UNIVERSITY OF CALGARY

FACULTY OF SCIENCE
Department of Mathematics and Statistics

Mathematics 335 / 355 — Analysis I / Honours Analysis I

(see Section 3.5C of Faculty of Science www.ucalgary.ca/pubs/calendar/current/sc-3-5.html and Course Descriptions: http://www.ucalgary.ca/pubs/calendar/current/course-main.html)

Syllabus

Topics	**Number of hours**
Sets and functions; cardinality; countable and uncountable sets.	3
Axioms for the real numbers; supremum, infimum and completeness; uncountability of the reals	3
Sequences and convergence; Cauchy sequences; the Bolzano-Weierstrass theorem	6
Topology of the real line: open, closed and compact sets. The Heine-Borel theorem.	3
Limits of functions; properties of limits; infinite limits	3
Continuous functions; continuous functions on compact intervals; uniform continuity.	5
The derivative and differentiability; differentiation rules; Rolle's theorem and the mean value theorem; applications; Taylor's theorem	5
The Riemann integral; integrability of monotone and continuous functions; The fundamental theorems of calculus; substitution and integration by parts	5
Infinite series and the sequence of partial sums; absolute convergence and rearrangements	3
TOTAL HOURS	**36**

Course Outcomes

Overview

This course is the first course students take in the abstract foundations of differential and integral calculus in one variable. The proof techniques and methods of approximation carry forward in many mathematical subjects, including ordinary and partial differential equations, complex analysis, functional analysis, probability and measure theory, numerical analysis and linear algebra. Honour students in Math 355 are expected to produce a higher level of rigour on written tests and solve more difficult and open-ended assignment problems.

Subject specific knowledge

By the end of this course, students are expected to

1. apply proof techniques and general problem solving in order to complete challenging take-home assignments.
2. produce definitions, basic proofs and simple examples on written tests.
3. state the axioms of the real line and demonstrate their basic consequences.
4. state the Archimedean property and prove its equivalent forms.
5. describe basic examples and construct arguments for countability or uncountable for sets.
6. construct a formal *epsilon* argument for the convergence of a sequence and the limit of a function.
7. state and apply the key definitions and theorems concerning continuity and differen- tiability for single-variable functions.
8. apply the notions of partitions of intervals and Riemann sums in order to explicitly construct the Riemann integral for a continuous function
9. state, prove and apply the Fundamental Theorem of Calculus.
10. use the various series convergence tests to determine the absolute or conditional con- vergence of a numerical series.

* * * * * * *

16:10:11
JM