

Identifier	Poplar - Grade 12 - Mathematics		Introduced	Completed
12 M 1	MATHEMATICAL PRACTICES			
12 M 1.1.01	Makes sense of problems and persevere in solving them.			
12 M 1.1.02	Reason abstractly and quantitatively.			
12 M 1.1.03	Construct viable arguments and critique the reasoning of others.			
12 M 1.1.04	Model with mathematics.			
12 M 1.1.05	Use appropriate tools strategically.			
12 M 1.1.06	Attend to precision.			
12 M 1.1.07	Look for and make use of structure.			
12 M 1.1.08	Look for and express regularity in repeated reasoning.			
12 M 2	NUMBER AND QUANTITY			
12 M 2.1.01	The Real Number System	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 radical in terms of rational exponents.		
12 M 2.1.02	The Real Number System	Rewrite expressions involving radicals and rational exponents using the properties of exponents.		
12 M 2.1.03	The Real Number System	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.		
12 M 2.2.01	Quantities	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.		
12 M 2.2.02	Quantities	Define appropriate quantities for the purpose of descriptive modeling.		
12 M 2.2.03	Quantities	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.		
12 M 2.3.01	The Complex Number System	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 real.		
12 M 2.3.02	The Complex Number System	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.		
12 M 2.3.03	The Complex Number System	Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.		
12 M 2.3.04	The Complex Number System	Represent complex numbers on the complex plane		
12 M 2.3.05	The Complex Number System	Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane		
12 M 2.3.06	The Complex Number System	Calculate the distance between numbers in the complex plane as the modulus of the difference		
12 M 2.3.07	The Complex Number System	Solve quadratic equations with real coefficients that have complex solutions.		
12 M 2.3.08	The Complex Number System	Extend polynomial identities to the complex numbers.		
12 M 2.3.09	The Complex Number System	Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.		
12 M 2.4.01	Vector and Matrix Quantities	Recognize vector quantities as having both magnitude and direction.		
12 M 2.4.02	Vector and Matrix Quantities	Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.		
12 M 2.4.03	Vector and Matrix Quantities	Solve problems from a variety of contexts (e.g., science, history, and culture), including those of Montana American Indians, involving velocity and other quantities that can be represented by vectors.		
12 M 2.4.04	Vector and Matrix Quantities	Add and subtract vectors		
12 M 2.4.05	Vector and Matrix Quantities	Multiply a vector by a scalar		
12 M 2.4.06	Vector and Matrix Quantities	Use matrices to represent and manipulate data		
12 M 2.4.07	Vector and Matrix Quantities	Multiply matrices by scalars to produce new matrices		
12 M 2.4.08	Vector and Matrix Quantities	Add, subtract, and multiply matrices of appropriate dimensions.		
12 M 2.4.09	Vector and Matrix Quantities	Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation		
12 M 2.4.10	Vector and Matrix Quantities	Understand that the zero and identity matrices play a role in matrix addition and multiplication		
12 M 2.4.11	Vector and Matrix Quantities	Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector.		
12 M 2.4.12	Vector and Matrix Quantities	Work with 2×2 matrices as a transformation of the plane, and interpret the absolute value of the determinant in terms of area.		
12 M 3	ALGEBRA			
12 M 3.1.01	Seeing Structure in Expressions	Interpret expression that represent a quantity in terms of its context		
12 M 3.1.02	Seeing Structure in Expressions	Interpret parts of an expression, such as terms, factors, and coefficients		
12 M 3.1.03	Seeing Structure in Expressions	Interpret complicated expressions by viewing one or more of their parts as a single entity.		
12 M 3.1.04	Seeing Structure in Expressions	Use the structure of an expression to identify ways to rewrite it.		
12 M 3.1.05	Seeing Structure in Expressions	Choose and produce an equivalent form of an expression to real and explain properties of the quantity represented by the expression		
12 M 3.1.06	Seeing Structure in Expressions	Factor a quadratic expression to reveal the zeros of the function it defines		
12 M 3.1.07	Seeing Structure in Expressions	Complete the square in a quadratic expression to reveal the maximum and minimum value of the function it defines		
12 M 3.1.08	Seeing Structure in Expressions	Use the properties of exponents to transform expressions for exponential functions		
12 M 3.1.09	Seeing Structure in Expressions	Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems.		

Identifier	Poplar - Grade 12 - Mathematics		Introduced	Completed
12 M 3.2.01	Arithmetic with Polynomials and Rational Expressions	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.		
12 M 3.2.02	Arithmetic with Polynomials and Rational Expressions	Know and apply the Remainder Theorem. For a polynomial $p(x)$ and a number a , the remainder on division by $x-a$ is $p(a)$, so $p(a)=0$ if and only if $(x-a)$ is a factor of $p(x)$.		
12 M 3.2.03	Arithmetic with Polynomials and Rational Expressions	Identify zeros of polynomials when suitable factorization are available, and use the zeros to construct a rough graph of the function defined by the polynomial.		
12 M 3.2.04	Arithmetic with Polynomials and Rational Expressions	Prove polynomial identities and use them to describe numerical relationships.		
12 M 3.2.05	Arithmetic with Polynomials and Rational Expressions	Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n , where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.		
12 M 3.2.06	Arithmetic with Polynomials and Rational Expressions	Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or for the more complicated examples, a computer algebra system.		
12 M 3.2.07	Arithmetic with Polynomials and Rational Expressions	Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.		
12 M 3.3.01	Creating Equations	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 MT American Indians.		
12 M 3.3.02	Creating Equations	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.		
12 M 3.3.03	Creating 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.		
12 M 3.3.04	Creating Equations	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.		
12 M 3.4.01	Reasoning with Equations and Inequalities	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.		
12 M 3.4.02	Reasoning with Equations and Inequalities	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.		
12 M 3.4.03	Reasoning with Equations and Inequalities	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.		
12 M 3.4.04	Reasoning with Equations and Inequalities	Solve quadratic equations in one variable.		
12 M 3.4.05	Reasoning with Equations and Inequalities	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.		
12 M 3.4.06	Reasoning with Equations and Inequalities	Solve quadratic equations by inspection, 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 $a + bi$ for real numbers a and b .		
12 M 3.4.07	Reasoning with Equations and Inequalities	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.		
12 M 3.4.08	Reasoning with Equations and Inequalities	Solve systems of linear equations exactly and approximately (e.g. with graphs), focusing on pairs of linear equations in two variables.		
12 M 3.4.09	Reasoning with Equations and Inequalities	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.		
12 M 3.4.10	Reasoning with Equations and Inequalities	Represent a system of linear equations as a single matrix equation in a vector variable.		
12 M 3.4.11	Reasoning with Equations and Inequalities	Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimensions 3×3 or greater).		
12 M 3.4.12	Reasoning with Equations and Inequalities	Understand that the graph of an equation in two variables is set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).		
12 M 3.4.13	Reasoning with Equations and Inequalities	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.		
12 M 3.4.14	Reasoning with Equations and Inequalities	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		
12 M 4	FUNCTIONS			
12 M 4.1.01	Interpreting Functions	Understand the concept of a function and use function notation		
12 M 4.1.02	Interpreting Functions	Interpret functions that arise in applications in terms of the context		
12 M 4.1.03	Interpreting Functions	Analyze functions using different representations		
12 M 4.2.01	Building Functions	Build a function that models a relationship between two quantities		
12 M 4.2.02	Building Functions	Build new functions from existing functions		
12 M 4.3.01	Linear, Quadratic, and Exponential Models	Construct and compare linear, quadratic, and exponential models and solve problems		
12 M 4.3.02	Linear, Quadratic, and Exponential Models	Interpret expressions for functions in terms of the situation they model		

Identifier	Poplar - Grade 12 - Mathematics		Introduced	Completed
12 M 4.4.01	Trigonometric Functions	Extend the domain of trigonometric functions using the unit circle		
12 M 4.4.02	Trigonometric Functions	Model periodic phenomena with trigonometric functions		
12 M 4.4.03	Trigonometric Functions	Prove and apply trigonometric identities		
12 M 5	GEOMETRY			
12 M 5.1.01	Congruence	Experiment with transformations in the plane		
12 M 5.1.02	Congruence	Understand congruence in terms of rigid motions		
12 M 5.1.03	Congruence	Prove geometric theorems		
12 M 5.1.04	Congruence	Make geometric constructions		
12 M 5.2.01	Similarity, Right Triangles, and Trigonometry	Understand similarity in terms of similarity transformations		
12 M 5.2.02	Similarity, Right Triangles, and Trigonometry	Prove theorems involving similarity		
12 M 5.2.03	Similarity, Right Triangles, and Trigonometry	Define trigonometric ratios and solve problems involving right triangles		
12 M 5.2.04	Similarity, Right Triangles, and Trigonometry	Apply trigonometry to general triangles		
12 M 5.3.01	Circles	Understand and apply theorems about circles		
12 M 5.3.02	Circles	Find arc lengths and areas of sectors of circles		
12 M 5.4.01	Expressing Geometric Properties with Equations	Translate between the geometric description and the equation for a conic section		
12 M 5.4.02	Expressing Geometric Properties with Equations	Use coordinates to prove simple geometric theorems algebraically		
12 M 5.5.01	Geometric Measurement and Dimension	Explain volume formulas and use them to solve problems		
12 M 5.5.02	Geometric Measurement and Dimension	Visualize relationships between two-dimensional and three-dimensional objects		
12 M 5.6.01	Modeling with Geometry	Apply geometric concepts in modeling situations		
12 M 6	STATISTICS AND PROBABILITY			
12 M 6.1.01	Interpreting Categorical and Quantitative Data	Summarize, represent, and interpret data on a single count or measurement variable		
12 M 6.1.02	Interpreting Categorical and Quantitative Data	Summarize, represent, and interpret data on two categorical and quantitative variables		
12 M 6.1.03	Interpreting Categorical and Quantitative Data	Interpret linear models		
12 M 6.2.01	Making Inferences and Justifying Conclusions	Understand and evaluate random processes underlying statistical experiments		
12 M 6.2.02	Making Inferences and Justifying Conclusions	Make inferences and justify conclusions from sample surveys, experiments and observational studies		
12 M 6.3.01	Conditional Probability and the Rules of Probability	Understand independence and conditional probability and use them to interpret data		
12 M 6.3.02	Conditional Probability and the Rules of Probability	Use the rules of probability to compute probabilities of compound events in a uniform probability model		
12 M 6.4.01	Using Probability to Make Decisions	Calculate expected values and use them to solve problems		
12 M 6.4.02	Using Probability to Make Decisions	Use probability to evaluate outcomes of decisions		