

# **TOPICS FOR MATHEMATICS 144, FALL 2006**

## **I. General considerations**

1. Overview of the course
2. Historical background and motivation
3. Selected problems

## **II. Basic concepts**

1. Topics from logic
2. Notation and first steps
3. Simple examples

## **III. Constructions in set theory**

1. Boolean algebra operations
2. Ordered pairs and Cartesian products
3. Larger constructions
4. A convenient assumption

## **IV. Relations and functions**

1. Binary relations
2. Partial and linear orderings
3. Functions
4. Constructions involving functions
5. Further constructions
6. Order types

## **V. Number systems and set theory**

1. General considerations
2. The Natural Numbers
3. Finite induction and recursion
4. Finite sets
5. The real number system
6. Further properties of the real numbers

## **VI. Infinite constructions in set theory**

1. Operations on indexed families
2. Infinite Cartesian products
3. Transfinite cardinal numbers
4. Countable and uncountable sets
5. The impact of set theory on mathematics
6. Transfinite recursion

## **VII. The Axiom of Choice and related properties**

1. Some questions
2. Extending partial orderings
3. Equivalence proofs
4. Additional consequences
5. Logical consistency
6. The Continuum Hypothesis

## **VIII. Set theory as a foundation for mathematics**

1. Simplifying axioms for number systems
2. Set theory and classical geometry