Course Outline for: MATH 1510 Calculus 1

A. Course Description:

1. Number of credits: 5
2. Lecture hours per week: 5
3. Prerequisites: MATH 1150 (C- or better); OR
   MATH 1500 (C- or better); OR
   High School GPA: 3.30+ and completion of high school Pre-Calculus or Higher-Level Math Course; OR
   ACT Math Sub-Score: 27+; OR
   Accuplacer Advance Algebra Score of 290+ and Quantitative Reason Score of 285+
4. Corequisites: None
5. MnTC Goals: Goal 4 Mathematical/Logical Reasoning

Calculus 1 is an introductory course designed to provide students with fundamental concepts and techniques essential for understanding calculus. The course emphasizes both theoretical understanding and practical applications through functions, limits, derivatives, and an introduction to integration. The mathematical applications of the content will involve topics that are found in science, engineering, economics, and ecology.

B. Date last reviewed/updated: April 2024

C. Outline of Major Content Areas:

1. Brief review of pre-calculus/trigonometry.
2. Limits and the derivative.
3. Derivative formulas.
4. Applications of the derivative.
5. Introduction to integration.
6. Constructing antiderivatives.

D. Course Learning Outcomes:

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

1. Demonstrate knowledge of the functions used in calculus and their basic properties. (4a, 4b)
2. Apply the concept of a limit of a function graphically, numerically, and algebraically; apply limit laws; define continuity using limits, and describe asymptotic behavior of functions. (2c; 4c, 4d)
3. Apply the limit concept to average rates of change and difference quotients to demonstrate the derivative as a measure of change. (2b; 4b, 4c, 4d)
4. Apply the rules and techniques of differentiation as to algebraic combinations, composites, inverses, implicit functions, and parametric functions. (4b, 4d)

5. Analyze the connections between derivatives and tangent lines, linearization, and approximations. (Goal 2a; 4b, 4d)
6. Determine the behavior of functions by using first and second derivatives. (Goal 4a, 4b, 4d)
7. Apply derivatives to examine families of functions, carry out extreme value searches, and apply calculus in other disciplines. (Goal 2a, 2c; 4b, 4d)
8. Apply derivatives for special topics: L'Hospital's Rule, Related Rates, and the Mean Value Theorem. (Goal 4a, 4b, 4c, 4d)
9. Examine the definite integral definition as a limit of Riemann Sums and apply its basic interpretations. (Goal 2c; 4a, 4b)
10. Use antiderivatives and substitution to evaluate definite integrals and formulate the fundamental theorems of calculus. (Goal 2a; 2b, 4a, 4c)
11. Describe the relationship between derivative and definite integral as expressed in both parts of the Fundamental Theorem of Calculus, and apply it to evaluate definite integrals using antiderivatives. (Goal 2a, 2b, 4a, 4c)

E. Methods for Assessing Student Learning:

Methods for assessment may include, but are not limited to, the following:

1. In-class testing
2. Take-home testing
3. Assignments
4. Quizzes
5. Attendance
6. Group or individual projects
7. Research

F. Special Information:

Instructors will often require some type of technology. This may include the use of one or more of a graphing calculator or computer algebra tools (such as the graphing calculators, Desmos, MAPLE, Mathematica, or Wolfram Alpha).