HUDSONVILLE HIGH SCHOOL COURSE FRAMEWORK

COURSE / SUBJECT Precalculus (A)

KEY COURSE OBJECTIVES/ENDURING UNDERSTANDINGS	OVERARCHING/ESSENTIAL SKILLS OR QUESTIONS
Functions and Graphs Polynomial, Power, and Rational Functions Exponential, Logistic, and Logarithmic Functions Trigonometric Functions	Make sense of problems and persevere in solving them. Reason abstractly and quantitatively. Construct viable arguments and critique the reasoning of others. Model with mathematics. Use appropriate tools strategically. Attend to precision. Look for and make use of structure. Look for and express regularity in repeated reasoning.

PACING	LESSON	STANDARD	LEARNING TARGETS	KEY CONCEPTS
Chapter 1 *Functions and Graphs* (11 days)	1.1 *Modeling and Equation Solving*	P1	Use numerical, algebraic, and graphical models to solve problems and will be able to translate from one model to another.	Mathematical Models; Zero Factor Property; Problem Solving
	1.2 *Functions and Their Properties*	P1.1 P1.6	Represent functions numerically, algebraically, and graphically, determine the domain and range for functions, and analyze function characteristics.	Function definition, notation, domain, range, continuity, increasing, decreasing, boundedness, local & absolute extrema, symmetry (even, odd, & neither), asymptotes, end behavior; Vertical Line Test
	1.3 *Twelve Basic Functions*	P1	Recognize and sketch graphs of twelve basic functions, and know their characteristics.	Functions x, x^2, x^3, $1/x$, $\sqrt{x}$, $\lvert x\rvert$, e^x, $\ln x$, $\sin x$, $\cos x$, $\operatorname{int} x$, logistic
	1.4 *Building Functions from Functions*	P1.2 P1.3	Build new functions from basic functions by adding, subtracting, multiplying, dividing, and composing functions.	$f+g, f-g, fg, f/g$ $f \circ g = f\left(g(x)\right)$ $g \circ f = g\left(f(x)\right)$
	1.5 *Parametric Relations and Inverses*	P1.4 P1.5 P9.3 P9.4	Define functions and relations parametrically and will be able to find inverses of functions and relations.	Parametric relations; finding an algebraic relationship; inverse relations and functions; Horizontal Line Test
	1.6 *Graphical Transformations*	P1.2 P2.2	Algebraically and graphically represent translations, reflections, stretches & shrinks, and absolute value compositions of functions, and their combinations.	Translations (horizontal, vertical), reflections (across x and y axes), stretches & shrinks (horizontal, vertical), $y = f\left(\lvert x\rvert\right)$, $y = \lvert f(x)\rvert$
	1.7 *Modeling With Functions*	P1	Identify appropriate basic functions with which to model real-world problems and be able to produce specific functions to model formulas and verbal descriptions.	Finding functions from formulas and verbal descriptions; writing and solving an equation for a problem

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Chapter 2 *Polynomial, Power, and Rational Functions* (14 days)	2.1 *Linear and Quadratic Functions and Modeling*	P1.8 P3.2 P3.3 P5.3	Recognize, graph, and determine linear and quadratic functions, and use them in modeling and problem solving.	Polynomial, linear ($y = ax + b$), and quadratic ($y = ax^2 + bx + c$ and $y = a(x-h)^2 + k$) functions & regression
	2.2 *Power Functions with Modeling*	P1	Sketch, write, analyze, and apply power functions in various settings.	Power function $y = kx^a$; direct & inverse variation; applications of power functions
	2.3 *Polynomial Functions of Higher Degree with Modeling*	P1.7 P4.2	Graph and write polynomial functions, predict their behavior, and find their real zeros using graphical and algebraic methods.	Polynomial functions and their degree, coefficients, form, shape, behavior (including limits), zeros & multiplicity
	2.4 *Real Zeros of Polynomial Functions*	P4.3	Divide polynomials using long division and synthetic division, apply the Remainder and Factor Theorems, and find real zeros algebraically and graphically.	Polynomial long and synthetic division; quotient-divisor-remainder relationship; finding exact zeros & factoring algebraically & graphically
	2.5 *Complex Zeros and the Fundamental Theorem of Algebra*	P4.3	Find and factor polynomials with real coefficients using factors with real and complex coefficients.	Complex zeros (conjugates); linear factorization; finding real coefficient polynomials from zeros
	2.6 *Graphs of Rational Functions*	P1.7 P5.1	Describe the graphs of rational functions, identify any horizontal and vertical asymptotes, and predict the end behavior.	Domain and transformation of rational functions including vertical and end behavior asymptotes (with limits); finding *x*- an *y*-intercepts
	2.7 *Solving Equations in One Variable*	P5.1	Solve equations involving fractions both algebraically and graphically, and identify extraneous solutions.	Solving equations by clearing fractions; extraneous solutions
	2.8 *Solving Inequalities in One Variable*	P4.1 P4.2 P5.1	Solve inequalities involving polynomials and rational functions both algebraically and graphically.	Solving inequalities by factoring, if needed, and using a sign chart

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Chapter 3 *Exponential, Logistic, and Logarithmic Functions* (10 days)	3.1 *Exponential and Logistic Functions*	P2.5	Evaluate exponential expressions and identify, graph, and describe, exponential functions and logistic growth functions	Exponential function $y = ab^x$ characteristics, including growth and decay; rules of exponential expressions; logistic growth function characteristics
	3.2 *Exponential and Logistic Modeling*	P2.5	Find exponential growth & decay functions, a logistic growth function, and use regression to model real-life problems.	Exponential population model; exponential growth & decay rates; initial value; logistic growth model
	3.3 *Logarithmic Functions and Their Graphs*	P2.2	Change between logarithmic and exponential form, evaluate natural & common logarithms, graph and describe logarithmic functions.	Converting between logarithmic and exponential form; basic properties of logarithms; characteristics of logarithmic functions
	3.4 *Properties of Logarithmic Functions*	P2.3 P2.5	Apply the properties of logarithms to evaluate & rewrite expressions and describe & graph logarithmic functions.	Expanding and condensing a logarithmic expression; change of base formula for logarithms
	3.5 *Equation Solving and Modeling*	P2.1 P2.4 P2.5 P3.1 P3.3	Solve exponential and logarithmic equations algebraically and graphically including applications.	Solving exponential equations with the same base ($2^{x+1} = 8^x$) and otherwise ($5e^{3x} = 10$); solving logarithmic equations; orders of magnitude; Richter Scale; selecting a regression model
	3.6 *Mathematics of Finance*	P2	Use exponential functions and formulas to solve business and finance applications related to compound interest and annuities.	Compound interest formula; annuity future value; present value of loan

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Chapter 4 (except 4.6) *Trigonometric Functions* (15 days)	4.1 *Angles and Their Measures*	P6.1	Convert between radians and degrees, work with degrees-minutes-seconds, find arc length, convert to nautical miles, and solve problems relating angular to linear speed.	Degrees-minutes-seconds relationship; degree-radian conversion; arc length formula; angular-linear motion conversion; nautical vs statute miles
	4.2 *Trigonometric Functions of Acute Angles*	P6.1	Apply the six trigonometric functions to right triangles, including special right triangles and applications.	Trigonometric ratios (sine, cosine, tangent, cosecant, secant, & cotangent); 30° – 60° – 90° & 45° – 45° – 90° triangles; solving a right triangle
	4.3 *Trigonometry Extended: The Circular Functions*	P6.1	Solve varied problems involving the circular trigonometric functions of real numbers.	Standard position angles (+ & −); coterminal angles; trigonometric functions of any real number angle using a reference triangle and the unit circle; periodic functions
	4.4 *Graphs of Sine and Cosine: Sinusoids*	P6.2 P6.7	Describe, graph, transform, and model the sine and cosine functions.	Sine and cosine functions; amplitude, period, phase shift, vertical shift, and frequency of sinusoids; modeling phenomena with sinusoids
	4.5 *Graphs of Tangent, Cotangent, Secant, and Cosecant*	P6	Describe and graph the tangent, cotangent, secant, and cosecant functions.	Tangent, cotangent, secant, & cosecant functions and their characteristics
	4.7 *Inverse Trigonometric Functions*	P6.3 P6.5	Relate the concept of inverse functions to the trigonometric functions to evaluate and graph them.	Inverse trigonometric functions arcsine, arccosine, and arctangent including notation, domain, and range; evaluate inverse trigonometric expressions
	4.8 *Solving Problems with Trigonometry*	P6.5 P6.7	Apply the concepts of trigonometry to solve real-world problems.	Right triangle trigonometry problems involving (i) the angle of elevation or depression, (ii) indirect measurements, and (iii) harmonic & circular motion