



MERCER
COUNTY COMMUNITY COLLEGE

COURSE OUTLINE

Course Number
MAT 146

Course Title
Precalculus

Credits
4

Hours:
Lecture/Lab/Other
4 lecture

Co- or Pre-requisite
MAT 038 Or MAT 044 Or Multiple Measure
Placement

Implementation
Semester & Year
Spring 2022

Catalog description:

Provides an in-depth study of functions needed for success in Calculus - algebraic, exponential, logarithmic, and trigonometric - with an introduction to graphing calculators. Grade of B- or better is strongly recommended to proceed to MAT 151.

General Education Category:
Goal 2: Mathematics

Course coordinator:
John Nadig, 609-570-3770, nadigi@mccc.edu

Required texts & Other materials:

Precalculus by Jay Abramson

For no charge: Book available online or to download as a pdf at

<https://openstax.org/details/books/prec calculus>

For a fee: Also available as a hardcover, paperback, or eText book through Amazon.

Hardcover ISBN-13: 978-1-938168-34-5 or Paperback ISBN-13: 978-1-50669-812-0

Graphing calculator required: TI – 83, 84, 86, or comparable model strongly recommended. No calculator with computer algebra system (CAS) is permitted (TI-89).

Course Student Learning Outcomes (SLO):

Upon successful completion of this course the student will be able to:

1. Demonstrate knowledge of function operations: arithmetic, composite, piecewise, and transformations using polynomials. (ILG #2, 11)
2. Generate and interpret the graphs of polynomial, absolute value, inverse, rational, exponential, logarithmic, trigonometric, and inverse trigonometric functions. (ILG #2, 11)
3. Recognize various types of functions, analyze their behavior, and use the properties of these functions to solve equations, real and complex, and application problems. (ILG #2, 11)
4. Define trigonometric functions; understand right-triangle trigonometry and the unit circle. (ILG #2, 11)
5. Apply trigonometric identities to recognize equivalent statements and to solve applications. (ILG #2, 11)

Appropriate use of technology will be encouraged but not accessed throughout the course.

Course-specific Institutional Learning Goals (ILG):

Institutional Learning Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.

Institutional Learning Goal 11. Critical Thinking: Students will use critical thinking skills to understand, analyze, or apply information or solve problems.

Units of study in detail – Unit Student Learning Outcomes:

Unit I [Functions: Operations, Composites, Transformations] [Supports Course SLO #1]

Learning Objectives

The student will be able to:

- Determine whether a relation represents a function, and whether it is one-to-one.
- Find the domain of a function defined by an equation.
- Graph piecewise-defined functions.
- Calculate the average rate of change of a function, using a graph to determine when a function is increasing, decreasing, or constant.
- Locate local or relative maximum and minimum values as well as absolute maximum and minimum values.
- Find the sum, difference, product, and quotient of two given functions, giving the domain and range of each.
- Create and evaluate composite functions. Find the domain, range of them and decompose them into the component functions.
- Graph functions using transformations. Vertical, horizontal, reflections, compressions, and stretches from the parent graph.

Unit II [Functions: Absolute value and Inverse; Complex numbers] [Supports Course SLO #2]

Learning Objectives

The student will be able to:

- Graph an absolute value function.
- Solve an absolute value equation and inequality.
- Verify inverse functions.
- Determine domain and range of an inverse function and restrict the domain of a function to make it one-to-one.
- Find and evaluate the inverse of a function.
- Using the graph of a function, graph its inverse function on the same axes.
- Express square roots of negative numbers as multiples of i .
- Perform the arithmetic operations of addition, subtraction, multiplication, and division of complex numbers.

Unit III [Functions: Polynomial and Rational] [Supports Course SLOs #2, 3]

Learning Objectives

The student will be able to:

- Understand how the graph of a parabola relates to the quadratic function.
- Determine minimum and maximum values, applying this concept to application problems.
- Identify power functions including end behavior.

- Identify the degree and leading coefficient of polynomial functions.
- Use factoring or division, long or synthetic, to find zeros of polynomial functions.
- Determine end behavior, the multiplicities of zeros, and use the relationship between degree and turning points to graph polynomial functions.
- Demonstrate the Intermediate Value Theorem.
- Apply the following theorems: Remainder, Factor, and Rational Zero Theorems to solve and evaluate polynomial equations.
- Use the Linear Factorization Theorem to find polynomial equations with given zeros.
- Use Descartes' Rule of Signs.
- Apply this knowledge to applications of polynomial equations.
- Find the inverse of polynomial functions by restricting the domain of the function.
- Find domains of rational functions.
- Identify vertical, horizontal, or oblique asymptotes to sketch graphs of rational functions.

Unit IV [Functions: Exponential and Logarithmic] [Supports Course SLOs #2, 3]

Learning Objectives

The student will be able to:

- Evaluate exponential functions with various bases.
- Graph exponential and logarithmic functions including those with transformations.
- Find the equation of an exponential function.
- Convert from exponential to logarithmic form and from logarithmic to exponential form.
- Evaluate logarithms, both common and natural.
- Identify the domain of exponential and logarithmic functions.
- Use the product, quotient, and power rules for logarithms to both condense and expand logarithmic expressions.
- Use the change-of-base formula for logarithms.
- Solve both exponential and logarithmic equations by using like bases, converting forms, using the definitions, and the one-to-one property.
- Solve application problems involving exponential and logarithmic equations.
- Model exponential growth and decay, including from data using a graphing calculator.

Unit V [Trigonometric Functions] [Supports Course SLOs #2, 3, 4]

Learning Objectives

The student will be able to:

- Use basic concepts of angles, standard form, converting between degree and radians, finding co-terminal angles, and the area of a sector of a circle.
- Use linear and angular speed to describe motion on a circular path.
- Find function values for the sine, cosine, and tangent functions of special angles.
- Use reference angles to evaluate other trigonometric functions.
- Find the function values for the remaining functions, secant, cosecant, and cotangent.
- Recognize and use fundamental identities.
- Use right triangles to evaluate trigonometric functions.
- Apply the definitions of trigonometric functions to solve applied problems.
- Analyze the graphs of $y = \sin(x)$ and $y = \cos(x)$.
- Graph sine and cosine functions of the form $y = A\sin(Bx - C) + D$ and $y = A\cos(Bx - C) + D$
- Analyze the graphs of the other four functions and graph them by using transformations.

- Understand and use the inverse sine, cosine, and tangent functions.
- Find exact values of expression involving the inverse functions.

Unit VI [Trigonometric Identities, Equations, Law of Sines/Cosines] [Supports Course SLOs #3, 5]

Learning Objectives

The student will be able to:

- Verify the fundamental trigonometric identities.
- Simplify trigonometric expressions by using algebra and identities.
- Use the sum and difference formulas for trigonometric functions and use them to verify identities.
- Use double-angle, half-angle, and reduction formulas to find exact values and to verify identities.
- Solve trigonometric equations, linear, quadratic in form, using fundamental identities, and with multiple angles.
- Determine the amplitude and period of sinusoidal functions.
- Model periodic behavior and harmonic motion functions.
- Use the Law of Sines and the Law of Cosines to solve oblique triangles and application problems.

Evaluation of student learning:

Selection of problems on graded assignments will assess the learning objectives listed above. Unit tests and a final, or unit tests, midterm, and a final weighted to 85%. In-class assignments or short out-of-class assignments should encompass the remaining 15%. Grade details given to students on the syllabus. The final must be cumulative and should be weighted 25% – 30%.