Montana Instructional Alignment
HPS Critical Competencies
Mathematics
Honors Pre-Calculus

Content Standards

Content Standard 1 - **Number Sense and Operations**

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.

Content Standard 2 - **Data Analysis**

A student, applying reasoning and problem solving, will use data representation and analysis, probability, statistics and statistical methods to evaluate information and make informed decisions within a variety of relevant cultural contexts.

Content Standard 3 - **Geometric Reasoning**

A student, applying reasoning and problem solving, will understand geometric properties and spatial relationships, transformation of shapes, representational systems, spatial reasoning and geometric models to analyze mathematical situations within a variety of relevant cultural contexts.

Content Standard 4 - **Algebraic Reasoning**

A student, applying reasoning and problem solving, will use algebraic and functional concepts and procedures to understand patterns, quantitative and functional relationships, algebraic representations, models and change within a variety of relevant cultural contexts.

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Content Standard 1 -	Number Sense and Operations			
	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.			
State Established Benchmark At the end of Grade 12, a proficient Student will:	**Essential Learning Expectation (ELE) / HPS Critical (Competencies)**	**NCTM Standard**	**Assessment Statements (Specific Examples)**	**Vocabulary** *(for instructional purposes)*
1.1 **(Magnitude):** Represent very large and very small numbers using multiple notations and interpret their effects in problem situations. 1.2 **Estimation:** Identify situations where estimation is appropriate and determine the needed degree of accuracy and precision. 1.3 **Equivalence:** Given a representation of a number or expression, find equivalent representations using multiple notations (e.g., exponents and roots). 1.4 **Properties:** Analyze and apply the properties of numbers and number systems. 1.5 **Modeling**: Identify givens and unknowns in an unfamiliar situation and describe relationships between variables (e.g., the effect of changing an interest rate on monthly payments).	*Implicit in all the standards below is the process standard specifying that all topics are taught with multiple representations through problem solving with appropriate technology.* **Polar Coordinates, Vectors, Coordinate Systems 1.4** **Trigonometric Identities 1.3 1.4**	• **Geometry** • **Algebra** • **Number and Operations** • **Algebra**	• Polar Coordinates-graph, convert between polar/rectangular coordinates, polar form of complex number, polar form of a linear equation • Pythagorean, Reciprocal, Ratio, Sum & Difference	Linear, Quadratic, Polynomial, Cubic, Quartic, Trigonometric, Square Root, Cube Root, Radical, Rational, Domain, Range, End Behavior, Sine, Cosine, Tangent, Cosecant, Secant, Cotangent, Radian, Unit Circle, Solution, Root, Zero, Intercepts, Asymptote, Extraneous

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Content Standard 2 -	Data Analysis
	A student, applying reasoning and problem solving, will use data representation and analysis, probability, statistics and statistical methods to evaluate information and make informed decisions within a variety of relevant cultural contexts.

State Established Benchmark At the end of Grade 12, a proficient Student will:	Essential Learning Expectation (ELE) / HPS Critical (Competencies)	NCTM Standard	Assessment Statements (Specific Examples)	Vocabulary (for instructional purposes)
2.1 **Represent Data:** Using technology when appropriate, select and create graphical or numerical representations for data set and compare different data sets using measures of central tendency and spread (e.g., percentiles, quartiles, inter-quartile range, and standard deviation). 2.2 **Evaluate Data:** Evaluate reports based on data collected and/or published by considering the source of the data, the design of the study, and the way data are analyzed and displayed (e.g. correlation does not prove causation). 2.3 **Regression:** Given two variable data, decide on an appropriate model, determine a regression equation using technology, and decide when predictions based on such regression equations are valid. 2.4 **Probability:** Use basic rules to compute probabilities and use probability to evaluate problem solving. 2.5 **Counting:** Determine the number of outcomes for an event or compound events using permutations, combinations, and other counting methods.	*Implicit in all the standards below is the process standard specifying that all topics are taught with multiple representations through problem solving with appropriate technology.* **Regressions and Curves of Best Fit 2.1 2.2 2.3**	• **Algebra**	• Logarithmic and Exponential Functions-graph, solve equations, applications such as time value of money, dB, and earthquakes • Logistic Curves, Polynomial Curves, Regression Curves	

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Content Standard 3 -	Geometric Reasoning
	A student, applying reasoning and problem solving, will understand geometric properties and spatial relationships, transformation of shapes, representational systems, spatial reasoning and geometric models to analyze mathematical situations within a variety of relevant cultural contexts.

State Established Benchmark At the end of Grade 12, a proficient Student will:	Essential Learning Expectation (ELE) / HPS Critical (Competencies)	NCTM Standard	Assessment Statements (Specific Examples)	Vocabulary *(for instructional purposes)*
3.1 **Reasoning:** Use inductive and deductive reasoning to verify conjectures about relationships (e.g., congruence) between two- and three-dimensional objects. 3.2 **Transformations:** Apply transformations on figures (e.g. dilations, rotations, translations, reflections) to solve problems, and interpret the results of composite transformations. 3.3 **Triangle Relationships:** Solve problems using triangles, including special triangles (e.g., 30-6-0-90) and properties of triangles (e.g. sine, cosine, tangent). 3.4 **Methods of Proof:** Make, test, and validate conjectures using a variety of techniques (e.g., counterexample, indirect proof). 3.5 **Applications:** Use spatial reasoning and geometric models to solve real world problems involving regular and irregular shapes.	*Implicit in all the standards below is the process standard specifying that all topics are taught with multiple representations through problem solving with appropriate technology.* **Trigonometry 3.2. 3.3**	• **Geometry**	• Unit Circle and special angle trigonometric values (0, 30, 45, 60 & 90 degrees) • Law of Cosines and Sines (including ambiguous case) with applications • Graphing trig. Functions (sine or cosine) • Modeling harmonic functions • Verifying and using trig. Identities • Solve trig. Equations • Polar Coordinates-graph, convert between polar/rectangular coordinates, polar form of complex number • Vectors-resultant (geometric and algebraic), polar/rectangular form, applications	

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Content Standard 4 -	Algebraic Reasoning
	A student, applying reasoning and problem solving, will use algebraic and functional concepts and procedures to understand patterns, quantitative and functional relationships, algebraic representations, models and change within a variety of relevant cultural contexts.

State Established Benchmark At the end of Grade 12, a proficient Student will:	Essential Learning Expectation (ELE) / HPS Critical (Competencies)	NCTM Standard	Assessment Statements (Specific Examples)	Vocabulary *(for instructional purposes)*
4.1 **Symbols:** Choose appropriate variables to construct expressions and equations representing given problem situations (e.g., linear, quadratic, exponential). 4.2 **Solving:** Solve a variety of equations, inequalities and their systems; justify the solution process using properties of numbers; and interpret solutions in context. 4.3 **Functions:** Represent functions in a variety of ways including tabular, graphic, symbolic, and verbal, and select an appropriate form for solving a given problem. 4.4 **Transforming Functions:** Analyze the effects of transformations on families of functions, recognize their characteristics, and represent functions in equivalent forms. 4.5 **Modeling:** Given data or a problem situation, select and use an appropriate function model to analyze results or make a prediction 4.6 **Connections with Geometry:** Represent geometric problems algebraically and algebraic situation geometrically.	*Implicit in all the standards below is the process standard specifying that all topics are taught with multiple representations through problem solving with appropriate technology.* **Modeling with Functions 4.2 4.3 4.5** **Matrices** **Discrete Math**	• **Algebra** • **Number and Operations** Algebra Algebra Geometry Algebra	• Factor and solve polynomial equations of various degrees, including those with complex roots-including polynomial long division and synthetic division. • Logarithmic and Exponential Functions-graph, solve equations, applications such as time, value of money, decibels, and earthquakes. • Determine composition and inverses of functions (where the inverse exists) • Graphing trigonometry functions • Modeling harmonic functions • Parametric Equations – modeling motion • Calculate determinants and multiplicative inverses • Solving 2-Dimensional and 3-dimensional systems including Reduced Row Echelon Form. • Arithmetic and Geometric Sequences and Series-recursive and explicit form equations, finding nth term, infinite sequences and series, special sequences and series.	