Algebra 2 Honors Unit 3

Marking Period	Unit Title	Recommended Instructional Days
2	**Exponential and Logarithmic Functions**	**14-15 days**

Domain: Algebra, Functions, Statistics and Probability

NJSLS Strand:

Key:

Major Cluster
Supporting Cluster
Additional Clust

A-SSE.A.1. Interpret expressions that represent a quantity in terms of its context.*
a. Interpret parts of an expression, such as terms, factors, and coefficients.
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.
A-SSE.A.2 Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 – y^4$ as $(x^2)^2$ -

Progress Indicator:
Tests ● Quizzes ● Practice problems for homework ● Online textbook ● Worksheets ● Leveled assessments

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

Essential Question/s:
How do the characteristics of exponential functions affect the graph?
What is the relationship between an exponent and a logarithm?
How do you use exponential and logarithmic functions to model situations and solve problems?

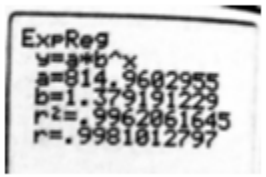
Activity Description:
Exponential Growth and Decay
Inverse Functions/Relations
Logarithmic Functions
Properties of Logarithms
Exponential and Logarithmic Equations and Inequalities
Natural base e
Transforming Exponential and Logarithmic Functions
Exponential and Logarithmic Regression Models

Interdisciplinary Connections: Financial Literacy
Elizabeth invests $400 in a savings account with 9% interest compounded annually. John Invests $400 in a money market account with 9% interest compounded quarterly. Who will have more money in their account after 5 years? Why?

Answer:
Elizabeth: $A = 400(1 + .09)^5 = \$615.45$

$(y^2)^2$, 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 inequalities, and by systems of		John: $A = 400(1 + .09/4)^{4(5)} = \$624.20$ John will have more money in his account at the end of 5 years. Interest is calculated and added to John's account four times a year. After every quarter, John is making interest on both his principal and the interest from the previous quarter. Elizabeth's interest is only added into her account once each year. **Content: Money Management** **NJSLS#: HS-CLKS-9.1.12.B.2** **Example Tasks:** **Task 1:** Consider the functions f and g given by $f(x)=\log_{10}(x-1)+\log_{10}(x+3)$ and $g(x)=\log_{10}(x+9)$. In the xy-plane, what are all x-coordinates of the points of intersection of the graphs of f and g ? (A) $x=3$ only (B) $x=7$ (C) $x=-4$ and $x=3$ (D) $x=-7$ and $x=-4$ **Answer:** A **Task 2:** Describe the transformation of each function. State the domain in interval notation. a) $f(x) = \ln(x + 2)$ b) $f(x) = -\log x$

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 linear, polynomial, rational,		c) f(x) = log(x) + 2 d) f(x) = ln (-x) **Answer:** a) Horizontal translation left 2 units. D (-2, ∞) b) Reflection over the x-axis. D (0, ∞) c) Vertical Translation 2 units up. D (0, ∞) d) Reflection over the y-axis. D (-∞, 0) **Task 3:** The table gives the approximate values of diamonds of the same quality. Find an exponential model for the data. Use the model to estimate the weight of a diamond worth $2325. Diamond Values Weight (carats) / Value ($) 0.5 / 920 1.0 / 1160 2.0 / 1580 3.0 / 2150 4.0 / 2900 **Answer:**

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. ★		An exponential model is $V(w) \approx 814.96(1.38)^w$, where V is the diamond value and w is the weight in carats.  ExpReg y=a*b^x a=814.9602955 b=1.379191229 r²=.9962061645 r=.9981012797 A diamond weighing about 3.26 carats will have a value of $2325. **At the end of each topic please review the Assessment Practice and Performance Tasks questions.**

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 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.

ASSESSMENT PRACTICE

31. The table shows the account information of five investors. Which of the following are true, assuming no withdrawals are made? Select all that apply.

Employee	*P*	*r*	*t*(years)	Compound
Anna	4000	1.5%	12	Quarterly
Nick	2500	3%	8	Monthly
Lori	7200	5%	15	Annually
Tara	2100	4.5%	6	Continuously
Steve	3800	3.5%	20	Semi-annually

Ⓐ After 12 years, Anna will have about $4,788.33 in her account.

Ⓑ After 8 years, Nick will have about $3,177.17 in his account.

Ⓒ After 15 years, Lori will have about $15,218.67 in her account.

Ⓓ After 6 years, Tara will have about $2,750.93 in her account.

Ⓔ After 20 years, Steve will have about $7,629.00 in his account.

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.

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*

. **Performance Task** Cassie is financing a $2,400 treadmill. She is going to use her credit card for the purchase. Her card charges 17.5% interest compounded monthly. She is not required to make minimum monthly payments.

Part A How much will Cassie pay in interest if she waits a full year before paying the full balance?

Part B How much additional interest will Cassie pay if she waits two full years before paying the full balance?

Part C If both answers represent a single year of interest, why is the answer in B greater than the answer in A?

Mixed Review Available Online

ASSESSMENT PRACTICE

55. Given that $\log_b x < 0$, which of the following are true? Select all that apply.

Ⓐ $b < 0$
Ⓑ $x < 0$
Ⓒ $b > 0$
Ⓓ $x > 0$
Ⓔ $x < 1$

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

57. Performance Task Money is deposited into two separate accounts. The money in one account is compounded continuously. The money in the other account is not compounded continuously. Neither account has any money withdrawn in the first 6 years.

Year	Account 1 Balance ($)	Account 2 Balance ($)
0	400	500
1	433.31	575
2	469.40	650
3	508.50	725
4	550.85	800
5	596.72	875

Part A Write a function to calculate the amount of money in each account given *t*, the number of years since the account was opened. Describe the growth in each account.

Part B Will the amount of money in Account 1 ever exceed the amount of money in Account 2? Explain. If so, when will that occur?

Spot Light on: LGBT&Q
Alan Mathison Turing was an English mathematician, computer scientist, logician, cryptanalyst, philosopher, and theoretical biologist.

(more generally) as a polynomial function **S-ID.A.6** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a.Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.		Climate Change Example: Students may create equations and/or inequalities to represent the economic impact of climate change. Climate Change Example: Students may represent constraints describing the economic impact of climate change by equations, inequalities, and/or by systems of inequalities, and interpret solutions as viable or nonviable options. Climate Change Example: Students may relate the domain of a function c(m) representing the amount of carbon dioxide produced by burning m molecules of ethane (gasoline), to its graph in order to determine the appropriate domain for c(m).
Mathematics Practices		
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: ***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:***
<u>Formative Assessments:</u> ● Entry and Exit Slips ● Quizzes ● Self Assessments	**<u>Benchmarks:</u>** ● Chapter Tests ● Projects ● LinkIT **<u>Summative Assessments:</u>** ● District Assessments ● 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**

• Savvas Envision • Achieve the core • Khan Academy • Desmos	• Skill building worksheets • Math Manipulatives	• Dictionary for native languages • Videos in their native language.	• Leveled Assessments • Enrichment worksheets

Supplemental Resources

Technology:
- **Chromebooks, Graphing Calculators, Smartboards**

Other:
- **Zoom and Google Meets, Schoology,, 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 utilizing varied learning styles including audio, visual, and tactile/kinesthetic, provide individual instruction as needed, modify assessments and/or rubrics, repeat**	• **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.**	• **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.**	• **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	
	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*	X	LGBT and Disabilities Law: *N.J.S.A. 18A:35-4.35*		Diversity & Inclusion: *N.J.S.A. 18A:35-4.36a*	X	Standards in Action: *Climate Change*