#### Anoka-Hennepin Secondary Curriculum Unit Plan

Department:	MATH	Course:	Advanced Algebra (H)	Unit 10 Title:	Modeling with Exponential Functions	Grade Level(s):	11
Assessed Trimester:	Trimester C	Pacing:	14-16 days	Date Created:	6/25/2014	Last Revision Date:	6/25/2014

**Course Understandings**: Student will understand that:

A. Relationships exist between real-world situations, mathematical equations, and graphs for sequences, series, polynomial functions, and exponential functions.

B. Sequences, series, polynomial, and exponential function can be categorized by form and that each form has specific processes to consider when solving and graphing.

C. There are a variety of strategies of varying efficiency for simplifying sequences, series, polynomial, and exponential expressions.

D. The numeric elements of a function have specific transformational effects on the graphs of those functions.

E. The context of a problem is important in recognizing the reasonableness of a solution.

F. There are benefits and limitations in the use of calculators and other technology to solve mathematical situations.

# DESIRED RESULTS (Stage 1) - WHAT WE WANT STUDENT TO KNOW AND BE ABLE TO DO?

#### **Established Goals**

### Minnesota State/Local/Technology Standard(s) addressed (2007):

- Standard (9.2.1.#): Understand the concept of function, and identify important features of functions and other relations using symbolic and graphical methods where appropriate. Benchmark:
  - **9.2.1.1** Understand the definition of a function. Use functional notation and evaluate a function at a given point in its domain.
  - **9.2.1.2** Distinguish between functions and other relations defined symbolically, graphically or in tabular form.
  - **9.2.1.3** Find the domain of a function defined symbolically, graphically or in a real-world context.
  - **9.2.1.4** Obtain information and draw conclusions from graphs of functions and other relations.
  - **9.2.1.6** Identify intercepts, zeros, maxima, minima and intervals of increase and decrease from the graph of a function.
  - 9.2.1.7 Understand the concept of an asymptote and identify asymptotes for exponential functions and reciprocals of linear functions, using symbolic and graphical methods.
  - 9.2.1.8 Make gualitative statements about the rate of change of a function, based on its graph or table of values.
  - 9.2.1.9 Determine how translations affect the symbolic and graphical forms of a function. Know how to use graphing technology to examine translations.
- Standard (9.2.2.#): Recognize linear, guadratic, exponential and other common functions in real-world and mathematical situations; represent these functions with tables, verbal descriptions, symbols and graphs; solve problems involving these functions, and explain results in the original context. Benchmark:

**9.2.2.2** Represent and solve problems in various contexts using exponential functions, such as investment growth, depreciation and population growth.

9.2.2.3 Sketch graphs of linear, guadratic and exponential functions, and translate between graphs, tables and symbolic representations. Know how to use graphing technology to graph these functions.

9.2.2.5 Recognize and solve problems that can be modeled using finite geometric sequences and series, such as home mortgage and other compound interest examples. Know how to use spreadsheets and calculators to explore geometric sequences and series in various contexts.

Standard (9.2.4.#): Represent real-world and mathematical situations using equations and inequalities involving linear, quadratic, exponential and n<sup>th</sup> root functions. Solve equations and inequalities symbolically and • graphically. Interpret solutions in the original context.

**Benchmark:** 

9.2.4.2 Represent relationships in various contexts using equations involving exponential functions; solve these equations graphically or numerically. Know how to use calculators, graphing utilities or other technology to solve these equations.

9.2.4.8 Assess the reasonableness of a solution in its given context and compare the solution to appropriate graphical or numerical estimates; interpret a solution in the original context.

Transfer					
<ul> <li>Students will be able to independently use their learning to: (product, high order reasoning)</li> <li>Model, analyze and solve real world situations using exponential functions.</li> </ul>					
Με	Meaning				
Unit Understanding(s): Students will understand that: • A real-world situation can be represented as an exponential function and will demonstrate an understanding of how to find reasonable solutions.	Essential Que Students will keep considering: • Where can I find situations involving exponential func- • When looking at an exponential function how do the representations? • How do I decide which formula or method to use to • How do the skills and knowledge that we are learning can be modeled by exponential functions?				
Acq	Acquisition				
<ul> <li>Knowledge - Students will: <ul> <li>Understand the definition of an exponential function and the vocabulary of the significant features of a graph.</li> <li>Understand the definition of a domain and range.</li> <li>Understand that logarithms are the inverse of exponential functions.</li> <li>Understand that base e and base 10 are the natural logs and common log,</li> <li>Understand how to use technology to evaluate logarithmic equations and expressions.</li> </ul> </li> <li>Reasoning - Students will: <ul> <li>Understand how real world situations relate to the significant features of a graph or table.</li> <li>Evaluate a function at a given point and understand that certain functions have a restricted domain and/or range.</li> <li>Analyze graphs, tables and real-life situations to identify and explain the domain, and functions behavio</li> <li>Understand if an exponential model is the best model to use.</li> <li>Interpret meaning of the graph in the context of the problems.</li> <li>Understand how rate of change differs between linear and exponential functions and how it relates to real world situations.</li> </ul> </li> </ul>	<ul> <li>Skills - Students will:</li> <li>Use tables and graphs to solve exponential equation between representations.</li> <li>Evaluate exponential functions in the form y=ab<sup>x</sup></li> <li>Identify the significant features of an exponential g</li> <li>Identify significant features of a function representer rate of change, maximums and minimums, intervation appropriate to the function).</li> <li>Model real-life situations using finite geometric set Use the change of base formula.</li> <li>Use technology to evaluate logarithmic equations</li> <li>T. Use the inverse relationship between exponential problems.</li> <li>Solve exponential functions when possible use logarithmic functions</li> <li>Solve logarithmic functions involving only one loga <i>*Expanding &amp; Condensing Logarithms will be tau</i></li> </ul>				
<ul> <li>Common Misunderstandings</li> <li>Students forget about extraneous solutions</li> <li>Students forget the base of common and natural logarithms</li> <li>Students forget the properties of exponents</li> <li>Students error as they translate from exponential form to logarithmic</li> <li>Students often struggle to create a mathematical model for a real-world situation.</li> </ul>	Essential new vocabulary <ul> <li>Common Log</li> <li>Compound Interest</li> <li>Logarithm</li> <li>Natural Log</li> <li>e</li> </ul>				

• Students may not take the real-world context for a quadratic relationship into account when giving solutions.

## uestion(s):

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