

Course Description

This course is a rigorous study of the ideas underlying calculus and an introduction to the real numbers. Rather than the computational focus of your previous calculus classes, our class will be devoted almost entirely to theory. We'll study the foundations of the real numbers, sequences and series of real numbers and the concept of a limit, continuity, derivatives, the Riemann integral considered rigorously, and sequences and series of functions.

Essential Information

Professor: David Maxwell
Office: Chapman 308C
Phone: 474-1196
Email: david.maxwell@uaf.edu
Web: <http://www.math.uaf.edu/~maxwell>
Prerequisites ENGL 111X; ENGL 211X or ENGL 213X; MATH 215 and 253X;
or my permission

Course Texts

The required text is: **Understanding Analysis**, Stephen Abbott, Springer-Verlag

There are lots of other nice texts out there. There are two older classics that I recommend in particular.

Calculus, by Michael Spivak, is a lovely calculus text with a mathematical viewpoint. It has lots of nice problems, a clear exposition, and covers material similar to that of Abbott as well as some more sophisticated topics (e.g. π is irrational).

Principles of Mathematical Analysis, by Walter Rudin, is a classic text. It's harder book than our course text, and has a more general approach via metric spaces. But it has very clean tidy proofs and is a joy to read. If you end up finding you like analysis, you might enjoy using this text for self study.

Class Time

There will be three hours of class lecture each week.

Lecture Times

MWF 11:45–12:45 Brooks 104A

Office Hours

My office hours will be posted on my web site and outside my office door. You are welcome to schedule an appointment outside of my regular office hours; please send me an email and we will arrange a time.

Piazza

We will use the Piazza social media site for announcements and after-class questions and discussions. See the course web page for instructions on how to sign up.

Homework

There will be a homework assignment due roughly every week, usually on Mondays. Each

week's assignment will be posted on my web page.

The course web page will also contain solutions to the less routine problems for each week's homework. If you are interested in the solution of a problem that is not listed on the web site, please come by office hours.

Regarding late homework, I will accept from each student a single late homework with no questions asked. To take advantage of this opportunity, simply hand in a piece of paper in lieu of your homework notifying me that you are using your free late assignment. Your late homework will be due when the subsequent homework is due, or one week later, whichever comes first. Exceptions: you may not use your freebie for either of the first two, or the last homework assignments.

Subsequent late homeworks will be accepted only under extenuating circumstances to be determined at my discretion.

Making an attempt at the homework is mandatory. If you fail to substantially complete two homework sets you will be dropped from the class.

Most of your homework will be graded by our TA, Max Hesser-Knoll. Some of the problems you will hand in to me, and generally one problem a week will be a (W) problem. (See the section below **On Proofs**). The homework handed in to me will be worth 20% of your homework grade, and the homework handed in to Max will be worth 80% of your homework grade.

Homework and \LaTeX

All homework in this class will be written using the mathematical typesetting program \LaTeX . Doing this will help you learn to use a tool universally used by mathematicians to publish their work, and will also help you focus your attention on the quality of your writing. After all, it's easier to revise something you've written on a computer.

\LaTeX has a reputation for having a steep 'learning curve'. I'll try to make it easy for you to get started with it. On the course web page there are instructions for installing \LaTeX , a sample homework solution file, and a guide for **Beginning \LaTeX** .

Midterms

There will be two midterm exams as listed in the schedule. There will be two components to each midterm – a take-home exam that focusses on harder proofs, and an in-class exam with an emphasis on definitions, statements of theorems, and shorter proofs.

Final Exam

The final exam will have a take home and in-class component. Both will be comprehensive. The written portion will be held 10:15 a.m.-12:15 p.m., Wednesday, December 14.

On Proofs

You will be expected to write proofs on every homework and on every exam. Lots of them. Unlike the proofs class you have taken, the main focus of our course is not how to write a proof – we have new mathematical ideas to learn! Nevertheless, this is a writing intensive class, and one of the goals of the class is to give you experience in writing proofs and more

broadly in clear mathematical exposition. All of your homework and exams will be graded for both mathematical content and exposition.

Roughly one to two problems a week will be labeled a (W) problem, and even more than usual there will be emphasis on grading these problems' exposition. These problems are intended to give you a chance to focus on mathematical writing. Try to make your proof sound as professional as you can, the kind of proof you might find in our text. To help you learn my expectations for mathematical writing, for the first two assignments I will let you resubmit a (W) problem after it has been graded. Resubmissions are due with the following week's homework.

Evaluation

Course grades will be determined as follows:

| | |
|----------|------|
| Homework | 35% |
| Midterms | 35% |
| Final | 30 % |

Letter grades will be assigned according to the following cutoff scores. This scale is a guarantee; I also reserve the right to lower the thresholds.

| | | | | | |
|----|-----|----|-----|---|-----------|
| A+ | 97% | C+ | 77% | F | ≤ 59 |
| A | 93% | C | 73% | | |
| A- | 90% | C- | 70% | | |
| B+ | 87% | D+ | 67% | | |
| B | 83% | D | 63% | | |
| B- | 80% | D- | 60% | | |

Tentative Schedule

The following is a tentative list of the topics to be covered in this class. As we proceed in the course, the course web page will list specific sections to be read for each week.

| Week | Topics and Events |
|---------------|--|
| 8/29 – 9/2 | Rationals and Reals. |
| 9/5 – 9/9 | Completeness and its consequences. Countability. Monday: Labor Day |
| 9/12 – 9/16 | Start sequences and series. |
| 9/19 – 9/23 | Sequences and series continued. Bolzano-Weierstrass Theorem. |
| 9/26 – 9/30 | Cauchy Criterion. Properties of Series. |
| 10/3 – 10/7 | Topology of \mathbb{R} . Compact sets. Friday: First take-home midterm posted. |
| 10/10 – 10/14 | Limits of Functions. Continuity. Friday: First midterm. |
| 10/17 – 10/21 | Intermediate Value Theorem. |
| 10/24 – 10/28 | Differentiation. |
| 10/31 – 11/4 | Sequences and series of functions. Uniform convergence. Friday: Last day to withdraw with a 'W' |
| 11/7 – 11/11 | Power series. Taylor series. |
| 11/14 – 11/18 | Series of functions continued. Wednesday: Second midterm |
| 11/21 – 11/25 | Start Riemann integral. Wednesday: Second midterm Thursday: Thanksgiving |
| 11/28 – 12/2 | Riemann integral. |
| 12/5 – 12/9 | Riemann integral. Friday: Last day of class |
| 12/12 – 12/16 | Catch-up and review. Wednesday: Final exam at 10:15 |

Rules and Policies

Collaboration

You are encouraged to work together in solving homework problems. But each student must write up his or her own solutions independently. If you receive significant help solving a problem, it is customary to make a note in your homework to give the person who helped you credit.

Makeup Exams

You can make up an exam if certain extenuating circumstances prevent you from taking it and if you inform me in advance. Contact me as soon as possible if you are going to miss an exam.

Attendance

Attendance is not included directly as part of your grade. Despite this fact, it is in your best interest to attend every class.

Cell Phones

Turn off your cell phone before you come to class.

Disabilities Services

I will work with the Office of Disabilities Services (203 Whitaker, 474-7043) to provide reasonable accommodation to students with disabilities.

Incomplete Grade

Incomplete (I) will only be given in Computer Science, Mathematics or Statistics courses in cases where the student has completed the majority (normally all but the last three weeks) of a course with a grade of C or better, but for personal reasons beyond his/her control has been unable to complete the course during the regular term. Negligence or indifference are not acceptable reasons for the granting of an incomplete grade. (Note: this is essentially the old University policy.)

Late Withdrawals

A withdrawal after the university deadline from a Department of Mathematical Sciences course will normally be granted only in cases where the student is performing satisfactorily (i.e., C or better) in a course, but has exceptional reasons, beyond his/her control, for being unable to complete the course. These exceptional reasons should be detailed in writing to the instructor, department head and dean.

Academic Dishonesty

Academic dishonesty, including cheating and plagiarism, will not be tolerated. It is a violation of the Student Code of Conduct and will be punished according to UAF procedures.