Mathematics 401: Introduction to Real Analysis
Fall 2012

Instructor: John Rhodes, `j.rhodes@alaska.edu`, 301B Chapman, 474-5445

Office Hours: T 9:00–10:00, W 2:00–3:00, F 10:30–11:30, and by appointment

Course web page: `http://www.dms.uaf.edu/~jrhodes/M401.html`

Prerequisites: ENGL F111; ENGL F211 or F213; MATH F202 and F215; with a grade of C (2.0) or better

Credit Hours: 3.0

Text: <u>Understanding Analysis</u>, by Stephen Abbott, Springer

Class Meetings: M W F 9:15-10:15, in Brooks 104A

Midterm Exam: In-class part on Monday, October 15, followed by Take-home part for the rest of the week

Final Exam: In-class part 8:00–10:00, Wednesday, December 12; a Take-home part of the exam will given out about a week before classes end, and will be due the last day of class

Course overview and goals:

This course rigorously studies the fundamental ideas underlying calculus and the real number system. But rather than focusing on computational techniques and applications as does the standard calculus sequence, the underlying theoretical idea of a *limit* will be carefully and thoroughly developed, through formal proofs. The understanding of limits of sequences, series, and functions that you gain will then be used in theoretical developments of calculus concepts such as derivatives and integrals, and for establishing many familiar theorems from calculus which you have previously been asked to accept without proof.

In addition to giving you understanding of fundamental mathematical notions, the course will further develop your skills at constructing and presenting proofs in good mathematical style. This is a writing intensive course, in which clarity of exposition is considered equally important to the correctness of your mathematical ideas.

Mechanics of the course:

Class meetings will be run as interactive lectures. That means that while I will usually be lecturing using the blackboard, and you will be taking notes, I will also be asking for suggestions, ideas, and questions about the material as we go along. I don't expect 'correct' answers, but I do expect you to be actively following and participating — that makes the class more interesting for us all.

Class attendance is expected, although I will not formally take roll. (Regularly missing class is sure to make this course much harder for you, and likely to

lead to failure.) If you have to miss a class, you should get notes from another student. Homework assignments will be given in class, but also posted on the course web page soon after class is over.

Homework will usually be assigned daily, and collected each Wednesday in class. You may turn in your homework later that day, as long as the grader receives it no later than 5pm. No late homework will be accepted, unless I have agreed in advance, or there is a genuine emergency (e.g., a death in the family, medical problem with doctor's excuse).

I encourage you to work with others on the homework, but you must *write up solutions independently*. You will learn nothing from simply copying someone's solution. I also encourage you to take advantage of my office hours; if you are stuck on a problem, I can help you to look at it in a different way. Even if you understand how to solve a problem, I can give pointers on how you can express the solution well. I particularly encourage you to come by my office with your classmates, so you may learn from them as well.

Most homework will be graded by a graduate student. Some problems (designated in advance, and turned in on separate paper) will be graded by me. For all problems, clarity of exposition will be a substantial part of the grade.

Examinations Your midterm exam will have two parts: An in-class hour exam will cover your knowledge of definitions, important theorems, examples, and simple proofs. A take-home part, which you will have several days to complete, will consist only of longer proofs and examples.

The final exam has a similar two-part format, but the take-home will be before completed before classes end, and the in-class during the exam period.

Grades: Your performance will be evaluated based on 30% homework, 13% midterm exam in-class, 20% midterm exam take-home, 17% final exam in-class, 20% final exam take-home.

Course grades will be determined according to the following cutoffs:

$$A \geq 90\%,$$
$$B \geq 80\%,$$
$$C \geq 70\%,$$
$$D \geq 60\%.$$

I reserve the right to move the cutoff points downward if particular exams turn out to be unexpectedly difficult. Note that you are not in competition with your peers – everyone in the class may get an A, or everyone may get an F.

University and Department Policies: Your work in this course is governed by the UAF Honor Code. The Department of Mathematics and Statistics has specific policies on incompletes, late withdrawals, and early final exams which can be found at

http://www.dms.uaf.edu/dms/Policies.html.

If you have any disabilities that I should know about, you should bring them to my attention soon so that we can work with the Office of Disability Services to set up any necessary accommodations.

Tentative Schedule

Week 0-1	Aug. 30 – Sept. 7	Rational and real numbers
Week 2	Sept. 10 – Sept.14	Completeness, countability
Week 3	Sept. 17 – Sept.21	Sequences and series
Week 4	Sept. 24 – Sept.28	Sequences and series, Bolzano-Weierstrass
Week 5	Oct. 1 – Oct. 5	Cauchy Criterion, properties of series
Week 6	Oct. 8 – Oct. 12	Topology of $\mathbb{R}$, compact sets
Week 7	Oct. 15 – Oct. 19	MIDTERM EXAM
Week 8	Oct. 22 – Oct. 26	Limits of functions, continuity
Week 9	Oct. 29 – Nov. 2	Intermediate Value Theorem
Week 10	Nov. 5 – Nov. 9	Differentiation
Week 11	Nov. 12 – Nov. 16	Sequences and series of functions, uniform convergence
Week 12	Nov. 19 – Nov. 21	Power serier, Taylor series
	THANKSGIVING	
Week 13	Nov. 26 –Nov. 30	Riemann integral
Week 14-15	Dec. 3 – Dec. 10	Riemann integral