





Algebra 2 Honors Unit 8

Marking Period	Unit Title	Recommended Instructional Days
4	Functions	14-15 days
Domain: Algebra, Functions, Statistics and Probability		
<p><i>NJSLS Strand:</i></p> <p>Key:</p> <p> Major Cluster</p> <p> Supporting Cluster</p> <p> Additional Clust</p> <p>A-SSE.A.1. Interpret expressions that represent a quantity in terms of its context.*</p> <p>a. Interpret parts of an expression, such as terms, factors, and coefficients.</p> <p>b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret $P(1 + r)^n$ as the product of P and a factor not depending on P.</p> <p> A-SSE.A.2 Use the structure of an expression to identify ways to rewrite it. For</p>	<p><i>Progress Indicator:</i></p> <p>Tests • Quizzes • Practice problems for homework • Online textbook • Worksheets • Leveled assessments</p>	<p style="text-align: center;">Recommended Activities, Investigations, Interdisciplinary Connections, and/or Student Experiences to Explore NJSLS-CLKS within Unit</p> <p><u>Essential Question/s:</u> What are the ways in which functions can be used to represent and solve problems involving quantities?</p> <p><u>Activity Description:</u> Comparing Average Rate of Change Operations with Functions Composition of Functions Evaluating Piecewise Functions</p> <p><u>Interdisciplinary Connections: Financial Literacy</u> A certain state has a tax code, where 10% tax is paid on all income up to the first \$10,000, a 15% tax is paid for any income over \$10,000 and up to \$25,000, and a tax rate of 25% on all income over \$25,000. Find a piecewise function to calculate the total tax $T(x)$ on an income of x dollars.</p> <p><u>Answer:</u></p>

example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.

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.

c. Use the properties of exponents to transform expressions for exponential functions.

A-CED.A.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. 🌱

A-CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

A-CED.A.3 Represent constraints by equations or

$$T(x) = \begin{cases} 0.1x & 0 \leq x \leq 10000 \\ 0.15x & 10000 < x \leq 25000 \\ 0.25x & 25000 < x \end{cases}$$

Financial Literacy, Content: taxes;NJSL-S#:9.1.12.A.2

Example Tasks:

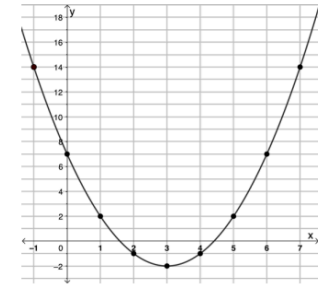
Task 1:

The quadratic function $y = f(x)$ is shown.

a. Find the average rate of change of f on each of the following intervals:

- [-1,0]
- [0,1]
- [1,2]
- [2,3]
- [3,4]
- [4,5]
- [5,6]
- [6,7]

b. Find the rate of change of the average rates of change.



c. Is the graph of f concave up or concave down? How does this support your answer in part b?

Answer:

inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. 🌱

■ **A-REI.A.1** Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

■ **A-REI.D.11** Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find solutions approximately; e.g., using technology to graph functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are

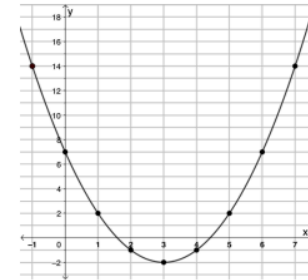
The quadratic function $y = f(x)$ is shown.

a. Find the average rate of change of f on each of the following intervals:

- $[-1,0]$ **-7**
- $[0,1]$ **-5**
- $[1,2]$ **-3**
- $[2,3]$ **-1**
- $[3,4]$ **1**
- $[4,5]$ **3**
- $[5,6]$ **5**
- $[6,7]$ **7**

b. Find the rate of change of the average rates of change.

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c. Is the graph of f concave up or concave down? How does this support your answer in part b?

Concave up - The avg. ROC is increasing by 2 over each consecutive interval

*Source: calc-medic.com

Task 2:

Given $f(x) = 3x + 1$ and $g(x) = x^3$, find $f(g(2))$

Answer:

$$f(g(2)) = 25$$

Taks 3:

Given $f(x) = 2x^2 + 4x - 6$ and $g(x) = 2x - 2$, find $(f/g)(x)$ and state any domain restrictions.

Answer:

$$(f/g)(x) = x + 3, \text{ where } x \neq 1$$

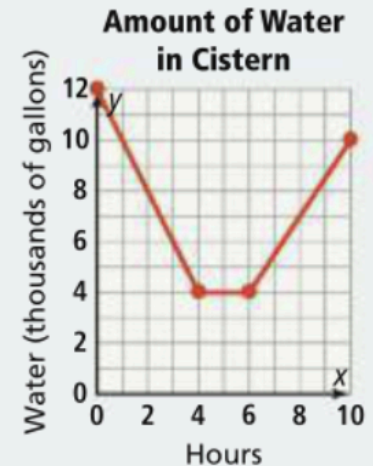
At the end of each topic please review the Assessment Practice and Performance Tasks questions.

linear, polynomial, rational, absolute value, exponential, and logarithmic functions.*
F-IF.A.1 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given in a verbal description of the relationship.

*Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.**

F-IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function $h(n)$ gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function. ★ 🌱

Performance Task The graph shows the amount of water in a water tank over several hours.



Part A What is the average rate of change on the interval $[0, 4]$ and on the interval $[6, 10]$? What is a possible explanation for what each rate of change indicates?

Part B What is a possible explanation for what occurred between 4 and 6 h?

Part C What is the average rate of change on the interval $[0, 10]$? What does the rate of change mean? Does this rate of change give a good indication as to what is happening with the water in the cistern from 0 h to 10 h? Explain.

F-IF.B.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the average rate of change from a graph. ★ 🌱

F-IF.C.7. Graph functions expressed symbolically and show key features if the graph, by hand in simple cases and using technology for more complicated cases.*

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

b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

c. Graph polynomial functions, identifying zeros, when suitable factorizations are available, and showing end behavior.

d.(+) Graph rational functions, identifying zeros, and asymptotes when suitable

ASSESSMENT PRACTICE

25. Does the function have a range of $(-\infty, 4)$? Write yes or no.

	Yes	No
a. $f(x) = \begin{cases} x-3, & \text{if } x < -2 \\ 5-x, & \text{if } x > 1 \end{cases}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
b. $h(x) = \begin{cases} x-1, & \text{if } x < -1 \\ 3-x, & \text{if } x > 2 \end{cases}$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c. $g(x) = \begin{cases} x+5, & \text{if } x < -1 \\ -x-5, & \text{if } x > 1 \end{cases}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
d. $k(x) = \begin{cases} x+2, & \text{if } x < -2 \\ x+4, & \text{if } x > 1 \end{cases}$	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Spot Light on: Diversity and Inclusion

Essential Questions: What is respect and how can we, as an individual/community express respect for ourselves and others at home or in the classroom?

Objective: Students will learn how to appreciate diversity, respect others and their differences and build relationships with mutual respect in school, at home and within the community. EOD artwork and quotes along with other educational sources, will be used.


factorizations are available, and showing end behavior.
e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

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.
b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.02)^{12t}$, $y = (1.2)^{t/10}$, and classify them as representing exponential growth and decay.*

F-BF.A.1 Write a function that describes a relationship between two quantities.
a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*

c. (+) Compose functions. *For example, if $T(y)$ is the temperature in the atmosphere as a function of height, and $h(t)$ is the height of a weather balloon as a function of time, then $T(h(t))$ is the temperature at the location of the weather balloon as a function of time.*

 **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. *Include recognizing even and odd functions from their graphs*

and algebraic expressions for them.

- F-BF.B.4** Find inverse functions.
- a. 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.
 - b. (+) Verify by composition that one function is the inverse of another.
 - c. (+) Read values of an inverse function from a graph or table, given that the function has an inverse.
 - d. (+) Produce an invertible function from a non-invertible function by restricting the domain.
- F-BF.B.5.** (+) Use the inverse relationship between exponents and logarithms to solve problems involving exponents and logarithms.
- 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		
Mathematics Practices		
<ol style="list-style-type: none"> 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reason 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: <i>Competencies</i>	Social and Emotional Learning: <i>Sub-Competencies</i>	
<p style="text-align: center;">Self- awareness</p> <p style="text-align: center;">Social Awareness</p> <p style="text-align: center;">Self- Management</p> <p style="text-align: center;">Relationship Skills</p> <p style="text-align: center;">Responsible Decision-Making</p>	<p>Recognizing the importance of self-confidence in handling daily tasks and challenges.</p> <p>Demonstrate an awareness of the expectations for social interactions in a variety of ways.</p> <p>Demonstrate an understanding of the need for mutual respect when viewpoints differ.</p> <p>Recognize the skills needed to establish and achieve personal and educational goals.</p>	

	<p>Utilize positive communication and social skills to interact effectively with others.</p> <p>Develop, implement, and model effective problem solving and critical thinking skills.</p>		
<p>Assessments (Formative) <i>To show evidence of meeting the standard/s, students will successfully engage within:</i></p>		<p>Assessments (Summative) <i>To show evidence of meeting the standard/s, students will successfully complete:</i></p>	
<p><u>Formative Assessments:</u></p> <ul style="list-style-type: none"> • Entry and Exit Slips • Quizzes • Self Assessments 		<p><u>Benchmarks:</u></p> <ul style="list-style-type: none"> • Chapter Tests • Projects • LinkIT <p><u>Summative Assessments:</u></p> <ul style="list-style-type: none"> • District Assessments • Midterms • Standardized Tests 	
<p align="center">Differentiated Student Access to Content: Teaching and Learning Resources/Materials</p>			
<p align="center">Core Resources</p>	<p align="center">Alternate Core Resources <i>IEP/504/At-Risk/ESL</i></p>	<p align="center">ELL Core Resources</p>	<p align="center">Gifted & Talented Core Resources</p>
<ul style="list-style-type: none"> • Savvas Envision • Achieve the core • Khan Academy • Desmos 	<ul style="list-style-type: none"> • Skill building worksheets • Math Manipulatives 	<ul style="list-style-type: none"> • Dictionary for native languages • Videos in their native language. 	<ul style="list-style-type: none"> • Leveled Assessments • Enrichment worksheets
<p align="center">Supplemental Resources</p>			
<p>Technology:</p> <ul style="list-style-type: none"> • Chromebooks, Graphing Calculators, Smartboards <p>Other:</p>			

<ul style="list-style-type: none"> Zoom and Google Meets, Schoology,, Interactive Textbooks 			
Differentiated Student Access to Content: Recommended <i>Strategies & Techniques</i>			
Core Resources	Alternate Core Resources <i>IEP/504/At-Risk/ESL</i>	ELL Core Resources	Gifted & Talented Core
<ul style="list-style-type: none"> Deliver instruction utilizing varied learning styles including audio, visual, and tactile/kinesthetic, provide individual instruction as needed, modify assessments and/or rubrics, repeat 	<ul style="list-style-type: none"> Utilize a multi-sensory (VAKT) approach during instruction, provide alternate presentations of skills by varying the method (repetition, simple explanations, additional examples, modeling, etc.), modify test content and/or format, allow students to retake test for additional credit, provide additional times and preferential seating as needed, review, restate and repeat directions, provide study guides, and/or break assignments into segments of shorter tasks. 	<ul style="list-style-type: none"> Extend time requirements, preferred seating, positive reinforcement, check often for understanding/review, oral/visual directions/prompts when necessary, supplemental materials including use of an online bilingual dictionary, and modified assessment and/or rubric. 	<ul style="list-style-type: none"> Create an enhanced set of introductory activities, integrate active teaching/learning opportunities, incorporate authentic components, propose interest-based extension activities, and connect student to related
NJSLs CAREER READINESS, LIFE LITERACIES & KEY SKILLS	Disciplinary Concept: Creativity and Innovation		
	Core Ideas:	Solutions to the problems faced by a global society require the contribution of individuals with different points of view and experiences.	
	Performance Expectation/s:	99.4.12.GCA.1: Collaborate with individuals to analyze a variety of	

		potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).
	Career Readiness, Life Literacies, & Key Skills Practices	
	<p>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.</p>	

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