

**MAT 171**  
**PRECALCULUS ALGEBRA**

**COURSE DESCRIPTION:**

Prerequisites: MAT 080 or MAT 090 or satisfactory score on placement test

Corequisites: MAT 171A

This is the first of two courses designed to emphasize topics which are fundamental to the study of calculus. Emphasis is on equations and inequalities; functions (linear, polynomial, and rational); systems of equations and inequalities; and parametric equations. Upon completion, students should be able to solve practical problems and use appropriate models for analysis and predictions. Additional topics include, but are not limited to, exponential and logarithmic functions and their applications. *This course has been approved to satisfy the Comprehensive Articulation Agreement for the general education core requirement in natural sciences/mathematics.* Students may not receive credit for both MAT 161 and MAT 171.

Course Hours Per Week: Class, 3. Semester Hours Credit, 3.

**LEARNING OUTCOMES:**

1. Students will be able to use techniques of algebra and algebraic formulas to simplify expressions and to manipulate and solve equations and inequalities both analytically and with the use of technology. Students will display proficiency by demonstrating the following competencies:
  - a. State the distance formula and the midpoint formula and use these equations to solve selected problems.
  - b. Solve linear, quadratic, absolute value, and radical equations both algebraically and graphically.
  - c. Solve linear, compound, absolute value, polynomial and rational inequalities both algebraically and graphically.
  - d. Given a point and the slope of a line, or two points on the line, write the equation of a line in both slope-intercept form and general form.
  - e. Given the equation of a line, write the equation of a line either parallel or perpendicular to the given line that passes through a specified point.
  - f. State the standard form of the equation of a circle and apply this equation to the solution of selected problems.
  - g. Solve systems of linear equations in two or three unknowns both algebraically and by using a graphing utility.
  - h. Find the composition of two functions and identify the domain of the resulting composite function.
  - i. Perform computations with complex numbers.
  - j. Evaluate exponential functions and solve exponential equations both algebraically and by using a graphing utility.

- k. Evaluate logarithmic functions and solve logarithmic equations both algebraically and by using a graphing utility.
  - l. Use the properties of logarithms to simplify and rewrite logarithmic expressions.
  - m. Solve systems of nonlinear equations both algebraically and by using a graphing utility.
  - n. Solve systems of inequalities both algebraically and by using a graphing utility.
2. Students will be able to explain the relationship between algebra and geometry by recognizing and analyzing the graph of a function from its equation, graphing the function by hand, and verifying the results using a graphing utility. Students will display proficiency by demonstrating the following competencies:
- a. Graph equations with a graphing calculator, making appropriate choices for the viewing window.
  - b. Graph equations by hand, find the intercepts, and test equations for symmetry.
  - c. Identify the slope and the intercepts of a line and sketch the graph of the line.
  - d. Graph a circle by hand and by using a graphing utility.
  - e. Identify the domain and range of selected functions.
  - f. Determine intervals over which a function is increasing or decreasing, locate maxima and minima, and identify functions as either even or odd.
  - g. Identify and sketch the graphs of the linear function, the constant function, the identity function, the quadratic function, the cubic function, the square root function, the reciprocal function, the absolute value function, the greatest-integer function, and piecewise functions.
  - h. Sketch the graph of selected functions using the techniques of shifting, stretching, compressing, and reflecting.
  - i. Construct the equations and sketch the graphs of polynomial functions. Identify, both algebraically and with the aid of a graphing utility, the domain, the range, the x-intercepts, the y-intercept, and any maximum or minimum points.
  - j. Utilize the Remainder and Factor Theorems and the Rational Zeros Theorem to find all zeros of a polynomial function.
  - k. Write the equations of selected rational functions and sketch their graphs. Identify, both algebraically and with the aid of a graphing utility, the horizontal, vertical, and oblique asymptotes, the x-intercepts, the y-intercept, the domain, and the range.
  - l. Find the inverse of an invertible function both algebraically and graphically, and identify the domain and range of the inverse function.
  - m. Write the equations of selected exponential functions and sketch their graphs. Identify, both algebraically and with a graphing utility, the horizontal asymptote, the y-intercept, the domain, and the range.
  - n. Write the equations of selected logarithmic functions and sketch their graphs. Identify, both algebraically and with a graphing utility, the vertical asymptote, the x-intercept, the domain, and the range.
  - o. Graph parametric equations and find a rectangular equation for a curve defined parametrically.

3. Students will be able to solve practical problems by choosing an appropriate model for the problem and using the model to analyze the situation and make predictions. Students will display proficiency by demonstrating the following competencies:
  - a. Translate verbal descriptions into mathematical equations and, given an applied problem, construct and analyze a function that models the given data.
  - b. Use a graphing utility to construct a scatter diagram and find the curve of best fit.
  - c. Construct models and solve applied problems using variation.
  - d. Use exponential and logarithmic equations to model compound interest and growth and decay problems.
  - e. Use all of the above techniques and skills to model and pose solutions for real life applications.

## **OUTLINE OF INSTRUCTION**

- I. Graphs
  - A. Rectangular Coordinates; Graphing Utilities
  - B. Introduction to Graphing Equations
  - C. Intercepts; Symmetry; Graphing Key Equations
  - D. Solving Equations
  - E. Lines
  - F. Circles
- II. Functions and Their Graphs
  - A. Systems of Linear Equations
  - B. Functions
  - C. The Graph of a Function
  - D. Properties of Functions
  - E. Library of Functions; Piecewise-defined Functions
  - F. Graphing Techniques: Transformations
  - G. Mathematical Models: Building Functions
- III. Linear and Quadratic Functions
  - A. Linear Functions, Their Properties, and Linear Models
  - B. Building Linear Models from Data
  - C. Quadratic Functions and Their Properties
  - D. Building Quadratic Models from Verbal Descriptions and from Data
  - E. Inequalities Involving Quadratic Functions
- IV. Polynomial and Rational Functions
  - A. Polynomial Functions and Models
  - B. Properties of Rational Functions
  - C. The Graph of a Rational Function
  - D. Polynomial and Rational Inequalities
  - E. The Real Zeros of a Polynomial Function

- F. Complex Zeros: Fundamental Theorem of Algebra
- V. Exponential and Logarithmic Functions
  - A. Composite Functions
  - B. One-to-One Functions; Inverse Functions
  - C. Exponential Functions
  - D. Logarithmic Functions
  - E. Properties of Logarithms
  - F. Logarithmic and Exponential Equations
  - G. Financial Models
  - H. Exponential Growth and Decay Models; Newton's Law; Logistic Growth and Decay Models
  - I. Building Exponential, Logarithmic, and Logistic Models from Data
- VI. Parametric Equations
  - A. Plane Curves and Parametric Equations
  - B. Using a Graphing Utility to Graph Curves Defined by Parametric Equations
- VII. Systems of Equations and Inequalities
  - A. Systems of Nonlinear Equations
  - B. Systems of Inequalities

**REQUIRED TEXTBOOK:**

Sullivan, Michael and Michael Sullivan, III. Precalculus Enhanced with Graphing Utilities. 5<sup>th</sup> Ed. Pearson Education, 2009.

**CALCULATOR:**

TI-83/84 Graphing Calculator

**STATEMENT FOR STUDENTS WITH DISABILITIES:**

Students who require academic accommodations due to any physical, psychological, or learning disability are encouraged to request assistance from a disability services counselor within the first two weeks of class. Likewise, students who potentially require emergency medical attention due to any chronic health condition are encouraged to disclose this information to a disability services counselor within the first two weeks of class. Counselors can be contacted by calling 536-7207, ext. 1413 or by visiting the Student Development Office in the Phail Wynn Jr. Student Services Center, room 1309.