Bemidji Area Schools
Outcomes in Mathematics – Accelerated Algebra 2

	Strand	Standard	No.	Benchmark
9, 10, 11	Algebra	Understand the concept of function, and identify important features of functions and other relations using symbolic and graphical methods where appropriate.	9.2.1.1	Understand the definition of a function. Use functional notation and evaluate a function at a given point in its domain. *For example*: If $f(x)=\frac{1}{x^2-3}$, find $f(-4)$.
			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. *For example*: The formula $f(x) = \pi x^2$ can represent a function whose domain is all real numbers, but in the context of the area of a circle, the domain would be restricted to positive x.
			9.2.1.4	Obtain information and draw conclusions from graphs of functions and other relations. *For example*: If a graph shows the relationship between the elapsed flight time of a golf ball at a given moment and its height at that same moment, identify the time interval during which the ball is at least 100 feet above the ground.
			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 $f(x) = a(x - \mathrm{h})^2 + k$, 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. *For example*: The function $f(x) = 3^x$ increases for all x, but it increases faster when $x > 2$ than it does when $x < 2$.
			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. *For example*: Determine how the graph of $f(x) = \|x - h\| + k$ changes as h and k change.

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9, 10, 11	Algebra	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.	9.2.2.1	Represent and solve problems in various contexts using linear and quadratic functions. *For example*: Write a function that represents the area of a rectangular garden that can be surrounded with 32 feet of fencing, and use the function to determine the possible dimensions of such a garden if the area must be at least 50 square feet.
			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.
			9.2.2.4	Express the terms in a geometric sequence recursively and by giving an explicit (closed form) formula, and express the partial sums of a geometric series recursively. *For example*: A closed form formula for the terms t_n in the geometric sequence 3, 6, 12, 24, ... is $t_n = 3(2)^{n-1}$, where $n = 1, 2, 3, ...$, and this sequence can be expressed recursively by writing $t_1 = 3$ and $t_n = 2t_{n-1}$, for $n \geq 2$. *Another example*: the partial sums s_n of the series 3 + 6 + 12 + 24 + ... can be expressed recursively by writing $s_1 = 3$ and $s_n = 3 + 2s_{n-1}$, for $n \geq 2$.
			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.
			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.

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9, 10, 11	Algebra	Generate equivalent algebraic expressions involving polynomials and radicals; use algebraic properties to evaluate expressions.	9.2.3.1	Evaluate polynomial and rational expressions and expressions containing radicals and absolute values at specified points in their domains.
			9.2.3.2	Add, subtract and multiply polynomials; divide a polynomial by a polynomial of equal or lower degree.
			9.2.3.3	Factor common monomial factors from polynomials, factor quadratic polynomials, and factor the difference of two squares. *For example*: $9x^6 - x^4 = (3x^3 - x^2)(3x^3 + x^2)$.
			9.2.3.4	Add, subtract, multiply, divide and simplify algebraic fractions. *For example*: $\frac{1}{1-x}+\frac{x}{1+x}$ is equivalent to $\frac{1+2x-x^2}{1-x^2}$.
			9.2.3.5	Check whether a given complex number is a solution of a quadratic equation by substituting it for the variable and evaluating the expression, using arithmetic with complex numbers. *For example*: The complex number $\frac{1+i}{2}$ is a solution of $2x^2 - 2x + 1 = 0$, since $2\left(\frac{1+i}{2}\right)^2-2\left(\frac{1+i}{2}\right)+1=i-(1+i)+1=0$.
			9.2.3.6	Apply the properties of positive and negative rational exponents to generate equivalent algebraic expressions, including those involving n^{th} roots. *For example*: $\sqrt{2}\times\sqrt{7}=2^{\frac{1}{2}}\times7^{\frac{1}{2}}=14^{\frac{1}{2}}=\sqrt{14}$. Rules for computing directly with radicals may also be used: $\sqrt{2}\times\sqrt{x}=\sqrt{2x}$.
			9.2.3.7	Justify steps in generating equivalent expressions by identifying the properties used. Use substitution to check the equality of expressions for some particular values of the variables; recognize that checking with substitution does not guarantee equality of expressions for all values of the variables.

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9, 10, 11	Algebra	Represent real-world and mathematical situations using equations and inequalities involving linear, quadratic, exponential, and nth root functions. Solve equations and inequalities symbolically and graphically. Interpret solutions in the original context.	9.2.4.1	Represent relationships in various contexts using quadratic equations and inequalities. Solve quadratic equations and inequalities by appropriate methods including factoring, completing the square, graphing and the quadratic formula. Find non-real complex roots when they exist. Recognize that a particular solution may not be applicable in the original context. Know how to use calculators, graphing utilities or other technology to solve quadratic equations and inequalities. *For example*: A diver jumps from a 20 meter platform with an upward velocity of 3 meters per second. In finding the time at which the diver hits the surface of the water, the resulting quadratic equation has a positive and a negative solution. The negative solution should be discarded because of the context.
			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.
			9.2.4.3	Recognize that to solve certain equations, number systems need to be extended from whole numbers to integers, from integers to rational numbers, from rational numbers to real numbers, and from real numbers to complex numbers. In particular, non-real complex numbers are needed to solve some quadratic equations with real coefficients.
			9.2.4.4	Represent relationships in various contexts using systems of linear inequalities; solve them graphically. Indicate which parts of the boundary are included in and excluded from the solution set using solid and dotted lines.
			9.2.4.5	Solve linear programming problems in two variables using graphical methods.
			9.2.4.6	Represent relationships in various contexts using absolute value inequalities in two variables; solve them graphically. *For example*: If a pipe is to be cut to a length of 5 meters accurate to within a tenth of its diameter, the relationship between the length x of the pipe and its diameter y satisfies the inequality $\lvert x - 5 \rvert \leq 0.1y$.

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			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.