Williamsville Central School District

Discipline: Mathematics
Course/Grade: <u>**Pre-Calculus A**</u> / High School
Final Exam: District Final Exam
Textbook: **Precalculus: Graphing and Data Analysis** By M. Sullivan
               Prentice Hall © 2001
               (ISBN: 0-13-093092-X)

Course Description:

Topics of study in all pre-calculus courses include: fundamental concepts of algebra, solving equations and inequalities, functions and graphs, polynomial functions, rational functions and functions involving radicals, exponential and logarithmic functions, trigonometric functions, matrices, sequences and series, and conic sections.

Pre-Calculus A thoroughly combines algebra and geometry to prepare students to undertake the study of calculus. Since functions are the foundations of calculus, this course has been specifically developed to give students a detailed understanding of elementary functions. The use of a graphing utility and the inclusion of realistic applications from the physical world, school environment, and from the quantitative world of mathematics, is an integral part of the fourth year mathematics course.

Pre-Calculus A focuses on the derivation, application, and extension of content found in Pre-Calculus R and includes additional topics of study. This course is highly recommended preparation for above-average, college bound student who is highly motivated.

Required Prerequisite:

Successful completion of "Algebra 2 & Trigonometry A" or "Algebra 2 & Trigonometry R" with notable achievement.

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Guide to Curriculum Related Vocabulary

Guaranteed and Viable Curriculum

Guaranteed: The guaranteed curriculum is what is **imperative** to teach – a curriculum that is communicated and assured to all groups; clear guidance to teachers regarding what knowledge is **expected** to be learned in courses or at grade levels.

Viable: a viable curriculum that can be realistically taught during the time available during the course of a school year. Its focus is on what is **essential vs. supplemental** to teach in a school year. It must be organized and sequenced to enable effective student learning – that is, to say, checking to make sure the essentials are being taught **AND** learned. The focus is on the standards that are most essential and demand the greatest amount of time.

Curriculum: the sequencing and pacing of essential declarative and procedural knowledge, common assessments along with the experiences students mush have with the content.

Power Performance Indicators

Power Performance Indicators: are essential parts of the curriculum and define the essential (inescapable) knowledge, understandings, skills, and processes of a particular course of study. They should be designated based on their endurance, leverage (capacity of the standard to be applied) and importance for higher level learning in the discipline.

Essential Components

Declarative Knowledge: Answers the questions, "What do students need to know and understand?" This includes: facts, concepts, principles, generalizations, cause/effect sequences, time sequences, and vocabulary terms.

Procedural Knowledge: Answers the questions, "What do students need to be able to do and at what level of application?" (i.e., Bloom's Taxonomy). This includes: skills and processes that result in construction of models, shaping of ideas, and internalization of knowledge (practice to achieve automaticity and fluency).

Key Vocabulary: Vocabulary deemed essential to the curriculum.

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Guide to Curriculum Design

Focus Questions
Focus questions provide specific content and facts about essential questions. They add depth and specificity, are answerable using the facts and materials of the unit, lead to particular understandings related to the topics of the unit, and provide for scaffolding leading to the essential questions.

Declarative Knowledge	Procedural Knowledge	Key Vocabulary
Answers the question… "What do students need to know and understand?" Includes facts, concepts, principles, generalizations, cause/effect sequences, time sequences, and vocabulary terms	Answers the question… "What do students need to be able to do and at what level of application?" Includes skills and processes that results in construction of models, shaping of ideas, and internalization of knowledge (Practice to achieve automaticity and fluency)	Vocabulary deemed essential to the curriculum

Williamsville's Learning Standard for Mathematics

In implementing the Pre-Calculus A curriculum, it is expected that students will identify and justify mathematical relationships, formally and informally. Local curriculum and local/state assessments must support and allow students to use any mathematically correct method when solving a problem.

Throughout this document the words *investigate, explore, discover, conjecture, reasoning, argument, justify, explain, proof,* and *apply*. Each of these terms is an important component in developing a student's mathematical reasoning ability. It is therefore important that a clear and common definition of these terms be understood. The order of these terms reflects different stages of the reasoning process.

Investigate/Explore - Students will be given situations in which they will be asked to look for patterns or relationships between elements within the setting.

Discover - Students will make note of possible patterns and generalizations that result from investigation/exploration.

Conjecture - Students will make an overall statement, thought to be true, about the new discovery.

Reasoning - Students will engage in a process that leads to knowing something to be true or false.

Argument - Students will communicate, in verbal or written form, the reasoning process that leads to a conclusion. A valid argument is the end result of the conjecture/reasoning process.

Justify/Explain - Students will provide an argument for a mathematical conjecture. It may be an intuitive argument or a set of examples that support the conjecture. The argument may include, but is not limited to, a written paragraph, measurement using appropriate tools, the use of dynamic software, or a written proof.

Proof - Students will present a valid argument, expressed in written form, justified by axioms, definitions, and theorems.

Apply - Students will use a theorem or concept to solve an algebraic or numerical problem.

Common Course Assessments

Assessment: is the means a teacher uses to determine whether or not students have learned the content, processes, and procedures required in the articulated guaranteed and viable curriculum. Assessment may be formative or summative in nature. It may also be used to screen or diagnose.

Formative Assessment: are designed to determine whether or not a student has grasped the curriculum that has been taught; it is assessment "for" learning and is administered at regular intervals; it is utilized to inform and adjust instruction "along the way." Formative assessments should be aligned to the summative assessment.

Benchmark assessments: are intended to measure the precise content of the curriculum that is intended to be learned in a given amount of time. They are typically administered about the time that grades are determined for a quarter or semester. Benchmark and common formative assessments are specific types of formative assessments. Examples: journal entries, exit tickets, performance tasks, quizzes, tests, projects

Common formative assessments are specifically designed by participating teachers of elementary grade level teams and secondary course/department teams who all teach the same content standards to their students. They provide a sharp focus for instruction and are directly linked to power standards.

Summative Assessment: occur at the end of a unit/course of study with the intent of evaluating student learning for reporting purposes. It is assessment "of" learning. Summative assessments are used to report final results to students, parents, and administrators. They typically support the assignment of grades and/or levels of proficiency. Examples: Unit tests, final examinations, final exhibitions

Screening Assessment: is an initial, first step to identify "red flags" and to inform whether a more thorough assessment is advisable. Example: Kindergarten screening test, ESL screening test

Diagnostic Assessment: is an in-depth assessment to identify special needs or areas where a student has a particular difficulty.

Rubric: A scoring guide that explains levels of performance and provides focus on the learning. A rubric should be designed to accompany all common assessments articulated in a curriculum. It serves as a guideline for rating student performance. Rubric types include holistic (general assessment of performance) and analytic (task specific).

Pre-Calculus A
Assessment Outline

Name of Assessment	Benchmark Formative	Common Formative	Summative	Screening	Diagnostic	Window of Admin.	Access of Results
Final Exam			X				

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Pre-Calculus A

<u>Unit 1</u>: **Fundamental Concepts of Algebra**

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 1	**Appendix Section 1-3** Algebra Review	Rules for exponents Rules for scientific notation Sets of numbers Natural ($\mathbb{N}$), Whole (W), Integer ($\mathbb{Z}$), Rational ($\mathbb{Q}$), Irrational (I), Complex ($\mathbb{C}$), Real ($\mathbb{R}$) Meaning of absolute value Rules for multiplying polynomials Recognize and actor the sum and difference of two cubes	Apply rules of exponents Write numbers in scientific notation Apply rules for multiplying polynomials Classify sets of numbers using correct notation Apply rules of factoring completely Use absolute value to find the distance on a number line	Exponents Scientific Notation Multiply Polynomials Sets of Numbers Natural ($\mathbb{N}$) Whole (W) Integer ($\mathbb{Z}$) Rational ($\mathbb{Q}$) Irrational (I) Complex ($\mathbb{C}$) Real ($\mathbb{R}$) Set Builder Notation Absolute Value Factoring
Day 2	**Appendix Section 4-6** Algebra Review	Long division of polynomials Synthetic division All types of factoring Solve equations by factoring	Use long division to find remainders Use synthetic division to determine roots and factors Factor with GCF, Difference of two Squares, trinomial to two binomials, sum and difference of two cubes and grouping Solve equations by factoring	Long Division Synthetic Division Factor by Grouping Roots Domain Zero Product Property

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 3	**Appendix Section 7** Algebra Review Rational Expressions	Operations with rational expressions Complex fractions Determining domain	Reduce to lowest terms, perform operations (add, subtract, multiply and divide) rational expressions List values where a rational expression is undefined Determine the domain of a rational expression	Domain Simplify Undefined Complex Fraction
Day 4	**Appendix Section 8** Algebra Review Radicals and Rational Exponents	Operations with radicals Properties of radicals Rationalize denominators and numerators Correct notation when writing a radical as an exponent	Perform operations with radicals (add, subtract, multiply and divide) and give answer in simplest form Rationalize denominators and numerators that include monomials and binomials Convert between radical notation and notation dealing with fractional exponents	Rationalize Radical

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 5	**Appendix Section 9** Geometry Review	Pythagorean Theorem and its converse Area and perimeter of basic figures Volume and surface area of basic solids	Determine lengths of sides of right triangles using Pythagorean Theorem Given lengths of the sides of a triangle, determine if the triangle is a right triangle using the converse of the Pythagorean Theorem Determine area and perimeter of 2-dimensional figures Determine volume and surface area of basic 3-dimensional figures	Hypotenuse Area Perimeter Surface Area Volume

Notes: Include 2 days for review and test.

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Unit 2: Graphs (Part 1)

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 1	**Section 1-1** Rectangular Coordinates; Graphing Utilities	Formula for distance between two points: $d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$ Midpoint formula: $\left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2}\right)$	Use the distance and midpoint formulas to solve geometry problems	Distance Midpoint

Day 2	**Section 1-2**
	Graphs of Equations
	
	Section 1-3
	Solving Equations
		x- and y-intercepts from a graph and algebraically
		
		Approximate solutions to equations
		
		Solving equations algebraically and graphically including:
		    Linear equations
		    Quadratic equations
		    Absolute value equations
		    Equations containing radicals
			List x- and y-intercepts using a graph as well as algebraically
			
			Find the solution to linear and quadratic equations algebraically (by factoring and by Quadratic Formula) and graphically (using a graphing calculator)
			
			Find the solution to equations containing absolute value expressions and radical expressions algebraically and graphically (using a graphing calculator)
				x-Intercept
				y-Intercept
				Symmetry
				Zero (Root)
				Extraneous Roots
				Quadratic Formula

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 3	**Section 1-4** Applications	Translate verbal descriptions into mathematical expressions

Equations can be written to model problems which include interest, mixture, uniform motion, constant rate job problems | Write equations and be able to solve verbal problems that include interest, mixture, uniform motions, constant rate job problems | Modeling Simple Interest Compound Interest Continuous Interest Velocity |
| **Day 4** | **Section 1-5** Solving Inequalities Interval Notation

Supplement: Solving Absolute Value Inequalities | Know how to solve inequalities algebraically and confirm solution graphically

Know how to write solutions to inequalities using correct inequality notation and correct interval notation

Know how to solve absolute value inequalities algebraically and confirm solution graphically

Know how to write solutions to absolute value inequalities using correct inequality notation and correct interval notation | Solve inequalities algebraically and confirm solution graphically (using a graphing calculator)

Write solutions to inequalities using correct inequality notation and correct interval notation

Solve absolute value inequalities algebraically and confirm solution graphically (using a graphing calculator)

Write solutions to absolute value inequalities using correct inequality notation and correct interval notation | Open-Interval Closed-Interval |

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 5	**Section 1-5** Additional Absolute value Inequalities and Application Problems	Translate verbal descriptions into mathematical expressions Equations can be written to model problems which include interest, mixture, uniform motion, constant rate job problems	Write equations and be able to solve verbal problems that include interest, mixture, uniform motions, constant rate job problems	

Notes: Include 2 days for review and test.

Unit 3: Graphs (Part 2)

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 1	**Section 1-6** Lines	Slope of a line Equation of a line in slope-intercept form, point-slope form and general form	Find the slope of a line using the slope formula or by looking at a graph Graph a line given a point and a slope Write the equation of a line given two points Write the equation of a line in slope-intercept form, point-slope form and general form	Slope General Form Slope-Intercept form Point-Slope Form
Day 2	**Section 1-6** Lines **Supplement**: Median, Altitude and Perpendicular Bisector	Slopes of parallel and perpendicular lines Equation of parallel and perpendicular lines to a given line Equations of median, altitude and perpendicular bisector of a triangle	Find and write the slope of a line parallel or perpendicular to a given line Find and write the equation of a line parallel or perpendicular to a given line Find and write the equations of median, altitude and perpendicular bisector of a triangle	Parallel Perpendicular Median Altitude Perpendicular Bisector

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 3	**Supplement**: Distance From a Point to a Line	Distance from a point to a line formula: $$d = \left\| \frac{Ax + By + C}{\sqrt{A^2 + B^2}} \right\|$$	Determine the distance from a point to a line geometrically and using the distance from a point to a line formula.	General Form
Day 4	**Applications**	Area of a triangle Distance between two parallel lines	Determine the area of a triangle given the vertices Determine the distance between two parallel lines given their equations	General Form Parallel
Day 5	**Applications** (Optional)	Tangent lines to a circle	Determine the equation of a line tangent to a circle	

Notes: Include 3 days for review (1 day for textbook topics and 1 day for supplemental topics) and test.

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Unit 4: Functions

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 1	**Section 2-1** Functions	Relation Function Vertical line test Evaluate a function Domain of a function Read and interpret graphs (domain, range, intercepts, evaluating function values)	Determine if a relation is a function using the vertical line test or by definition Evaluate a function Find the domain of a function algebraically Read and interpret graphs (domain, range, intercepts, evaluating function values)	Function Relation Domain Range Vertical Line test
Day 2	**Section 2-2** Characteristics of Functions	A function may contain parts that increase and/or decrease Local minimum or maximum Even or odd functions	Use a graphing calculator to determine when a function is increasing or decreasing Determine when a function is increasing or decreasing Use a graphing calculator to determine if a function has a local minimum or maximum Determine if a function is even or odd both graphically and algebraically	Increasing Decreasing Min Max Even Odd

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 3	**Section 2-2** More Even/Odd Average Rate of Change	Difference quotient (slope of a secant) Average rate of change of a function	Find the difference quotient (slope of secant) Find the average rate of change of a function	Difference Quotient Secant
Day 4	**Supplement**: Ten Basic Functions	Know how to graph and evaluate the twelve basic functions (see a list of the twelve in the vocabulary to the right) Memorize the domain and range of the twelve basic functions	Graph and evaluate the twelve basic functions List the domain and range of the ten basic functions	Identity Constant Reciprocal Absolute Value Signum Greatest Integer Quadratic Square Root Cubic Cube Root Logarithmic Exponential
Day 5	**Section 2-3** Piece-Wise Functions	Piece-wise functions Domain and range	Graph piece-wise functions by hand Determine a piece-wise function's domain and range Solve verbal problems using piece-wise functions	Piece-Wise Function

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 6	**Section 2-4** Transformations & Quiz (days 1-5)	Vertical and horizontal shifts, compressions and stretches and reflections about the *x*-axis or *y*-axis (parabolas only)	Graph parabolas using vertical and horizontal shifts, compressions and stretches and reflections about the *x*-axis or y-axis and list their domain and range	Transformation Vertical Shift Horizontal Shift Compression Stretch Reflection
Day 7	**Section 2-5** Composite Functions	Operations on functions Composite function Components of a composite function Domain of a composite function	Find the sum, difference, product and quotient of two or more functions Evaluate a composite function Find a composite function Show that two composite functions are equal Find the components of a composite function Determine the domain of a composite function	Composite Function
Day 8	**Review & Transformations** on Other Functions from the Ten Basic Functions	Graph functions using vertical and horizontal shifts, compressions and stretches and reflections about the *x*-axis or *y*-axis	Graph the twelve basic functions using vertical and horizontal shifts, compressions and stretches and reflections about the *x*-axis or *y*-axis and list their domain and range	

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 9	**Section 2-6** Mathematical Models	Verbal expressions may be represented as mathematical models	Solve verbal problems using equations and inequalities Construct and analyze function from verbal expressions	

Notes: Include 2 days for review and additional word problems and 2 days for testing (day 1 of test = Compositions and Verbal Problems; day 2 of test = Graphing Transformations and Verbal Problems).

Unit 5: Polynomial Functions

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 1	**Section 4-1** Zeros of a Polynomial Function	Remainder and Factor Theorems	Find the factors of a polynomial function Determine the zeros of a polynomial function Find the remainder when two polynomial functions are divided	Polynomial Function Zero Factor Remainder
Day 2	**Section 4-1**	Rational Roots Theorem	Find the rational roots of a polynomial function using the rational root theorem	Rational Root
Day 3	**Section 4-3** Complex Zeros & Fundamental Theorem of Algebra	Descartes Rule of Signs Write equation when given the zeros of a polynomial function	Find all of the zeros of a polynomial function Write the equation given the zeros of a polynomial function	Complex Number Double Root Conjugate
Day 4	**Section 4-4** Polynomial and Rational Inequalities	Quadratic inequalities Polynomial inequalities Rational inequalities	Solve Quadratic inequalities, polynomial inequalities and rational inequalities algebraically.	Rational Function Polynomial Function

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 5	**Section 4-4**	Quadratic inequalities Polynomial inequalities Rational inequalities.	Solve Quadratic inequalities, polynomial inequalities and rational inequalities algebraically and confirm with the graphing calculator	

Notes: Include 2 days for review and 1 day for the test.

Unit 6: Rational Functions

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Days 1-2	**Section 3-4** Rational Functions	Domain of a rational function Equations for any vertical asymptote, horizontal asymptote or slant (oblique) asymptote Points of discontinuity *x*- and *y*-intercepts of a rational function	Find the domain of a rational function Determine the equation for any vertical asymptote, horizontal asymptote or slant (oblique) asymptote Determine any points of discontinuity Find the *x*- and *y*-intercepts of a rational function	Rational Function Vertical Asymptote Horizontal Asymptote Slant/Oblique Asymptote
Days 3-4	**Section 3-5** Rational Functions: Analyzing Graphs	Graph of a rational function Applied problems involving rational functions Domain and range of rational functions	Analyze and sketch the graph of a rational function Solve applied problems involving rational functions Determine domain and range of rational functions (include physical constraints in real world application problems)	

Notes: Include 1 day for review and 1 day for the test.

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<u>Unit 7</u>: **Exponential Functions**

Pacing	**Section** Topic	**Declarative Knowledge** *"What do students need to know and understand?"*	**Procedural Knowledge** *"What do students need to be able to do and at what level of application?"*	**Key Vocabulary**
Day 1	**Section 5-1** One-to-One and Inverse Functions	One-to-one Inverse function Domain and range of a function and its inverse	Determine whether a function is one-to-one Obtain the graph of an inverse function from the graph of the function Find the domain and range of a function and its inverse	One-to-one Horizontal Line Test Inverse
Day 2	**Section 5-1** (continued)	Inverse functions	Prove two functions are inverses of each other	Composition
Day 3	**Section 5-2** Exponential Functions	Exponential Functions Graph exponential functions using transformations Exponential equations Definition of *e*	Graph exponential functions using transformations including base *e* Solve exponential equations	Exponential Function *e*
Day 4	**Section 5-3** Logarithmic Functions	Logarithmic Domain and range of a logarithmic function	Graph logarithmic functions using transformations Determine the domain and range of a logarithmic function	logarithm

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 5	**Section 5-4** Properties of Logarithms	Logarithms Exponential and logarithmic forms	Convert between Exponential and Logarithmic forms	Change of Base
Day 6	**Section 5-5** Logarithmic and Exponential Equations	Logarithmic equations and inequalities (include change of base) Exponential equations	Solve logarithmic and exponential equations and inequalities (include change of base) both algebraically and using a graphing calculator	
Day 7	**Section 5-6** Compound Interest Applications	Future value of a lump sum of money Effective rates of return Present value of a lump sum of money Time required to double or triple a lump sum of money	Determine the future value of a lump sum of money Calculate effective rates of return Determine the present value of a lump sum of money Determine the time required to double or triple a lump sum of money	Compound Interest Continuous Interest Effective Rate of Interest
Day 8	**Section 5-7** Growth and Decay Applications	Exponential growth and decay	Determine solutions to real world problems involving exponential growth and decay	Exponential Growth Exponential Decay Half Life

Notes: Include 2 days for review and 1 day for the test.

Unit 8: Trigonometric Functions

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 1	**Section 6-1 – 6-2** Angles and their Measure Unit Circle	Degrees and radians Length of the arc of a circle Exact value of a trigonometric function Approximate the value of a trigonometric function	Convert between degrees and radians Determine the length of the arc of a circle Find the exact value of a trigonometric function Use a graphing calculator to approximate the value of a trigonometric function	Degree Radian Sine Cosine Tangent Cosecant Secant Cotangent
Day 2	**Section 6-3 – 6-4** Properties of Trigonometric Functions Graphs of Sine and Cosine	Domain and range of the trigonometric functions Period of the trigonometric functions Exact value of the trigonometric functions Sine and cosine functions	Find the domain and range of the trigonometric functions Determine the period of the trigonometric functions Determine the exact value of the trigonometric functions Graph the sine and cosine functions using transformations by hand	Period Amplitude Phase Shift Exact Value

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 3	**Section 6-5** Graphs of Tangent, Cotangent, Secant and Cosecant Functions	Tangent and Cotangent Domain and range	Graph tangent and Cotangent using transformations and determine their domain and range	
Day 4	**Section 6.5** (continued)	Secant and Cosecant Domain and range	Graph Secant and Cosecant using transformations and determine their domain and range	

Notes: Include 1 day for review and 1 day for the test.

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<u>Unit 9</u>: **Inverses of Trigonometric Functions**

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 1	**Section 7-5** Inverse Trigonometric Functions I	Notation for inverse trigonometric functions (include Arc notation) Restricted domains for inverse sine, inverse cosine and inverse tangent $f(x) = \sin^{-1}(x)$, $f(x) = \cos^{-1}(x)$, $f(x) = \tan^{-1}(x)$ and their domain and range Asymptotes	Graph $f(x) = \sin^{-1}(x)$, $f(x) = \cos^{-1}(x)$, $f(x) = \tan^{-1}(x)$ and state their domain, range and equations of asymptotes, if any	Restricted Domain Inverse Sine Inverse Cosine Inverse Tangent ArcSine ArcCosine ArcTangent
Day 2	**Section 7-5** (continued) **Section 7-6** Inverse Trigonometric Functions II	$f(x) = \sin^{-1}(x)$, $f(x) = \cos^{-1}(x)$, $f(x) = \tan^{-1}(x)$ Exact value of expressions involving inverse trigonometric functions	Graph $f(x) = \sin^{-1}(x)$, $f(x) = \cos^{-1}(x)$, $f(x) = \tan^{-1}(x)$ using transformations and determine their domain and range Find the exact value of expressions involving inverse trigonometric functions algebraically	

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 3	**Section 7-7 – 7-8** Trigonometric Equations	Trigonometric equations Factoring	Solve equations involving trigonometric functions where solutions can be obtained by factoring	

Notes: Include 2 days for review and 1 day for the test.

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Unit 10A: Conic Sections – Parabola

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 1	**Section 10-1 – 10-2** Conics and The Parabola	Names of the conic sections Equation of a parabola in standard and general form Parabola	Names the conic sections Write the equation of a parabola in standard and general form. Graph a parabola with transformations and state the domain and range with horizontal or vertical directrix	Circle Parabola Ellipse Hyperbola Directrix Vertex Focus Right Chord Latus Rectum Axis of Symmetry
Day 2	**Section 10-2** (continued)	Equation of a parabola	Write the equation of a parabola given specific information	
Day 3	**Section 10-2** & Applications	Translate verbal problems into mathematical expressions and solve	Translate verbal problems into mathematical expressions and solve	
Day 4	**Section 10-2** (continued) **Supplement**: Degenerate case for Parabolas	Complete the square and identify the resulting equation as a parabola, two parallel lines or no graph	Complete the square and identify the resulting equation as a parabola, two parallel lines (write their equations) or no graph	Degenerate case

Notes: Include 1 day for review and 1 day for the test.

Unit 10B: Conic Sections - Ellipse

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 1	**Section 10-3** The Ellipse	Equation of an ellipse in standard form including transformations	Graph a ellipse with horizontal or vertical major axis using transformations and state the domain and range	Center Major Axis Minor Axis Latus Rectum Right Chord Vertices Eccentricity
Day 2	**Section 10-3** (continued)	Equation of an ellipse	Write the equation of an ellipse given specific information	
Day 3	**Section 10-3** (continued) **Supplement**: Degenerate case for ellipse	Complete the square Identify the resulting equation as a ellipse, a point or no graph Translate verbal problems into mathematical expressions and solve	Complete the square and identify the resulting equation as a ellipse, a point or no graph Translate verbal problems into mathematical expressions and solve	Degenerate case

Notes: Include 1 day for review and 1 day for the test.

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Unit 10C: Conic Sections - Hyperbola

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 1	**Section 10-4** The Hyperbola	Equation of a hyperbola in standard form	Graph a hyperbola with a vertical or horizontal transverse axis using transformations and state the domain and range	Center Transverse Axis Conjugate Axis Latus Rectum Right Chord Vertices Fundamental Rectangle Asymptotes Eccentricity
Day 2	**Section 10-4** (continued)	Equation of a hyperbola	Write the equation of a hyperbola given specific information	
Day 3	**Section 10-4** (continued) **Supplement**: Degenerate case for ellipse	Complete the square and identify the resulting equation as a hyperbola or two intersecting lines Translate verbal problems into mathematical expressions and solve	Complete the square and identify the resulting equation as a hyperbola or two intersecting lines Translate verbal problems into mathematical expressions and solve	Degenerate case
Day 4	**Section 10-4** (continued)	Equations of the asymptotes of the hyperbola	Write the equations of the asymptotes of the hyperbola	

Notes: Include 1 day for review and 1 day for the test.

Unit 10D: Conic Sections - All

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Days 1-2	Review All Conics	Sections 10-1 – 10-4		
Day 3	Test			

Unit 11: Polar Coordinates, Vectors and Parametrics

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 1	**Section 9-1** Polar Coordinates	Polar coordinates Rectangular and polar coordinates and their equations	Plot points using polar coordinates Convert between rectangular and polar coordinates and equations	Polar Axis Pole Rectangular Coordinate Polar Coordinate
Day 2	**Section 9-2** Polar Equations and their Graphs	Polar equations	Graph polar equations by plotting points and by using a graphing calculator	Polar equation Rose Curve Limacon Cardioid Spiral
Day 3	**Section 9-3** Complex Plane and DeMoivre's Theorem	Complex and rectangular forms Complex plane Products and quotients of complex numbers in polar form DeMoivre's Theorem	Convert between complex and rectangular forms; write complex numbers in rectangular form and rectangular numbers in complex form Plot points in the complex plane and determine r and θ Determine the products and quotients of complex numbers in polar form and be able to convert to rectangular form Use DeMoivre's Theorem to raise complex numbers to powers	Complex Number DeMoivre's Theorem

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 4	**Section 9-3** (continued)	Complex roots	Determine the complex roots of a polynomial equation using the formula	Complex root
Day 5	**Section 9-3** (continued)	CIS notation	Write $(\cos\theta + i\sin\theta)$ using CIS notation	CIS
Day 6	**Section 9-4** Vectors	Graph vectors Position vector Add and subtract vectors Scalar product Magnitude Unit vector Resultant vector Static equilibrium (optional) 2-dimensions	Graph vectors and determine their horizontal and vertical components and magnitude Determine the sum, difference and scalar product, and magnitude algebraically Determine a unit vector and a resultant vector Solve problems involving static equilibrium (optional)	Vector Horizontal component Vertical component Magnitude Unit vector Resultant vector Static equilibrium
Day 7	**Section 9-5** Dot product	Dot product of two vectors Angle between two vectors Parallel and orthogonal vectors	Determine the dot product of two vectors Find the angle between two vectors using right triangle trigonometry or the formula for the angle between two vectors Determine if two vectors are parallel or orthogonal	Dot product Parallel Orthogonal

Pacing	Section Topic	**Declarative Knowledge** *"What do students need to know and understand?"*	**Procedural Knowledge** *"What do students need to be able to do and at what level of application?"*	**Key Vocabulary**
Day 8	**Section 10-7** Parametric Equations	Parametric equations Rectangular equation for a curve defined parametrically	Graph parametric equations by hand and using a graphing calculator Convert a parametric equation to rectangular form	Parametric equation
Day 9	**Section 10-7** (continued)	Vectors with parametric	Apply concepts of vectors to parametric equations (horizontal and vertical components of forces acting on an object)	

Notes: Include 2 days of review and 1 day for the test.

Unit 12: Matrices

Pacing	Section Topic	**Declarative Knowledge** *"What do students need to know and understand?"*	**Procedural Knowledge** *"What do students need to be able to do and at what level of application?"*	**Key Vocabulary**
Day 1	**Section 11-2** Solving Systems of Linear Equations Containing Three Variables	Systems containing three variables Inconsistent systems Dependent equations	Algebraically solve systems of equations containing three variables and determine whether or not the system is inconsistent or dependent	Inconsistent Dependent
Days 2–3	**Section 11-2** (continued)	Equations of circles	Determine the equation of a circle given three points that lie on the circle	
Days 4–5	**Section 11-3** Matrices	Augmented matrix Row operations on a matrix Systems using matrices	Write the augmented matrix of a system of linear equations Perform row operations: ▪ Interchange any two rows ▪ Replace a row by a non-zero multiple of that row ▪ Replace a row by the sum of that row and a constant non-zero multiple of some other row Solve systems using matrix operations	Augmented matrix Row echelon form Reduced row echelon form

Pacing	Section Topic	**Declarative Knowledge** *"What do students need to know and understand?"*	**Procedural Knowledge** *"What do students need to be able to do and at what level of application?"*	**Key Vocabulary**
Day 6	**Section 11-2 & Section 11-3**	Systems of equations	Solving systems of equations using matrices and the graphing calculator	
Day 7	**Applications & Review**	Matrices	Solve real world problems using matrices	
Day 8	**Finish Review & Begin Test**			
Day 9	**Finish Test**			

Notes:

Unit 13A: Sequences

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 1	**Section 12.1** Sequences	Terms of a sequence Recursion formula Summation notation Sum of a sequence	Write the first several terms of a sequence Write a recursion formula for a sequence Write a sequence using summation (Σ) notation Find the sum of a sequence by hand	Series Sequence Recursion Summation (Σ)
Day 2	**Section 12.2** Arithmetic Sequences	Arithmetic sequence	Determine if a sequence is arithmetic Write a formula for an arithmetic sequence Find the sum of an arithmetic sequence	Arithmetic sequence Common difference
Day 3	**Section 12.3** Geometric Sequences	Geometric sequence	Determine if a sequence is geometric Write a formula for an geometric sequence Find the sum of an geometric sequence Find the sum of an infinite geometric series	Geometric sequence Common ratio Infinite geometric series

Notes: Include 1 day for review and 1 day for the test on sequences

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 1	**Section 12-4** Mathematical Induction	Prove statements using mathematical induction (summation proofs)	Write a mathematical induction proof for a summation	Mathematical Induction
Days 2–3	**Section 12-4** (continued)	Prove statements using mathematical induction (divisibility proofs)	Write a mathematical induction proof for a division	

Notes: Include 1 day for review and 1 day for the test

Unit 14A: Limits

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 1	**Section 14-1** Finding Limits using Tables and Graphs	Limits	Find a limit using a table of values and a graph	Limit
Day 2	**Section 14-2** Algebra Techniques For Finding Limits	Limit of a sum Limit of a difference Limit of a product Limit of a quotient Limit of a power or root	Find the limit of a sum, difference, product, quotient or power using algebra techniques	
Day 3	**Section 14-3** One-sided Limits and Continuous Functions	One-sided limits of a function Continuous functions	Understand notation and find the one-sided limits of a function Determine if a function is continuous at a point	Continuous function Left-hand limit $\lim\limits_{x \to c^-} f(x)$ Right-hand limit $\lim\limits_{x \to c^+} f(x)$

Notes: Include 1 day for review and 1 day for the test on limits.

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Day 1	**Section 14-4** The Derivative	Definition of the derivative Derivatives of polynomial functions	Using the definition of the derivative, write the derivative of a polynomial function	Derivative $\dfrac{dy}{dx} = f\,'(x) = y\,'$
Day 2	**Section 14-4** (continued)	Rational functions and functions with radicals Slope of a line tangent to a curve Tangent line to a curve	Using the definition of the derivative, write the derivative of rational functions and functions with radicals Use the derivative to find the slope of the line tangent to a curve Write the equation of a line tangent to a curve	Tangent Instantaneous rate of change
Days 3-4	**Section 14-4** (continued)	Short cut method for derivatives	Using the short cut method to find the derivative of a function Evaluate first derivative to find rate of change at a point on the curve Apply the short cut method to optimization problems	Optimization Minimum Maximum
Day 5	**Section 14-4** (continued)	First derivative Second derivative	Use characteristics about the first and second derivatives to sketch functions	Increase Decrease Maximum Minimum Inflection point Concavity

Pacing	Section Topic	Declarative Knowledge *"What do students need to know and understand?"*	Procedural Knowledge *"What do students need to be able to do and at what level of application?"*	Key Vocabulary
Days 6-7	**Section 14-4** (continued)	First derivative Second derivative	Use information about the first and second derivatives to sketch functions (without knowing the equation of the function) Incorporate AP questions	
Day 8	**Section 14-5** The Integral (optional)	Area under a curve Integrals	Approximate the area under a curve Write the integral to find the area under a curve Use a graphing calculator to approximate the area under a curve	Area Integration

Notes: Include 2 days for review and 1 day for the test