

## Mathematics: Essential Learning Expectations:

### 9<sup>th</sup>-12th Grade:

**Content Standard 1: Number Sense and Operation – A student, applying reasoning and problem solving, will use number sense and operations to represent numbers in multiple ways, understand relationships among numbers and number systems, make reasonable estimates, and compute fluently within a variety of relevant cultural contexts, including those of Montana American Indians.**

Content Standard	Essential Learning Expectations	Vocabulary	
1.1 Whole Number Relationships:	A. Evaluate expressions containing very large and very small numbers using multiple notations. (10) B. Describe the effects of operations with very large or very small numbers. (10)		
1.2 Estimation and Operations:	A. Identify and explain situations where an estimate is adequate and appropriate. (10) B. Use estimated values of irrational numbers to check for reasonableness of solution to problems. (10) C. Round solutions and choose the appropriate precision to report the answer based on the context of the problem. (10)	precision, error	
1.3 Whole Number Concepts:	A. Express a real number in a variety of equivalent forms using	rational exponent, radical, irrational number, real	

	<p>rational exponents, radicals, or irrational numbers.</p> <p><b>B. Simplify real number expressions containing rational exponents, radicals or irrational numbers.</b></p>	number, rational number	
<b>1.4 Common Fractions and Decimals</b>	<p><b>A. Define and classify real numbers by the subset to which they belong. (10)</b></p> <p><b>B. Apply real-number properties to solve problems. (10)</b></p>		
<b>1.5 Length, Time, and Temperature:</b>	<p><b>A. Given a situation, including those of Montana American Indians, determine the unknowns, write and solve the equation or system of equations, and interpret the results. (10)</b></p> <p><b>B. Identify independent and dependent variables when a dependency exists. (10)</b></p>	independent variable, dependent variables	
<p><b>Content Standard 2: Data Analysis Mathematics – A student, applying reasoning and problem solving, will use data representation and analysis, simulations, probability, statistics, and statistical methods to evaluate information and make informed decisions within a variety of relevant cultural contexts, including those of Montana American Indians.</b></p>			
<b>2.1 Representing Data:</b>	<p><b>A. For univariate data, be able to display the distribution, describe its shape, and select and calculate summary statistics. (10)</b></p> <p><b>B. Describe and interpret the tendency of bivariate data in a scatter plot. (10)</b></p> <p><b>C. Calculate and</b></p>	percentile, positive correlation, negative correlation, no correlation, standard deviation	

	<p>interpret measures of spread to make comparisons among sets of data.</p> <p><b>D. Explain how linear transformations of univariate data affect shape, center, and spread (e.g. adding or multiplying a constant to each data set, adding an outlier).</b></p> <p><b>E. Construct and interpret a back-to-back stem-and-leaf plot. (10)</b></p>		
<p><b>2.2 Evaluating Data:</b></p>	<p><b>A. Analyze, interpret and evaluate the validity of a survey and identify possible sources of bias. (10)</b></p> <p><b>B. Design and conduct a survey based on an appropriate sample then interpret and determine the validity of the results. (10)</b></p> <p><b>C. Interpret and justify how sample statistics reflect the values of population parameters.</b></p>	<p>population, parameter, bias</p>	
<p><b>2.3 Likelihood of Events:</b></p>	<p><b>A. Compute and interpret the expected value of random events.</b></p> <p><b>B. Make, evaluate, and justify decisions based on probabilities.</b></p> <p><b>C. Solve problems using the concepts of conditional probability and independent events in multicultural situations, including those of Montana American Indians. (10)</b></p>	<p>expected value, conditional probability, independent events</p>	

<p><b>2.4 Counting Methods:</b></p>	<p><b>A. Distinguish between independent and dependent compound events and apply the multiplication rule for probability to determine the probability for the events. (10)</b></p> <p><b>B. Use the Fundamental Counting Principle to determine the size of a finite sample space and the probabilities of the events in those spaces. (10)</b></p> <p><b>C. Determine the probabilities of complementary events and calculate the probability of the outcome of events. (10)</b></p> <p><b>D. Use permutations and combinations to count outcomes and determine probabilities of events.</b></p>	<p><b>compound event, Fundamental Counting Principle, complementary events, permutations, combinations</b></p>	
<p><b>2.5 Curve Fitting:</b></p>	<p><b>A. Given a set of bivariate data, develop an equation that models the relationship between the variables and determine its validity (e.g., linear with and without technology). (10)</b></p> <p><b>B. Make and justify the validity of predictions (interpolate, extrapolate) based on mathematical models (e.g., linear). (10)</b></p> <p><b>C. Calculate the correlation coefficient</b></p>	<p><b>interpolate, extrapolate, least squares regression equation, median-median line, correlation coefficient</b></p>	

	of a set of data with technology, and interpret the coefficient as a measure of the strength and direction of the relationship between the variables.		
<b>Content Standard 3: Geometric Reasoning – A student, applying reasoning and problem solving, will understand geometric properties, spatial relationships, and transformation of shapes, and will use spatial reasoning and geometric models to analyze mathematical situations within a variety of relevant and cultural contexts, including those of Montana American Indians.</b>			
<b>3.1 Two-Dimensional Attributes</b>	<b>A. Formulate and evaluate conjectures based on geometric properties.  B. Apply deductive and inductive reasoning to solve geometric problems</b>	<b>conjecture, inductive reasoning, deductive reasoning</b>	
<b>3.2 Three-Dimensional Attributes</b>	<b>A. Build and create isometric drawings, foundational drawings, and orthographic drawings of geometric solids and their views. (10)  B. Visualize and draw three-dimensional objects from different perspectives and identify cross sections. (10)  C. Construct geometric representations with and without technology. (10)  D. Use geometric models and spatial reasoning to solve problems in the context of art,</b>	<b>cross sections, compass, straight edge</b>	

	<p>science, and culture, including those of Montana American Indians. (10)</p>		
<p><b>3.3 Basic Transformations:</b></p>	<p><b>A. Perform transformations of shapes in a plane with and without the coordinate system. (10)</b></p> <p><b>B. Model and describe simple transformations and their compositions (e.g., composition of two reflections over parallel lines produces a translation).</b></p> <p><b>C. Use specific geometric approaches to solve problems (e.g., computer applications, physical models).</b></p>	<p><b>composition of transformations</b></p>	
<p><b>3.4 Linear Measurement:</b></p>	<p><b>A. Find sides and angles of right triangles using the Pythagorean Theorem, proportionality and trigonometric ratios. (10)</b></p> <p><b>B. Use appropriate strategies to find the measures of length, perimeter, area, surface area and volume of composite figures and solids (e.g., pyramids, cones). (10)</b></p> <p><b>C. Use the law of sines and cosines to find indirect</b></p>	<p><b>sine, cosine, tangent, composite figure</b></p>	

	measurements in on-right triangles.		
<b>3.5 Area and Perimeter:</b>	<p><b>A. Use deductive reasoning, indirect proof and counterexamples to justify geometric conjectures and properties.</b></p> <p><b>B. Make and evaluate logical arguments justifying properties of figures on the coordinate plane (e.g., triangles and quadrilaterals). (10)</b></p> <p><b>C. Make and evaluate logical arguments justifying congruency and similarity of figures (e.g., triangles and quadrilaterals). (10)</b></p>	<b>deductive reasoning, proof format ('T' /two column proof, flow, paragraph, algebraic), indirect proof, counterexample</b>	
<b>Content Standard 4:Algebraic and Functional Reasoning – A student, applying reasoning and problem solving, will use algebraic concepts and procedures to understand processes involving number, operation, and variables and will use procedures and function concepts to model the quantitative and functional relationships that describe change within a variety of relevant cultural contexts, including those of Montana American Indians.</b>			
<b>4.1 Patterns and Relations:</b>	<p><b>A. Generate equivalent forms of linear equations such as slope-intercept, point-slope, and standard form and justify the choice for solving a given problem. (10)</b></p> <p><b>B. Represent functions in a variety of ways and justify the choice for solving a given problem.</b></p>	<b>slope-intercept form, point-slope form, standard form, arithmetic sequence, geometric sequence, explicit form, recursive form</b>	

	<b>C. Classify a pattern, table, or graph as arithmetic or geometric and write the rule in recursive and explicit form.</b>		
<b>4.2 Symbols and Expressions</b>	<b>A. Determine an equation or inequality that best models a contextual problem (e.g. linear, quadratic, or exponential). (10)</b>	<b>quadratic function, exponential function, parameter</b>	
<b>4.3 Properties of Number and Operation</b>	<b>A. Solve and graph equations and inequalities within the real number system, justify each step and interpret the solution(s) (e.g. linear, absolute value and quadratic). (10) B. Solve systems of equations or inequalities using graphing, substitution, elimination, and matrices, justify and interpret the solution(s) (e.g., linear). (10)</b>	<b>quadratic equation, zero product property, system of equations, systems of inequalities</b>	
<b>4.4 Equivalent Expressions:</b>	<b>A. Describe how changing one or more parameters in one of the general forms of a function effects the graph and behavior of the function (e.g., linear, quadratic, and exponential). (10) B. Represent and use functions in</b>	<b>families of functions, polynomial functions, sine function, cosine function, parent function</b>	

	<p>equivalent forms to identify and perform transformations.</p>		
<p><b>4.5 Numerical Modeling with Manipulatives:</b></p>	<p><b>A. Justify the selection of a function as the best choice to model a problem situation including those involving Montana American Indians, analyze the results, and make future predictions (e.g., linear, quadratic and exponential). (10)</b></p> <p><b>B. Decide if a solution is reasonable in the context of the original situation. (10)</b></p>	<p><b>discrete data, continuous data</b></p>	