MAT 320 Introduction to Analysis

Review Sheet

The final exam is cumulative and covers everything we have learned in MAT319/MAT320 during the semester. You must know all the definitions and statements of the important theorems, and also understand all proofs (although you will not be asked to reproduce a proof of a theorem presented in class). You can use (with clear references) all theorems and facts covered in class, but you have to explain all the steps in your proofs. No books, calculators, or notes will be permitted.

An outline of the material covered since the second midterm is given below. Consult the review sheets for Midterm 1/Midterm 2 for the outline of the previous material; also, go over all past homeworks and make sure you know how to solve all the questions.

Derivatives

- definition of the derivative
- a differentiable function is continuous; converse not true
- Differentiation Rules
- Relative maxima/minima and their relation to points where $f'(x)=0$
- Rolle's Theorem
- Mean Value Theorem; its geometric and physical interpretations
- $f'(x) \geq 0$ iff f is increasing; $f'(x) \leq 0$ iff f is decreasing
- L'Hospital's Rule
- Taylor polynomials; Taylor's Theorem; applications to approximation
- Detection of relative max/min with higher derivatives

Integrals

- Riemann sums, definition of Riemann integral, integrable functions
- Calculations of integral/proof of integrability from definition
- Examples of non-integrable functions
- Integrals of $f+g$, kf with $k = \text{const}$
- $f(x) \leq g(x) \Longrightarrow \int_a^b f(x) \leq \int_a^b g(x)$
- Integrable functions are bounded*
- Continuous functions are integrable
- $\int_a^b f(x) = \int_a^c f(x) + \int_c^b f(x)$ *
- The Fundamental Theorem of Calculus*

(*) At the time of writing, I do not know whether we'll be able to cover the topics marked with *. The topics that we don't cover certainly won't be on exam.