Unit 03: Modeling with Functions

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
LA.K-12.NJSLSA.R	Reading
LA.K-12.NJSLSA.R1	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
LA.K-12.NJSLSA.R2	Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
LA.K-12.NJSLSA.R3	Analyze how and why individuals, events, and ideas develop and interact over the course of a text.
LA.K-12.NJSLSA.R4	Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
LA.K-12.NJSLSA.R5	Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.
LA.K-12.NJSLSA.R6	Assess how point of view or purpose shapes the content and style of a text.
LA.K-12.NJSLSA.R7	Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
LA.K-12.NJSLSA.R8	Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
MA.F-IF.C	Analyze functions using different representations
MA.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
LA.K-12.NJSLSA.R10	Read and comprehend complex literary and informational texts independently and proficiently with scaffolding as needed.
MA.F-IF.C.7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
LA.RST.11-12.1	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
MA.F-IF.C.7e	Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
LA.RST.11-12.2	Determine the central ideas, themes, or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

LA.RST.11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
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.
LA.RST.11-12.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
MA.F-IF.C.8b	Use the properties of exponents to interpret expressions for exponential functions.
LA.RST.11-12.5	Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
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).
LA.RST.11-12.6	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.
MA.F-BF	Building Functions
LA.RST.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
MA.F-BF.A	Build a function that models a relationship between two quantities
LA.RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
MA.F-BF.A.1	Write a function that describes a relationship between two quantities.
LA.RST.11-12.10	By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.
MA.F-BF.A.1b	Combine standard function types using arithmetic operations.
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-BF.B.4a	Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse.
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.4	Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to ab to the ct power = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

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

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

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

Transfer / Overview / Rationale

Unit Rationale

The purpose of this unit…

In this unit students synthesize and generalize what they learned about a variety of function families. They extend their work with exponential functions to include solving exponential equations with logarithms. They explore the effects of transformations on graphs of diverse functions, including functions arising in an application, in order to abstract the general principle that transformations on a graph always have the same effect regardless of the type of the underlying function. They identify appropriate types of functions to model a situation, they adjust parameters to improve the model, and they compare models by analyzing appropriateness of fit and making judgments about the domain over which a model is a good fit. The description of modeling as "the process of choosing and using mathematics and statistics to analyze empirical situations, to understand them better, and to make decisions" is at the heart of this unit. The narrative discussion and diagram of the modeling cycle should be considered when knowledge of functions, statistics, and geometry is applied in a modeling context.

Meaning

Essential Questions

1. How do variables help you model real-life situations?
2. How does representing functions graphically help you solve a systems of equations?
3. Does it matter what form of a linear equation you use?
4. How can you model data with a linear function?
5. How is any quadratic function related to the parent quadratic function $y = x^2$?

Enduring Understanding/Indicators of Understanding

- Students will graph transformations of the parent quadratic function $y = x^2$
- Students will compare translations to the parent functions
- Students will identify the parts of a function and differentiate between forms
- Students will solve a system of linear equations by graphing the equations to find the point of intersection

Acquisition (Student Learning Objectives)

Knowledge

Knowledge

Students will know…

- the behavior and intercepts of square root, cube root, piecewise functions including step and absolute value
- the behavior and intercepts of exponential and logarithmic functions
- Trigonometric functions including period, midline, and amplitude
- reveal and explain properties of different functions
- compare properties of two functions
- identify and recognize the effects of the value of k on functions both algebraically and graphically
- recognize even and odd functions from their graphs and algebraic expressions for them
- Evaluate the logarithms

Skills

Skills

Student will be skilled at …

- graph functions expressed symbolically and show key features on the graph
- graph square root, cube root, piecewise, absolute value, step, exponential, logarithmic, and trigonometric funtions
- write a function defined by an expression in different but equivalent forms
- write a function that describes a relationship between two quantities
- Find values for k given a graph of a function
- Find inverse functions
- For exponential models, espress as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e.
- Evaluate logarithm using technology

Stage 3: Learning Plan

Resource and Mentor Texts

Resources and Mentor Texts

Pearson - Algebra 2 - online book at https://www.pearsonsuccessnet.com/snpapp/login/login.jsp

login: CommonCore2012 Password: pearsonmath

Online Textbook

Formative Assessment Strategies

Formative Assessment Strategies

Homework

Labs

Projects

Class Participation

Classwork

Quizzes

Tests

Learning Activities/Unit of Study

Learning Activities/Unit of Study

Day Activity

1. Section 5.1 – Graphing Quadratic Functions
2. Section 5.1 – Graphing Quadratic Functions Continued
3. Section 5.7 – Graphing and Solving Quadratic Inequalities
4. Section 5.7 – Graphing and Solving Quadratic Inequalities Continued
5. Section 5.8 – Modeling with Quadratic Functions
6. Section 5.8 – Modeling with Quadratic Functions Continued
7. Section 6.2 – Evaluating and Graphing Polynomial Functions
8. Section 6.2 – Evaluating and Graphing Polynomial Functions Continued
9. Section 6.8 – Analyzing Graphs of Polynomial Functions
10. Section 6.8 – Analyzing Graphs of Polynomial Functions Continued
11. Section 6.9 Activity – Exploring Finite Differences
12. Section 6.9 – Modeling with Polynomial Functions
13. Section 7.3 – Power Functions and Function Operations – Domain & Range
14. Section 7.4 – Inverse Functions
15. Section 7.4 – Inverse Functions Continued
16. Section 7.5 –Graphing Square Root and Cube Root Functions
17. Section 7.5 – Graphing Square Root and Cube Root Functions Continued
18. Section 8.1 – Exponential Growth
19. Section 8.1 – Exponential Growth
20. Section 8.2 – Exponential Decay Continued
21. Section 8.6 – Solving Exponential and Logarithmic Equations
22. Section 8.6-8.7 – Solving Exponential and Logarithmic Equations Continued and Logistic Growth Functions
23. Section 8.7 – Logistic Growth Functions Continued
24. Section 9.2 – Graphing Simple Rational Functions
25. Section 9.2 – Graphing Simple Rational Functions Continued
26. Section 9.3 – Graphing General Rational Functions
27. Section 9.3 – Graphing General Rational Functions Continued
28. Section 9.3 - Graphing General Rational Functions Technology
29. Section 2.7 – Piecewise Functions
30. Section 2.7 – Piecewise Functions Continued
31. Quiz
32. Assessment
33. Review Unit 3 – Quizzes and Assessments
34. Review Unit 3 – Quizzes and Assessments
35. Unit 3 Assessment

Modifications and/or Accommodations

Suggested Modifications (ELL, Sp. Ed, Glfted, 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.