Anoka-Hennepin Secondary Curriculum Unit Plan

Department:	Mathematics	Course:	Intermediate Algebra	Unit 6 Title:	Polynomial Functions	Grade Level(s):	9
Assessed Trimester:	Trimester B	Pacing:	10-11 Days	Date Created:	6/13/2013	Last Revision Date:	08/27/2014

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.
B. Equations and inequalities 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 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.#):** Understand the concept of function, and identify important features of functions and other relations using symbolic and graphical methods where appropriate.
  Benchmark:
  9.2.1.3 Find the domain of a function defined symbolically, graphically or in a real-world context.
  9.2.1.6 Identify intercepts, zeros, maxima, minima and intervals of increase and decrease from the graph of a function.

- **Standard (9.2.2.# - Modified):** Students recognize cubic 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:
  9.2.2.6 Sketch the graphs of common non-linear functions such as $f(x) = \sqrt{x}, f(x) = |x|$, $f(x) = \frac{1}{x}$, $f(x) = x^3$, and translations of these functions, such as $f(x) = \sqrt{x-2} + 4$. Know how to use graphing technology to graph these functions.

- **Standard (9.2.3.# - Modified):** Students extend earlier work with expressions to adding, subtracting, and multiplying polynomials to generate equivalent algebraic expressions and use algebraic properties to evaluate expressions.
  Benchmark:
  9.2.3.2 Add, subtract and multiply polynomials; divide a polynomial by a polynomial of equal or lower degree.

Transfer

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

- Model, analyze and solve real world situations using polynomial (primarily cubic) functions.

Meaning

Unit Understanding(s):	Essential Question(s):

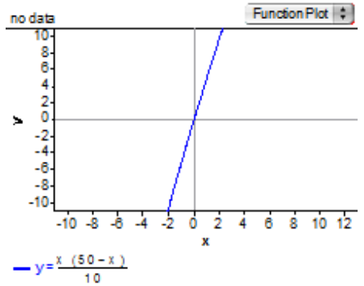
Students will understand that:	**Students will keep considering:**
● A real-world situation can be represented as a polynomial (cubic) function and will demonstrate an understanding of how to find reasonable (rational) solutions.	● Where can I find situations involving polynomial functions in the real world? ● When looking at cubic functions, how do the significant features of the graph, its algebraic equation and real world representation relate to each other? ● How do I decide the best method to solve a cubic equation? ● How do the skills and knowledge that we are learning influence the task of understanding situations that can be modeled polynomial functions?

Acquisition

Knowledge - Students will:	**Skills - Students will:**
● Demonstrate an understanding of the significant features of its graph and their relationship to real-world situations. ○ Intercepts, zeros, maxima, minima ,intervals of increase and decrease, domain and range **Reasoning - Students will:** ● Understand advantages of different forms of cubic functions	● Graph cubic functions ● Demonstrate understanding of operations with polynomials. ○ Add, subtract, multiply, divide ● Convert between Standard form and Factored Form ● Find rational solutions of cubic equations

Common Misunderstandings

- 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 $y = \frac{x(50-x)}{10}$ 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 endpoints of a function within a specific graphing window to represent the maximum or minimum values of the function.
- Students confuse the meaning of exponents and incorrectly calculate the value of exponential expressions (e.g., $2^{-3} = -8$, $2^0 = 0$, or $9^{\frac{1}{2}} = 4.5$).
- Students incorrectly state that graphs of cubic functions have vertical asymptotes.
- Students will calculate too small a set of point to graph a function. For example, a student asked to graph $y = x^3$ will correctly calculate the ordered pairs (-1, -1), (0, 0) and (1, 1) and incorrectly graph a line passing through the points.

Essential new vocabulary

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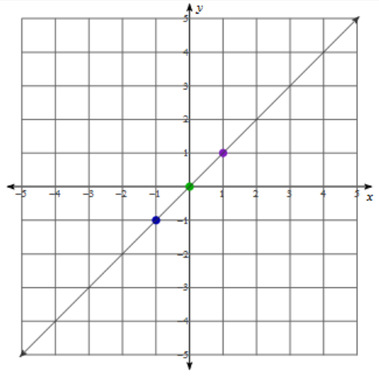

- Students do not use the correct syntax when entering a function into a graphing utility. Students who are trying to graph $y = (x - 2)^3$ often enter $x - 2^3$, which results in a graph of a different function $y = x - 8$.

- Students will incorrectly add terms that are not like terms (i.e. $2a + 3b = 5ab$ *or* $2x^2 + 5x = 7x^3$). Students incorrectly subtract polynomial expressions as shown below:

  $(3x^2-5x+7)-(x^2-3x-2)$

  $3x^2-5x+7-x^2-3x-2$ (not an equivalent expression)

  $2x^2-8x+5$

- Students will neglect partial products when multiplying polynomials. For example, some students incorrectly simplify the expression $(x-3)^2$ by writing $(x)^2+(-3)^2$ and ending up with $x^2 + 9$ for an answer.
- Some students incorrectly apply a memorized "FOIL" procedure when simplifying expressions like $(x^2-3x+9)(x+2)$.