HIGH SCHOOL

ALGEBRA I

Mathematical Practices

The Standards for Mathematical Practice are essential in the extension of mathematical thinking. Students develop these habits of mind through specific, intentional experiences of writing, reading, talking, and reasoning that connect mathematics to their daily lives and career situations. All of the Standards are important for all quality math courses:

- Make sense of problems and persevere in solving them (MP.1)
- Reason abstractly and quantitatively (MP.2)
- Construct viable arguments and critique the reasoning of others (MP.3)
- Modeling with mathematics (MP.4)
- Use appropriate tools strategically (MP.5)
- Attend to precision (MP.6)
- Look for and make use of structure (MP.7)
- Look for and express regularity in repeated reasoning (MP.8)

In elementary school mathematics is primarily focused on the study of numbers and it is very concrete; whereas, high school mathematics is extremely abstract and focuses on several different fields of study. In the field of numbers, high school students focus on the complex number systems as it relates to various content domains. Two other areas in the field of numbers are the choosing of appropriate scales when graphing and appropriate levels of accuracy in approximating values. These are valuable both inside and outside mathematics classes.

Content Area: Number

● Real number system is built on rational and irrational numbers, and represents all points on the number line ● Quantitative reasoning and mathematical modeling needs attention to units of measurement

Standards	Strands	Goals and Performance Objectives
HSN.RN.1	1 Solving Linear Equations	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.
HSN.RN.2	1 Solving Linear Equations	Rewrite expressions involving radicals and rational exponents using the properties of exponents.

HSN.RN.3	1 Solving Linear Equations	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; that the product of a nonzero rational number and an irrational number is irrational.
HSN.Q.1	1 Solving Linear Equations	Use units as a way to understand problems 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.
HSN.Q.2	1 Solving Linear Equations	Define appropriate quantities for the purpose of descriptive modeling.
HSN.Q.3	1 Solving Linear Equations	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
HSN.CN.1	9 Solving Quadratic Equations	Know there is a complex number *i* such that $i^2 = -1$, and every complex number has the form $a + bi$ with *a* and *b* are real.

Two topics, Algebra and Functions are linked tightly to each other. Solving problems flexibly is the main focus of algebra, and functions model many situations in real-life that involve change. When students work with functions, they need not only the skills for working with equations and expressions and their interdependence.The real difficult decisions evolve when and where technology is integrated here. In the past, many hours in the classroom were devoted to learning algebraic manipulations - with today's technology, class time can now be focused on interpretation of the algebraic data. This progression is a huge step towards using algebra more effectively for mathematical modeling. Recognizing structures in expressions has become the main focus for algebra.This process can be quite creative, as students can find multiple paths to solutions and students need to determine effective strategies for finding the best method.

t Area: Algebra and Functions

Fluency 1: Algebra

- Expressions can be written in different, but equivalent forms - each makes different characteristics or features visible.
- Finding solutions to equations, inequalities, or systems of equations/inequalities may yield extraneous solutions and the answers should be check to ensure they are accurate to the problem
- In order to find, if possible, a solution to an algebraic problem, students must be able to analyze the structure of it and develop an efficient strategy to solve it.
- Algebraic expressions and equations can make predictions and should be analyzed and applied in different contexts. Regression analysis should be used both with and without technology.

Standards	Strand	Goals and Performance Objectives
HSA.SSE.1	ing Linear Functions	ret expressions that represent a quantity in terms of its context.
HSA.SSE.2	7 Polynomial Equations & Factoring	Use the structure of an expression to identify ways to rewrite it.
HSA.APR.1	7 Polynomial Equations & Factoring	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, multiply polynomials.
HSA.APR.6	7 Polynomial Equations & Factoring	Rewrite simple rational expressions in different forms; using inspection, long division, or, for more complicated examples, a computer algebra system.
HSA.CED.1	1 Solving Linear Equations	Create equations and inequalities in one variable and use them to solve problems from a variety of contexts, including those of Montana American Indians.
HSA.CED.3	1 Solving Linear Equations	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.
HSA.CED.4	1 Solving Linear Equations	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

HSA.REI.1	1 Solving Linear Equations	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.
HSA.REI.2	10 Radical Functions	Solve simple rational and radical equations in one variable, and give examples how extraneous solutions may arise.
HSA.REI.3	1 Writing Linear Equations	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
HSA.REI.4	8 Solving Quadratic Equations	Solve quadratic equations in one variable.
HSA.REI.5	5 Solving Systems of Linear Equations	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.
HSA.REI.6	5 Solving Systems of Linear Equations	Solve systems of linear equations exactly and approximately, focusing on pairs of linear equations in two variables.
HSS.ID.7	3 Graphing Linear Functions	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

Analyzing graphs is required for understanding today's media. Students need to explore how the graphs of functions behave - i.e. rates of change, critical points, intercepts, and symmetry. Understanding the graphs extrema will help students apply them to real-life modeling. Finding a relationship between variables and creating a rule or equation to represent that is an important algebraic skill, and technology can aid in this by creating the graphs and providing the ability to examine constraints as they affect the graph. Technology allows students to concentrate on the structures and principles of the functions instead of concentrating on creating the graphs to analyze.

Fluency 2: Connecting Algebra to Functions

- Shifting of the point by point approach of functions to a more holistic approach to an entire set of ordered pairs that possesses unique features and characteristics
- Graphs are essential - students need to use them to obtain approximate or exact solutions of functions.

Standards	Strand	Goals and Performance Objectives
HSF.IF.1	3 Graphing Linear Functions	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.
HSF.IF.2	3 Graphing Linear Functions	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
HSF.IF.4	3 Graphing Linear Functions	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.
HSF.IF.5	3 Graphing Linear Functions	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
HSF.IF.6	4 Writing Linear Equations	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 fom a graph.
HSF.IF.7	4 Writing Linear Equations	Graph function expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
HSA.REI.10	3 Graphing Linear Functions	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 curve (which could be a line)

HSA.REI.11	5 Solving Systems of Linear Equations	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 using technology
HSA.REI.12	5 Solving Systems of Linear Equations	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.
HSA.CED.2	5 Solving Systems of Linear Equations	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
HSA.APR.3	8 Graphing Quadratic Functions	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

Particular "parent" functions are studied extensively in high school. The goal of high school function study is to recognize the similar traits of the functions - their characteristics, their extrema, etc. Comparing and connecting these different characteristics helps students connect the features of the graph to real-world applications.

Fluency 3: Functions
- Functions need to be described in multiple ways
- Common attributes of family of functions need to be distinguished
- Functions' key features need to be interpreted in terms of equivalent symbolic representation
- Modeling should be incorporated with functions and represented in multiple ways

Standards	Strand	Goals and Performance Objectives
HSF.IF.8	7 Polynomial Equations & Factoring	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
HSF.IF.9	4 Writing Linear Functions	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

HSF.BF.1	4 Writing Linear Functions	Write a function that describes a relationship between two quantities.
HSF.BF.3	4 Writing Linear Functions	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. Experiments with cases and illustrate an explanation of the effect on the graph using technology. Include recognizing even and odd functions from their graphs and algebraics expression for them.
HSA.SSE.3	9 Solving Quadratic Equations	Factor a quadratic expression to reveal the zeros of a function it defines.