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

Topics

	Number of Hours
Pre-Calculus Review and Functions	10
Limits	6
The derivative and differentiation	13
Applications of differentiation	10.5
Integration	7.5
Optional topics: Taylor polynomials, Partial differentiation (Time permitting)	2
TOTAL HOURS	**47-49**

December 10, 2014 Effective: Fall 2015
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MATH 249 Introductory Calculus

TOPICS	Hours
PRE-CALCULUS REVIEW	
Inequalities, signs of factored expressions, absolute value	(1.5)
Coordinate geometry – distance, lines, circles, parabolas	(1)
Trigonometry	(1)
Functions – representations, domain, combinations, inverse functions	(2)
Functions – definitions and properties of absolute value, power, polynomial, rational, trigonometric functions	(1)
Exponential and logarithmic functions	(2)
Inverse trigonometric functions	(1.5)
LIMITS	
Limit: Concept, numerical and graphical, one-sided limits, infinite limits, vertical asymptotes	(1.5)
Calculating limits: Limit laws, Squeeze Theorem, limit of sin(x)/x	(1.5)
Continuity, Intermediate Value Theorem	(1.5)
Limits at infinity, horizontal asymptote	(1.5)
THE DERIVATIVE AND DIFFERENTIATION	
Derivatives: definition, geometric interpretation and rate of change	(1)
Derivative as a function	(0.5)
Formulas and rules of differentiation, power, trigonometric, inverse trigonometric, exponential and logarithmic functions, the chain rule and the differentiation rule for inverse functions, implicit differentiation	(7)
Rate of change in natural and social sciences, velocity, acceleration; Exponential growth and decay	(1.5)
Related rates	(1.5)
Linear approximations	(1.5)
Taylor polynomials (optional)*	(0.5)*
APPLICATIONS OF DIFFERENTIATION	
Maxima and minima, extreme value theorem	(1.5)
Rolle's theorem, Mean value theorem	(1.5)
Increasing and decreasing functions, concavity, first derivative test, second derivative test	(1.5)
Indeterminate forms and l'Hôpital's rule, the limit of (1 + r/x)^x at infinity	(1.5)
Curve Sketching	(1)
Optimization Problems	(2)
Newton's method	(0.5)
Partial differentiation, the chain rule (optional)*	(1.5)*
Antiderivatives	(1)
INTEGRATION	
Area, Riemann sum and the definite integral	(1)
Properties of the definite integral	(1)
Fundamental theorem of Calculus	(1.5)

Substitution rule	(1)
Improper integrals	(2)
Area between curves	(1)

Total = (47)

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 also it 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.