Williamsville Central School District

Discipline: Mathematics
Course/Grade: **Pre-Calculus** / High School
Final Exam: District Final Exam
Textbook: **Algebra and Trigonometry (6th Ed.)** By M. Sullivan
Prentice Hall © 2001
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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.

The main goal of this course is for students to continue their formal study of elementary functions begun in Integrated Algebra and Algebra 2 & Trigonometry and develop a deeper understanding of the fundamental concepts and relationships of functions while to reinforcing one's mathematical skills. Students will investigate and explore mathematical ideas, develop multiple strategies for analyzing complex situations, and use graphing calculators and mathematical software to build understanding, and make connections between representations.

Pre-Calculus is highly recommended preparation for students whose plans include the possibility of formal education beyond high school.

Required Prerequisite:

Successful completion of at least "Algebra 2 & Trigonometry."

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NOTES:

1. The curriculum has been designed to allow for 15 days for final exam review.
2. There are 17 unassigned days that can be added to any Unit as needed (this does not include the 15 final exam review days).

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.

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 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
Assessment Outline

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

Williamsville Central School District
Pre-Calculus

Unit 1: Sequences and Series (Chapter 13)

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	**Sect. 13.1** Sequences	A sequence is a function whose domain is the set of positive integers Summation Notation is a concise way to express the sum of the first *n* terms of a sequence	Write the first several terms of a sequence Write the terms of a sequence defined by a recursive formula Use summation notation to find the sum of a specified number of terms Example: $\sum_{x=2}^{8} x^2 + 3x$ Find the sum of a sequence	Sequences Summation/Sigma Notation: $\sum$
Day 2	**Sect. 13.2** Arithmetic Sequences	An Arithmetic Sequence starts with a first term, and each successive term is found by adding a common difference The sum of the members of a finite arithmetic sequence is called an arithmetic series	Determine if a sequence is Arithmetic. Find a formula for an Arithmetic Sequence Find the sum of the Arithmetic Sequence	Common Difference First term Last term *n*th term Arithmetic Series Arithmetic Sequence

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	**Sect 13.3** Geometric Sequences	A Geometric Sequence starts with a first term, and each successive term is found by multiplying the previous term by a common ratio The sum of the members of a finite geometric sequence is called a geometric series	Determine if a sequence is Geometric Find a formula for a Geometric Sequence Find the sum of a Geometric Sequence Find the sum of a Geometric Series Find the sum of an infinite Geometric Series	Common Ratio Geometric Series Geometric Sequence Sum of Geometric Series
Day 4	**Supplement:** Arithmetic and Geometric Means	Geometric Means and Arithmetic Means are the numbers between two given numbers Geometric: 3 , _ , _ , 24 (where $r = 2$, and the means are 6 and 12) Arithmetic: 5, _ , _ , 14 (where $d = 3$, and the means are 8 and 11)	Find a specified number of means between two given numbers Determine if the sequence is Arithmetic or Geometric Find the common difference Find the common ratio	Arithmetic/Geometric Means
Day 5	**13.5** Binomial Theorem	The expansion of a binomial can be found using Pascal's Triangle or combination notation The binomial theorem is a formula for the expansion of $(x+a)^n$	Expand a given binomial to the *nth* power, using combination notation **or** Pascal's triangle Find a specific term of a binomial expansion	Full expansion Specific Term

Notes: Include 3 days for review and test.

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Unit 2: Fundamental Concepts of Algebra Part 1 (Review Chapter)

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 R.1** Properties of Real Numbers	Whole numbers, integers, rational numbers, irrational numbers, and natural numbers	Classify numbers as $\mathbb{R}$, $\mathbb{Z}$, $\mathbb{C}$, $\mathbb{Q}$, $\mathbb{N}$ Evaluate numerical expressions Work with properties of real numbers	Interval Notation Set Notation Symbols (i.e., $\mathbb{R}$, $\mathbb{Z}$, $\mathbb{C}$, $\mathbb{Q}$, $\mathbb{N}$)
Day 2	**Section R.4** Integer Exponents	An expression that is raised to a negative power of one results in its reciprocal	Evaluate expressions with integer exponents Example: $\left(\frac{x^{-3}y^4}{x^5y^{-8}}\right)^{-2}$	Reciprocal
Day 3	**Section R.5** Add and Subtract with Polynomials	Polynomials are added and subtracted by group and combining like terms	Add and subtract polynomials Example: $\left(x^2-3x-4\right)-\left(5x^3-3x^2+10\right)$	Sum Difference
Day 4	**Section R.5** Multiply Polynomials	Polynomials are added and subtracted by group and combining like terms Products of polynomials are found by repeated use of the distributive property and the laws of exponents	Multiply polynomials using the distributive property Example: $(2x-3)\left(3x^2-2x+1\right)$	Distribute Product Multiply

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 R.5** Dividing Polynomials	The procedure for dividing two polynomials is similar to the procedure for dividing two integers To divide polynomials, they must first be written in standard form	Use long division to find the quotient and remainder Example: $\left(3x^3 - x^2 + x - 2\right) \div \left(x - 4\right)$	Quotient Remainder Standard form

Notes: Include 2 days for review and test.

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Unit 3: Fundamental Concepts of Algebra Part 2 (Review Chapter)

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 R.6** Factoring polynomials	Finding the factors of a polynomial is called factoring To factor a second degree polynomial $x^2 + Bx + C$, find integers whose product is C and whose sum is B. That is, if there are numbers a, b, where $ab = C$ and $a + b = B$, then $x^2 + Bx + C = (x + a)(x + b)$. Factor a second degree polynomial with $a \geq 1$ Recognize the difference of two perfect squares Greatest common factor	Factor trinomials with coefficients ≥ 1 Factor the difference of two squares Factor using GCF Factor completely	Difference Of Two Squares GCF Trinomial Binomial
Day 2	**Section R. 6** Factoring perfect cubes	Recognize the sum and difference of two perfect cubes $x^3 + y^3 = (x + y)(x^2 - xy + y^2)$ $x^3 - y^3 = (x - y)(x^2 + xy + y^2)$ **Note:** students are responsible for knowing these formulas. These will be printed on a formula sheet for the *final exam only.*	Factor the sum of two perfect cubes Factor the difference of two perfect cubes	Perfect cubes Common Factors

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 2 continued)	Sometimes a common factor does not occur in every term of the polynomial, but in each of several groups of terms that together make up the polynomial. When this happens, the common factor can be factored out of each group by means of the distributive property. This technique is called factoring by grouping	Factor a polynomial completely by grouping	
Day 3	**Section R.6** Review all factoring methods	Identify and solve problems, using any of the factoring methods previously learned	Factor polynomials without explicit instructions as to what method of factoring	Difference Of Two Squares GCF Trinomial Binomial Perfect Cubes Common Factors
Day 4	**Section R. 7** Rational Expressions Factoring Quiz	Identify expressions which need to be reduced	Reduce monomials to lowest terms Simplify polynomial rational expressions by factoring	Rational Expression
Day 5	**Section R.7** Multiplying and Dividing Rational Expressions	Differentiate types of factoring used to reduce rational expressions	Factor and reciprocate, when necessary, before cancelling	Reciprocal

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 R. 7** Add and Subtract Rational Expressions	Identify and combine common terms. Awareness of distributing negatives	Multiply to obtain common denominators for all rational expressions	Common Denominator Distribute
Day 7	**Section R.7** Complex Fractions	Recognize a complex fraction Identify the LCM	Use LCM to simplify complex fractions	Complex Fraction LCM
Day 8	**Section R.8** Simplifying Radicals Adding and Subtracting Radicals	Perfect *nth* roots (squares, cubes, …) Like terms are necessary before adding and subtracting	Simplify square roots Simplify *n*th roots	Square root Cube root *n*th root Like terms
Day 9	**Section R.8** Multiplying and Dividing with Radicals	Algebraic techniques to eliminate radicals from denominators	Multiply and divide with radicals Eliminate radicals from the denominators using the conjugate	Rationalize Conjugate

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 10	**Section R.9** Rational Exponents	Laws of exponents $x^a \bullet x^b = x^{a+b}$ $x^a \div x^b = x^{a-b}$ $\left(x^a\right)^b = x^{ab}$ $x^{-a} = \frac{1}{x^a}$ $x^{\frac{1}{a}} = \sqrt[a]{x}$ $x^{\frac{a}{b}} = \sqrt[b]{x^a}$	Write expressions containing fractional exponents as radicals Write expressions containing radicals using fractional exponents Apply the laws of exponents to simplify given expressions	Simplify

Notes: On Day 5, simplifying rational expressions is a short lesson. Give Factoring Quiz the same day. Include 3 days for review and test.

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Unit 4: Equations and Inequalities (Chapter 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** Linear equations Literal equations	Steps for solving linear equations Equations may not always have solutions Steps for solving first degree literal equations	Solve an equation in one variable Example: $8x-(3x+2)=3x-10$ Example: $\frac{x}{x^2-9}+\frac{4}{x+3}=\frac{3}{x^2-9}$ Example: $ax-b=c$, solve for x	Linear equation
Day 2	**Section 1.1** Quadratic equations	Steps for solving quadratic equations	Solve a quadratic Example: $2x^2+5x-3=0$	Quadratic equation
Day 3	**Section 1.3** Completing the square	Steps for completing the square	Solve a quadratic by completing the square Example: $x^2+10x=20$	Complete the square
Day 4	**Section 1.3** Quadratic formula	$ax^2+bx+c=0$ is a quadratic equation in standard form	Solve a quadratic using the quadratic formula: $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$	Quadratic formula Standard form Coefficient
Day 5	**Section 1.4** Radical equations	Steps for solving radical equations	Solve a radical equations Example: $\sqrt{15-2x}=x$ Example: $\left(x^2-16\right)^{\frac{1}{2}}=9$	Extraneous solutions
Day 6	**Review Days 1-5**	Identify the techniques used to solve equations	Use appropriate methods to solve a given equation	Same vocabulary from Days 1-5

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 7	**Quiz**	Sections 1.1 to 1.5		
Day 8	**Section 1.5** Linear Inequalities	Properties of inequalities	Solve linear inequalities Example: $\frac{1}{2}(x-4) > x+8$ Example: $-3 \leq 3-2x < 9$	Inequality Compound inequality Interval notation
Day 9	**Section 4.5** Polynomial inequalities	A critical point is a point where the function crosses the x-axis When a polynomial inequality is not equal to zero, it is either always positive or always negative	Solve polynomial inequalities by factoring and making a sign chart with the critical points Example: $x^2 + x \geq 2$	Critical points Sign chart Interval notation
Day 10	**Section 4.5** Rational inequalities	A fraction is undefined when the denominator is equal to zero	Solve rational inequalities by identifying critical points and distinguishing between zeros and undefined Example: $\frac{x+1}{x-5} > 0$	Critical points Undefined Interval notation Zero
Day 11	**Section 1.6** Absolute value equations and inequalities	Steps used to solve equations and inequalities involving absolute value	Solve absolute value equations and inequalities Example: $\lvert x+1 \rvert - 4 = 10$ Example: $\lvert 3x-5 \rvert \leq 7$	Absolute value Equation Inequality Interval notation

Notes: Include 3 days for review and test.

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Unit 5: Linear Functions (Chapter 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 2.1 - 2.3** Rectangular coordinates	Distance formula Midpoint formula Slope formula	Find the distance between two given points Find the midpoint of two given points Find the slope between two given points	Distance Midpoint Slope
Day 2	**Section 2.3** Writing the equation of lines	The equation of a line in point slope form is: $(y-k)=m(x-h)$ The equation of a line in slope intercept form is: $y=mx+b$	Write the equation of a line in point slope form, given two points Write the equation of a line in slope intercept form, given two points	Point slope form Slope intercept form
Day 3	**Supplement** General form Distance from a point to a line	The equation of a line in general form is: $ax+by+c=0$ Distance formula from a point to a line: $d=\frac{\lvert ax+by+c\rvert}{\sqrt{a^2+b^2}}$	Write the equation of a line in general form and find the distance from a given point to a given line Example: find the distance from the line $3x-4y+5=0$ to the point $(2,-1)$	General form Distance
Day 4	**Section 2.4** Parallel and Perpendicular lines	Parallel lines have the same slope Perpendicular lines have negative reciprocal slopes	Write the equation of a line parallel or perpendicular to a given line through a given point	Parallel Perpendicular Negative reciprocal Slope

Notes: Include 3 days for review and test.

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<u>Unit 6</u>: Functions and their Graphs (Chapter 3)

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 3.1** Functions	Definition of a Function	Use definition of a function to determine if a relation is a function Use Vertical Line Test to determine if the graph is a function	Function Domain Range Relation
Day 2	**Section 3.1** Domain and Range	Difference between Domain and Range	Find the domain algebraically and graphically Find the range based on the given graph	Domain Range
Day 3	**Section 3.3** Basic Functions	Recognize the graphs of the following basic functions: - Linear - Constant - Identity - Square (Quadratic) - Cube (Cubic) - Square Root - Cube Root - Absolute Value - Greatest Integer - Signum - Reciprocal	Identify and graph each of the basic functions State the domain and range of each basic function	Linear Constant Identity Square (Quadratic) Cube(Cubic) Square Root Cube Root Absolute Value Greatest Integer Signum Reciprocal

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 3.3** Piece-wise Functions	Piece-wise functions are functions defined by more than one equation	Graph given piecewise functions Find the Domain of a piecewise function Find the Range of a piecewise function	Restricted Domain Piece-wise function
Day 5	**Review**	Sections 3.1 and 3.3		
Day 6	**Quiz Day**	Sections 3.1 and 3.3		
Days 7–9	**Section 3. 4** Transformations	Identify different types of transformations as a shift left, right, up, down or horizontal/vertical stretches/compressions	Shift graphs left, right, up, down Vertical and horizontal stretches and compressions List the transformations performed on the basic function	Vertical stretch Horizontal stretch Compress Shift/Translate Reflect
Days 10–11	**Section 3.5** Composition of Functions	Composition Notation	Evaluate a composite function Example: $f(x)=2x+3,\ g(x)=x^2-1$ Find: $(f\circ g)(-3)$ Write the expression for a composite function Example: $f(x)=2x+3,\ g(x)=x^2-1$ Find: $(f\circ g)(x)$	Composite Function

Notes: Include 3 days for review and test.

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Unit 7: Zero's of a Polynomial and Rational Functions (Chapter 5)

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** Synthetic Division	The process of dividing polynomials using synthetic division	Divide polynomials using synthetic division	Quotient Remainder Synthetic Division
Day 2	**Section 5.2** Factor and Remainder Theorems	If $f(c) = 0$ then c is a root of the polynomial equation	Use synthetic division to determine if a given binomial is a factor of a higher degree polynomial	Factor Root
Days 3–5	**Section 5.2** Finding possible zero's	Identify rational zeros using the calculator Calculate imaginary zeros	Use calculator to find rational zeros of a function Use synthetic division to find irrational zeros and imaginary zeros	Zeros – rational, irrational, and imaginary
Days 6–7	**Section 4.3** Graphing Rational Functions	Steps for finding Vertical Asymptote Steps for finding Horizontal Asymptote	Find equations of vertical and horizontal asymptotes; zero's, *y*-intercept, and coordinates of additional points on calculator	Horizontal asymptote Vertical asymptote Zero y-intercept

Notes: Include 3 days for review and test. Stop here for midterm review and test (7–9 days).

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<u>Unit 8</u>: Exponential and Logarithmic Functions (Chapter 6)

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** One to One and Inverse functions	A function that passes a horizontal line test is one-to-one Procedure for finding an inverse function	Apply the horizontal line test to determine if a function is one to one Interchange *x* and *y* to determine its inverse Solve for *y* to find the inverse in function notation	Horizontal Line Test One-to-one function Inverse
Day 2	**Section 6..2** Exponential function	An exponential function is a function of the form $f(x) = a^x$	Graph exponential functions Identify the transformations of an exponential function	Domain Range Horizontal Asymptote Exponential Function
Day 3	**Section 6.3** Log Functions	A logarithm is a name for an exponent $y = a^x \leftrightarrow \log_a y = x$	Convert an exponential equation to a log equation Convert a log equation to an exponential equation	Base Exponent (Power) 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
Days 4–5	**Section 6.4** Properties of Logs	Properties of logs: $\log(xy) = \log x + \log y$ $\log\left(\frac{x}{y}\right) = \log x - \log y$ $\log x^a = a \log x$ $\log_a x = \frac{\log x}{\log a}$	Use the properties of logs to evaluate given logarithmic expressions (application problems not required in this course)	Change of Base
Days 6–7	**Section 6.5** Log and Exponential Equations	Identify appropriate techniques in solving logarithmic and exponential equations	Solve logarithmic and exponential equations	

Notes: Include 3 days for review and test.

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Unit 9: Trigonometric Functions (Chapter 7)

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 7.6** Graphing Sine and Cosine	Label the axes and intervals in radians	Graph $f(x) = \sin x$ and $f(x) = \cos x$ using radian measure along the *x*-axis	Radians
Day 2	**Section 7.6** Using Amplitude, Period and Frequency	Definitions of Amplitude, Frequency and Period	Given the equation of a trigonometric function, determine the amplitude, period, and frequency	Amplitude Frequency Period
Days 3-4	**Section 7.6** Transformations of sine and cosine graphs	Graphing Techniques Describe transformations	Use knowledge of amplitude, frequency, and period to shift trigonometric graphs left, right, up, down	Vertical shift Horizontal Amplitude Reflection
Day 5	**Section 7.6** Writing Equations of trig functions	Difference between a sine and a cosine curve	Write the equation of a trigonometric function based on a given graph	Amplitude Frequency Period

Notes: Include 3 days for review and test.

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<u>Unit 10</u>: Vectors and Matrices (Chapters 10 & 12)

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** Introduction to Vectors	Represent vectors in a plane Basic operations with vectors (+,-, scalar multiplication) Scalar is a magnitude without a direction	Graph resultant vector after adding/subtracting given vectors	Vector Resultant Scalar
Day 2	**Section 10.4** Position Vectors	Tail of a vector is the starting point of a vector Head of a vector is the end point that indicates direction with an arrow Magnitude is the length of a vector Notation for magnitude is $\|\ \|$	Finding magnitude (length) of two and three dimensional vectors Write the position vector given the coordinates of the head and the tail	Head Tail Magnitude Direction
Day 3	**Section 10.4** Dot Product	If the dot product of two vectors is zero, then the vectors are perpendicular (orthogonal)	Use the dot product to find the angle between two vectors	Dot Product Orthogonal
Days 4-5	**Review and Quiz** Section 10.4			

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 12.5** Matrix Algebra	Represent a matrix in row and column form	Add and Subtract matrices with same dimensions Multiply a matrix by a constant	Matrix Row Column Constant
Day 7	**Section 12.5** Multiplication of Matrices	Row by column matrix multiplication Matrices must be compatible in order to be multiplied	Multiply two matrices using row by column method Demonstrate use of calculator to multiply matrices	Product
Days 8-9	**Section 12.2 & 12.3** Systems of equations	Interpret RREF to find the values of the variables	Solve systems of equations using algebraic methods Solving systems of two and three variable equations using matrices	Coefficients Reduced Row Echelon Form (RREF)

Notes: Include 3 days for review and test.

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<u>Unit 11</u>: Circles and Parabolas (Chapters 2 & 11)

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 2.4** Circles	General and Standard form of equation of circle Steps for writing the equation of a circle in standard form	Write the equation of a circle in standard form given the center and radius Find the center and radius given an equation of a circle Convert equation from general to standard form using completing the square	Center Radius Standard Form
Day 3	**Section 11.2** Parabola Basics	Identify the focus, directrix and latus rectum of a parabola with vertex $(0,0)$ that open to the right $y^2 = 4ax$	Graph a parabola using its equation in standard form Write equations of parabolas given key information	Axis of Symmetry Vertex Focus Directrix Latus Rectum Domain Range
Day 4	**Section 11.2** Changing Positions	Standard form equations for the four positions of the parabola with vertex $(0,0)$ $y^2 = 4ax$ $x^2 = 4ay$ $y^2 = -4ax$ $x^2 = -4ay$	Graph a parabola in any of the four positions using its equation Write equations of parabolas given key information	Four Positions

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 11.2** Changing the vertex	Standard form of a parabola with vertex (h,k) $(y-k)^2 = 4a(x-h)$ $(x-h)^2 = 4a(y-k)$ $(y-k)^2 = -4a(x-h)$ $(x-h)^2 = -4a(y-k)$	Graph a parabola with vertex (h,k) in any of the four positions using its equation Write equations of parabolas with vertex (h,k) given key information	
Day 6	**Section 11.2** General form to standard form	Steps to convert an equation from general form to standard form General form: $ax^2 + by^2 + cx + dy + e = 0$	Complete the square to convert an equation from general to standard form	General Form

Notes: Include 3 days for review and test.

Williamsville Central School District
Pre-Calculus

<u>Unit 12</u>: Ellipses and Hyperbolas (Chapter 11)

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 11.3** Ellipse	Identify the foci, vertices, endpoints of an ellipse with center $(0,0)$ that is in the horizontal position $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$	Graph an ellipse using its equation in standard form Write equation of an ellipse given key information	Ellipse Center Vertices Endpoints Major axis Minor Axis Foci
Day 2	**Section 11.3** Changing Positions	Standard form equations for the two positions of the ellipse with center $(0,0)$ $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ $\frac{y^2}{a^2}+\frac{x^2}{b^2}=1$	Graph an ellipse in either of the two positions using its equation Write equations of ellipses given key information	

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 11.3** Changing the center	Standard form of ellipse with center (h,k) $\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1$ $\frac{(y-k)^2}{a^2}+\frac{(x-h)^2}{b^2}=1$	Graph an ellipse with center (h,k) in either of the two positions using its equation Write equations of ellipses with center (h,k) given key information	
Day 4	Ellipse Review (**Sect. 11.3**)			
Day 5	**Section 11.4** Hyperbola	Identify the vertices, foci, lengths of converse and transverse axes of a hyperbola with center $(0,0)$ $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$	Draw the fundamental rectangle and the asymptotes of a hyperbola Graph a hyperbola using its equation in standard form Write equation of a hyperbola given key information	Foci Vertices Center Transverse Axis Conjugate Axis Asymptotes Fundamental Rectangle
Day 6	**Section 11.4** Changing Positions	Standard form equations for the two positions of the hyperbola with center $(0,0)$ $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ $\frac{y^2}{a^2}-\frac{x^2}{b^2}=1$	Draw the fundamental rectangle and the asymptotes of a hyperbola Graph a hyperbola using its equation in standard form Write equation of a hyperbola given key information	

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 7	**Section 11.4** Changing the Center	Standard form of hyperbola with center (h,k) $\frac{(x-h)^2}{a^2}-\frac{(y-k)^2}{b^2}=1$ $\frac{(y-k)^2}{a^2}-\frac{(x-h)^2}{b^2}=1$	Graph a hyperbola with center (h,k) in either of the two positions using its equation Write equations of hyperbolas with center (h,k) given key information	

Notes: Include 3 days for review and test.