Anoka-Hennepin Secondary Curriculum Unit Plan

Department:	Mathematics	Course:	Algebra II	Unit 5 Title:	Exponential & Logarithmic Functions	Grade Level(s):	
Assessed Trimester:	Trimester B	Pacing:	13-19 Days	Date Created:	2/6/2014	Last Revision Date:	2/6/2014

Course Understandings: *Students will understand that:*

A. Relationships exist between real world situations and mathematical equations and graphs.
B. Equations and inequalities can be categorized by form and that each form has specific processes to consider when solving.
C. There are a variety of strategies of varying efficiency for simplifying mathematical expressions.
D. The numeric elements of a function have specific transformational effects on the graphs of those functions.
E. The complex number system is an essential extension of the real number system for the manipulation of all quadratic functions.
F. The context of a problem is important in recognizing the reasonableness of a solution.
G. 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 qualitative 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, quadratic, 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, quadratic 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 (9.2.3.#):** Generate equivalent algebraic expressions involving polynomials and radicals; use algebraic properties to evaluate expressions.
  Benchmark:
  9.2.3.1 Evaluate polynomial and rational expressions and expressions containing radicals and absolute values at specified points in their domains.

- **Standard (9.2.4.#):** Represent real-world and mathematical situations using equations and inequalities involving linear, quadratic, exponential and n^{th} 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.

  9.2.4.7 Solve equations that contain radical expressions. Recognize that extraneous solutions may arise when using symbolic methods.

  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

Students will be able to independently use their learning to: (product, high order reasoning)

-

Meaning

Unit Understanding(s):	Essential Question(s):
Students will understand that:	**Students will keep considering:**
-	-

Acquisition

Knowledge - Students will:

- Identify functions based on the definition (A, 9.2.1.1)
- Define domain and range (A, 9.2.1.1)
- Recognize if a relation is a function (A, B, C, D, E, F, G, 9.2.1.2)
- Recognize which type of function based on graph, symbols or table of values (A, B, C, D, E, F, G, 9.2.1.2)
- How to use the vertical line test (A, B, C, D, E, F, G, 9.2.1.2)
- Understand the definition of a domain (A, 9.2.1.3)
- Understand certain functions have a restricted domain (A, 9.2.1.3)
- Understanding of intercepts, rate of change and asymptotes when appropriate to the function (D, 9.2.1.4)
- Identify zeros, intercepts and intervals of increase and decrease from a graph (D, 9.2.1.6)
- Identify values of the restricted domain of an exponential and inverse variation (reciprocals of linear functions) equation and graph (D, 9.2.1.7)
- Definition of an asymptote (D, 9.2.1.7)
- Understand what rate of change is (A, D, 9.2.1.8)
- Understand properties of negative exponents (A, D, 9.2.1.8)
- Coefficients of the variables in each equation (D, G, 9.2.1.9)
- Horizontal and vertical shift of an equation (D, G, 9.2.1.9)
- Recognize and identify situations that are exponential functions (A, 9.2.2.2)
- Recognize the difference between exponential growth and exponential decay (A, 9.2.2.2)
- Recognize the graphs of exponential functions (B, D, E, F, G, 9.2.2.3)
- Recognize problems that can be modeled using finite sequences and series (C, F, G, 9.2.2.5)
- How to apply compound interest (C, F, G, 9.2.2.5)
- Define domain and range (C, 9.2.3.1)
- Simplify radicals (C, 9.2.3.1)
- Recognize extraneous {solutions} (F, G, 9.2.3.7)
- Order of operations (D, 9.2.4.2)
- Identify different exponential functions and understand which one to use (D, 9.2.4.2)

Skills - Students will:

- Use graphing calculators to examine translations (D, G, 9.2.1.9)
- Model real world situations with exponential expressions (A, 9.2.2.2)
- Evaluate exponential equations (A, 9.2.2.2)
- Sketch graphs of exponential functions (B, D, E, F, G, 9.2.2.3)
- Demonstrate the use of graphing technology (B, D, E, F, G, 9.2.2.3)
- Model real-life situations using finite geometric sequences (C, F, G, 9.2.2.5)
- Demonstrate the use of graphing technology (C, F, G, 9.2.2.5)
- Evaluate expressions containing radicals, logarithmic, exponential, at specified points in their domains (C, 9.2.3.1)
- Use technology to solve exponential functions (D, 9.2.4.2)
- Solve exponential equations graphically and numerically (D, 9.2.4.2)

● Properties of logarithms (D, 9.2.4.2) ● Recognize linear and exponential (F, 9.2.4.8) **Reasoning - Students will:** ● Distinguish between a function and a relation (A, 9.2.1.1) ● Evaluate a function at a given point (A, 9.2.1.1) ● Distinguish between the different functions given tables, graphs or symbols (A, B, C, D, E, F, G, 9.2.1.2) ● Distinguish between a function and a relation (A, B, C, D, E, F, G, 9.2.1.2) ● Analyze graphs, tables and real life situations to identify and explain the domain (A, 9.2.1.3) ● Draw qualitative conclusions based on the graphs (D, 9.2.1.4) ● Interpret meaning of the graph in the context of the problems (D, 9.2.1.4) ● Interpret graphs to find rate of change and explain in the context of the situation (A, D, 9.2.1.8) ● Describe the translation of an equation (D, G, 9.2.1.9) ● Analyze real-life situations and determine if an exponential model fits (A, 9.2.2.2) ● Evaluate exponential functions at specific domains (A, 9.2.2.2) ● Analyze graphic, table and symbolic representations (B, D, E, F, G, 9.2.2.3) ● Investigate graphic, table and symbolic data and explain the functions' behavior (B, D, E, F, G, 9.2.2.3) ● Compare and contrast the differences between arithmetic sequences and geometric sequences (arithmetic series and geometric series) (C, F, G, 9.2.2.5) ● Identify an expression as polynomial, radical, logarithmic, exponential (C, 9.2.3.1) ● Evaluate numerous exponential equations (D, 9.2.4.2) ● Interpret a graph to identify an exponential function (D, 9.2.4.2) ● Interpret the effects of time graphically (D, 9.2.4.2) ● Interpret a solution in the original context (F, 9.2.4.8) ● Compare solutions to appropriate graphical or numerical estimates (F, 9.2.4.8)	

Common Misunderstandings	**Essential new vocabulary**
● Students forget about extraneous solutions ● Students forget the base of common and natural logarithms ● Students forget the properties of exponents ● Students error as they translate from exponential form to logarithmic ● Students use the quotient rule for two logarithms being divided rather than the log of a quotient (i.e. (log 2)/(log 3) = log 2/3 then use log 2 – log 3 to simplify)	● Asymptote ● Compound Interest