UNIVERSITY OF CALGARY

FACULTY OF SCIENCE
Department of Mathematics and Statistics

Mathematics 249 Introductory Calculus

(see Course Descriptions for the applicable academic year: http://www.ucalgary.ca/pubs/calendar/)

Syllabus

Topic	Number of Instructional Hours
Limits: motivating examples; evaluation of limits graphically; limit laws and limits of algebraic, exponential, logarithmic and trigonometric functions; infinite limits and limits at infinity; continuity and the intermediate value theorem	12
The derivative and differentiation: motivation and examples from the natural sciences; tangent lines; differentiation laws; higher-order derivatives; implicit differentiation; inverse functions and their derivatives; logarithmic differentiation	8
Applications of differentiation: related rates; linear approximation and Newton's method; Taylor polynomials and Taylor's theorem; L'Hôpital's rule; the Mean Value theorem; critical points and intervals of increase/decrease; absolute extrema and the closed interval method; local extrema and the first derivative test; concavity, inflection points and the second derivative test; optimization problems	16
Integration: the area problem and definite integrals; antiderivatives and indefinite integrals; the Fundamental Theorem of Calculus; the substitution method; improper integrals; area between curves (time-permitting); volumes and surfaces of revolution (time-permitting)	12
	Total Hours: 48

Course Outcomes

Overview. This course is the introductory calculus course chiefly for students without a high school calculus preparation. We shall study the fundamental concepts and build the basic skills of Calculus. Specifically, by the end of this course students should be able to:

1. Use the language and notion of differential calculus, and apply the key concepts to compute derivatives of functions of a real variable.

2. Explore the relationship between key calculus concepts and their geometric representation, and seek to apply calculus techniques to a wide variety of practical problems.

3. Recognize that not only the technology can be used to achieve some desired results; but it also has limitations.

Subject specific knowledge:

4. **Mathematical Literacy -** This includes the fluent reading, manipulation, and graphic interpretation of algebraic expressions and functions.

5. **The concept of Limit -** Students will gain an intuition of the concept of limit, and acquire a basic level of mathematical literacy on limits and their computations.

6. **The concept of Derivative -** Students will be to associate the concept of differentiation with rates of change, and they will be able to compute and manipulate derivatives.

7. **Applications of Derivatives -** Students will be able to analyze the shape of functions through their derivatives. Students will use derivatives to solve a variety of applied problems, including optimization problems.

8. **The Riemann Integral -** Students will explore the process of estimating areas under a curve, develop the notion of integral, and compute basic integrals. Students will be able to demonstrate the fundamental relations between the processes of integration and differentiation.

* * * * * * * * * *