

## Masconomet Regional High School Curriculum Guide

**COURSE TITLE:** Pre – Calculus

**COURSE NUMBER:** 1422

**DEPARTMENT:** Mathematics

**GRADE LEVEL(S) & PHASE:** 12, CP

**LENGTH OF COURSE:** Full Year

### **Course Description:**

This course integrates the background students must have to be successful in Calculus. Topics for this course will include rational functions, the complex number system, analytical trigonometry, systems of equations, matrices, sequences, series and conics. If time permits, a preview of Calculus with an introduction to limits will be included.

### **Objectives:**

(Some are adapted from the Massachusetts Mathematics Curriculum Framework – November 2000)

At the end of the course, students will be able to:

- A. Graphs of functions including maxima/minima, sequences and limits and sine/cosine functions.
- B. Graphs of functions with emphasis on composite and inverses, absolute value and transformations.
- C. Manipulation of integers and polynomials including remainder theorem, factor theorem, synthetic division and modular arithmetic.
- D. Rational functions, irrational numbers, asymptotes and the remaining trigonometric functions.
- E. Trigonometric equations and identities including reduction formulae and inverses.
- F. Polar coordinates, polar graphs and complex numbers.
- G. The derivative as it applies to graphs, velocity and acceleration.

These objectives address the Academic Expectations relating to effective communication, mathematical competency and problem solving skills.

### **Materials and Activities:**

**Text(s):** Pre-Calculus with Limits: A Graphing Approach (4<sup>th</sup> ed.)

By: Ron Larson, Robert P. Hostetler, Bruce H. Edwards  
Houghton Mifflin Company: Boston, MA: 2005

Students are expected to have and use a graphing calculator in class and when doing assignments. Parents may request that their child borrow a school owned calculator for the year.

- Lecture and class discussion to explain concepts and processes.
- Individual and group work to practice skills presented in class, to apply them to various problem-solving situations and to develop the ability to work cooperatively in such situations.
- Student assignments to develop proficiency in those skills and processes presented and practiced in class.
- Group and individual investigations related to understanding and applying the concepts in the central objectives.
- Independent projects such as reports and computer work may be presented by students.

### **Scope and Sequence:**

Trigonometric Functions: (Chapter 4)

Upon completion of this chapter, the student will be able to:

- Describe angles
- Use radian measure
- Use degree measure and convert between degree and radian measure
- Use angles to model and solve real-life problems
- Identify a unit circle and describe its relationship to real numbers
- Evaluate trigonometric functions using the unit circle
- Use domain and period to evaluate sine and cosine functions
- Use a calculator to evaluate trigonometric functions
- Evaluate trigonometric functions of acute angles

- Use the fundamental trigonometric identities
- Evaluate trigonometric functions of any angle
- Use reference angles to evaluate trigonometric functions
- Evaluate trigonometric functions of real numbers
- Sketch the graphs of basic sine and cosine functions
- Use amplitude and period to help sketch the graphs of sine and cosine functions
- Sketch translations of graphs of sine and cosine functions
- Sketch the graphs of tangent, cotangent, secant and cosecant functions
- Evaluate inverse trigonometric functions
- Evaluate compositions of trigonometric functions
- Use trigonometric functions to model and solve real-life problems
- Solve real-life problems involving right triangles
- Solve real-life problems involving directional bearings

#### Analytic Trigonometry: (Chapter Five)

Upon completion of this chapter, the student will be able to:

- Recognize and write the fundamental trigonometric identities
- Use the fundamental trigonometric identities to evaluate trigonometric functions, simplify trigonometric expressions, and rewrite trigonometric expressions
- Verify trigonometric identities
- Use standard algebraic techniques to solve trigonometric equations
- Solve trigonometric equations of quadratic type
- Solve trigonometric equations involving multiple angles
- Use inverse trigonometric functions to solve trigonometric equations
- Use sum and difference formulas to evaluate trigonometric functions, verify identities, and solve trigonometric equations
- Use double-angle formulas to rewrite and evaluate trigonometric functions
- Use half-angle formulas to rewrite and evaluate trigonometric functions

#### Additional Topics in Trigonometry: (Chapter 6)

Upon completion of this chapter, the student will be able to:

- Use the Law of Sines to solve oblique triangles (AAS or ASA or SSA)
- Use the Law of Sines to model and solve real-life problems
- Use the Law of Cosines to solve oblique triangles (SSS or SAS)
- Use the Law of Cosines to model and solve real-life problems
- Use special formulas to find the area of any triangle, right or oblique (SSS or SAS)

#### Polar Coordinates and Polar Graphs: (Sections 9.6, 9.7, 6.5)

Upon completion of these sections, the student will be able to:

- Plot points and find multiple representations of points in the polar coordinate system
- Convert points from rectangular to polar form and vice versa
- Convert equations from rectangular to polar form and vice versa
- Graph polar equations by point plotting
- Test for symmetry to assist in the sketching of polar graphs
- Find zeros and maximum r-values as sketching aids
- Recognize special polar graphs
- Find absolute values of complex numbers
- Write trigonometric forms of complex numbers
- Multiply and divide complex numbers written in trigonometric form
- Use De Moivre's Theorem to find powers of complex numbers
- Find nth roots of complex numbers

#### ***If time permits, for students who do not go on a senior internship:***

##### Limits and an Introduction to Calculus: (Chapter Eleven)

Upon completion of this chapter, the student will be able to:

- Use the definition of a limit to establish limits
- Determine whether limits of functions exist

- Use properties of limits and direct substitution to evaluate limits
- Use the dividing out technique to find limits of functions
- Use the rationalizing technique to find limits of functions
- Approximate limits of functions graphically and numerically
- Evaluate one-sided limits of functions
- Evaluate limits of difference quotients from calculus
- Use a tangent line to approximate the slope of a graph at a point
- Use the limit definition of slope to find exact slopes of graphs
- Find derivatives of functions and use derivatives to find slopes of graphs
- Evaluate functions of limits at infinity
- Find limits of sequences
- Find limits of summations
- Use rectangles to approximate areas of plane regions
- Use limits of summations to find areas of plane regions

**Assessment:**

- Daily assignments to be evaluated in light of completeness, care of presentation and the student's ability to explain the results. Late or incomplete assignments can earn at most half credit. Generally, no credit will be given for any assignment not completed within one day of the time it was due.
- Individual and group classwork/investigations to be evaluated in light of their completeness, care of presentation, student participation in the process and the student's ability to discuss the results/conclusions.
- Frequent quizzes to assess the student's progress in achieving course objectives on a short-term basis.
- Chapter tests to assess the student's ability to synthesize several classes and achieve course objectives on a long-term basis.
- First semester exam given in January.
- Assessments designed to determine how the student has met the Academic Expectations relating to effective communication, mathematical competency and problem solving skills.

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