Butler Community College
Behavioral Science, Math, Science and
Physical Education Division

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Fall 2004

COURSE OUTLINE
Calculus II with Analytic Geometry

Course Description
MA 152. Calculus II with Analytic Geometry. 5 hours credit. Prerequisite: MA 151 with a "C" or better. This course will enable the student to understand applications and methods of integration, improper integrals, convergence and divergence of infinite series, graphs of conic sections, the polar coordinate system, parametric equations, and linear algebra.

Course Relevance
The student will find the study of calculus invaluable for preparation to his/her career in the physical sciences or engineering.

Required Materials
MA 152 Textbook & materials: Larson (2006). *Calculus* (8^{th} ed.). Houghton Mifflin.

Linear Algebra addendum.

Graphing Calculator: A TI83 is recommended. Calculators that perform symbolic differentiation and integration (such as the TI89) may not be allowed on some exams.

Learning Outcomes
The intention is for the student to be able to
1. Understand the connection between the mathematical and the physical worlds
2. Form mathematical models of physical concepts
3. Connect analytic and geometric concepts

Primary Learning PACT Skills that will be DEVELOPED and/or documented in this course
Through the student's involvement in this course, he/she will develop his/her ability in the following primary PACT skill areas:
1. Problem Solving
   - Through analysis and multi-step processes of calculus performed on functions and infinite series, the student will become a skilled problem solver.
2. Critical Thinking
   - Through development of mathematical models, the student will gain experience in applying critical thinking to the mathematical solution of real - world problems.

Secondary skills (developed but not documented):
Self-Concept
Time Management

Major Summative Assessment Task(s)
These learning outcomes and the primary Learning PACT skills will be demonstrated by
1. Solving of problems that synthesize the material covered in class

Course Content
I. Themes – Key recurring concepts that run throughout this course:
   A. Integrals
   B. Infinite series
   C. Conic sections
   D. Polar coordinates
   E. Parametric equations
   F. Linear algebra
II. Issues – Key areas of conflict that must be understood in order to achieve the intended outcome:
   A. Application of basic mathematics skills to advanced mathematics courses
   B. Analytical problem solving vs. solving with technical tools
   C. Recognizing when a solution is reasonable
III. Concepts – Key concepts that must be understood to address the issues:
   A. Basic arithmetic, algebra, trigonometry, differentiation, and integration of single-variable functions
   B. Choosing effective methods of solving problems
IV. Skills/Competencies – Actions that are essential to achieve the course outcomes:
   A. Use definite integrals in applications in geometry, science, and engineering
   B. Evaluate integrals using appropriate integration techniques
   C. Analyze infinite sequences and series for convergence or divergence
   D. Apply concepts of analytic geometry to calculus
   E. Apply concepts of linear algebra

Learning Units
I. Definite integrals
   A. Compute area of planar regions
   B. Compute volume by disks and shells of solids of revolution
   C. Compute surface area of solids of revolution
   D. Compute length of a curve
   E. Compute work
   F. Compute fluid pressure and force
   G. Analyze hyperbolic functions

II. Evaluation of integrals
   A. Apply the method of Integration by Parts
   B. Evaluate integrals involving products and powers of trigonometric functions
   C. Apply the method of Trigonometric Substitution

D. Apply the method of Partial Fractions
E. Apply numerical methods
F. Evaluate improper integrals

III. Infinite sequences and series
A. Form Maclaurin and Taylor polynomials and series
B. Analyze sequences for monotonicity and convergence or divergence
C. Analyze infinite series for convergence or divergence using convergence tests
D. Form Maclaurin and Taylor series and other power series
E. Analyze power series for convergence and divergence
F. Form new power series from old ones using calculus

IV. Analytic Geometry and Calculus
A. Convert points and equations of curves from rectangular coordinates to polar coordinates and polar coordinates to rectangular coordinates
B. Graph curves defined by parametric equations
C. Find tangent lines to polar and parametric curves
D. Find lengths of polar and parametric curves
E. Find areas of polar regions

V. Linear Algebra
A. Perform arithmetic operations on matrices
B. Find determinants of square matrices
C. Find the inverse of a square matrix and determine when such a matrix is singular
D. Solve systems of equations using inverse matrices and Gaussian reduction
E. Find eigenvalues and eigenvectors of matrices
F. Use eigenvalues and eigenvectors to rotate coordinate axes and graph conic sections

Learning Activities
Independent and collaborative learning activities will be assigned within and outside the classroom 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, or projects will also contribute to learning.

Grade Determination
Grade determination will be based on assessment tasks and other activities such as exams, assignments, or attendance that the instructor identifies in the syllabus.