Curriculum Sample Template

Max. 8 Pages

Grade Level	11th Grade	**Content Area**	Math
Course Title (grades 9-12 Only)	Algebra II		
Expected Prior Knowledge *The knowledge/skills mastered earlier in the year foundational to the mastery of the required Standard in the current sample.*	• Students understand how to work in precision partnerships effectively. • Students know how to use their math journals effectively. • Students are familiar with, and have used, the 8 CCSS Mathematical Practices. • Students will have mastered graphing, manipulating exponential functions. • Students will be familiar with determining the inverse of functions.		
Alignment to Program of Instruction *Briefly outline methods of instruction found in this sequence of lessons that align to the Program of Instruction described in A.3.*	This unit is built on the framework of the SIOP Model and incorporates all 8 of the SIOP Model components. Sentence framing and precision partnering are instructional strategies which promote the use and mastery of academic language. Instructional technology is incorporated by teacher and students. The core curriculum is implemented with fidelity.		
Standard Number and Description *List the Number* and the full description for the Required Standard or Science Performance Objective listed in section A.6.*	Functions Domain: Linear, Quadratic, and Exponential Models Standard: #4: For exponential models, express 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 the logarithm using technology.		
Materials/Resources Needed	Chrome Books SMART Board Graphing Calculators or Graphing Calculator Application		

* ***Standard Number****: For English Language Arts (Reading and Writing), use Grade, Strand, Standard (e.g., 3.RI.2). For K-8 Math, use Grade, Domain, Standard (e.g., 6.EE.7). For HS Math, use Conceptual Category-Domain, Standard (e.g., A-REI.6). For Science, use Grade, Strand, Concept, PO (e.g., 4.1.3.1).*

Lesson (add as needed)	Instructional Strategies	Student Activities
1	**Vocab:** **Logarithm, base of logarithm** • Teacher guides student pairs through graphing exponential functions $y=10^x$ on graphing calculators or application on Chromebooks. • Teacher will check for understanding and guide students with scaffolding questions while partners are documenting information about the function and making conclusions. • Teacher will pose questions regarding the value of x at different values of y in the form of an incomplete table of values, and request that the students determine the meaning for the values that they use to complete the table, and then graph the points. • Teacher will facilitate whole-class discussion regarding the inverse of the graphed functions and introduces the vocabulary of a logarithm with examples and explanations. • Teacher will pose the following problem and ask students to write an exponential model for the problem and then determine the inverse by applying the logarithm function. Problem: "If I want to sell an IPad that I received last year at for my birthday as a gift, what is a fair price to sell it at if I know it depreciates in value by 50% every full year?" • Teacher will check for understanding and guide students with scaffolding questions while partners are determining their models and solutions. • Teacher will facilitate whole-class discussion to share reasoning and solutions to IPad problem.	• Students add vocabulary definitions, pictures, and sentences/examples into their vocabulary journals. • Students will graph the function into their graphing calculators or graphing calculator application. • Students will reason with partners and write a brief description of the model including the following key items: domain, range, increasing or decreasing, horizontal and vertical asymptotes, x and y intercepts. • Students will work together to determine the values of x for the given values of y and complete a table of values and then interpret the meaning of this process. • Students will graph the values as an inverse function on their graphing calculators. • Students will reason with partners and write a brief description of the new model including the following key items: domain, range, increasing or decreasing, horizontal and vertical asymptotes, x and y intercepts. • Students will write a summary that compares the two models. • Students will participate in a whole-class discussion regarding the comparisons. • Students will add additional examples and explanations to their vocabulary journals. • Students will work with precision pairs to determine the solution to the IPad problem first determining the exponential model and then finding the inverse by applying the logarithm. • Students will participate in sharing their solutions and reasoning in a whole-class discussion. • Students will complete a formative 'exit ticket' to demonstrate their understanding of logarithms as a

	• Teacher will provide and collect exit tickets to be used for intervention the following day.	solution to an exponential model.
2	**Vocab** **Natural logarithm** • Teacher will allow students to complete bell ringer and pulls selected students to provide intervention based on the students' exit ticket from the previous day. • Teacher will introduce how to determine the time of death by showing a video clip from a familiar movie or a show related to a murder investigation. Newton's Law of Cooling Formula: $T(t)= T_0 + (T_I - T_0)e^{-kt}$ where T_I is the initial body temperature, T_0 is the temperature of the room, and t is the time in minutes. Problem: "How do they really determine the time of death based on temperature? If a crime scene is being investigated the temperature of the body and the room must be determined, then one hour later the temperature of the body must be determined again. If a body is found in a room that is set to 70°F and its temperature is first determined at 11:00A.M. to be 94.5°F and one hour later it is 93.3°F, what was the time of death? • Teacher will check for understanding and guide students with scaffolding questions while partners are determining their models and solutions. Teacher will make sure that students apply the natural logarithm to the problem. • Teacher will facilitate whole-class discussion to share reasoning and solutions. Extension option discuss how the change in the room temperature will effect the rate of change and the model, or discuss what happens when the body temperature reaches the room temperature what other methods can be used to	• Students add vocabulary definitions, pictures, and sentences/examples into their vocabulary journals. • Students will complete bell ringer activity related to previous days tasks involving exponential and logarithmic functions as inverses of one another. • Students will work with precision partners to devise a plan, reason, model, and solve the time of death problem using their graphing calculators. • Students will summarize their plan for solving the problem and write a summary that includes their reasoning and solution. • Students will participate in a whole-class discussion regarding the comparisons. • Students will watch the video and participate in whole-class discussion regarding what they want to know/need to know from the video. • Students will work with partners to determine the inverse of the pressure formula by applying the natural logarithm. • Students will graph their new formula on a graphing calculator and complete a table of values for their graphical model. • Students will complete a formative 'exit ticket' to demonstrate their understanding of logarithms as a solution to an exponential model.

	determine the time of death see http://www.pbs.org/wnet/nature/episodes/crime-scene-creatures/interactive-determine-the-time-of-death/4390/ • Teacher will show only lesson 1 from the video http://www.youtube.com/watch?feature=player_detailpage&v=BBADsuLQ8nY • Teacher will prompt students to ask questions about what was shown in the video, guiding them to want to know when to pull the parachute string and even ask how high up the parachuter is when they release the parachute. • Teacher will provide the students with the formula for determining air pressure by an altimeter and ask students to solve for the inverse of the formula in order to determine the height of the parachuter based on the given airpressure. Formula: $P = 101{,}300e^{-(1/8005)h}$ where P is the pressure and h is the height in meters. • Teacher will check for understanding and guide students with scaffolding questions while partners are working on their solution and graphs. • Teacher will provide and collect exit tickets to be used for intervention the following day.	
3	• Teacher will allow students to complete bell ringer and pulls selected students to provide intervention based on the students' exit ticket from previous day. • Teacher will provide practice problems for students to solve exponential functions using logarithmic expressions algebraically, and model the functions graphically. • Teacher will check for understanding and guide students with scaffolding questions while they are working on their solutions and graphs. • Teacher will facilitate whole-class discussion regarding	• Students will complete bell ringer activity related to previous day's tasks involving applying the inverse to an exponential function and using a natural log when the base value of the exponential expression is the value e. • Students will work to solve practice problems by devising a plan for each problem and determine a solution. • Students will participate in a whole-class discussion to evaluate the solutions given by the students and refine their strategies for applying logarithmic properties to solve exponential functions.

	the solutions completed by students and allow students to evaluate their different methods. If students have not given satisfactory solutions teacher will provided an additional example. • Teacher will provide and collect exit tickets to be used for intervention the following day.	• Students will complete a formative 'exit ticket' to demonstrate their understanding of applying logarithmic properties to solve exponential functions algebraically and through graphing.
4	• Teacher will allow students to complete bell ringer and pulls selected student to provide intervention based on the students completed tasks from previous day. • Teacher will provide additional review if needed. • Teacher will allow students to complete summative assessment.	• Students will complete bell ringer activity related to previous day's tasks regarding the applications of logarithmic expressions to solve exponential models. • Students will complete the summative assessment.

Summative Assessment Items: *Attach here.* For each summative assessment item, include an answer key or scoring rubric describing how points are to be awarded.

Solving Exponential Functions with Logarithms Quiz

Domain: Linear, Quadratic, and Exponential Models

Standard: #4: For exponential models, express 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 the logarithm using technology..

Essential Student Question: How do you know the solution to an exponential expression, and what does is it mean?

1. Express the solution to the following exponential equations using logarithmic functions.
   A. $10^{-3x}=10000$ B. $e^{4x}=35$

Use the following situation to answer questions #2-5.

Two friends are playing a game where one of them picks a word out from the dictionary and asks the other friend to guess the word with as few guesses as possible. The best method to start guessing is to pick a word that is right in the middle of the dictionary and ask "Does your word come before this word in the dictionary?" If the answer is yes or no it has reduced the amount of words to guess from by half. This half can be cut in half again and again by repeating the process using new middle words for each range that has been determined until the word has been zeroed in on. This process can be modeled using $y = d(2)^{-x}$ where d is the number of words in the dictionary to begin with.

2. Graph the functions $y = d(2)^{-x}$ if given that there are 50,000 words in the dictionary, and complete the table below.

x	y
0	
1	
4	
10	
15	

3. Explain the relationship between the points in the table and the inverse of the points.

4. Complete the inverse algebraically of the function used in problem #2.

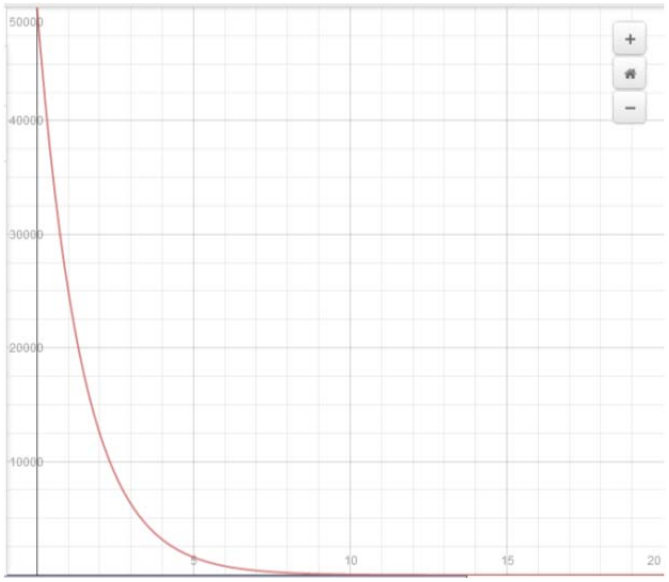
5. Using a graphing calculator or application graph the function $y = \log_2(x)$ where x represents the number of words in the dictionary used. Explain the relationship between this graph and the situation modeled in problem #2 and how $y = \log_2(x)$ can be used if there was a different number of words in the dictionary at the beginning.

Solving Exponential Functions with Logarithms Quiz Answer Key

1. A. $x = \frac{1}{8} \log (1000)$

   B. $x = -\frac{1}{4} \ln 35$

2. see below



x	y
0	50,000
1	25,000
4	3125
10	48.828
15	1.5259

3. The points in the table and the inverse of the points are related by switching the x and y values, and by doing this the solution of y becomes the independent or given value and the x becomes the solution value.
4. $x = -\log_2\left(\frac{y}{50000}\right)$
5. The function $y = \log_2(x)$ calculates the number of times it will take based on the beginning number of words in the dictionary to zero in on the selected word. When used for the situation in problem #2 it estimates that it will take 15.61 times before the word is guessed which would be rounded to mean about 16 guesses. This function could then be used to determine how many guesses it would take no matter how many words where in the dictionary to begin with.

Solving Exponential Functions with Logarithms Quiz Scoring Guide

5 questions weighted at 1 points each **5 points total**

Raw score X 20 = _____/100 points

The 100 points possible assessment will reflect the school's grading scale:
90 -100 = A – Mastery
80 – 89 = B - Mastery
70 – 79 = C – Needs Screening for Remediation
60 – 69 = D – Needs Remediation
0 – 59 = F – Needs Intensive Remediation