Unit 05: Quadratic Functions and Modeling

Content Area: **Template**
Course(s):
Time Period: **Full Year**
Length: **FY**
Status: **Published**

Standards Alignment

New Jersey Student Learning Standards

MA.F-IF	Interpreting Functions
MA.N-RN	The Real Number System
MA.N-RN.B	Use properties of rational and irrational numbers.
MA.N-RN.B.3	Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.
MA.F-IF.C	Analyze functions using different representations
MA.F-IF.C.7a	Graph linear and quadratic functions and show intercepts, maxima, and minima.
MA.F-IF.C.7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
MA.F-IF.C.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
MA.F-IF.C.8a	Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
MA.F-IF.C.8b	Use the properties of exponents to interpret expressions for exponential functions.
MA.F-IF.C.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
MA.F-BF	Building Functions
MA.F-BF.B	Build new functions from existing functions
MA.F-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.
MA.F-BF.B.4	Find inverse functions.
MA.F-LE	Linear and Exponential Models
MA.F-LE.A	Construct and compare linear and exponential models and solve problems
MA.F-LE.A.3	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

Integration of Career Readiness, Life Literacies and Key Skills

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP3	Attend to personal health and financial well-being.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP10	Plan education and career paths aligned to personal goals.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

Technology / Integration of Computer Science and Design Thinking

TECH.8.1.12	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.12.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
TECH.8.1.12.A.4	Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.

Interdisciplinary Connections: NJSLS for ELA, Social Studies, Science and/or Math Section

Capacities of the Literate Individual
Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language

They demonstrate independence.

They build strong content knowledge.

They comprehend as well as critique.

They use technology and digital media strategically and capably.

Integration of Diversity, Equity and Inclusion; Climate Change; Informational and Media LiteracyNew Section

see Crosswalks

21st Century Life and Careers

Stage I: Desired Results

Transfer/Overview/Rationale

Unit Rationale

The purpose of this unit…

Students now how a good foundation of the properties of quadratic equations. Students will now use this knowledge and apply it to practical situations. In addition, because students have been exposed to transformations of functions, specific attention will be given to how certain transformations affect quadratic functions. Similarly, students will be able to take the graphic form, or the algebraic form, of a quadratic function and analyze its key features helping convert from one form to the other. By the end of Unit 5, students will now have the necessary skills to be able to continue into Algebra II.

Meaning

Essential Questions

- Why do we use different representations of a quadratic function?
- Why are some values on a graph more critical than others?

Enduring Understanding/Indicators of Understanding

- The graph of any quadratic function is a transformation of the graph of the parent quadratic function..
- Linear functions have a constant difference, whereas exponential functions have a constant ratio.

Acquisition (Student Learning Objectives)

Knowledge

Knowledge

Students will know…

- How to use properties of rational and irrational numbers.
- How to interpret functions that arise in applications in terms of context focusing on quadratic functions.
- How to analyze functions using different representations.
- How to build a function that models a relationship between two quantities focusing on situations that exhibit a quadratic relationship.
- How to build new functions from existing functions.
- How to construct and compare linear, quadratic, and exponential models and solve problems.

Skills

Skills

Student will be skilled at …

- Explaining why the sum or product of two rational numbers is rational; that the sum of a rational number and irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. (bellringers)

- Solving quadratic equations in one variable using methods such as taking square roots, completing the square*, or using the Quadratic Formula. (9-4, 9-5, & 9-9)

- Solving a simple system of equations consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.

- Interpreting key features of graphs and tables and sketch graphs showing key features such as intercepts, intervals, maximums, minimums, and symmetry. (9-1 - 9-2)

- Relating the domain of a function to its graph and, where applicable to the quantitative relationship it describes.

- Graphing functions expressed symbolically by hand in simple cases and using technology for more complicated cases, and showing key features such as intercepts, maxima, and minima.

- Writing a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

- Using the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph. (section 9-1 -9-2)

- Solving vertical motion problems when an object is dropped or thrown. (section 9-2)

- Comparing properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

- Writing a function that describes a relationship between two quantities.

- Identifying the effect on a graph and its function by performing transformations.

- Finding inverse functions.

- Observing, using tables and graphs, that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

- Making sense of problems and persevere in solving them.

- Reasoning abstractly and quantitatively.

- Constructing viable arguments and critique the reasoning of others.
- Modeling with mathematics.
- Using appropriate tools strategically.
- Attending to precision.
- Looking for and making use of structure.
- Looking for and expressing regularity in repeated reasoning.

Stage 3: Learning Plan

Resource and Mentor Texts

Resources and Mentor Texts

- Textbook (Algebra I Common Core Pearson)
- Teacher created materials
- -powerpoint games

  -centers (review stations)

  -worksheets

  -scavenger hunts

  -organizers

- Problems from the web

Formative Assessment Strategies

Formative Assessment Strategies

Discussion

Quizzes

Student Engagement sheet

Exit Tickets

Homework/Classwork

Learning Activities/Unit of Study

Learning Activities/Unit of Study

- Do Now--problem of the day related to previous learned skills or bellringers problems

- Review/Check Homework - (group check, partner check, whiteboard check)- Lecture

- Lecture

- Work together to understand and practice the skill - partner work/larger group work to read lesson, and practice skills through “On Your Own” problems incorporated throughout each lesson

- Stations - (Small group instruction, skills practice - scavenger hunts, online games, board work)

- Board/White Board Work - (solve problems/practice skills at board, or at seat with individual white boards)

- Kahoot to reinforce skills

- Review and practice skills using a variety of materials - (text, workbook, chromebook, games, activities, discussion)

- Thumbs up/down/sideways - quick formative assessment to gauge students level of understanding

- Scavenger hunts--self-checking, out of seats activity

- Jeopardy style review games

-Relay races--each student does one part of a problem, hands it to the next student to check then completes the next part, etc.

- Socrative--non-multiple choice technology option where students can either “race” or work at the teacher-pace

- Partner/Group investigation where students must create a formula, method, or strategy to solve a problem.

- Students “as teachers” where they present a method or formula they discovered through investigation

- Pear Deck--an interactive online powerpoint where students enter answers, watch videos, and record notes from the information shown on their own device as well as projected.

- Videos by Shmoop to introduce or reinforce concepts in an engaging and comical way

- Math created songs to help reinforce concepts

- Online games on chromebooks

Modifications and/or Accommodations

Suggested Modifications (ELL, Sp. Ed, GIfted, At-risk of Failure)

English Language Learners

Native language support: The teacher provides auditory or written content to students in their native language.

Adjusted Speech: The teacher changes speech patterns to increase student comprehension. This could include facing the students, paraphrasing, clearly indicating the most important ideas, and speaking more slowly.

Visuals: The teacher uses graphics, pictures, visuals, and manipulatives. This helps ELL students better understand and comprehend the subjects at hand.

Front-Loading Vocabulary: The teacher front loads vocabulary. This means providing students with a list of important vocabulary words they will need to know for a book, lesson, etc. prior to the lesson being taught. Including pictures to go with the vocabulary words is also very beneficial for the students.

Special Education Students

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Oral Reading: The teacher will read work orally to students. Class work such as tests and literature circles may need to be read aloud to the student.

Timers: The teacher will use timers as an instructional tool. The use of timers is beneficial for students who have trouble completing tasks. Timers can be helpful so the student is aware of how

much time they have to complete an assignment.

Students with 504 Plans

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Gifted & Talented Strategies

Extensions/Enrichments: Teachers will provide gifted and talented students with extension/enrichment projects. Students will be challenged to further their understanding, to apply acquired knowledge, and/or to produce something in reference to acquired knowledge.

Modify/Change Activities: Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project work is necessary for those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

Students at Risk of School Failure

Directions or Instructions: Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

Peer Support: Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

Alternate or Modified Assignments: Always ask yourself, "How can I modify this assignment to ensure the students at risk are able to complete it?" Sometimes you'll simplify the task, reduce the length of the assignment or allow for a different mode of delivery. For instance, many students may hand something in, the at-risk student may jot notes and give you the information verbally. Or, it just

may be that you will need to assign an alternate assignment.

Increase One to One Time: When other students are working, always touch base with your students at risk and find out if they're on track or needing some additional support. A few minutes here and there will go a long way to intervene as the need presents itself.

Contracts: It helps to have a working contract between you and your students at risk. This helps prioritize the tasks that need to be done and ensure completion happens. Each day write down what needs to be completed, as the tasks are done, provide a checkmark or happy face. The goal of using contracts is to eventually have the student come to you for completion sign-offs.

Hands On: As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them. A child may have to listen to a story being read instead of reading it him/herself.

Tests/Assessments: Tests can be done orally if need be. Break tests down in smaller increments by having a portion of the test in the morning, another portion after lunch and the final part the next day.

Seating: Seat students near a helping peer or with quick access to the teacher. Those with hearing or sight issues need to be close to the instruction which often means near the front.