Unit 4: Quadratic Functions

Content Area: **Mathematics**
Course(s): **Algebra 2H**
Time Period: **January**
Length: **4 weeks**
Status: **Published**

Unit Overview

- • Represent and analyze mathematical situations and structures using algebraic symbols
- • Understand meanings of operations and how they relate to one another.

Enduring Understandings

- • Changing the parameters of quadratic function changes the graph in predictable ways.
- • There are different methods that can be used to solve quadratic functions.
- • There are different methods to solving quadratic functions.

Essential Questions

- How are quadratic equations and their graphs useful in solving real-world problems?
- How can we classify functions?
- How do graphs of mathematical models help us better understand the world in which we live?
- Why is it important to have more than one method to solve a problem?

Student Learning Objectives

- SWBAT analyze a quadratic function, draw its graph, and find its minimum or maximum value
- SWBAT determine the nature of the roots of a quadratic equation by using its discriminant
- SWBAT graph parabolas whose equations have the form y - k = a(x-h)^2 and to find the vertices and axes of symmetry
- SWBAT learn the relationship between the roots and coefficients of a quadratic equation
- SWBAT recognize and solve equations in quadratic form
- SWBAT solve quadratic equations by completing the square
- SWBAT solve quadratic equations by using the quadratic formula
- SWBAT write a quadratic equation or function using information about the roots or the graph

Lesson Titles

- Analyzing the graphs of quadratic functions
- Completing the Square

- Graphing Quadratic Functions
- Solving Equations in Quadratic Form
- The Discriminant
- The Quadratic Formula

Standards

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.5	Use appropriate tools strategically.
MA.A-SSE.B.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
MA.K-12.7	Look for and make use of structure.
MA.A-REI.B.4	Solve quadratic equations in one variable.

Indicators

MA.A-SSE.B.3a	Factor a quadratic expression to reveal the zeros of the function it defines.
MA.A-SSE.B.3b	Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
MA.A-REI.B.4a	Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.
MA.A-REI.B.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.
MA.A-REI.C.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.
	Functions describe situations where one quantity determines another. For example, the return on $10,000 invested at an annualized percentage rate of 4.25% is a function of the length of time the money is invested. Because we continually make theories about dependencies between quantities in nature and society, functions are important tools in the construction of mathematical models.
	A graphing utility or a computer algebra system can be used to experiment with properties of these functions and their graphs and to build computational models of functions, including recursively defined functions.

Career Readiness, Life Literacies & Key Skills

TECH.9.4.2.CI.1	Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2).
TECH.9.4.2.CI.2	Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a).
TECH.9.4.2.CT.2	Identify possible approaches and resources to execute a plan (e.g., 1.2.2.CR1b, 8.2.2.ED.3).

TECH.9.4.2.CT.3	Use a variety of types of thinking to solve problems (e.g., inductive, deductive).
TECH.9.4.2.DC.3	Explain how to be safe online and follow safe practices when using the internet (e.g., 8.1.2.NI.3, 8.1.2.NI.4).
TECH.9.4.2.TL.2	Create a document using a word processing application.
TECH.9.4.2.TL.3	Enter information into a spreadsheet and sort the information.

Inter-Disciplinary Connections

LA.RST.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
LA.W.9-10.6	Use technology, including the Internet, to produce, share, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
9-12.HS-ETS1-4.5	Using Mathematics and Computational Thinking

Instructional Strategies/Learning Activities/Levels of Blooms

- Intro. Applications of the Quadratic form.
- Intro. Solve Quadratic equations by completing the square.
- Intro. Solving the second equation using the quadratic formula.
- Intro. Using the Quadratic Formula to solve quadratic equations.
- Partner activiy: students will work with a partner on 8 problems. It will be collected at the end of the period.
- Review quiz
- Review test
- students will be 5 questions. they will hand these problems in by the end of the period.
- Assessment
- have students describe graph of a parabola and develop an equation.
- Intro. analyzing a Quadratic function.
- Intro. axis of symmetry and vertex.
- intro. basic form of the equation
- Intro. Completing the squares.
- Intro. drawing the graph of a quadratic function.
- Intro. finding the minimum and maximum values of a quadratic function.
- intro. graphing parabolas by hand from the equation
- intro. how to write quadratic equations given the roots.
- Intro. idea of substituting in a "z" to make an easier equation to work with.
- intro. parabolas
- Intro. Quadratics Equations that are unfactorable.
- intro. shifts that occur using the graphing calculator. (vertical and horizontal)

- intro. the discriminant and using it to find the number of solutions of a quadratic equation.
- Intro. The Quadratic Formula.
- intro. the relationship between the roots and coefficients of quadratic equations by having the students determine a pattern.
- Intro. What makes the graph open up or down.
- Intro. writing the equation of a parabola given the vertex and a point.
- intro. y = x squared
- partner activity: students will work solving 10 problems. 5 each. they will then check each others work.
- partner activity: students will work with a partner on a practice test.
- review 5 questions collect previous day.
- Review analyzing a Quadratic function.
- Review Anticipatory Set
- review completing the square.
- Review drawing the graph of a quadratic function.
- review finding the minimum and maximum values of a quadratic function.
- review game
- review general form of parabolas and finding max/min, vertex and graphing.
- Review graphing absolute value equations.
- review graphing and analyzing graphs of parabolas
- review hmwk
- Review Perfect Trinomial Squares
- review problem solving using quadratic formulas.
- Review the relationship between the roots of the equation and the coefficients.
- review vertices, axis of symmetry, roots of quadratic equations.
- review writing equations of parabolas.
- students will be called randomly to place a solution on the board and explain their process.
- Using Quizlet: students will have to state the roots of a given equation and give an equation given the roots.

Modifications

ELL Modifications

- Assess ELL students continuously using formative assessment methods
- Be flexible with time frames and deadlines
- During Delsea One - one on one with a student who speaks the same language
- Intentional scheduling/grouping with student/teacher who speaks the same language if possible
- Khan Academy offers lesson in several languages https://es.khanacademy.org/

- Offer resources for specific topics in primary language (Youtube web resources)
- Repeat, reword, clarify
- Use google translator, especially for application problems
- Using technology, such as but not limited to: graphing calculator and desmos

IEP & 504 Modifications

- Allowing co-teaching with general education and special education teachers in the same classroom so that the special education teacher can re-teach students with special needs in a different way in a smaller group (pulled to the side)
- For assessments - allowing student to correct mistakes or answer wrong questions correctly for additional credit if failed the first test (another way to re-teach material)
- For assessments - rewording questions so that there are not higher level vocabulary within the question (you are testing for understanding of the content not the ability to understand the question)
- For assessments - students could use calculator and/or other math tools (x grids, chips, ect)
- If not in a co-teaching setting allowing time in the schedule for a special education teacher to consult with general education teachers on what specifically can be modified or how to paraphrase things in a different way specific to that lesson
- Khan Academy offers extra practice and examples in all areas. https://www.khanacademy.org/
- Modeling and showing lots of examples
- Non-verbal redirection of behaviors
- Providing study guides that don't lead the student to study too much extraneous information (less unnecessary details)/scaffolded study guides
- Scaffolded notes
- Videos that offer extra practice and examples in all areas are posted on google classroom and taken from: mathispower4u

G & T Modifications

- Ask students' higher level questions that require students to look into causes, experiences, and facts to draw a conclusion or make connections to other areas of learning
- Determine where students' interests lie and capitalize on their inquisitiveness. (Is there a Invite students to explore different points of view on a topic of study and compare the two. Specific career they are interested in? How would this apply to their interest?)
- Employ differentiated curriculum to keep interest high
- Encourage students to explore concepts in depth and encourage independent studies or investigations.
- Encourage students to make transformations- use a common task or item in a different way
- Invite students to explore different points of view on a topic of study and compare the two
- Khan Academy offers extra practice and examples in all areas. https://www.khanacademy.org/
- Provide additional rigorous challenge problems for advanced students
- Refrain from having them complete more work in the same manner
- Videos that offer extra practice and examples in all areas are posted on google classroom and taken

from: mathispower4u

At Risk Modificaions

- Keep in contact with parents/guardians and guidance counselors about progress
- Refer to Organizational Management
- Require Delsea One Tutoring

Formative Assessment

- Anticipatory Set
- Closure
- Partner activity
- Pass out of class
- Quiz on Solving Quadratic Equations
- Quiz on the Graphs of Quadratic Functions
- Warm Up

Summative Assessment

- Benchmark Assessment
- Chapter 7 test - Quadratic Functions
- Marking Period Assessment

Resources & Materials

- Algebra and Trigonometry Book 2
- Establish a set of general strategies for student independence and self-evaluation
- Evoke student participation from their seats and at the board
- Independent/Cooperative learning explorations
- Powerpoint lessons
- Smartboard lessons
- Teacher Generated Worksheets
- united streaming math videos
- Use mathispower4u videos to introduce/demonstrate concepts in real-life situations.

Technology

- Chromebooks

- Desmos
- Equatio
- Graphing Calculators
- MathXLforschool.com

TECH.8.1.12.A.CS1	Understand and use technology systems.
TECH.8.1.12.E.CS3	Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.
TECH.8.2.12.A.CS3	The relationships among technologies and the connections between technology and other fields of study.