Marking Period: 2	Unit Title: Exponential, Logistic, And Logarithmic Functions	Recommended Instruction Days: 15 - 20

Standard-New Jersey Student Learning Standards: A-SSE,F-IF, F-BF, F-LE
Exponential, Logistic, and Logarithmic Functions (Chapter 3)

Strand:

A-SSE: Seeing Structure in Expressions

Write expressions in equivalent form to solve problems

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.
4. Derive and/or explain the formula for the sum of a finite geometric series (when the common ratio is not 1) and use the formula to solve problems (For example, calculate mortgage payments).

F-IF: Interpreting Functions

Analyze functions using different representations

7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
   e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
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.

F-BF: Building Functions

Build a function that models a relationship between two quantities

1. Write a function that describes a relationship between two quantities
   b. Combine standard function types using arithmetic operations.

Build New Functions from Existing Functions

5. Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

F-LE: Linear and Exponential Models

Construct and Compare Linear and Exponential Models and Solve Problems

1. Distinguish between situations that can be modeled with linear functions and with exponential functions.
   c. Recognize situations in which quantity grows or decays by a constant percent rate per unit interval relative to another.

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.

LGBT and Disabilities Law: *N.J.S.A. 18A:35-4.35*

Kate Hutton - "Earthquake Kate." Staff seismologist at the California Institute of Technology.

The mission is to ensure that every student is able to see themselves in our rich and diverse history.

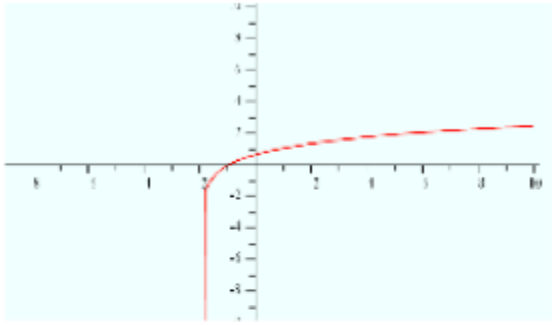
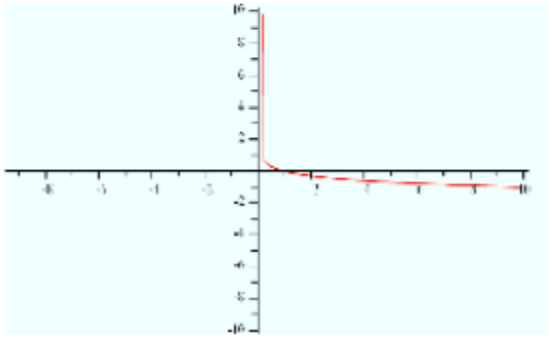
Social and Emotional Learning: ***Competencies***	**Social and Emotional Learning:** ***Sub-Competencies***
Self-Awareness Social Awareness Self-Management Relationship Skills Responsible Decision-Making	• Recognizing the importance of self-confidence in handling daily tasks and challenges. • Demonstrate 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.

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

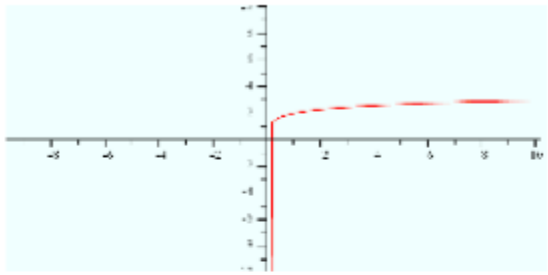
Essential Questions	**Progress Indicators**	**Activity Description**

• What is the relationship between a logarithm and an exponent? • How is the graph of a logarithmic function determined? • How can exponential functions be used to model real-world data?	• Tests • Quizzes • Practice problems for homework • Worksheets • Leveled assessments • Projects	❖ Exponential and Logistic Functions ❖ Exponential and Logistic Modeling ❖ Logarithmic Functions ❖ Properties of Logarithmic Functions ❖ Equation Solving and Modeling ❖ Mathematics of Finance ❖ Example Tasks Below **Interdisciplinary Connections:** **Personal Financial Literacy Domain Planning, Saving, and Investing:** 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 $A = 400(1 + 0.9)^{5} = 615.45$ John $A = 400(1 + \frac{0.9}{4})^{4(5)} = 624.20$ 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 to her account once a year. **Task**

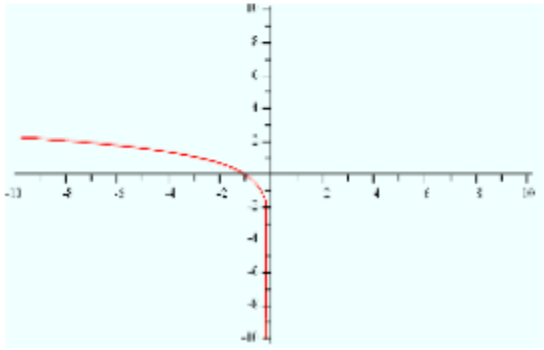
		Complete the following statements: a). $2^5 = 32$ in logarithmic form is _____ b). Product rule: $\log_3 5x$ = _____ c). Quotient rule: _____ = log y – log 17. d). Power rule: ln 2^{-5} = _____ e). Change-of-base formula: _____ = log4/ log3 **Answer** a). $\log_2 32 = 5$ b). $\log_3 5 + \log_3 x$ c). log(y/17) d). -5ln2 e). $\log_3 4$ **Task** Describe the transformation of each function, then graph: a) f(x) = ln (x + 2) b) f(x) = -logx c) f(x) = log(x) + 2 d) f(x) = ln (-x) **Answer**

		a). Graph moves left by 2.  b). Reflection over the x-axis. 

c). Graphs shifts up by 2.



d). Reflection over the y-axis



Spot Light On: *Ask challenging questions equitably of all students.*

Mathematical 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.**

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 Assessment: ● Entry and Exit Slips ● Quizzes ● Self Assessments ● Focus Packets	**Benchmarks:** ● Chapter Tests ● Projects **Summative Assessments:** ● District assessments

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

Core Resources	**Alternate Core Resources**	**ELL Core Resources**	**Gifted & Talented Core Resources**

	IEP/504/At-Risk/ESL		
online albert resource online achievethecore resource online learnzillion resource online khanacademy resource online desmos resource online edulastic resource	Reteaching worksheets Skill building workbook Math manipulatives Leveled practice worksheets	Dictionary for native language Video tutorial in native language Success for English Learners worksheets Leveled Strategies for English Learners Linguistic Support	Enrichment worksheets Art of Problem Solving Leveled assessments
Supplemental Resources			
● Technology: Chromebooks, Graphing Calculators, Smartboards, ● Other: Zoom and Google Meets, Schoology, Google Classroom			
Differentiated Student Access to Content: Recommended *Strategies & Techniques*			
Core Resources	**Alternate Core Resources *IEP/504/At-Risk/ESL***	**ELL Core Resources**	**Gifted & Talented Core Resources**
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	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	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

	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.	dictionary, and modified assessment and/or rubric.	

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*	x	Diversity & Inclusion: *N.J.S.A. 18A:35-4.36a*		Standards in Action: *Climate Change*