Math 6c: Course Syllabus

I. *Propositional Logic*

Syntax of propositional logic

Semantics of propositional logic

Truth functions

Normal forms

König's Lemma and applications

The Compactness Theorem

Ramsey Theory

The Resolution Method

A Hilbert-type proof system

Formal proofs

Completeness

II. *First-Order Logic*

Structures

Syntax of first-order logic

Semantics of first-order logic

Definability in a structure

Prenex normal forms and games

Theories

A proof system for first-order logic

The Gödel Completeness Theorem

The Compactness Theorem

Finiteness and infinity

Non-standard models of arithmetic

III. *Computability and Complexity*

Decision problems

Turing machines

Register machines

The Church-Turing Thesis

Universal machines

The Halting Problem

Undecidability of the validity problem

The Hilbert Tenth Problem

Decidable problems

The Class P

The Class NP and the P = NP Problem

NP-complete problems