ALGEBRA 1 AND HONORS ALGEBRA 1
Grade 9

Unit of Credit: 1 Year (Required)

Prerequisite: None

Course Overview

Domains	**Seeing Structure in Expressions**	**Arithmetic with Polynomials and Rational Expressions**	**Creating Equations**	**Reasoning with Equations and Inequalities**
Clusters	• Interpret the structure of expressions • Write expressions in equivalent forms to solve problems	• Perform arithmetic operations on polynomials • Understand the relationship between zeros and factors of polynomials • Use polynomial identities to solve problems • Rewrite rational expressions	• Create equations that describe numbers or relationships	• Understand solving equations as a process of reasoning and explain the reasoning • Solve equations and inequalities in one variable • Solve systems of equations • Represent and solve equations and inequalities graphically
Mathematical Practices	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively.	3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics.	5. Use appropriate tools strategically. 6. Attend to precision.	7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the middle grades. Because it is built on the middle grades standards, this is a more ambitious version of Algebra I than has generally been offered. The critical areas, called units, deepen and extend understanding of linear and exponential relationships by contrasting them with each other and by applying linear models to data that exhibit a linear trend, and students engage in methods for analyzing, solving, and using quadratic functions. The Mathematical Practice Standards apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.

Critical Area 1: By the end of eighth grade, students have learned to solve linear equations in one variable and have applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. Now, students analyze and explain the process of solving an equation. Students develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations.

Critical Area 2: In earlier grades, students define, evaluate, and compare functions, and use them to model relationships between quantities. In this unit, students will learn function notation and develop the concepts of domain and range. They explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the imitations of various representations. Students build on and informally extend their understanding of integer exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change. Students explore systems of equations and inequalities, and they find and interpret their solutions. They interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.

Critical Area 3: This unit builds upon prior students' prior experiences with data, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe approximately linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit.

Critical Area 4: In this unit, students build on their knowledge from unit 2, where they extended the laws of exponents to rational exponents. Students apply this new understanding of number and strengthen their ability to see structure in and create quadratic and exponential expressions. They create and solve equations, inequalities, and systems of equations involving quadratic expressions.

Critical Area 5: In this unit, students consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions. They select from among these functions to model phenomena. Students learn to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions. In particular, they identify the real solutions of a quadratic equation as the zeros of a related quadratic function. Students expand their experience with functions to include more specialized functions—absolute value, step, and those that are piecewise-defined.

Expressions.
An expression is a record of a computation with numbers, symbols that represent numbers, arithmetic operations, exponentiation, and, at more advanced levels, the operation of evaluating a function. Conventions about the use of parentheses and the order of operations assure that each expression is unambiguous. Creating an expression that describes a computation involving a general quantity requires the ability to express the computation in general terms, abstracting from

specific instances. Reading an expression with comprehension involves analysis of its underlying structure. This may suggest a different but equivalent way of writing the expression that exhibits some different aspect of its meaning. For example, $p + 0.05p$ can be interpreted as the addition of a 5% tax to a price p. Rewriting $p + 0.05p$ as $1.05\ p$ shows that adding a tax is the same as multiplying the price by a constant factor. Algebraic manipulations are governed by the properties of operations and exponents, and the conventions of algebraic notation. At times, an expression is the result of applying operations to simpler expressions. For example, $p + 0.05p$ is the sum of the simpler expressions p and $0.05p$. Viewing an expression as the result of operation on simpler expressions can sometimes clarify its underlying structure. A spreadsheet or a computer algebra system (CAS) can be used to experiment with algebraic expressions, perform complicated algebraic manipulations, and understand how algebraic manipulations behave.

Equations and inequalities.
An equation is a statement of equality between two expressions, often viewed as a question asking for which values of the variables the expressions on either side are in fact equal. These values are the solutions to the equation. An identity, in contrast, is true for all values of the variables; identities are often developed by rewriting an expression in an equivalent form. The solutions of an equation in one variable form a set of numbers; the solutions of an equation in two variables form a set of ordered pairs of numbers, which can be plotted in the coordinate plane. Two or more equations and/or inequalities form a system. A solution for such a system must satisfy every equation and inequality in the system. An equation can often be solved by successively deducing from it one or more simpler equations. For example, one can add the same constant to both sides without changing the solutions, but squaring both sides might lead to extraneous solutions. Strategic competence in solving includes looking ahead for productive manipulations and anticipating the nature and number of solutions. Some equations have no solutions in a given number system, but have a solution in a larger system. For example, the solution of $x + 1 = 0$ is an integer, not a whole number; the solution of $2x + 1 = 0$ is a rational number, not an integer; the solutions of $x2 – 2 = 0$ are real numbers, not rational numbers; and the solutions of $x2 + 2 = 0$are complex numbers, not real numbers. The same solution techniques used to solve equations can be used to rearrange formulas. For example, the formula for the area of a trapezoid, $A = ((b1+b2)/2)h$, can be solved for h using the same deductive process. Inequalities can be solved by reasoning about the properties of inequality. Many, but not all, of the properties of equality continue to hold for inequalities and can be useful in solving them.

Connections to Functions and Modeling.
Expressions can define functions, and equivalent expressions define the same function. Asking when two functions have the same value for the same input leads to an equation; graphing the two functions allows for finding approximate solutions of the equation. Converting a verbal description to an equation, inequality, or system of these is an essential skill in modeling.

Honors Algebra 1
Students successfully completing the Honors Algebra 1 course designation will cover the same standards below with greater depth. In addition, there are community service, career exploration, and research project components required.

Algebra 1 Enhancement
The Algebra 1 Enhancement course is designed to lend effective support to students concurrently enrolled in Algebra 1. Using the Response to Intervention (RtI) model, the Enhancement course is a Tier 2 Intervention aimed at students who are at-risk in mathematics. It allows for rapid response to student difficulties and provides opportunities for: additional time spent on daily targets, intensity of instruction, explicitly teaching and moving from the concrete to the abstract, frequent response from students and feedback from teachers, as well as strategic teaching using data to direct instruction. Students are placed in the Algebra 1 Enhancement course based on test scores, teacher/parent request, and academic achievement. These students are concurrently enrolled in Algebra 1. Students receive elective credit for the Algebra 1 Enhancement course.

Number and Quantity Content Standards

Domain: The Real Number System N-RN

Cluster: Extend the properties of exponents to rational exponents.

1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.*
   - I can apply the properties of exponent to rational exponents.
   - I can explain how rational exponents follow from the properties of integer exponents. (See above)

2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.
   - I can write radical expressions using rational exponents and vice versa.

Cluster: Use properties of rational and irrational numbers.

3. Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.
   - I can use the closure property or show by example the sum or product or two rational numbers are rational.
   - I can use the closure property or show by example the sum of a rational and an irrational number is irrational.
   - I can use the closure property or show by example the product or a nonzero rational number and an irrational is irrational.

Domain: Quantities N-Q

Cluster: Reason quantitatively and use units to solve problems.

1. Use units as a way to understand problems from a variety of contexts (e.g., science, history, and culture), including those of Montana American Indians, and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

- I can interpret units in the context of the problem.
- I can use unit analysis to check the reasonableness of my solution.
- I can choose and interpret an appropriate scale given data to be represented on a graph or display.

2. Define appropriate quantities for the purpose of descriptive modeling.
   - I can determine an appropriate quantity to model a situation.

3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
   - I can choose a level of accuracy appropriate to the measuring tool or situation.

Algebra Content Standards

Domain: Seeing Structure in Expressions A-SSE

Cluster: Interpret the structure of expressions.

1. Interpret expressions that represent a quantity in terms of its context.
   a. Interpret parts of an expression, such as terms, factors, and coefficients.
   - I can interpret expressions that represent a quantity in terms of its context.
   - I can identify the different parts of an expression and explain their meaning within the context of a problem.

   b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P.*
   - I can interpret expressions and make sense of the multiple factors and terms by explaining the meaning of the individual parts.

2. Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 – y^4$ as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.*
   - I can rewrite algebraic expressions in equivalent forms such as factored or simplified form.
   - I can use factoring techniques such as common factors, grouping, the difference of two squares, the sum or difference of two cubes, or a combination of methods to factor an expression completely.
   - I can simplify expressions by combining like terms, using the distributive property and using other operations with polynomials.

Cluster: Write expressions in equivalent forms to solve problems.

3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
   a. Factor a quadratic expression to reveal the zeros of the function it defines.
   - I can choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

- I can write expressions in equivalent forms by factoring to find the zeros of a quadratic function and explain the meaning of the zeros.

b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
   - I can complete the square in a quadratic expression to convey the vertex form and determine the maximum or minimum value of the quadratic function, and to explain the meaning of the vertex.

c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression 1.15^t can be rewritten as $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*
   - I can use properties of exponents (such as power of a power, product of powers, power of a product, power of a quotient) to write an equivalent form of an exponential function to reveal and explain specific information about its approximate rate of growth or decay.

Domain: Arithmetic with Polynomials and Rational Expressions A-APR

Cluster: Perform arithmetic operations on polynomials.

1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
   - I can identify polynomials.
   - I can add, subtract, and multiply polynomials.
   - I can recognize how closure applies under these operations.

Domain: Creating Equations A-CED

Cluster: Create equations that describe numbers or relationships.

1. Create equations and inequalities in one variable and use them to solve problems from a variety of contexts (e.g., science, history, and culture), including those of Montana American Indians. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*
   - I can create linear, quadratic, rational and exponential equations and inequalities in one variable and use them in a contextual situation to solve problems.

2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
   - I can create equations in two or more variables to represent relationships between quantities.
   - I can graph equations in two variables on a coordinate plane and label the axes and scales.

3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*

- I can write and use a system of equations and/or inequalities to solve a real world problem.
- I can use equations and inequalities to represent problem constraints and objectives (linear programming).

4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law $V = IR$ to highlight resistance R.*
   - I can solve multi-variable formulas or literal equations for a specific variable.

Domain: Reasoning with Equations and Inequalities A-REI

Cluster: Understand solving equations as a process of reasoning and explain the reasoning.

1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Cluster: Solve equations and inequalities in one variable.

1. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

2. Solve quadratic equations in one variable.
   a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.
   b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.
3. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
4. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
5. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.

Cluster: Represent and solve equations and inequalities graphically.

10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curse (which could be a line).
11. Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive

approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.⋆

- I can calculate and justify the solution(s) to a system of equations using multiple methods.

12. Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

Functions Content Standards

Domain: Interpreting Functions F-IF

Cluster: Understand the concept of a function and use function notation.

1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.
   - I can use the definition of a function to determine whether a relationship is a function given a table, graph or words.
   - I can identify x as an element of the domain and $f(x)$ as an element in the range given the function f.
   - I can identify that the graph of the function f is the graph of the function $y=f(x)$.

2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
   - I can use function notation, $f(x)$, when a relation is determined to be a function.
   - I can evaluate functions for inputs in their domains.
   - I can interpret statements that use function notation in terms of a context in which they are used.

3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
   - I can recognize that arithmetic and geometric sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
   - I can write a recursive formula in function notation for a generated sequence.

Cluster: Interpret functions that arise in applications in terms of the context.

4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*⋆
   - I can identify key features in graphs and tables to include intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior for a linear, exponential and quadratic function.
   - I can sketch the graph of a function given its key features.

5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*⋆
   - I can interpret a graph to determine the appropriate numerical domain being described in the linear, exponential and quadratic functions.

6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★
   - I can calculate and interpret the average rate of change of a function presented symbolically or as a table.
   - I can estimate the average rate of change over a specified interval of a function from its graph.

Cluster: Analyze functions using different representations.

7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★
   a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
   - I can graph linear functions showing intercepts.
   - I can graph quadratic functions showing intercepts, a maximum or a minimum.

   b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
   - I can graph square root, cube root and piecewise-defined functions, including step functions and absolute value functions.

   e. Graph exponential showing intercepts.
   - I can graph exponential functions, showing intercepts and end behavior.

8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
   a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
   - I can use the process of factoring and completing the square in a quadratic function to show zeros, a maximum or minimum, and symmetry of the graph, and interpret these in terms of a real-world situation.
   - I can explain different properties of a function that are revealed by writing a function in equivalent forms.

   b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, and classify them as representing exponential growth or decay.
   - I can use the properties of exponents to interpret exponential functions as growth or decay.
   - I can identify the percent rate of change in an exponential function.

9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*
   - I can compare the key features of two linear, exponential, quadratic, absolute value, step and piecewise defined functions that are represented in different ways.

Domain: Building Functions F-BF

Cluster: Build a function that models a relationship between two quantities.

1. Write a function that describes a relationship between two quantities.★
   a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
   - I can write an explicit or recursive expression or describe the calculations needed to model a function given a situation.
   - I can write a linear, quadratic or exponential function that describes a relationship between two quantities.

   b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
   - I can combine function types, such as linear and exponential, using arithmetic operations.

2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations from a variety of contexts (e.g., science, history, and culture, including those of the Montana American Indian), and translate between the two forms.★
   - I can make connections between linear functions and arithmetic sequences, and exponential functions and geometric sequences.
   - I can write and translate between the recursive and explicit formula for a arithmetic sequence and use the formulas to model a situation.
   - I can write and translate between the recursive and explicit formula for a geometric sequence and use the formulas to model a situation

Cluster: Build new functions from existing functions.

3. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\ f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.
   - I can experiment to identify, using technology, the transformational effects on the graph of a function $f(x)$ (*linear, exponential, quadratic or absolute value functions*) when $f(x)$ is replaced by $f(x)+k$, $k{\cdot}f(x)$, $f(kx)$, and $f(x+k)$ for specific values of k, both positive and negative.
   - I can find the value of k given the graph of a transformed function.
   - I can recognize even and odd functions from their graphs and equations.

4. Find inverse functions.
   a. Solve an equation of the form $f(x) = ax + b$ for a simple function f that has an inverse and write an expression for the inverse. *For linear functions only.*
   - I can solve a linear function for the dependent variable and write the inverse of a linear
   - function by interchanging the dependent and independent variables.

Domain: Linear, Quadratic, and Exponential Models F-LE

Cluster: Construct and compare linear, quadratic, and exponential models and solve problems.

1. Distinguish between situations that can be modeled with linear functions and with exponential functions.
   a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
      - I can determine a situation as linear or exponential by examining rates of change between data points.
      - I can show there is a constant difference in a linear function over equal intervals.
      - I can show there is a constant ratio in an exponential function over equal intervals.
   b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
      - I can describe situations where one quantity grows or decays by a constant ratio per unit
      - interval relative to another.
   c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
      - I can describe situations where one quantity changes at a constant rate per unit interval relative to another.

2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
   - I can write a linear or exponential function given an arithmetic or geometric sequence, a graph, a description of the relationship, or two points which can be read from a table.

3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
   - I can use graphs and tables to make the connection that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or any other polynomial function.

Cluster: Interpret expressions for functions in terms of the situation they model.

5. Interpret the parameters in a linear or exponential function in terms of a context.
   - I can explain the meaning of the coefficients, constants, factors, exponents, and intercepts in a linear or exponential function in terms of a context.

Modeling Content Standards

Modeling links classroom mathematics and statistics to everyday life, work, and decision-making. Modeling is the process of choosing and using appropriate mathematics and statistics to analyze empirical situations, to understand them better, and to improve decisions. Quantities and their relationships in physical, economic, public policy, social, and everyday situations can be modeled using mathematical and statistical methods. When making mathematical models, technology is valuable for varying assumptions, exploring consequences, and comparing predictions with data.

Modeling is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards.

Statistics and Probability Content Standards

Domain: Interpreting Categorical and Quantitative Data S-ID

Cluster: Summarize, represent, and interpret data on a single count or measurement variable.

1. Represent data with plots on the real number line (dot plots, histograms, and box plots).
    - I can construct dot plots, histograms and box plots on a real number line.

2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
    - I can describe a distribution using center and spread.
    - I can use the correct measure of center and spread to describe a distribution that is symmetric or skewed.
    - I can compare two or more different data sets using the center and spread of each.

3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
    - I can identify outliers (extreme data points) using IQR and their effects on data sets.
    - I can interpret differences in different data sets in context.
    - I can interpret differences due to possible effects of outliers.

Cluster: Summarize, represent, and interpret data on two categorical and quantitative variables.

5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
    - I can create a two-way table from two categorical variables and read values from a two-way table
    - I can interpret joint, marginal, and relative frequencies in context.
    - I can recognize associations and trends in data from a two-way table.

6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
    a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear models. Discuss general principles referring to quadratic, and exponential models.
    - I can create a scatter plot from two quantitative variables.
    - I can describe the form (linear, quadratic or exponential), strength (strong to weak) and direction (positive or negative) of the relationship.

- I can explain the meaning of slope and y-intercept (linear model) or the meaning of the growth rate and y-intercept (exponential model) or the meaning of the coefficients (quadratic model) in context.
- I can use algebraic methods or technology to fit the data to a linear, exponential or quadratic function.

b. Informally assess the fit of a function by plotting and analyzing residuals.
- I can calculate a residual.
- I can create and analyze a residual plot.

c. Fit a linear function for a scatter plot that suggests a linear association.
- I can use algebraic methods or technology to fit the data to a linear function.
- I can use the function to predict values.

Cluster: Interpret linear models.

7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
   - I can explain the meaning of the slope and y-intercept in context.

8. Compute (using technology) and interpret the correlation coefficient of a linear fit.
   - I can use a calculator or computer to find the correlation coefficient for a linear association.
   - I can interpret the meaning of the correlation coefficient in the context of the data.

9. Distinguish between correlation and causation.
   - I can explain the difference between correlation and causation.

Standards	Explanations and Examples
Students are expected to:	**The Standards for Mathematical Practice describe ways in which students ought to engage with the subject matter as they grow in mathematical maturity and expertise.**
HS.MP.1. Make sense of problems and persevere in solving them.	High school students start to examine problems by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. By high school, students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. They check their answers to problems using different methods and continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.
HS.MP.2. Reason abstractly and quantitatively.	High school students seek to make sense of quantities and their relationships in problem situations. They abstract a given situation and represent it symbolically, manipulate the representing symbols, and pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Students use quantitative reasoning to create coherent representations of the problem at hand; consider the units involved; attend to the meaning of quantities, not just how to compute them; and know and flexibly use different properties of operations and objects.
HS.MP.3. Construct viable arguments and critique the reasoning of others.	High school students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. High school students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. High school students learn to determine domains to which an argument applies, listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.
HS.MP.4. Model with mathematics.	High school students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. High school students making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
HS.MP.5. Use appropriate tools strategically.	High school students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. High school students should be sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. They are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.
HS.MP.6. Attend to precision.	High school students try to communicate precisely to others by using clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. By the time they reach high school they have learned to examine claims and make explicit use of definitions.
HS.MP.7. Look for and make use of structure.	By high school, students look closely to discern a pattern or structure. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 – 3(x – y)2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y. High school students use these patterns to create equivalent expressions, factor and solve equations, and compose functions, and transform figures.

HS.MP.8. Look for and express regularity in repeated reasoning.	High school students notice if calculations are repeated, and look both for general methods and for shortcuts. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x2 + x + 1)$, and $(x - 1)(x3 + x2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, derive formulas or make generalizations, high school students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Algebra 1 Montana Common Core Standards Vocabulary		
absolute value	factorization	quotient
acute	factor	radical
addition rule	frequency table	random sample
approximate	function	range
box plots	half-plane	rate of change
causation	histogram	ratio
center	horizontal	rational
closure	identity	rational expression
coefficient	independence	right triangle
communicative	inequality	root (zero)
complement	inference	sample space
conditional probability	intercept	scatter plot
constant	interpret	shape
constant rate	intersect	similar (triangle)
constraints	inverse	similarity
construct	irrational	slope
coordinate axis	linear equation	solution
coordinate plane	maxima	spread
correlation coefficient	minima	square
cube root	model	square root
curve	obtuse	subsets
data set	plot	systems of equality
derive	polynomial	systems of equation
domain	probability	table of values
dot plot	product	terms
equation	property	trigonometry
equivalent	Pythagorean Theorem	union
expression	quadratic equation	variable
extraneous	quantitative	vertical
function notation f(x)		