MATHEMATICS 3210-1. Fall 2001  
Foundations of Analysis I.


**When/Where:** TH, 2:00-3:20 PM, JTB 110.

We will have 5 min break during the class (approximately at 2:40).

**Instructor:** Prof. Michael Kapovich.

**Office:** JWB 329; **phone:** 581-7916; **e-mail:** kapovich@math.utah.edu

**Office hours:** MW 12:00–1:00 p.m., or by appointment.

**Prerequisites:** Math 1210-1220, 2210.

**Sections of the textbook to be covered:**


If the time will permit I will also discuss sections 12, 23–26.

I will also use handout material, especially early in the class. [Our first two lectures will deal with the set theory and logic.]

**Exams:** There will be a comprehensive final examination and three midterm exams:

Exam 1: September 18.
Exam 2: October 23.
Exam 3: November 20.

Each midterm exam is 80 minutes long.

Final Exam: Monday, December 10, 1:00 p.m. – 3:00 p.m. in JTB 110.

**Overview:** Math 3210 has two aims: the first, of course, is to teach you the foundations of analysis, i.e., the rigorous mathematical theory underlying just about everything you have learned in one and multi-variable calculus. The second is to teach you how to do mathematics rigorously, i.e., how to do proofs. The two aims will be inextricably intertwined: you cannot learn any mathematics rigorously without being able to understand and do proofs, and it is almost impossible to learn how to do proofs without an extended example to practice on. If you are someone who will never need to do more than apply some mathematical formulas, or perhaps use a computer algebra system to solve a differential equation, you do not need to take this course. On the other hand, if you plan on taking any higher level course in pure math-5310, etc., or if you will ever need to answer a serious question asked by an ambitious high school student, you will need this course. This is not an easy course. Many of you will find it frustrating, especially in the early weeks: for many of you this is the first class where you have to do rigorous proofs. You are expected to spend considerable time outside of class, time when you are alert and focused, working on problems. To learn to do proofs, you must practice a lot. If you cannot do the typical homework problem which inevitably consists of proving something by the end of the semester, I cannot in good conscience, pass you. However most students at your level can learn this material. By the end of the year, one and multivariable calculus will no longer seem like a hodge-podge of formulas to be memorized, but rather a coherent theoretical entity which makes sense! At some point you will really understand the proof of some theorem. Hopefully, you will appreciate the innate beauty of it all. I promise to do my best to get you there.
Ask questions both during the class, after the class if I have time, by email and during my office hours! What to do if you do not understand the answer: ask again. I would repeat explanation several times if necessary. However on some occasions I would ask you to repeat the question after the end of the class (our time during the class is limited).

Outline: Our goal for math 3210 is to cover most of Ross’ book. We will start with real numbers and their sequences: operations on sequences, convergence, Cauchy sequences, subsequences, series, etc. We then study functions: limits, continuity and uniform continuity (which will be a new idea for most of you). It is at this point that we will prove two crucial theorems which are stated and used in first-year calculus, but (almost) never proved: the intermediate value theorem and the extreme value theorem (any continuous function on a closed interval attains its minimal and maximal values). Next we will discuss differentiation and integration of the functions of one variable.

Homework: I will assign homework during most lectures, either from the book or problems of my own. The homework will not be graded (because of the recent budget cuts graders are no longer assigned to math courses of the level $\geq 3000$). It is absolutely essential that you do the homework as we talk about the material. You will not truly understand the definitions and theorems presented in this course without applying them to problems, nor will you learn how to write mathematical proofs without quite a bit of practice. Discussion can be an effective way to problem solving, so you are encouraged to work together on homework; I think you will find the process of explaining your ideas to others extremely helpful. A note of caution: it’s probably best to try the problems by yourself first, so that you can bring something to the discussion.

I will post the homework problems (and solutions) on my homepage:
http://www.math.utah.edu/~kapovich/teaching0.html

Grading: Course grades will be computed as follows. I will drop the lowest midterm test score and then will add two remaining midterm test scores (30% each) and the final (40)

Cell phones: Turn them off during the class.

Coming late: If you are more than 5 minutes late for the class, wait for the break and come in during the break.

ADA Statement: The Americans with Disabilities Act requires that reasonable accommodations be provided for students with physical, sensory, cognitive, systemic, learning and psychiatric disabilities. Please contact me at the beginning of the quarter to discuss any such accommodations for the course.

There will be no classes on Thursday, October 4th (Fall Break), Thursday, November 22nd (Thanksgiving Holiday.)