Anoka-Hennepin Secondary Curriculum Unit Plan

Department:	Mathematics	Course:	Intermediate Algebra	Unit 2 Title:	Functions	Grade Level(s):	9
Assessed Trimester:	Trimester A	Pacing:	12-14 Days	Date Created:	6/13/2013	Last Revision Date:	07/26/2014

Course Understandings: *Students will understand that:*

A. Relationships exist between real-world situations, mathematical equations, inequalities and graphs for linear, exponential, absolute value, radical, and polynomial functions.

C. There are a variety of strategies of varying efficiency for simplifying linear, absolute value, exponential, radical, complex and polynomial expressions.

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.# - Modified):** Understand the concept of function, and identify important features of functions and other relations using tabular 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.
  - **9.2.1.5** Identify the vertex, line of symmetry and intercepts of the parabola corresponding to a quadratic function, using symbolic and graphical methods, when the function is expressed in the form $f(x) = ax^2 + bx + c$, in the form $f(x) = a(x - h)^2 + k$, or in factored form.
  - **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.

Transfer

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

- Analyze a real world situation using the features of a function.

Meaning

Unit Understanding(s):	Essential Question(s):
Students will understand that: ● The definition of a function and can determine when relations are functions given a graph, table or real-world situation ● Function notation can be used to evaluate functions for a given input or output. ● Real-world situations relate to significant features of a graph or table	**Students will keep considering:** ● What are the characteristics of functions? ● What is the purpose of function notation? ● How do the skills and knowledge that we are learning influence the task of making decisions and understanding real world situations. ● How can I use tables, graphs or real-world situations to describe relationships?

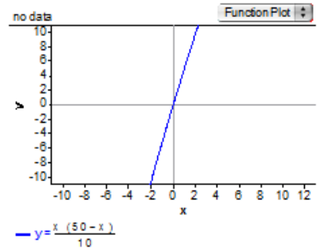
Acquisition

Knowledge - Students will:
- Understand the definition of a function and the vocabulary of the significant features of a graph.
- Understand the definition of a domain and range.
- Understand the meaning of function notation.
- Understand what rate of change is.

Reasoning - Students will:
- Understand how real world situations relate to the significant features of a graph or table.
- Understand certain functions have a restricted domain
- Distinguish between the different functions given tables, graphs or symbols
- Analyze graphs, tables and real life situations to identify and explain the domain
- Interpret meaning of the graph in the context of the problems
- Interpret graphs to find rate of change and explain in the context of the situation

Skills - Students will:
- Determine when relations are functions given a table, graph or real world situation.
- Identify and recognize functions (in symbolic, tabular, or graphical form) based on the definition of a function
- Identify significant features of a function represented as a graph, table or real-world situation (intercepts, rate of change, maximums and minimums, intervals of increase and decrease and asymptotes appropriate to the function)
- Evaluate a function at a given point and draw qualitative conclusions based on the graphs

Common Misunderstandings
- Students struggle with function notation, specifically the $f(x)$. Some students think that $f(5)$ means a variable f multiplied by 5 rather than knowing that $f(5)$ is the value of the dependent variable y when the value of the independent variable x is 5.
- Students use the vertical line test as the definition of a function rather than a method for determining if a graph of a relation plotted on a coordinate plane is a function or not. This overgeneralization fails to work if the members in a set are not numbers and cannot be plotted on a coordinate plane.
- 'Graph as a picture' confusion occurs when students believe that the graph of a relationship between two variables is the actual picture of the situation. For example, suppose a ball is thrown straight up in the air and allowed to drop to the ground. The relationship between the time in the air and height of the ball is a parabola but the actual path of the ball follows a vertical line. Many students think that the path of the ball follows a parabola when actually only the relationship between time and height is parabolic. This problem also shows up when students are asked to sketch the graph of height of a person riding on a Ferris wheel as a function of time. Many students will draw a circle to represent the relationship rather than the periodic function that it is.
- Students interchange the x-intercept and the y-intercept
- Students state that x and y-intercepts are values rather than the coordinates of points on a graph. The y-intercept of the line $y = 2x + 7$ is the coordinate (0,7) not the value 7. The x-intercepts of the function $y = 3(x + 5)(2 - x)$ are (-5,0) and (2,0) not -5 and 2. This is an important distinction since intercepts highlight important features of the relationship between two variables and not simply the value of one variable.
- Students incorrectly identify the features of a function based on limited information. For example, a student might incorrectly explain that the graph of the function $y = \frac{1}{10}x\ (50 - x)$ is a linear function because when the function is entered into a graphing calculator using the default settings the graph looks like a line.



- Students use end behaviors of a function within a specific graphing window to represent the maximum or minimum values of the function.
- Students may struggle with the concept of asymptotes. Students may not realize the effect of the graphing window in viewing asymptotes.
- Students incorrectly state that lines described symbolically as $y = 3$ (or $x = -2$) are points rather than a collection of infinitely many ordered pairs that form a horizontal (or vertical) line.
- Students are unable to explain that the slope of a vertical line is undefined.

Essential new vocabulary
- Asymptote
- Domain
- Function Notation
- Intercepts
- Interval
- Maximum
- Minimum
- Range
- Rate of Change
- Vertex