04 Quadratic Functions and Complex Numbers

Content Area: **Math**
Course(s):
Time Period: **Full Year**
Length: **5 weeks**
Status: **Published**

General Overview, Course Description or Course Philosophy

This unit will focus on strengthening the prerequisite skills and conceptual understanding needed to graph quadratic functions and identify key components of a quadratic function. Lesson activities will reinforce new content and address common misconceptions and errors to support students' progress toward analyzing quadratic functions.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Objectives/Enduring Understandings:

- Solutions exist that are not within the set of real numbers
- All number systems are subsets of the complex number system

Essential Questions:

- Why is there a need to solve numbers that are not in the set of real numbers?
- What types of situations model quadratic behavior and why can it be useful to obtain a quadratic model?

STUDENT LEARNING TARGETS

Declarative Knowledge

Students will understand that:

- The definition of a complex number and how it applies to the possible solutions of an equation

- Complex numbers can be represented graphically on a complex plane
- Powers of the complex numbers, i, can be written in the form of using the definition $i^2 = -1$
- The product of a conjugate of a complex number and itself will always be a real number; the conjugate can be used to simplify expressions and equations containing complex numbers.
- Operations can be performed within the set of complex numbers written in standard form.

Procedural Knowledge

Students will be able to:

- Find the solution to a quadratic equation by using the quadratic formula
- Graph a quadratic function based upon the value of the vertex and the a value
- Tell if a graph opens upwards or downwards
- State the domain and range of the quadratic function
- Perform arithmetic operation with complex numbers.
- Transform a complex number into its standard form a + bi
- Evaluate any power of i
- Represent complex numbers and their operations on the complex plane.
- Use complex numbers in polynomial identities and equations.
- Solve linear and non linear equations with/without complex solutions
- Cite phenomena that have context in the complex number system.

CONTENT AREA STANDARDS

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.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.C	Use complex numbers in polynomial identities and equations.
MA.N-CN.C.7	Solve quadratic equations with real coefficients that have complex solutions.
MA.N-CN.C.8	Extend polynomial identities to the complex numbers.
MA.A-REI.B.4	Solve quadratic equations in one variable.

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

CS.K-12.3.a	Identify complex, interdisciplinary, real-world problems that can be solved

	computationally.
CS.K-12.3.b	Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures.
CS.K-12.3.c	Evaluate whether it is appropriate and feasible to solve a problem computationally.
LA.K-12.NJSLSA.R7	Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
TECH.9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).
TECH.9.4.12.IML.4	Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4).
TECH.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
TECH.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.

EVIDENCE OF LEARNING

Formative Assessments

- Student feedback/questioning/observation
- Error analysis
- Specific skill assessment/questions
- Survey/polling
- Task completion and review of quizzes and material presented in the Algebra II class

Summative Assessments

There will be no formal assessments in this course.

RESOURCES (Instructional, Supplemental, Intervention Materials)

Desmos Activities: Visualizing the imaginary, Imaginary numbers Introduction Card Sort, Introduction to the quadratic formula, Practice Solving Quadratic Equations
Kuta Software worksheets

Approved course textbook

INTERDISCIPLINARY CONNECTIONS

Interdisciplinary connections are frequently addressed through modeling and application problems whereby students solve and analyze situations taken from business, physics, engineering, biology, statistics, geography, and numerous other fields. Examples can be found in topic specific textbook problems and digital resources.

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.