MAT 295: Calculus I

MAT 295
Calculus I
(4 credits)
Class Size: 10-25

Faculty: Pawel Grzegrzolka, Assistant Teaching Professor, Syracuse University
Administrative Contact: Tavish Van Skoik, Assistant Director, Project Advance

Course Catalog Description

Analytic geometry, limits, derivatives, maxima-minima, related rates, graphs, differentials, exponential and logarithmic functions, mean-value theorem, L'Hospital's rule, integration. For science majors. Shared Competencies Scientific Inquiry and Research Skills

Course Overview

MAT 295 is the first course in the introductory calculus sequence for science, engineering and mathematics majors at Syracuse University. The mathematical content of this course is typical of most traditional first semester university calculus courses. The concepts of limit, continuity, derivative, and anti-derivative and definite integral are developed and are then applied to many types of functions. These include: polynomial, rational, trigonometric, and exponential functions together with their inverses, compositions, and algebraic combinations. The concepts developed are applied to a wide variety of problems from geometry, physics, and other sciences. These include maximum and minimum problems, related rates, areas, volumes and

surfaces of revolution, arc length, work, fluid pressure, velocity and acceleration, and exponential growth and decay. Curve sketching is emphasized throughout the course. Graphing calculators can be useful as they can contribute to an understanding of the functions being sketched. They are, however, only an instructional aid. Calculators are not used as a substitute for the skill itself.

1. Review of Pre-Calculus: a) trigonometry, b) graphing of functions, c) special functions, including 1×1, sgn x, and [x].
2. Limits (including one-sided and at ± ∞): a) definitions (intuitive and formal), b) techniques of evaluation.
3. Continuity: a) definitions (at a point and on an interval), b) the Intermediate Value Theorem, c) use of IVT for numerical approximation of roots.
4. Derivatives: a) definition, b) geometric and physical interpretation, c) formulas for xn, sin x, and cos x, d) product, quotient, and chain rules, e) implicit differentiation, f) higher derivatives, g) Rolle's Theorem and the Mean Value Theorem for derivatives, h) differentials, i) anti-derivatives.
5. Applications of Derivatives: a) increasing and decreasing functions, b) critical points and extreme values, c) max-min problems, d) related rate problems, e) concavity and inflection points, f) linear approximation, g) error estimates, h) Newton's Method.
6. Brief Review of Conic Sections.
7. Definite Integral: a) definition (area under a curve, Riemann sum), b) average value of a function, c) Mean Value Theorem for integrals, d) Fundamental Theorem of Calculus (two versions), e) integrals of xn, sin x, and cos x, f) substitution in an integral.
8. Applications of the Definite Integral: a) areas between curves, b) volumes and surface areas of solids of revolution, c) arc lengths of curves, d) work done by a force, e) force due to fluid pressure.

Pre- / Co-requisites

Completion of a standard high school mathematics sequence including pre-calculus with a “B” average or better or approval by the course supervisor.

Course Objectives

N/A

Laboratory

N/A

Required Materials

Stewart’s Essential Calculus: Early Transcendentals, second edition: https://www.stewartcalculus.com/media/13_home.php

Instructor Recommendations

N/A