

Masconomet Regional High School Curriculum Guide

COURSE TITLE: Advanced Math

COURSE NUMBER: 1323

DEPARTMENT: Mathematics

GRADE LEVEL(S) & PHASE: 11 – 12, CP

LENGTH OF COURSE: Full Year

Course Description:

Advanced Mathematics integrates ideas of functions and trigonometry usually studied at this level, with the data analysis necessary to function successfully in the world of today and tomorrow. Where functions are widely recognized as a major unifying theme in mathematics, Advanced Mathematics builds that understanding with real-world problems establishing a firm foundation for future work in mathematics programs and in applications the student will meet during his/her lifetime. Solutions to problems are often presented from multiple perspectives – algebraic, graphical and numerical. Collecting, analyzing, processing, and displaying data are ever increasing needs for today's student, as they move into the work force and into society in general. Trigonometry is fundamental to many real-world problems. This course introduces the key concepts of trigonometry related to both right triangles and the unit circle.

Objectives:

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

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

- A. Develop an ability to display, describe, transform and interpret numerical information in the form of data, graphs, or equations.
- B. Appreciate the need, not only for precision and accuracy in an advanced math program, but also for correct interpretation from results gathered.
- C. Understand the integration of statistical and algebraic concepts.
- D. Be able to use functions and statistics to model and analyze real-world situations.
- E. Develop strategies for solving problems, especially those embedded in application settings.
- F. Relate concepts of functions in their graphical and algebraic form.
- G. Gain an ability to utilize technology (graphing calculator) to investigate problem situations and to help the student to see the parallel effects of transformations on functions and on data.
- H. Develop an ability to use, apply, and communicate information relating to problems associated with a given lesson.
- I. Understand the application of trigonometry to geometry, algebra and real-life situations.
- J. Realize the importance of independent thinking and learning, as well as teamwork, in gaining a full understanding of the concepts presented.
- K. Appreciate the importance and application of advanced mathematical concepts (functions, statistics, and trigonometry) to the many fields of human endeavor, whether it be in career development (especially the sciences and engineering), a future study of mathematics, or daily living in general.

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 (4th 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:

Functions and their Graphs: (Chapter 1)

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

- Find and use the slope of a line to write and graph linear equations
- Evaluate functions and find their domains
- Analyze graphs of functions
- Identify and graph shifts, reflections, and non-rigid transformations of functions
- Find arithmetic combinations and compositions of functions
- Find inverse functions graphically and algebraically
- Use scatter plots and a graphing utility to find linear models for data
- Find a least squares regression line for a set of data
- Find a least squares regression parabola for a set of data

Polynomial and Rational Functions: (Chapter 2 sections 1 – 5, 8)

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

- Analyze graphs of quadratic functions
- Write quadratic functions in standard form and use the results to sketch graphs of functions
- Find minimum and maximum values of functions in real-life applications
- Use transformations to sketch graphs of polynomial functions
- Use the Leading Coefficient test to determine the end behavior of graphs of polynomial functions
- Find and use the zeroes of polynomial functions as sketching aids
- Use the Intermediate Value Theorem to help locate the zeroes of polynomial functions
- Use long division to divide polynomials by other polynomials
- Use the Remainder and Factor Theorems
- Determine the number of rational and real zeroes of polynomial functions and find the zeroes
- Find conjugate pairs of complex zeroes
- Use the imaginary unit i to write complex numbers
- Add, subtract, multiply and divide complex numbers
- Use complex conjugates to write the quotient of two complex numbers in standard form
- Plot complex numbers in the complex plane
- Use the Fundamental Theorem of Algebra to determine the number of zeroes of a polynomial function
- Find all complex zeroes of polynomial functions
- Classify scatter plots
- Use scatter plots and a graphing utility to find quadratic models for data
- Chose a model that best fits a set of data

Linear Systems: (Chapter 7 sections 1 – 8) This chapter is done out of order because it bridges the 2 semesters with sections 1 and 2 covered in semester 1 and the rest of the chapter covered in semester 2.

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

- Use substitution, graphing and linear combination – as appropriate – to solve systems of equations in two variables
- Use systems of linear equations in two variables to model and solve real-life problems
- Write matrices to represent data
- Identify the order of a matrix
- Add, subtract, and do scalar multiplication to matrices (by hand)
- Determine whether two matrices are equal
- Determine the value of one or more variables that would make 2 matrices equal
- Perform matrix multiplication using a graphing calculator
- Given the order of 2 matrices, explain whether or not matrix multiplication is possible
- Show that matrix multiplication is not commutative

- Find the inverse of a matrix using a graphing calculator
- Find the determinant of a matrix using a graphing calculator
- Solve a system of linear equations in three or more variables using matrices and a graphing calculator
- Use matrices and a graphing calculator to find the area of a triangle or quadrilateral given the coordinates of its vertices
- Use matrices and a graphing calculator to determine whether points are collinear
- Use systems of linear equations in three or more variables to model and solve real-life problems

Exponential and Logarithmic Functions: (Chapter 3)

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

- Recognize and evaluate exponential functions with base a
- Graph exponential functions
- Recognize, evaluate and graph exponential functions with base e
- Use exponential functions to model and solve real-life problems
- Recognize and evaluate logarithmic functions with base a
- Graph logarithmic functions
- Recognize, evaluate and graph logarithmic functions with base e
- Use logarithmic functions to model and solve real-life problems
- Rewrite logarithms with different bases
- Use properties of logarithms to evaluate or rewrite logarithmic expressions
- Use properties of logarithms to expand or condense logarithmic expressions
- Use logarithmic functions to model and solve real-life problems
- Solve exponential and logarithmic equations
- Use exponential and logarithmic equations to model and solve real-life problems
- Recognize the five most common types of models involving exponential or logarithmic functions
- Use exponential growth and decay functions to model and solve real-life problems
- Use Gaussian, logistic and logarithmic functions to model and solve real-life problems
- Classify scatter plots
- Use scatter plots and a graphing utility to find models for data and choose a model that best fits a set of data

Sequences, Series and Probability: (Chapter 8 sections 1 – 3, 6, 7)

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

- Generate the terms of a sequence described recursively
- Generate the terms of a sequence described explicitly
- Give the recursive rule for a sequence based on information about terms in the sequence
- Give the explicit rule for a sequence based on information about terms in the sequence
- Determine whether a given sequence is arithmetic, geometric or neither
- Use factorial notation
- Use summation notation to represent sums
- Find sums of infinite series
- Use sequences and series to model and solve real world problems
- Recognize, write and find the n^{th} terms of arithmetic and geometric sequences
- Find n^{th} partial sums of arithmetic and geometric sequences
- Use arithmetic and geometric sequences to model and solve real world problems
- Find sums of infinite geometric series
- Solve simple counting problems
- Use the Fundamental Counting Principle to solve more complicated counting problems
- Use permutations to solve counting problems
- Use combinations to solve counting problems
- Find probabilities of events
- Find probabilities of mutually exclusive events
- Find probabilities of independent events
- Find probabilities of complements of events

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.

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