

# MAC1147 Course Outline

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## *Precalculus Algebra and Trigonometry*.....(5) (P)

Description: This course is an intensive review of both Precalculus Algebra and Trigonometry topics. It is designed as a rigorous preparation for serious STEM (Science, Technology, Engineering, Mathematics) students for the calculus sequence MAC2311, MAC2312 and MAC2313. The course includes an in-depth study of functions; polynomial, rational, algebraic, piecewise, logarithmic, exponential, trigonometric, and inverse trigonometric functions, including their properties, graphs, and applications; conic sections; nonlinear inequalities; the binomial theorem; induction; matrices and determinants; sequences and series; trigonometric identities; conditional trigonometric equations and parametric equations; vector algebra; polar coordinates; and solutions of triangles.

General Education Learning Outcome: The primary General Education Learning Outcome (GELO) for this course is Quantitative Reasoning, which is to understand and apply mathematical concepts and reasoning, and analyze and interpret various types of data. The GELO will be assessed through targeted questions on either the comprehensive final or an outside assignment.

Prerequisite: MAC1105 with a grade of “B” or better, OR the equivalent. **HOWEVER**, students wishing for a slower paced course or who do not have a strong mathematical background would be better served by taking MAC 1140 (Precalculus Algebra) and MAC 1114 (Trigonometry) separately.

Rationale: In an increasingly complex world, mathematical thinking, understanding, and skill are more important than ever. Many concepts will be introduced using real world data from various areas, and other concepts will be reinforced by applying them to problems in the areas of science, business, economics, and medicine. By offering the material from both Precalculus and Trigonometry in one unified course, students will see how the different concepts fit together as well as get the experience of applying a variety of skills in different areas as preparation for Calculus.

Impact Assessment: *Precalculus Algebra and Trigonometry* provides students with skills and proficiency in understanding the concepts needed for the calculus sequence, including an in-depth understanding of functions and their applications, and the opportunity to learn to communicate and reason mathematically. The course also applies toward the General Education mathematics requirement area A for an Associate of Arts degree. MAC1147, in one semester, will satisfy the prerequisites for MAC2311 which is required for many degrees in mathematics and the sciences, allowing these students to progress quickly and confidently.

Broad Course Objectives: This course supports the following goals of the Math Department:

- Engage students in sound mathematical thinking and reasoning. This should include students finding patterns, generalizing, and asking/answering relevant questions.
- Provide a setting that prepares students to read and learn mathematics on their own.
- Explore multiple representations of topics including graphical, symbolic, numerical, oral, and written. Encourage students to make connections among the various representations to gain a richer, more flexible understanding of each concept.

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- Analyze the structure of real-world problems and plan solution strategies. Solve the problems using appropriate tools.
- Develop a mathematical vocabulary by expressing mathematical ideas orally and in writing.
- Enhance and reinforce the student's understanding of concepts through the use of technology when appropriate.

As a result of successfully completing MAC1147, students should be able to demonstrate the following:

- Analyze/interpret quantitative data verbally, graphically, symbolically and numerically.
- Communicate quantitative data verbally, graphically, symbolically and numerically.
- Appropriately integrate technology into mathematical processes.
- Use mathematical concepts in problem-solving through integration of new material and modeling.

## Topical Outline with Specific Course Objectives:

- I. *Introduction of Functions, the Properties, Graphs, and Inverses*
  - A. Analyze and interpret functions using graphs, tables, and equations.
  - B. Determine domain and range both algebraically and graphically.
  - C. Construct the inverse of a function, including trigonometric functions, both graphically and algebraically when feasible.
  - D. Demonstrate an intuitive understanding of functions including limits, continuity, increasing, decreasing, maximum and minimum values, and concavity.
- II. *Polynomial, Rational, Exponential, Logarithmic, Piecewise-Defined, and Trigonometric Functions*
  - A. Model real-world applications using these functions.
  - B. Explain the relationship between logarithmic and exponential functions.
  - C. Demonstrate an understanding of the trigonometric functions as functions of real numbers.
  - D. Analyze and interpret trigonometric functions using graphs, tables and equations.
  - E. Discuss the scientific basis for radian measure.
  - F. Apply radian measure to arc length and area.
- III. *Conic Sections*
  - A. Identify and graph a conic section from its equation.
  - B. Find the equation of a conic section from its description.
  - C. Identify the attributes of a conic section.
- IV. *Coordinate Transformation*
  - A. Relate the algebra of functions to graphical representations.
  - B. Use function notation to describe graphical transformations.

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## VI. *Required Special Topics*

- A. Use matrices and determinants to solve linear systems of equations.
- B. Demonstrate an understanding of Proof by Induction.
- C. Apply the Binomial Theorem.
- D. Recognize arithmetic and geometric sequences and series in summation or iterative notation.
- E. Solve non-linear inequalities numerically and graphically, as well as algebraically.
- F. Demonstrate the ability to find unknown angles and side lengths of right and non-right triangles using trigonometry.
- G. Solve applications using solutions of triangles.

## VII. *Trigonometric identities and conditional trigonometric equations*

- A. Verify and apply trigonometric identities.
- B. Solve trigonometric equations numerically, graphically, and algebraically.

## VIII. *Vector algebra and polar coordinates*

- A. Demonstrate an understanding of vectors, their graphical representation and vector algebra.
- B. Sketch and identify graphs in polar coordinates.
- C. Convert rectangular equations to polar form and vice versa.

## IX. *Parametric equations*

- A. Sketch and identify graphs using parametric equations.
- B. Convert rectangular equations to parametric form and vice versa.

Evaluation: Each instructor will determine the specific criteria for determining the final course grade. These criteria will be delineated in the first day handout provided to each student. Each instructor will give a comprehensive final exam during the assigned final exam period.

Commonality: All instructors will use the same textbook and cover all topics in the topical outline. A computer lab with mathematical software is provided to facilitate collaboration and the use of technology. A graphing calculator will be required for this course. Either the TI-83 or the TI-84 line of calculators is recommended; any other graphing calculator will need to be approved by the instructor.