

Masconomet Regional High School Curriculum Guide

COURSE TITLE: Pre – Calculus

COURSE NUMBER: 1331

DEPARTMENT: Mathematics

GRADE LEVEL(S) & PHASE: 11, 12, H

LENGTH OF COURSE: Full Year

Course Description:

This course is the final step in the preparation of students for Advanced Placement Calculus and is directed towards the student who has an interest in pursuing the sciences or a related field that would require a higher level of mathematics. By its very nature, it is rigorous and requires a high degree of effort and interest on the part of each student. The essential purpose of the course is to make a careful study of exponential, circular, and polynomial functions and the graphs that represent them. The course concludes with a beginning study of Calculus. Throughout the course, mathematical theory is introduced through the use of models developed in other disciplines. Technology is seen not only as a tool to graph functions and solve equations, but also as a way to analyze data, draw scatter diagrams and find curves of best fit.

Objectives:

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

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

- A. Represent situations that involve variable quantities with matrices.
- B. Use tables and graphs as tools to interpret higher order equations, inequalities and matrices.
- C. Model real world phenomena with a variety of non-linear functions.
- D. Analyze the effect of parameter changes on the graphs of functions.
- E. Explore and describe periodic real world phenomena using trigonometric functions.
- F. Investigate and describe limiting processes by examining infinite sequences and series.
- G. Determine extrema of a graph and interpret the results in problem situations.
- H. Investigate and describe limiting processes by examining area under curves.
- I. Apply transformations when solving problems.
- J. Use curve fitting to predict data.
- K. Apply measures of central tendency, variability and correlation.

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

Materials and Activities:

Text: Pre-Calculus: Enhanced with Graphing Utilities, 5e

By: Michael Sullivan and Michael Sullivan III

Prentice Hall, Inc.; Upper Saddle River, NJ: 2009

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:

Chapter One: ***Graphs***

At the end of this chapter, the student should be able to:

- Apply the distance formula
- Graph equations by plotting points and using a graphing utility
- Find the intercepts of a graph
- Test an equation for symmetry
- Analyze the equation for a line

- Solve linear and quadratic equations in one variable
- Solve linear inequalities
- Determine the equation for a line and for a circle
- Find the center and radius of a circle from its equation
- Solve equations and inequalities involving absolute value

Chapter Two: ***Functions and Their Graphs***

At the end of this chapter, the student should be able to:

- Determine whether a relation is a function
- Find the domain and range of a function from its graph and from its equation
- Determine whether a function is odd or even without graphing it
- Graph certain functions by shifting, compressing, stretching, and reflecting
- Use a graphing utility to find local extrema of a function
- Construct functions, including piecewise functions, from applications

Chapter Three: ***Linear and Quadratic Functions***

- Use average rate of change to identify linear functions
- Determine whether a function is increasing, decreasing, or constant
- Build linear and quadratic models from verbal descriptions and data
- Draw and interpret scatter diagrams
- Discriminate between linear and nonlinear relations
- Find the line of best fit
- Graph a quadratic functions using its vertex, axis, and intercepts

Chapter Four: ***Polynomial and Rational Functions***

At the end of this chapter, the student should be able to:

- Graph quadratic, power and polynomial functions
- Graph rational functions
- Use synthetic division to divide a polynomial by $x - c$
- Find the real zeroes of a polynomial by using Descartes' Rule of Signs, the Rational Zeroes Theorem and depressed equations
- Solve polynomial functions using Descartes' Rule of Signs, the Rational Zeroes Theorem and depressed equations
- Find the complex zeroes of a polynomial
- Solve polynomial and rational inequalities

Chapter Five: ***Exponential and Logarithmic Functions***

At the end of this chapter, the student should be able to:

- Find the composite of two functions
- Identify one-to-one functions and find their inverses
- Graph the inverse function of f given the graph of f
- Graph exponential and logarithmic functions
- Solve certain exponential equations
- Solve certain logarithmic equations
- Solve problems involving compound interest
- Solve problems involving growth and decay
- Determine exponential, logarithmic and logistic functions of best fit
- Choose models of best fit

Chapter Six: ***Trigonometric Functions***

At the end of this chapter, the student should be able to:

- Convert an angle from radian measure to degree measure
- Convert an angle from degree measure to radian measure
- Find the value of the remaining trigonometric functions given one value and the quadrant the angle is in
- Graph the trigonometric functions, including transformations
- Use reference angles to find the value of a trigonometric function
- Use a calculator to find the value of a trigonometric function

Chapter Seven: **Analytic Trigonometry**

At the end of this chapter, the student should be able to:

- Find the exact value of certain inverse trigonometric functions
- Use a calculator to find the approximate values of inverse trigonometric functions
- Establish identities (sum, difference, half-angle)
- Solve a trigonometric equation algebraically and graphically

Chapter Eight: **Applications of Trigonometric Functions**

At the end of this chapter, the student should be able to:

- Solve right triangles
- Use the theorem on co-functions of complementary angles
- Use the Law of Sines to solve a SAA, ASA or SSA triangle
- Use the Law of Cosines to solve a SAS or SSS triangle
- Find the area of a triangle (right or oblique)
- Find the period and the amplitude of a sinusoidal function and use them to graph the function
- Find a function whose sinusoidal graph is given
- Find a sinusoidal function of best fit

Chapter Nine: **Polar Coordinates**

At the end of this chapter, the student should be able to:

- Plot polar coordinates
- Convert from polar to rectangular coordinates
- Convert from rectangular to polar coordinates
- Graph polar equations by testing for symmetries and plotting points
- Write a complex number in polar form
- Use DeMoivre's theorem to find powers of complex numbers
- Find the n th roots of a complex number

Chapter Ten: **Analytic Geometry**

At the end of this chapter, the student should be able to:

- Find the vertex, focus, and directrix of a parabola given its equation
- Graph a parabola given its equation
- Find the equation for a parabola given certain information about the parabola
- Find the center, foci, and vertices of an ellipse given its equation
- Graph an ellipse given its equation
- Find an equation of an ellipse given certain information about the ellipse
- Find the center, foci, vertices and asymptotes of a hyperbola given its equation
- Graph a hyperbola given its equation
- Find the equation of a hyperbola given certain information about the hyperbola
- Identify conics without completing the square or a rotation of axes

Chapter Eleven: **Systems of Equations and Inequalities**

At the end of this chapter, the student should be able to:

- Solve a system of linear equations using substitution, elimination, matrices and determinants
- Recognize equal matrices
- Add, subtract, and multiply matrices
- Find the inverse of a nonsingular matrix
- Solve a system of linear equations using the inverse of a matrix (matrix algebra)
- Write the partial fraction decomposition of a rational expression
- Solve a system of nonlinear equations
- Graph a system of inequalities
- Find the corner points of the graph of a system of linear inequalities
- Solve linear programming problems.

Chapter Twelve: **Sequences and the Binomial Theorem**

At the end of this chapter, the student should be able to:

- Write down the terms of a sequence

- Use summation notation
- Identify arithmetic and geometric sequences
- Find the sum of the first n terms of arithmetic and geometric sequences
- Solve annuity problems
- Apply the binomial theorem
- Find the sum of an infinite geometric series, where possible
- Use mathematical induction to prove statements about natural numbers

Chapter Thirteen: ***Counting and Probability***

- Find unions, intersections and complements of sets
- Use Venn diagrams to illustrate sets
- Recognize permutation and combinations problems
- Solve certain probability problems
- Count the elements in a sample space
- Draw a tree diagram

Chapter Fourteen: ***A Preview of Calculus***

At the end of this chapter, the student should be able to:

- Find limits by using tables and graphs
- Find limits algebraically by using limit properties
- Find left and right limits
- Determine whether a function is continuous
- Find the equation of a tangent line to the graph of a function f at P
- Find the derivative of a function at c
- Find the instantaneous rate of change

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.
- Semester exams given in January and June.
- Assessments designed to determine how the student has met the Academic Expectations relating to effective communication, mathematical competency and problem solving skills.

Revised 07/09