COURSE OUTLINE
Calculus 1 with Analytic Geometry

Course Description
MA 151. Calculus 1 with Analytic Geometry. 5 hours credit. Prerequisite: Placement score or MA 135 (or MA132, MA133, and MA134) and MA 140 or MA 145 all with a C or better. This course will enable the student to solve problems involving limits, derivatives and some types of definite and indefinite integrals both analytically and graphically, and use them in physical applications. The learning outcomes and competencies detailed in this outline meet, or exceed the learning outcomes and competencies specified by the Kansas Core Outcomes Project for this course, as approved by the Kansas Board of Regents (Transfers as MAT2010).

Required Materials
For complete material(s) information, refer to https://bookstore.butlercc.edu

A graphing calculator is required for this course. The TI 83/84 is recommended, and calculators that perform symbolic differentiation and integration (such as the TI-89) may not be allowed on some exams.

Butler-assessed Outcomes
The intention is for the student to be able to
1. Solve problems using calculus concepts of limits, derivatives and integrals both analytically and graphically.
2. Use calculus concepts in physical applications.

Learning PACT Skills that will be developed and documented in this course
Through involvement in this course, the student will develop ability in the following PACT skill area(s):

Analytical Thinking Skills
- Problem solving - Through the solution of multi-step calculus scenarios, the student will develop increased ability to analyze and solve problems.
- Critical thinking - Through the formation of mathematical models, the student will develop solutions to real-world situations.

Technology Skills
- Discipline-specific technology - Through the use of the graphing calculator, the student develops skill in using this math tool for mathematical problems.

Major Summative Assessment Tasks
These Butler-assessed outcome(s) and Learning PACT skill(s) will be demonstrated by:
1. Solving problems (A skill) involving limits, derivatives and integrals, including those that involve physical applications (T skill), that synthesize (A skill) the material covered in the course.

Skills or Competencies
These actions are essential to achieve the course outcomes:
1. Manipulate functions.
2. Evaluate limits and identify discontinuities.
3. Find explicit and implicit derivatives of algebraic and transcendental functions.
4. Use derivatives in applications of rates of change, optimization and to analyze graphical characteristics.
5. Evaluate basic integrals directly and with u-substitution.
6. Use integrals in applications of area and rectilinear motion.

Learning Units
I. Preparation for calculus
   A. Graphs and models (covered as needed)
   B. Linear models and rates of change (covered as needed)
   C. Functions and their graphs (covered as needed)
   D. Review of trigonometric functions

II. Limits and their properties
   A. A preview of calculus
   B. Finding limits graphically and numerically
   C. Evaluating limits analytically
   D. Continuity and one-sided limits
   E. Infinite limits

III. Differentiation
   A. The derivative and the tangent line problem
   B. Basic differentiation rules and rates of change
   C. Product and quotient rules and higher-order derivatives
   D. The chain rule
   E. Implicit differentiation
   F. Related rates

IV. Applications of differentiation
   A. Extrema on an interval
   B. Rolle’s Theorem and the Mean Value Theorem
   C. Increasing and decreasing functions and the first derivative test
   D. Concavity and the second derivative test
   E. Limits at infinity
   F. A summary of curve sketching
   G. Optimization problems
   H. Newton’s Method
   I. Differentials
V. Integration
   A. Antiderivatives and indefinite integration
   B. Area
   C. Riemann sums and definite integrals
   D. The Fundamental Theorem of Calculus
   E. Integration by substitution

VI. Logarithmic, exponential, and other transcendental functions
   A. The natural logarithmic function: differentiation
   B. The natural logarithmic function: integration
   C. Inverse functions
   D. Exponential functions: Differentiation and integration
   E. Bases other than $e$ and applications
   F. Indeterminate forms and L'Hôpital's Rule
   G. Inverse trigonometric functions: differentiation
   H. Inverse trigonometric functions: integration
   I. Hyperbolic functions (optional, time permitting)

Learning Activities
Independent and collaborative learning activities will be assigned to assist the student in achieving the intended learning outcomes. Activities identified in the syllabus, such as class discussion, lecture, reading, in-class presentations, group work, projects and other activities at the discretion of the instructor will also contribute to learning.

Grade Determination
Grade determination will be based on assessment tasks and other activities such as exams, assignments or other methods of evaluation at the discretion of the instructor.