Imlay City High School Pre-Calculus and Trigonometry Alignment Record
Textbook: Houghton Mifflin "Pre-Calculus 7th Edition"

HSCE Code	Expectation	Textbook Chapter-Section
P1	**Functions**	
P1.1	Know and use a definition of a function to decide if a given relation is a function.	1.1, 1.2, 1.3, 1.4, 1.5, 1.6
P1.2	Perform algebraic operations (including compositions) on functions and apply transformations (translations, reflections, and rescalings).	1.8
P1.3	Write an expression for the composition of one given function with another and find the domain, range, and graph of the composite function. Recognize components when a function is composed of two or more elementary functions.	1.7, 1.8
P1.4	Determine whether a function (given symbolically or graphically) has an inverse and express the inverse and express the inverse (symbolically, if the function is given symbolically, or graphically, if given graphically) if it exists. Know and interpret the function notation for inverses.	1.9
P1.5	Determine whether two given functions are inverses, using composition.	1.9
P1.6	Identify and describe discontinuities of a function (e.g., greatest integer function, 1/x) and how these relate to the graph.	1.5
P1.7	Understand the concept of limit of a function as *x* approaches a number or infinity. Use the idea of limit to analyze a graph as it approaches an asymptote. Compute limits of simple functions (e.g., find the limit as *x* approaches 0 of $f(x) = 1/x$) informally.	1.5
P1.8	Explain how the rates of change of functions in different families (e.g., linear functions, exponential functions, etc.) differ, referring to graphical representations.	1.5, 1.10
P2	**Exponential and Logarithmic Functions**	
P2.1	Use the inverse relationship between exponential and logarithmic functions to solve equations and problems.	3.1, 3.2
P2.2	Graph logarithmic functions. Graph translations and reflections of these functions.	3.2
P2.3	Compare the large-scale behavior of exponential and logarithmic functions with different bases and recognize that different growth rates are visible in the graphs of the functions	3.3
P2.4	Solve exponential and logarithmic equations when possible, (e.g. $5x=3(x+1)$). For those that cannot be solved analytically, use graphical methods to find approximate solutions.	3.4, 3.5
P2.5	Explain how the parameters of an exponential or logarithmic model relate to the data set or situation being modeled. Find an exponential or logarithmic function to model a given data set or situation. Solve problems involving exponential growth and decay.	3.4, 3.5
P3	**Quadratic Functions**	
P3.1	Solve quadratic-type equations (e.g. $e2x$-4 ex+4=0) by substitution.	2.1
P3.2	Apply quadratic functions and their graphs in the context of motion under gravity and simple optimization problems.	2.1, 2.2
P3.3	Explain how the parameters of an exponential or logarithmic model relate to the data set or situation being modeled. Find a quadratic function to model a given data set or situation.	2.2
P4	**Polynomial Functions**	
P4.1	Given a polynomial function whose roots are known or can be calculated, find the intervals on which the function's values are positive and those where it is negative.	2.2
P4.2	Solve polynomial equations and inequalities of degree greater than or equal to three. Graph polynomial functions given in factored form using zeros and their multiplicities, testing the	2.2

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	sign-on intervals and analyzing the function's large-scale behavior.	
P4.3	Know and apply fundamental facts about polynomials: the Remainder Theorem, the Factor Theorem, and the Fundamental Theorem of Algebra.	2.3, 2.4, 2.5
P5	**Rational Functions and Difference Quotients**	
P5.1	Solve equations and inequalities involving rational functions. Graph rational functions given in factored form using zeros, identifying asymptotes, analyzing their behavior for large *x* values, and testing intervals.	2.6
P5.2	Given vertical and horizontal asymptotes, find an expression for a rational function with these features.	2.6
P5.3	Know and apply the definition and geometric interpretation of difference quotient. Simplify difference quotients and interpret difference quotients as rates of change and slopes of secant lines.	2.7
P6	**Trigonometric Functions**	
P6.1	Define (using the unit circle), graph, and use all trigonometric functions of any angle. Convert between radian and degree measure. Calculate arc lengths in given circles.	4.1, 4.2, 4.3, 4.4
P6.2	Graph transformations of the sine and cosine functions (involving changes in amplitude, period, midline, and phase) and explain the relationship between constants in the formula and transformed graph.	4.5
P6.3	Know basic properties of the inverse trigonometric functions sin-1 *x*, cos-1 *x*, tan-1 *x*, including their domains and ranges. Recognize their graphs.	4.7
P6.4	Know the basic trigonometric identities for sine, cosine, and tangent (e.g., the Pythagorean identities, sum and difference formulas, co-functions relationships, double angle and half-angle formulas).	5.1, 5.2
P6.5	Solve trigonometric equations using basic identities and inverse trigonometric functions.	5.2, 5.3
P6.6	Prove trigonometric identities and derive some of the basic ones (e.g., double-angle formula from sum and difference formulas, half-angle formula from double angle formula, etc.).	5.2, 5.3, 5.4, 5.5
P6.7	Find a sinusoidal function to model a given data set or situation and explain how the parameters of the model relate to the data set or situation.	5.4, 5.5
P7	**Vectors, Matrices, and Systems of Equations.**	
P7.1	Perform operations (addition, subtraction, and multiplication by scalars) on vectors in the plane. Solve applied problems using vectors.	6.3
P7.2	Know and apply the algebraic and geometric definitions of the dot product of vectors.	6.4
P7.3	Know the definitions of matrix addition and multiplication. Add, subtract, and multiply matrices. Multiply a vector by a matrix.	6.3, 6.4
P7.4	Represent rotations of the plane as matrices and apply to find the equations of rotated conics.	7.3, 10.5
P7.5	Define the inverse of a matrix and compute the inverse of two-by-two and three-by-three matrices when they exist.	8.3
P7.6	Explain the role of determinants in solving systems of linear equations using matrices and compute determinants of two-by-two and three-by-three matrices.	8.3
P7.7	Write systems of two and three linear equations in matrix form. Solve such systems using Gaussian elimination or inverse matrices.	7.3
P7.8	Represent and solve systems of inequalities in two variables and apply these methods in linear programming situations to solve problems.	7.5, 7.6
P8	**Sequences, Series, and Mathematical Induction**	
P8.1	Know, explain, and use sigma and factorial notation.	9.1, 9.2, 9.3
P8.2	Given an arithmetic, geometric, or recursively defined sequence, write an	9.2, 9.3

	expression for the *n*th term when possible. Write a particular term of a sequence when given the *n*th term.	
P8.3	Understand, explain, and use the formulas for the sums of finite arithmetic and geometric sequences.	9.2, 9.3
P8.4	Compute the sums of infinite geometric series. Understand and apply the convergence criterion for geometric series.	9.3
P8.5	Understand and explain the principle of mathematical induction and prove statements using mathematical induction.	9.4
P8.6	Prove the binomial theorem using mathematical induction. Show its relationships to Pascal's triangle and to combinations. Use the binomial theorem to find terms in the expansion of a binomial to a power greater than 3.	9.5, 9.6
P9	**Polar Coordinates, Parameterizations, and Conic Sections**	
P9.1	Convert between polar and rectangular coordinates. Graph functions given in polar coordinates.	10.7, 10.8
P9.2	Write complex numbers in polar form. Know and use De Moivre's Theorem.	10.7
P9.3	Evaluate parametric equations for given values of the parameter.	10.8
P9.4	Convert between parametric and rectangular forms of equations.	10.8
P9.5	Graph curves described by parametric equations and find parametric equations for a given graph.	10.8, 10.9
P9.6	Use parametric equations in applied contexts (e.g., orbits and projectiles) to model situations and solve problems.	10.8, 10.9
P9.7	Know, explain, and apply the locus definitions of parabolas, ellipses, and hyperbolas and recognize these conic sections in applied situations.	10.3, 10.4
P9.8	Identify parabolas, ellipses, and hyperbolas from equations, write the equations in standard form, and sketch an appropriate graph of the conic section.	10.2, 10.3, 10.4
P9.9	Derive the equation for a conic section from given geometric information (e.g., find the equation of an ellipse given its two axes). Identify key characteristics (e.g. foci and asymptotes) of a conic section from its equation or graph.	10.3, 10.4
P9.10	Identify conic sections whose equations are in polar or parametric form.	10.6, 10.7