Precalculus 2 - High School
CURRICULUM MAP

INSTRUCTIONAL TIME PERIOD	SKILLS/OUTCOMES	ASSESSMENT
Unit 5	***Analytic Trigonometry*** **The students will be able to:** 1. Recognize and write the fundamental trig identities. 2. Use the fundamental trig identities to evaluate, simplify, and rewrite trig expressions. 3. Verify trig identities using algebraic proofs. 4. Solve basic, quadratic, multiple-angle, and inverse trig functions. 5. Use sum and difference formulas to evaluate trig functions, verify identities, and solve trig equations. 6. Rewrite and evaluate trig functions using multiple-angle formulas. 7. Rewrite and evaluate trig functions using power-reducing formulas. 8. Use half-angle formulas to rewrite and evaluate trig functions. 9. Use product-to-sum and sum-to-product formulas. 10. Solve real world applications using trig formulas. **Standards:** **Algebra:** M.A.SSE.A.1 **Functions:** M.F.BF.A.1, M.F.BF.B.4, M.F.IF.A.2, M.F.IF.C.8	• Homework Problems • Mid-Chapter Quiz • End-Chapter Test
Unit 6	***Additional Topics in Trigonometry*** **The students will be able to:** 1. Apply the law of sines to solve oblique triangles, including real world applications. 2. Calculate the area of an oblique triangle. 3. Use the law of cosines to solve oblique triangles, including real world applications. 4. Find the area of triangles using Heron's formula. 5. Represent vectors as directed line segments. 6. Write the component forms of vectors. 7. Perform basic vector operations and represent them graphically. 8. Write vectors as linear combinations of unit vectors. 9. Find the direction angles of vectors. 10. Use vectors to model and solve real life problems. 11. Find and use properties of the dot product of two vectors. 12. Find the angle between two vectors and determine if they are orthogonal. 13. Write a vector as the sum of two vector components. 14. Use vectors to find the work done by a force.	• Homework Problems • Mid-Chapter Quiz • End-Chapter Test

	15. Connect complex numbers and trig functions. **Standards:** **Number and Quantity:** M.N.VM.A.1, M.N.VM.A.2, M.N.VM.A.3, M.N.VM.B.4, M.N.VM.B.5a-b **Geometry:** M.G.SRT.D.9, M.G.SRT.D.10, M.G.SRT.D.11	
Unit 7	***Systems of Equations and Inequalities*** **The students will be able to:** 1. Solve systems of linear and nonlinear equations using substitution. 2. Solve systems of equations in two variables by graphing. 3. Use elimination to solve systems of linear equations and determine the number of solutions. 4. Use substitution or elimination to solve multi-variable linear systems. 5. Recognize and find partial fraction decompositions of rational expressions. 6. Graph and solve systems of inequalities. 7. Solve real world linear programming problems. **Standards:** **Algebra:** M.A.REI.C.5, M.A.REI.C.6, M.A.REI.C.7, M.A.REI.D.11, M.A.REI.D.12, M.A.CED.A.2, M.A.CED.A.3 **Functions:** M.F.IF.C.7	• Homework Problems • Mid-Chapter Quiz • End-Chapter Test
Unit 8	***Matrices and Determinants*** **The students will be able to:** 1. Write matrices and identify their dimensions. 2. Perform elementary row operations. 3. Use matrices and Gaussian elimination to multi-variable systems of linear equations. 4. Use matrices and Gauss-Jordan elimination to solve systems. 5. Add, subtract, and perform scalar multiplication on matrices. 6. Multiply two matrices. 7. Verify that two matrices are inverses of each other. 8. Use Gauss-Jordan elimination to find the inverses of matrices. 9. Use the formula to find the inverse of a 2 x 2 matrix. 10. Solve systems of linear equations using inverse matrices. 11. Find the determinants of square matrices. 12. Use Cramer's Rule to solve systems of linear equations. 13. Find the areas of triangles using determinants.	• Homework Problems • Mid-Chapter Quiz • End-Chapter Test

	14. Test for collinear points using a determinant then find the equation of the line. 15. Use matrices to encode and decode messages. **Standards:** **Number and Quantity:** M.N.VM.C.6, M.N.VM.C.7, M.N.VM.C.8, M.N.VM.C.9, M.N.VM.C.10, M.N.VM.C.12 **Algebra:** M.A.REI.C.5, M.A.REI.C.6, M.A.REI.C.7, M.A.CED.A.2, M.A.CED.A.3	
Unit 9	***Sequences, Series, and Probability*** **The students will be able to:** 1. Use sequence notation to write the terms of a sequence. 2. Use summation notation to write and find sums of infinite series. 3. Recognize, write, and find the nth terms of arithmetic sequences. 4. Find nth partial sums of arithmetic sequences. 5. Recognize, write, and find the nth terms of geometric sequences. 6. Find nth partial sums of geometric sequences. 7. Find the sum of an infinite geometric series. 8. Apply knowledge of sequences and series to model real life scenarios. 9. Use mathematical induction to prove statements involving a positive integer. 10. Recognize patterns and write the nth term of a sequence. 11. Find the sums of powers of integers. 12. Find finite differences of sequences. 13. Use the Binomial Theorem and Pascal's Triangle to calculate binomial coefficients. 14. Use binomial coefficients to write binomial expansions. 15. Solve counting problems using the fundamental counting principle, permutations, and combinations. 16. Find the probabilities of mutually exclusive, independent, and the complement of events. **Standards:** **Algebra:** M.A.SSE.B.4, M.A.APR.C.5 **Statistics and Probability:** M.SP.CP.A.1, M.SP.CP.A.2, M.SP.CP.B.9	• Homework Problems • Mid-Chapter Quiz • End-Chapter Test
Unit 10	***Topics in Analytic Geometry*** **The students will be able to:** 1. Find the inclination of a line. 2. Find the angle between two lines. 3. Find the distance between a point and a line. 4. Recognize a conic as an intersection of a plane and a double-napped cone.	• Homework Problems • Mid-Chapter Quiz • End-Chapter Test

	5. Write and graph equations of parabolas in standard form. 6. Use the reflective properties of parabolas to solve real life problems. 7. Write and graph equations of ellipses in standard form. 8. Find the eccentricity of ellipses. 9. Write and graph equations of hyperbolas in standard form. 10. Find asymptotes of hyperbolas. 11. Classify conics from their general equations. 12. Rotate the coordinate axis to eliminate the xy term in equations of conics. 13. Use the discriminant to classify conics. 14. Evaluate sets of parametric equations. 15. Sketch curves that are represented by sets of parametric equations. 16. Rewrite parametric equations as single rectangular equations. 17. Find sets of parametric equations for graphs. 18. Plot points on the polar coordinate system. 19. Convert points and equations between polar and rectangular. 20. Graph polar equations by point plotting or using symmetry. 21. Graph polar equations by finding zeros and maximum r values. 22. Recognize special polar graphs. 23. Define conics in terms of eccentricity. 24. Write and graph equations of conics in polar form. 25. Apply knowledge of conics to model real life problems. **Standards:** **Algebra:** M.A.SSE.A.2, M.A.CED.A.2 **Functions:** M.F.IF.C.7 **Geometry:** M.G.GPE.A.2, M.G.GPE.A.3, M.G.GMD.B.4	
Unit 12	***Limits and an Introduction to Calculus*** **The students will be able to:** 1. Estimate limits using the definition of a limit. 2. Determine whether limits of a function exist. 3. Use properties of limits and direct substitution to evaluate limits. 4. Evaluate limits of functions using various algebraic techniques. 5. Approximate limits graphically and numerically. 6. Evaluate one sided limits of functions. 7. Evaluate limits of difference quotients. 8. Approximate the slope of a graph at a given point using a tangent line.	• Homework Problems • Mid-Chapter Quiz • End-Chapter Test

	9. Calculate exact slopes of graphs using the limit definition of slope. 10. Find derivatives of functions and use them to find slopes of graphs. 11. Evaluate limits of functions at infinity. 12. Calculate limits of sequences. 13. Find limits of summations. 14. Use rectangles to approximate areas of plane regions. 15. Use limits of summations to find areas of plane regions. **Standards:** **Algebra:** M.A.SSE.A.2, M.A.CED.A.2	

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Wisconsin Academic Standards for Math Covered in Precalculus II - Essential Standards are in RED

Number and Quantity

- M.N.VM.A.1 (+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., v, |v|, ||v||, v).
- M.N.VM.A.2 (+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.
- M.N.VM.A.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors.
- M.N.VM.B.4 (+) Add and subtract vectors.
    - a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.
    - b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.
    - c. Understand vector subtraction v - w as v + (-w), where -w is the additive inverse of w, with the same magnitude as w and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.
- M.N.VM.B.5 (+) Multiply a vector by a scalar.
    - a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as $c(v_x, v_y) = (cv_x, cv_y)$.
    - b. Compute the magnitude of a scalar multiple cv using ||cv|| = |c|v. Compute the direction of cv knowing that when |c|v ≠ 0, the direction of cv is either along v (for c > 0) or against v (for c < 0).
- M.N.VM.C.6 (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.
- M.N.VM.C.7 (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.
- M.N.VM.C.8 (+) Add, subtract, and multiply matrices of appropriate dimensions.
- M.N.VM.C.9 (+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.
- M.N.VM.C.10 (+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.
- M.N.VM.C.12 (+) Work with 2 x 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.

Algebra

- M.A.SSE.A.1 (F2Y) Interpret expressions that represent a quantity in terms of its context.
  - A. Interpret parts of an expression, such as terms, factors, and coefficients.
  - B. Interpret complicated expressions by viewing one or more of their parts as a single entity.
- M.A.SSE.A.2 (F2Y) Use the structure of an expression to identify ways to rewrite it.
- 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.
- M.A.APR.C.5 (+) 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.
- 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.CED.A.3 (F2Y) 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.
- M.A.REI.C.5 (F2Y) Justify 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.
- M.A.REI.C.6 (F2Y) Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
- M.A.REI.C.7 (F2Y) Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.
- M.A.REI.D.11 (F2Y) 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.
- M.A.REI.D.12 (F2Y) 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.

Functions

- 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.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.4 Identify and create inverse functions, using tables, graphs, and symbolic methods to solve for the other variable.

Geometry

- M.G.SRT.D.9 (+) Derive the formula A = 1/2 ab sin(C) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
- M.G.SRT.D.10 (+) Prove the Laws of Sines and Cosines and use them to solve problems.
- M.G.SRT.D.11 (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).
- M.G.GPE.A.2 (+) Derive the equation of a parabola given a focus and directrix.
- M.G.GPE.A.3 (+) Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.
- M.G.GMD.C.4 (F2Y) [WI.2010. M.G.MG.A.1] Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

Statistics & Probability

- M.SP.CP.A.1 (F2Y) Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").
- M.SP.CP.A.2 (F2Y) Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
- M.SP.CP.B.9 (+) Use permutations and combinations to compute probabilities of compound events and solve problems.