

MATH 136 General Education Proposal

- 1. A sample syllabus for this course. See attached**
- 2. Statement of how your course meets the Colonnade Plan's learning objectives.**

Course Description: MATH 136: Calculus I (4 hours) meets the five learning objectives included in the Quantitative Reasoning section of the Colonnade Plan. Math 136 is a course in one variable calculus including topics from analytic geometry. Limits, derivatives, integration, and applications of polynomials, rational, trigonometric and transcendental functions are covered. The goal for MATH 136 is to provide students with the ability to understand and apply mathematical skills and concepts. Students will learn basic concepts of calculus, such as limits, differentiation, and integration. Further, students will learn to model and solve problems appropriate for the field of study in majors of the sciences. Students with a Math ACT of 26 or higher will receive 3 hours credit for this requirement.

MATH 136 specifically meets the five learning objectives as detailed below:

Learning Objective 1: Interpret information presented in mathematical forms.

Students in MATH 136 learn to interpret information presented in mathematical form by first learning to recognize the presence of mathematical information such as functions, equations, graphs, tables, diagrams, figures or descriptive text.

More specifically, students in Math 136 will learn to:

- evaluate limits analytically
- find, determine, and discuss continuity at a point and on an open interval
- determine one sided limits
- determine infinite limits and asymptotes
- understand the relationship between differentiability and continuity
- use mathematical notation to describe relation form, rates of change, velocity, marginal cost, revenue, and profit, and areas of regions; as well as the converse of such concepts

Learning Objective 2: Illustrate and communicate mathematical information symbolically, visually and/or numerically.

Students in MATH 136 learn to illustrate and communicate mathematical information symbolically by learning when and how to use a mathematical expression, equation or function to express quantitative information.

More specifically, students in Math 136 will be able to:

- illustrate and communicate mathematical information visually by learning when and how to use a graph, figure or diagram to express quantitative information
- change mathematical expressions to the appropriate symbols so that they can communicate this information in such problems as optimization, and related rates
- visually communicate the minimum and maximum values of functions through the use of derivatives
- illustrate the asymptotes of graphs
- illustrate the concavity of a graph
- sketch a slope field of a differential equation and find a particular solution
- properties of derivatives and antiderivatives and appropriate uses in a variety of functions

Learning Objective 3: Determine when computations are needed and execute the appropriate computations.

Students in MATH 136 learn to determine when computations are needed and execute the appropriate computations through exercises that develop skills in carrying out procedures accurately and efficiently to solve problems.

More specifically, students in Math 136 will learn through the use of homework to:

- to compute limits
- to compute derivatives through a variety of differentiation rules
- to compute related rates
- to approximate a zero of a function using Newton's Method, and integrals
- to evaluate indefinite integrals using basic integration rules

- to evaluate a sum and approximate the area of a plane region
- to approximate a definite integral using such rules as the Trapezoidal Rule and Simpson's Rule
- to find antiderivatives of a variety of functions such as: natural logarithmic functions and inverse trigonometric functions
- analyze functions and their graphs for such notions as concavity, points of inflection, relative and absolute extrema, increasing and decreasing, and asymptotes.

Learning Objective 4: Apply an appropriate model to the problem to be solved.

Students in MATH 136 learn to apply an appropriate model to the problem to be solved via exercises designed to teach recognition of limits, continuity, derivatives, and differentiation. Appropriately models of a given problem and to develop skill in performing such applications.

More specifically, students in Math 136 will be able to apply:

- appropriate models of derivatives
- appropriate model of integrals
- appropriate models of limits
- appropriate models for related rates
- appropriate models for finding areas of regions
- models using exponential functions to find growth and decay
- model the use of derivatives to locate extrema of functions
- Rolle's Theorem and the Mean Value Theorem
- solve optimization problems
- approximation techniques to solve a variety of problems

Learning Objective 5: Make inferences, evaluate assumptions, and assess limitations in estimation modeling.

Students in MATH 136 learn to make inferences, evaluate assumptions and assess limitations in estimation modeling via application exercises from finance, business, medicine and biology which require imposing "real-world" assumptions and/or limitations on procedures selected and inferences made from results.

More specifically, students in Math 136 will learn to:

- use and approximate the modeling of error analysis in a variety of functions
- apply theorems correctly as a part of hypothesis testing.

Brief description of how your department will assess this course's effectiveness.

For MATH 136, assessment will occur at the end of the semester. To assess the course objectives, each student will complete a problem that addresses the five learning objectives. A committee of at least three faculty members will select a sample and evaluate the common assessment problem that addresses the skills and concepts as stated in the learning outcomes. The committee will randomly collect 25% to 30% of the sample across all sections of MATH 136 to help assess students' mastery of the learning outcomes. The following criterion will be used to assess student learning outcomes:

Each test question will be scored on scale of 0 to 5, using a scoring guide developed by the committee in conjunction with the department. A common rubric (5 -Excellent ; 4 - Good; 3 - Satisfactory; 2 - Poor; 0 and 1- Fail).

The goals will be as follows:

Satisfactory = at least 70% of students scored 3 or better

Unsatisfactory = under 70% of students scored 3 or better

- **If necessary, a list of any proposed revisions needed to bring your course in line with the Colonnade Plan.**

MATH 136 will be re-evaluated at the end of each academic year to determine if the learning objectives are being met, and will be updated accordingly.