

Haverhill High School

Pre Calculus
Curriculum Map

Pre Calculus

General Outline:

<u>Term</u>	<u>Topics</u>
1	Functions and Their Graphs – <i>Chapter 1</i> Polynomial and Rational Functions – <i>Chapter 2</i> Exponential and Logarithmic Functions – <i>Chapter 3</i>
2	Trigonometric Functions – <i>Chapter 4</i> Analytical Trigonometry – <i>Chapter 5</i>
3	Additional Topics in Trigonometry – <i>Chapter 6</i> Linear Systems and Matrices – <i>Chapter 7</i>
4	Sequences, Series & Probability – <i>Chapter 8</i> Limits and an Introduction to Calculus – <i>Chapter 11</i> Topics in Analytical Geometry – <i>Chapter 9</i>

Primary Textbook:

- Larson, Hostetler & Edwards, Precalculus with Limits, Houghton Mifflin Co., 4th ed., 2005

Supplementary Textbook:

- Brown, Richard G. Advanced Mathematics, McDougal Littell, Houghton Mifflin Co 2000
- PreCalculus Part I: Trigonometry and Related Topics, B Johnson, 1998

Technology:

- TI-83 or TI-84 Graphing Calculators

Instructional Activities

Direct Instruction
Class Exercises & Activities
Cooperative Learning
Homework Exercises
Study Guides
Review Exercises
Technology Integration
Integrated Skills Projects

Assessment

Quizzes
Chapter Tests
Class work
Homework
Project Assessment
Self Assessment & Peer Reviews
Open Response Rubric

TERM 1

Topic: **Functions and Their Graphs**

- 1.1 – Lines in the Plane
- 1.2 - Functions
- 1.3 – Graphs of Functions
- 1.4 – Shifting, Reflecting, and Stretching Graphs
- 1.5 – Combinations of Functions
- 1.6 – Inverse Functions
- 1.7 – Exploring Data: Linear Models and Scatter Plots

Learning Standards:

- 12.P.5 Perform operations on functions, including composition. Find inverses of functions
- 12.P.8 Solve a variety of equations and inequalities using algebraic, graphical, and numerical methods, including the quadratic formula; use technology where appropriate. Include polynomial, exponential, logarithmic, and trigonometric functions; expressions involving absolute values; trigonometric relations; and simple rational expressions.
- 12.P.10 Use symbolic, numeric, and graphical methods to solve systems of equations and/or inequalities involving algebraic, exponential, and logarithmic expressions. Also use technology where appropriate. Describe the relationships among the methods.
- 12.P.11 Solve everyday problems that can be modeled using polynomial, rational, exponential, logarithmic, trigonometric, and step functions, absolute values, and square roots. Apply appropriate graphical, tabular, or symbolic methods to the solution. Include growth and decay; joint (e.g., $I = Prt$, $y = k(w_1 + w_2)$) and combined ($F = G(m_1 m_2)/d^2$) variation, and periodic processes.
- 12.P.13 and PC.P.6 Describe the translations and scale changes of a given function $f(x)$ resulting from substitutions for the various parameters a , b , c , and d in $y = af(b(x + c/b)) + d$. In particular, describe the effect of such changes on polynomial, rational, exponential, logarithmic, and trigonometric functions.
- 12.G.4 Relate geometric and algebraic representations of lines, simple curves, and conic sections.
- 12.D.3 Apply regression results and curve fitting to make predictions from data.

TERM 1 (continued)

Topic: Polynomial and Rational Functions

- 2.1 – Quadratic Functions
- 2.2 – Polynomial Functions of Higher Degree
- 2.3 – Real Zeros of Polynomial Functions
- 2.4 – Complex Numbers
- 2.5 - The Fundamental Theorem of Algebra
- 2.6 – Rational Functions and Asymptotes
- 2.7 – Graphs of Rational Functions
- 2.8 – Exploring Data: Quadratic Models

Learning Standards:

12.N.1 Define complex numbers (e.g., $a + bi$) and operations on them, in particular, addition, subtraction, multiplication, and division. Relate the system of complex numbers to the systems of real and rational numbers.

12.N.2 Simplify numerical expressions with powers and roots, including fractional and negative exponents.

12.P.6 Given algebraic, numeric and/or graphical representations, recognize functions as polynomial, rational, logarithmic, exponential, or trigonometric.

12.P.7 Find solutions to quadratic equations (with real coefficients and real or complex roots) and apply to the solutions of problems.

12.P.8 Solve a variety of equations and inequalities using algebraic, graphical, and numerical methods, including the quadratic formula; use technology where appropriate. Include polynomial, exponential, logarithmic, and trigonometric functions; expressions involving absolute values; trigonometric relations; and simple rational expressions.

12.P.10 Use symbolic, numeric, and graphical methods to solve systems of equations and/or inequalities involving algebraic, exponential, and logarithmic expressions. Also use technology where appropriate. Describe the relationships among the methods.

12.P.11 Solve everyday problems that can be modeled using polynomial, rational, exponential, logarithmic, trigonometric, and step functions, absolute values, and square roots. Apply appropriate graphical, tabular, or symbolic methods to the solution. Include growth and decay; joint (e.g., $I = Prt$, $y = k(w_1 + w_2)$) and combined ($F = G(m_1m_2)/d^2$) variation, and periodic processes.

12.P.12 Relate the slope of a tangent line at a specific point on a curve to the instantaneous rate of change. Identify maximum and minimum

values of functions in simple situations. Apply these concepts to the solution of problems.

12.P.13 and PC.P.6 Describe the translations and scale changes of a given function $f(x)$ resulting from substitutions for the various parameters a , b , c , and d in $y = af(b(x + c/b)) + d$. In particular, describe the effect of such changes on polynomial, rational, exponential, logarithmic, and trigonometric functions.

12.G.4 Relate geometric and algebraic representations of lines, simple curves, and conic sections.

PC.P.2 Relate the number of roots of a polynomial to its degree. Solve quadratic equations with complex coefficients.

TERM 1 (continued)

Topic: Exponential and Logarithmic Functions

- 3.1 – Exponential Functions and Their Graphs
- 3.2 – Logarithmic Functions and Their Graphs
- 3.3 – Properties of Logarithms
- 3.4 – Solving Exponential and Logarithmic Equations
- 3.5 - Exponential and Logarithmic Models
- 3.6 - Exploring Data: Nonlinear Models

Learning Standards:

- 12.N.2 Simplify numerical expressions with powers and roots, including fractional and negative exponents.
- 12.P.4 Demonstrate an understanding of the trigonometric, exponential, and logarithmic functions
- 12.P.6 Given algebraic, numeric and/or graphical representations, recognize functions as polynomial, rational, logarithmic, exponential, or trigonometric.
- 12.P.8 Solve a variety of equations and inequalities using algebraic, graphical, and numerical methods, including the quadratic formula; use technology where appropriate. Include polynomial, exponential, logarithmic, and trigonometric functions; expressions involving absolute values; trigonometric relations; and simple rational expressions.
- 12.P.10 Use symbolic, numeric, and graphical methods to solve systems of equations and/or inequalities involving algebraic, exponential, and logarithmic expressions. Also use technology where appropriate. Describe the relationships among the methods.
- 12.P.11 Solve everyday problems that can be modeled using polynomial, rational, exponential, logarithmic, trigonometric, and step functions, absolute values, and square roots. Apply appropriate graphical, tabular, or symbolic methods to the solution. Include growth and decay; joint (e.g., $I = Prt$, $y = k(w_1 + w_2)$) and combined ($F = G(m_1 m_2)/d^2$) variation, and periodic processes.
- 12.P.13 and PC.P.6 Describe the translations and scale changes of a given function $f(x)$ resulting from substitutions for the various parameters a , b , c , and d in $y = af(b(x + c/b)) + d$. In particular, describe the effect of such changes on polynomial, rational, exponential, logarithmic, and trigonometric functions.
- 12.G.4 Relate geometric and algebraic representations of lines, simple curves, and conic sections.

TERM 2

Topic: Trigonometric Functions

- 4.1 – Radian and Degree Measure
- 4.2 – Trigonometric Functions: The Unit Circle
- 4.3 – Right Triangle Trigonometry
- 4.4 – Trigonometric Functions of Any Angle
- 4.5 – Graphs of Sine and Cosine Functions
- 4.6 – Graphs of Other Trigonometric Functions
- 4.7 – Inverse Trigonometric Functions
- 4.8 – Applications and Models

Learning Standards:

- 12.P.4 Demonstrate an understanding of the trigonometric, exponential, and logarithmic functions
- 12.P.6 Given algebraic, numeric and/or graphical representations, recognize functions as polynomial, rational, logarithmic, exponential, or trigonometric.
- 12.P.11 Solve everyday problems that can be modeled using polynomial, rational, exponential, logarithmic, trigonometric, and step functions, absolute values, and square roots. Apply appropriate graphical, tabular, or symbolic methods to the solution. Include growth and decay; joint (e.g., $I = Prt$, $y = k(w_1 + w_2)$) and combined ($F = G(m_1m_2)/d^2$) variation, and periodic processes.
- 12.P.13 and PC.P.6 Describe the translations and scale changes of a given function $f(x)$ resulting from substitutions for the various parameters a , b , c , and d in $y = af(b(x + c/b)) + d$. In particular, describe the effect of such changes on polynomial, rational, exponential, logarithmic, and trigonometric functions.
- 12.G.1 Define the sine, cosine, and tangent of an acute angle. Apply to the solution of problems.
- 12.G.4 Relate geometric and algebraic representations of lines, simple curves, and conic sections.
- 12.G.5 and PC.G.3. Apply properties of angles, parallel lines, arcs, radii, chords, tangents and secants to solve problems.
- 12.M.1 Describe the relationship between degree and radian measures, and use radian measure in the solution of problems, in particular, problems involving angular velocity and acceleration.
- PC.P.3 Demonstrate an understanding of the trigonometric functions (sine, cosine, tangent, cosecant, secant, and cotangent). Relate the functions to their geometric definitions.

TERM 2 (continued)

Topic: Analytic Trigonometry

- 5.1 – Using Fundamental Identities
- 5.2 – Verifying Trigonometric Identities
- 5.3 – Solving Trigonometric Functions
- 5.4 – Sum and Difference Formulas
- 5.5 – Multiple-Angle and Product-to-Sum Formulas

Learning Standards:

- 12.P.4 Demonstrate an understanding of the trigonometric, exponential, and logarithmic functions
- 12.P.6 Given algebraic, numeric and/or graphical representations, recognize functions as polynomial, rational, logarithmic, exponential, or trigonometric.
- 12.P.8 Solve a variety of equations and inequalities using algebraic, graphical, and numerical methods, including the quadratic formula; use technology where appropriate. Include polynomial, exponential, logarithmic, and trigonometric functions; expressions involving absolute values; trigonometric relations; and simple rational expressions.
- 12.G.2 Derive and apply basic trigonometric identities (e.g., $\sin^2\theta + \cos^2\theta = 1$, $\tan^2\theta + 1 = \sec^2\theta$) and the laws of sines and cosines.
- 12.G.5 and PC.G.3. Apply properties of angles, parallel lines, arcs, radii, chords, tangents and secants to solve problems.
- PC.P.4. Explain the identity $\sin^2\theta + \cos^2\theta = 1$. Relate the identity to the Pythagorean theorem.

TERM 3

Topic: Additional Topics in Trigonometry

- 6.1 - Law of Sines
- 6.2 - Law of Cosines
- 6.3 - Vectors in the Plane
- 6.4 - Vectors and Dot Products
- 6.5 - Trigonometric Form of a Complex Number

Learning Standards:

- 12.G.1 Define the sine, cosine, and tangent of an acute angle. Apply to the solution of problems.
- PC.P.3 Demonstrate an understanding of the trigonometric functions. Relate the functions to their geometric definitions
- PC.G.1 Demonstrate an understanding of the laws of sines and cosines. Use the laws to solve for the unknown sides or angles in triangles. Determine the area of a triangle given the length of two adjacent sides and the measure of the included angle.
- 12.G.2 Derive and apply basic trigonometric identities.
- 12.G.3 Use the notion of vectors to solve problems. Describe addition of vectors, multiplication of a vector by a scalar, and the dot product of two vectors, both symbolically and geometrically. Use vector methods to obtain geometric results. (PC.G.2)
- PC.N.1 Plot complex numbers using both rectangular and polar coordinates systems. Represent complex numbers using polar coordinates, i.e., $a + bi = r(\cos \theta + i \sin \theta)$. Apply DeMoivre's theorem to multiply, take roots, and raise complex numbers to a power.

TERM 3 (continued)

Topic: Linear Systems and Matrices

- 7.1 - Solving Systems of Equations
- 7.2 - Systems of Linear Equations in Two Variables
- 7.3 - Multivariable Linear Systems
- 7.4 - Matrices and Systems of Equations
- 7.5 - Operations with Matrices
- 7.6 - Inverse of a Square Matrix
- 7.7 - Determinant of a Square Matrix
- 7.8 - Applications of Matrices and Determinants

Learning Standards:

12.P.9 Use matrices to solve systems of linear equations. Apply to the solution of everyday problems.

TERM 4

Topic: Sequences, Series, and Probability

- 8.1 - Sequences and Series
- 8.2 - Arithmetic Sequences and Partial Sums
- 8.3 - Geometric Sequences and Series
- 8.4 - Mathematical Induction
- 8.5 - Binomial Theorem
- 8.6 - Counting Principles
- 8.7 - Probability

Learning Standards:

- 12.P.1 Describe, complete, extend, analyze, generalize, and create a wide variety of patterns, including iterative and recursive patterns such as Pascal's Triangle.
- 12.P.2 Identify arithmetic and geometric sequences and finite arithmetic and geometric series. Use the properties of such sequences and series to solve problems, including finding the general term and sum recursively and explicitly.
- PC.P.1 Use mathematical induction to prove theorems and verify summation formulas.
- 12.P.3 Demonstrate an understanding of the binomial theorem and use it in the solution of problems.
- 12.D.6 Use combinatorics (e.g., "fundamental counting principle," permutations, and combinations) to solve problems, in particular, to compute probabilities of compound events. Use technology as appropriate.

TERM 4 (continued)

Topic: Limits and an Introduction to Calculus

- 11.1 - Introduction to Limits
- 11.2 - Techniques for Evaluating Limits
- 11.3 - Tangent Line Problem
- 11.4 - Limits at Infinity and Limits of Sequences
- 11.5 - Area Problem

Learning Standards:

PC.P.9 Relate the slope of a tangent line at a specific point on a curve to the instantaneous rate of change. Explain the significance of the horizontal tangent line. Identify maximum and minimum values of functions in simple situations. Apply these concepts to the solution of problems. (12.P.12)

Topic: Topics in Analytic Geometry

- 9.1 - Introduction to Conics: Parabolas
- 9.2 - Ellipses
- 9.3 - Hyperbolas
- 9.4 - Rotation and systems of Quadratic Equations
- 9.5 - Parametric Equations
- 9.6 - Polar Coordinates
- 9.7 - Graphs of Polar Equations
- 9.8 - Polar Equations of Conics

Learning Standards:

12G.4 Relate geometric and algebraic representations of lines, simple curves, and conic sections.

PC.P.8 Identify and discuss features of conic sections: axes, foci, asymptotes, and tangents. Convert between different algebraic representations of conic sections.

PC.P.7 Translate between geometric, algebraic, and parametric representations of curves. Apply to the solution of problems.