

MA114 Calculus II

MA 114 Course Objectives

1. Use integration to find the volume of solids of revolution and the arc length of graphs of a function.
2. Use integration to solve application problems.
3. Compute integrals using various techniques including the methods of substitution, integration by parts, trigonometric substitution, partial fractions, and tables.
4. Evaluate improper integrals.
5. Determine and compute convergence/divergence of sequences and series.
6. Find power series and Taylor and Maclaurin series representations of a given function and determine their intervals of convergence.
7. Represent curves by parametric equations, and apply the methods of calculus to parametric curves.
8. Determine the slope of a tangent line to and the arc length of the graph of a parametric function.
9. Calculate the slope of a tangent line to and the arc length of a polar graph, and determine the volume and surface area of solids formed by revolving regions bound by polar functions.

MA114 Course Competencies

- A. Knowledge of human cultures and the physical and natural worlds through study in the sciences and mathematics, social sciences, humanities, histories, languages, and the arts.
- B. Intellectual and practical skills, including
 - inquiry and analysis
 - critical and creative thinking
 - written and oral communication
 - quantitative literacy
 - information literacy
 - teamwork and problem solving
- C. Personal and social responsibility, including
 - civic knowledge and engagement (local and global)
 - intercultural knowledge and competence
 - ethical reasoning and action
 - foundations and skills for lifelong learning
- D. Integrative and applied learning, including synthesis and advanced accomplishment across general and specialized skills.

Student Learning Outcomes for Quantitative Reasoning

In MA 114, students will learn to:

1. Interpret information presented in mathematical and/or statistical forms by (Gen Ed Comp B):
 - Determining and computing convergence/divergence of sequences and series.
 - Finding power series and Taylor and Maclaurin series representations of a given function and determining their intervals of convergence.
2. Illustrate and communicate mathematical and/or statistical information symbolically, visually, and/or numerically by (Gen Ed Comp A, B, C):
 - Representing curves by parametric equations, and applying the methods of calculus to parametric curves.
3. Determine when computations are needed and execute the appropriate computations by (Gen Ed Comp A, B):
 - Computing integrals using various techniques including the methods of substitution, integration by parts, trigonometric substitution, partial fractions, and tables.
 - Evaluating improper integrals.
 - Determining the slope of a tangent line to and the arc length of the graph of a parametric function.
 - Calculating the slope of a tangent line to and the arc length of a polar graph, and determining the volume and surface area of solids formed by revolving regions bound by polar functions.
4. Apply an appropriate model to the problem to be solved by (Gen Ed Comp A, B, C):
 - Using integration to solve application problems.
5. Make inferences, evaluate assumptions, and assess limitations in estimation modeling and/or statistical analysis by (Gen Ed Comp A, D):
 - Using integration to find the volume of solids of revolution and the arc length of graphs of a function.

MA 114 Course Outline

- I. Applications of Integrals
 - A. Area Between Curves
 - B. Volumes of Revolution
 - 1. Disks
 - 2. Washers
 - 3. Shells
 - C. Average Value
 - D. Work
 - E. Arc Length
 - II. Integration Techniques/Strategies
 - A. Integration by Parts
 - B. Trigonometric Integrals
 - 1. Powers of $\sin(x)$, $\cos(x)$, $\sec(x)$ & $\tan(x)$
 - 2. Products of $\sin(x)$ & $\cos(x)$
 - 3. Products of $\sec(x)$ & $\tan(x)$
 - 4. Arbitrary Combinations of Trigonometric Functions
 - C. Trigonometric Substitution
 - D. Partial Fractions
 - 1. Long Division
 - 2. Completing the Square
 - E. Rationalizing Substitutions
 - F. Tables
 - G. Approximate Integration
 - 1. Midpoint Rule
 - 2. Simpson's Rule
 - 3. Trapezoidal Rule
 - III. Improper Integrals
 - A. Infinite Intervals
 - B. Discontinuous Integrands
 - IV. Sequences
 - A. Definition
 - 1. Convergent
 - 2. Divergent
 - V. Series
 - A. Definition
 - 1. Convergence
 - 2. Divergence
 - 3. Absolute Convergence
 - 4. Conditional Convergence
 - B. Geometric Series
 - C. P-Series
 - D. Alternating Series
 - E. Tests
 - 1. Test for Divergence
 - 2. Integral Test
 - 3. Comparison Tests
 - a. Direct Comparison Test
 - b. Limit Comparison Test
 - 4. Alternating Series Test
 - 5. Ratio Test
 - 6. Root Test
 - F. Power Series
 - 1. Radius of Convergence
 - 2. Interval of Convergence
 - 3. Properties
 - a. Derivative
 - b. Integral
 - 4. Expressing Functions as Power Series
 - a. Taylor Series
 - b. Maclaurin Series
- VI. Parametric Equations
 - A. Conversion to Cartesian Equation
 - B. Parametric Curves
 - 1. Graphing
 - 2. Tangents
 - 3. Areas
 - 4. Arc Length
- VII. Polar Coordinates
 - A. Conversions
 - 1. Polar to Cartesian
 - 2. Cartesian to Polar
 - B. Polar Curves
 - 1. Graphing
 - 2. Tangents
 - 3. Areas
 - 4. Arc Length