Content Area: Mathematics (NJSLS-M)
ALGEBRA 1

Dev. Date:
2021

Updated:
November 2021

Marking Period	Unit Title	Recommended Instructional Days
TBD	**Algebra 1 – Quadratic Modeling – Unit 3 - Module C**	**15-20 days**

Conceptual Category: FUNCTIONS
Domains: Interpreting Functions, Linear and Exponential Models, Building Functions

NJ Student Learning Standards
(Taught and Assessed):

☐ **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.★ (modeling standard)

a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

☐ **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.

☐ **F.IF.C.8** Write a function defined by an expression in different but equivalent forms

Progress Indicators:

● ***Tests*** ● ***Quizzes*** ● ***Homework and Classwork*** ● ***Online Activities*** ● ***Projects***

Recommended Activities, Investigations, Interdisciplinary Connections, and/or Student Experiences to Explore NJSLS-CLKS within Unit

Essential Question(s):

- How can you identify and use intercepts in linear relationships?
- How do you graph an exponential function of the form f(x) = abx ?
- How can you obtain the graph of $g(x) = a(x - h)^2 + k$ from the graph of $f(x) = x^2$?
- How can you use the graph of a quadratic function to solve its related quadratic equation?
- How can you use the Zero Product Property to solve quadratic equations in factored form?
- How can you use factoring to solve quadratic equations in standard form for which a = 1?
- How can you use factoring to solve quadratic equations in standard form for which $a \neq 1$?
- How can you use completing the square to solve a quadratic equation?

Activity Description(s):

- ❖ Graphs of Quadratic Functions
- ❖ Exponential growth versus linear/polynomial growth
- ❖ Transforming the graph of a function
- ❖ Factoring Quadratics
- ❖ Zero product property

to reveal and explain different properties of the function. a. 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. **F.IF.C.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.* **F.BF.B.3.** Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, 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.		• **See example tasks below:** **Task 1: (Illustrative math: Standard F.IF.C7)** c. Make up an equation for a quadratic function whose graph satisfies the given condition. Use whatever form is most convenient. i. Has a vertex at $(-2, -5)$. ii. Has a y-intercept at $(0, 6)$ iii. Has x-intercepts at $(3, 0)$ and $(5, 0)$ iv. Has x-intercepts at the origin and $(4, 0)$ v. Goes through the points $(4, 2)$ and $(1, 2)$ Task 1 solution **Task 2: (Illustrative math: Standard F.LE.A.3)** The population of a country is initially 2 million people and is increasing at 4% per year. The country's annual food supply is initially adequate for 4 million people and is increasing at a constant rate adequate for an additional 0.5 million people per year. a. Based on these assumptions, in approximately what year will this country first experience shortages of food? b. If the country doubled its initial food supply and maintained a constant rate of increase in the supply adequate for an additional 0.5 million people per year, would shortages still occur? In approximately which year? c. If the country doubled the rate at which its food supply increases, in addition to doubling its initial food supply, would shortages still occur?

Key:

Major Cluster

Supporting Cluster

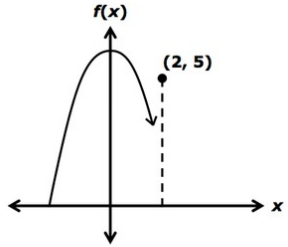
Additional Cluster

[Task 2 solution]

Task 3: (Illustrative math: Standard F.BF.B.3)

A computer game uses functions to simulate the paths of an archer's arrows. The x-axis represents the level ground on which the archer stands, and the coordinate pair $(2, 5)$ represents the top of a castle wall over which he is trying to fire an arrow.

In response to user input, the first arrow followed a path defined by the function $f(x) = 6 - x^2$, failing to clear the castle wall.



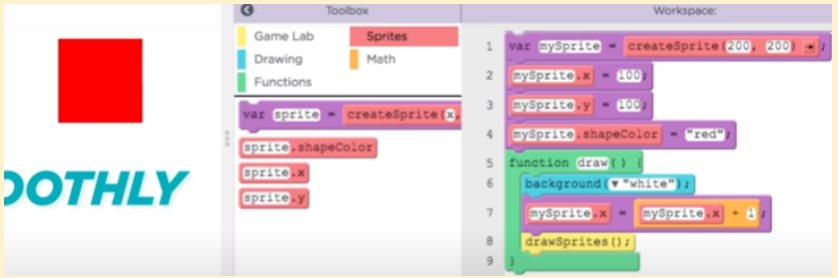
The next arrow must be launched with the same force and trajectory, so the user must reposition the archer in order for his next arrow to have any chance of clearing the wall.

a. How much closer to the wall must the archer stand in order for the arrow to clear the wall by the greatest possible distance?

b. What function must the user enter in order to accomplish this?

c. If the user can only enter functions of the form $f(x + k)$, what are all the values of k that would result in the arrow clearing the castle wall?

[Task 3 solution]

		Interdisciplinary Connections: (Standard F.BF.B.3) The purpose of this discussion is to start students thinking about how they might use the various sprite properties they've seen so far to make animations with purposeful motion. If students struggle to come up with ideas, you can narrow down the question to specific properties. For example: • What would happen to a sprite if you constantly increased its `x` property? • What would happen to a sprite if you constantly increased its `y` property? Coding is used by game designers/software engineers to build their animations and websites. In this case we can compare sprites to variables. Line 1 is equivalent to our variables. Line 5 is our "function" and line 7 can be compared to a composition of function/translation of a function.  **Content(s):** Computer science: code.org **NJSLS#:** CSTA K-12 Computer Science Standards (2017) **AP - Algorithms & Programming** https://www.csteachers.org/

		Highlight on: Lottery: Study how the Lottery works, why it is nearly impossible to win, and the economic damage it may cause.
Mathematics Practices		
1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.		
Social and Emotional Learning: ***Competencies***	**Social and Emotional Learning:** ***Sub-Competencies***	

Self-Awareness Social Awareness Self-Management Relationship Skills Responsible Decision-Making	Recognizing the importance of self-confidence in handling daily tasks and challenges. Demonstrate an awareness of the expectations for social interactions in a variety of ways. Demonstrate an understanding of the need for mutual respect when viewpoints differ. Recognize the skills needed to establish and achieve personal and educational goals. Utilize positive communication and social skills to interact effectively with others. Develop, implement, and model effective problem solving and critical thinking skills.	

Assessments (Formative) ***To show evidence of meeting the standard/s, students will successfully engage within:***	**Assessments (Summative)** ***To show evidence of meeting the standard/s, students will successfully complete:***
Formative Assessments: ● Entry and Exit Slips ● Homework and Classwork ● Quizzes ● Self Assessments ● IXL ● Edulastic	**Benchmarks:** ● Tests ● Projects **Other Summative Assessments:** ● District Assessments ● Midterm and/or Final Exams ● Standardized Tests

Differentiated Student Access to Content:
Teaching and Learning *Resources/Materials*

Core Resources	**Alternate Core Resources** ***IEP/504/At-Risk/ESL***	**ELL Core Resources**	**Gifted & Talented Core Resources**

• Textbooks websites resources • Khan Academy • Desmos • IXL Learning • Understanding ELLs • GeoGebra • Edulastic • Illustrative Math • Achieve the core • NJDOE resources	• Skill building worksheets • Math Manipulatives • Guided notes • Guided Practice • (other alternate core resources)	• Bilingual editions, if available • Dictionary for native languages • Videos in students' native language. • Mathematical Literacy and vocabulary activity • (other ELL resource)	• Leveled Assessments • Enrichment Activities • (other G&T resources)

Supplemental Resources

Technology:

- **Chromebooks, Scientific and Graphing Calculators, Online Math Activities (Desmos, Digital interactive notebooks, Kahoot, Edulastic, Quizlet, Kuta Software, BOOM Cards, EDPUZZLE, Thatquiz.org, QUIZIZZ, BLOOKET, JAMBOARD, Peardecks, Nearpod, Socrative, IXL Diagnostic Arena, Prodigy, etc.)**

Other:

- **Google Meets or Zoom, Google Classroom, Interactive Textbooks**

Differentiated Student Access to Content:
Recommended *Strategies & Techniques*

Core Resources	**Alternate Core Resources** ***IEP/504/At-Risk/ESL***	**ELL Core Resources**	**Gifted & Talented Core**
• Deliver instruction for varied learning styles (auditory, visual, tactile/kinesthetic, etc) • Provide individual instruction as needed • Modify assessments and/or rubrics as needed.	• Utilize a multi-sensory (VAKT) approach during instruction • Provide alternatives to skill development by varying the methods (repetition, simple explanations, additional examples, modeling, etc.) • Modify test content and/or format • Allow students to retake or correct tests for additional credit • Provide additional time and preferential seating as needed • Review, restate and repeat directions	• Extend allowable time if possible and as needed • Preferred seating • Positive reinforcement • Check often for understanding • Oral/visual directions/prompts when necessary • Supplemental materials (ie. online bilingual dictionary) • Modified assessments and/or rubrics • Other Accommodations and Modifications for ESL (Source:	• Create an enhanced set of introductory activities • Integrate active teaching/learning opportunities • Incorporate authentic components • Propose interest-based extension activities, and/or additional interdisciplinary connections, etc.

	• Provide study guides, and/or break assignments into segments or shorter tasks, etc.	https://studylib.net/doc/6610362/general-accomodations-and-modifications-checklist)	

NJSLS CAREER READINESS, LIFE LITERACIES & KEY SKILLS	**Disciplinary Concept: Technology Literacy**	
	Core Ideas:	**Collaborative digital tools can be used to access, record and share different viewpoints and to collect and tabulate the views of groups of people.**
	Performance Expectation/s:	**• 9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.** **• 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).**
	Career Readiness, Life Literacies, & Key Skills Practices	
	Act as a responsible and contributing community member and employee. **Attend to financial well-being.** **Consider the environmental, social and economic impacts of decisions.** **Demonstrate creativity and innovation.** **Utilize critical thinking to make sense of problems and persevere in solving them.** **Model integrity, ethical leadership and effective management.** **Plan education and career paths aligned to personal goals.** **Use technology to enhance productivity, increase collaboration and communicate effectively.** **Work productively in teams while using cultural/global competence.**	

New Jersey Legislative Statutes and Administrative Code (place an "X" before each law/statute if/when present within the curriculum map)									
	Amistad Law: *N.J.S.A. 18A 52:16A-88*		Holocaust Law: *N.J.S.A. 18A:35-28*		LGBT and Disabilities Law: *N.J.S.A. 18A:35-4.35*		Diversity & Inclusion: *N.J.S.A. 18A:35-4.36a*		Standards in Action: *Climate Change*