



MATH 301 – Concepts of Calculus Course Syllabus

Course Description: Limiting processes and other concepts of calculus. Includes analysis of numerical approaches to problem solving using technology and appropriate software with historical and grades 4-8 classroom connections. Students will be required to have a graphing calculator.

Credit hours: 3

Course Prerequisites and Corequisites: MTH 300

Course outline:

Approximate time spent

- **Relations, Functions, and Concepts of Infinity** 50%
 - Numerical techniques applied to arithmetic and geometric sequences and series
 - Patterns in growth and decay
 - Iterative and recursive processes
 - Summation and product notation: applications to programming using loops
 - Computer simulation: random number generator
 - Numerical and graphical techniques for solving equations
 - Graphing systems
 - Intermediate Value Theorem
 - Bisection
 - Historical and classroom connections
- **Other Concepts of Calculus** 50%
 - Introduction to limit concepts: numerical and theoretical approaches
 - Convergence and divergence
 - Sequences of partial sums: patterns, conjectures, and proof by induction
 - Introduction to derivative concepts: numerical and theoretical approaches
 - Functions and rates of change
 - Fitting curves to derivative data
 - Connections to Pascal's Triangle and Binomial Theorem
 - Introduction to integral concepts: numerical and theoretical approaches
 - Rectangular and Monte Carlo approximations
 - Area between curves
 - Fundamental Theorem of Calculus
 - Historical and classroom connections

Student Learning Outcomes (SLO): At the end of MTH 301, a student who has studied and learned the material should be able to:

1. Find limits, derivatives, and integrals using numerical and graphical techniques. [SBEC: II, III]
2. Use proper notation for derivatives and integrals. [SBEC: II, III]
3. Find derivatives and antiderivatives of polynomial functions using the power function rule. [SBEC: II, III]
4. Demonstrate an understanding of the connection between limits and asymptotic behavior in functions. [SBEC: II, III]
5. Use the Fundamental Theorem of Calculus to evaluate definite integrals. [SBEC: III]
6. Communicate orally and in written form an understanding of the connections among geometric, graphic, numeric, and algebraic solutions to problems. [SBEC: V]
7. Demonstrate an understanding of the connections between limits, derivatives, and integrals. [SBEC: II, III]

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8. Use calculus concepts to answer questions about rates of change, areas, volumes, and properties of functions and their graphs. [SBEC: II, III]
9. Relate the concepts of limit, rate of change, and area under a curve as conceptual foundations of calculus to middle school mathematics. [SBEC: II]
10. Use spreadsheets and graphing calculators to perform simulations, solve problems, and support understanding of calculus concepts. [SBEC: III, V]
11. Apply principles of logic, iteration and recursion, and algorithmic thinking to write graphing calculator programs to solve a variety of problems numerically. [SBEC: I, V]
12. Demonstrate an understanding of the historical development of calculus and technology and the ensuing societal impacts. [SBEC: VI]

There are no specific program learning outcomes for this major addressed in this course. It is a general education core curriculum course and/or a service course.

Texas State Board for Educator Certification (SBEC): Mathematics Standards

Standard I. Number Concepts: The mathematics teacher understands and uses numbers, number systems and their structure, operations and algorithms, quantitative reasoning, and technology appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in order to prepare students to use mathematics.

Standard II. Patterns and Algebra: The mathematics teacher understands and uses patterns, relations, functions, algebraic reasoning, analysis, and technology appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in order to prepare students to use mathematics.

Standard III. Geometry and Measurement: The mathematics teacher understands and uses geometry, spatial reasoning, measurement concepts and principles, and technology appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in order to prepare students to use mathematics.

Standard V. Mathematical Processes: The mathematics teacher understands and uses mathematical processes to reason mathematically, to solve mathematical problems, to make mathematical connections within and outside of mathematics, and to communicate mathematically.

Standard VI. Mathematical Perspectives: The mathematics teacher understands the historical development of mathematical ideas, the interrelationship between society and mathematics, the structure of mathematics, and the evolving nature of mathematics and mathematical knowledge.