

**Precalculus 1 - High School
CURRICULUM MAP**

INSTRUCTIONAL TIME PERIOD	SKILLS/OUTCOMES	ASSESSMENT
Unit A	<i>Review of Fundamental Concepts of Algebra</i> The students will be able to: 1. Classify real numbers. 2. Represent inequalities using interval notation. 2. Evaluate algebraic expressions. 4. Simplify exponential expressions using their properties. 5. Simplify radical expressions using their properties. 6. Perform basic operations with polynomials. 7. Factor polynomials. 8. Find the domain of rational functions. 9. Simplify rational expressions using their properties. 10. Perform basic operations with rational expressions. 11. Simplify complex fractions. 12. Simplify difference quotients. 13. Solve a variety of algebraic equations in family of functions. 14. Solve linear and absolute value inequalities. Standards: Review of standards addressed in Algebra 1 and Algebra 2	● Homework Problems ● Mid-Chapter Quiz ● End-Chapter Test
Unit 1	<i>Functions and Their Graphs</i> The students will be able to: 1. Plot and identify points on a Cartesian plane. 2. Find missing side lengths of a right triangle using the Pythagorean Theorem. 3. Calculate the distance between two points using the distance formula. 4. Find the midpoint of a segment using the midpoint formula. 5. Find x and y intercepts of a variety of graphs. 6. Test equations for symmetry using graphical and algebraic methods. 7. Write equations of circles in standard form. 8. Write and graph linear equations in two variables. 9. Determine if equations are functions. 10. Evaluate functions, including piecewise functions.	● Homework Problems ● Mid-Chapter Quiz ● End-Chapter Test

	11. Evaluate difference quotients. 12. Analyze graphs of functions (zeros, increasing/decreasing intervals, relative min/max). 13. Calculate average rate of change for non-linear functions. 14. Use algebraic tests to determine if a function is even or odd. 15. Graph and identify 8 basic parent functions. 16. Graph the greatest integer function and piecewise functions. 17. Perform transformations on all function types. 18. Perform basic operations with functions. 19. Compose functions and identify the domain. 20. Find and graph inverse functions. 21. Determine if a function is 1-1 using the horizontal line test. 22. Model direct variation, inverse variation, and joint variation. 23. Find a least squares regression line and use it to make predictions. Standards: Algebra: M.A.APR.B.3, M.A.CED.A.2 Functions: M.F.BF.A.1.b, M.F.BF.A.1.C, M.F.BF.B.3, M.F.BF.B.4, M.F.IF.A.1, M.F.IF.A.2, M.F.IF.B.4, M.F.IF.B.5, M.F.IF.B.6, M.F.IF.C.7	
Unit 2	<i>Polynomial and Rational Functions</i> The students will be able to: 1. Analyze, write, and graph quadratic functions. 2. Sketch graphs of polynomial functions using zeros and the leading coefficient test. 3. Use the intermediate value theorem. 4. Perform basic operations with complex numbers. 5. Simplify imaginary numbers using complex conjugates. 6. Perform polynomial long division and synthetic division. 7. Use the remainder and factor theorems to factor polynomials and find zeros. 8. Use the Fundamental Theorem of Algebra to determine the number of zeros a function contains. 9. Find rational zeros using the rational zeros test. 10. Write polynomial functions based on a given set of zeros. 11. Use possible rational zeros to factor polynomial functions over real numbers, over complex numbers, and over rational numbers. 12. Find the domain, horizontal asymptotes, and vertical asymptotes of rational functions. 13. Graph rational functions. 14. Determine if a function has a slant asymptote and use that information to graph the function. 15. Solve polynomial inequalities using interval tests.	• Homework Problems • Mid-Chapter Quiz • End-Chapter Test

	Standards: Number and Quantity: M.N.CN.A.1, M.N.CN.A.2, M.N.CN.A.3, M.N.CN.C.7, M.N.CN.C.8, M.N.CN.C.9 Algebra: M.A.SSE.B.3a-b, M.A.APR.B.2, M.A.APR.B.3, M.A.APR.D.6 Functions: M.F.IF.B.4, M.F.IF.C.7, M.F.IF.C.8, M.F.IF.C.8a	
Unit 3	<i>Exponential and Logarithmic Functions</i> The students will be able to: 1. Graph and transform exponential, logarithmic, and natural base functions. 2. Calculate compound interest. 3. Use properties of logarithms to evaluate logarithmic equations. 4. Approximate logarithms using the change of base formula. 5. Expand and condense logarithmic expressions using properties. 6. Solve exponential and logarithmic equations. 7. Use the five common types of exponential and logarithmic functions to model real world scenarios. Standards: Functions: M.F.LE.B.5, M.F.BF.B.5, M.F.IF.C.7e, M.F.BF.B.3, M.F.LE.A.4	• Homework Problems • Mid-Chapter Quiz • End-Chapter Test
Unit 4	<i>Trigonometry</i> The students will be able to: 1. Identify the six basic trig ratios. 2. Find missing pieces of right triangles using basic trig ratios. 3. Apply special angle trig ratios to solve real world problems. 4. Write equivalent trig expressions relating sine, cosine, and tangent. 5. Draw positive and negative angles in standard position. 6. Convert degrees to radians and vice versa. 7. Find coterminal angles, degrees, or radians. 8. Use arc length and the area of a sector to solve real world problems. 9. Apply the reciprocal and Pythagorean identities to find equivalent trigonometric values. 10. Approximate trigonometric functions using the calculator. 11. Evaluate trig functions using the unit circle. 12. Identify functions as even or odd and use that information to evaluate. 13. Memorize unit circle values. 14. Evaluate trig functions for any given angle. 15. Use reference angles to evaluate trig functions. 16. Graph sine and cosine functions using amplitude, period, and phase shifts. 17. Graph tangent and cotangent functions using x-intercepts and vertical asymptotes. 18. Graph cosecant and secant functions using properties of reciprocals.	• Homework Problems • Mid-Chapter Quiz • End-Chapter Test

	19. Graph damped trig functions. 20. Graph inverse trig functions. 21. Compose trig functions and evaluate their result. 22. Apply knowledge of trigonometric functions to real world scenarios. Standards: Functions: M.F.BF.A.1, M.F.BF.A.1c, M.F.BF.B.3, M.F.BF.B.4 , M.F.IF.A.2, M.F.IF.B.4 , M.F.IF.C.7e , M.F.TF.A.1, M.F.TF.A.2, M.F.TF.A.3, M.F.TF.A.4, M.F.TF.B.5, M.F.TF.B.6, M.F.TF.B.7 Geometry: M.G.SRT.C.6, M.G.SRT.C.7 , M.G.SRT.C.8	
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Wisconsin Academic Standards for Math Covered in Precalculus I - Essential Standards are in RED

Number and Quantity

- M.N.CN.A.1 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. Understand why complex numbers exist.
- M.N.CN.A.2 (+) Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
- M.N.CN.A.3 (+) Find the conjugate of a complex number; use conjugates to find moduli (absolute values) and quotients of complex numbers.
- M.N.CN.C.7 Solve quadratic equations with real coefficients that have complex solutions. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b .
- M.N.CN.C.8 (+) Extend polynomial identities to the complex numbers.
- M.N.CN.C.9 (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

Algebra

- M.A.APR.B.2 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 $p(x)$.
- **M.A.APR.B.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.**
- **M.A.APR.D.6 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.**
- **M.A.CED.A.2 (F2Y) Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.**

- M.A.SSE.B.3 (F2Y) Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
 - a. Factor a quadratic expression to reveal the zeros of the function it defines.
 - b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
 - c. Use the properties of exponents to transform expressions for exponential functions.

Functions

- M.F.IF.A.1 (F2Y) Understand that a function from one set, discrete or continuous, (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range.
- M.F.IF.A.2 (F2Y) Use function notation, evaluate functions. and interpret statements that use function notation in terms of a context.
- M.F.IF.B.4 (F2Y) For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.
- M.F.IF.B.5 Relate the domain of a function to its graph and find an appropriate domain (discrete or continuous) in the context of the given problem.
- M.F.IF.B.6 Calculate and interpret the average rate of change of a linear or nonlinear function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
- M.F.IF.C.7 M.F.IF.C.7a (F2Y) Graph functions expressed symbolically and show key features of the graph using an efficient method.
 - b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
 - c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
 - d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
 - e. Graph logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
- M.F.IF.C.8 (F2Y) Write a function defined by an expression in equivalent forms to reveal and explain different properties of the function.
 - a. Use an efficient process to rewrite $f(x) = ax^2 + bx + c$ as $f(x) = a(x-h)^2 + k$ or $f(x) = a(x-p)(x-q)$ to determine the characteristics of the function and interpret these in terms of a context.
 - b. Use the properties of exponents to interpret expressions for exponential functions.
- M.F.BF.A1 Write a function that describes a relationship between two quantities.
 - a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
 - b. Combine standard function types using arithmetic operations.
 - c. Work with composition of functions using tables, graphs and symbols.
- M.F.BF.B.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ using transformations for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.
- M.F.BF.B.4 Identify and create inverse functions, using tables, graphs, and symbolic methods to solve for the other variable.
- M.F.BF.B5 Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.
- M.F.LE.A.4 For exponential models, express as a logarithm the solution to $abc^t = d$ where a , c , and d are numbers and the base b is 2, 10, or e ; evaluate the logarithm using technology.
- M.F.LE.B.5 (F2Y) Interpret the parameters in a linear or exponential function in terms of a context.
- M.F.TF.A.1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
- M.F.TF.A.2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

- M.F.TF.A.3 (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi-x$, $\pi+x$, and $2\pi-x$ in terms of their values for x , where x is any real number.
- M.F.TF.A.4 (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.
- M.F.TF.B.5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
- M.F.TF.B.6 (+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.
- M.F.TF.B.7 (+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.

Geometry

- M.G.SRT.C.6 (F2Y) Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.
- M.G.SRT.C.7 (F2Y) Explain and use the relationship between the sine and cosine of complementary angles.
- M.G.SRT.C.8 (F2Y) Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.