identify the effect on the graph of replacing f(x) by f(x)+k, kf(x), f(kx), and f(x+k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.
HSF-IF.B.4
For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the

Transferable Skills

Students will be able to independently use their learning to...

- **apply complex numbers, rational exponents, mathematical knowledge, skill, and reasoning to solve real-world problems.**
- develop clear and effective communication.
- increase self-direction.
- develop creative and practical problem-solving.
- develop informed and integrative thinking.
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Meaning

Understandings
Students will understand that...

- property of exponents extend to rational exponents
- learn that a number is a *square root* of *c* if it squares to make *c* and square roots of *c* are solutions to the equation $x^2 = c$
- the positive square root is given the symbol $\sqrt{\ }$, so the positive square root of *c* is written $\sqrt{c}$ and the negative square root is written $-\sqrt{c}$.
- squaring each side of an equation can sometimes introduce new solutions that aren't solutions to the original equation
- the $\sqrt{-1}$ can be rewritten using the notation *i* and that negative real numbers also have two square roots, one on the positive imaginary axis, and one on the negative imaginary axis.
- that $i^2 = -1$ and can use the commutative, associative, and distributive properties to add, subtract, and multiply

Essential Questions

- How can we use advanced algebraic techniques to model and solve real-world problems?
- What are the properties and applications of functions, including rational functions?
- What are the properties and applications of complex numbers, and how can we use them to solve equations and represent geometric figures?
- How do you add, subtract, multiply and divide complex numbers?
- How is the process of completing the square used to solve a quadratic function and write it.

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relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. **HSF-IF.C** Analyze functions using different representations. **HSF-IF.C.8** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. **HSF-LE.B** Interpret expressions for functions in terms of the situation they model. **HSS-ID.B.6.a** Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.	complex numbers to express them in the form *a+bi*, where *a* and *b* are real numbers. ● quadratic equations can have complex solutions	
	Acquisition	
	Students will know... ● how to calculate square and cube roots. ● how to write square and cube roots as exponents. ● how to interpret exponents that are fractions. ● how to interpret exponents that are negative fractions. ● that the square root symbol means the positive square root. ● how to find real and imaginary parts of complex numbers. ● how to solve quadratic equations by completing the square ● or by using the quadratic formula. ● how find complex solutions to quadratic equations by ● completing the square. ● how to find complex solutions to quadratic equations by ● using the quadratic formula. ● how to find complex solutions to quadratic equations.	*Students will be able to...* ● evaluate expressions with integer exponents. ● solve equations by squaring or finding square roots. ● solve equations by cubing or finding cube roots. ● solve equations with radicals in them. ● represent the square root of i and multiples of it. ● solve equations. ● add complex numbers and calculate powers of imaginary numbers. ● do arithmetic with complex numbers ● multiply complex numbers. Mathematical Practices: ● make sense of problems and persevere in solving them. ● reason abstractly and quantitatively. ● construct viable arguments and critique the reasoning of others. ● model with mathematics. ● use appropriate tools strategically. ● attend to precision. ● look for and make use of structure. ● look for and express regularity in repeated reasoning.