MATH 3320: Introduction to Analysis (3 credits)
Spring 2019

MW   3:00pm – 4:15pm   Stokes Hall 295S

Instructor

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Prerequisites: Math 2202 (Multivariable Calculus) and Math 2216 (Introduction to Abstract Mathematics). Definitions, theorems and proofs will be stressed throughout this course.

Course website: The course website is on Canvas (access through Agora). Canvas will be used to post course materials such as homework assignments, study materials etc. **Please check Canvas regularly.**

Textbook: *Understanding Analysis* 2nd Edition, by Stephen Abbott (ISBN: 9781493927111). Any additional hand-outs, review problems or reading material will appear on the the Canvas page.

Course description: This course is an introduction to the theory underlying Calculus, which is based on the structure of the real numbers, and on the precise notion of limit. Many undergraduate students find Analysis to be the most challenging pure mathematics course they take at college. Beginning with basic definitions (axioms), we will study numbers and functions, constructing fundamental mathematical ideas, on solid foundations, from the ground up. We are interested in giving precise answers to such basic questions as:

- What exactly do we mean by the square-root of two? Why should I believe there is such a number if I can't write it down?

- What is a continuous function, precisely?

- Are there more real numbers than rational numbers? What does "more" even mean?

The work in the course will always involve rational mathematical argument (proofs). Ultimate precision and clarity is the business of Analysis, and the primary goal throughout is to achieve precise mathematical expression and mathematical understanding. In order to achieve this lofty standard, you will learn to become critical of everything you read and hear: Did that last part make sense? Is what was said true in all cases? What's the precise meaning of that word, anyway? This applies most of all to those things you yourself write and say! Expect to rewrite your own proofs again and again so that each sentence, down to word order and punctuation, is crafted and honed until your logic is airtight. With this emphasis on rigour and intellectual honesty, we will develop a full understanding of many familiar concepts from Calculus, discovering many fascinating new ones along the way.

Homework: Each week you will be assigned one piece of written homework, posted on the Canvas course website (usually due Wednesday unless otherwise indicated). Homework should be typeset in LaTeX (see below), printed out, and submitted in class, with multiple pages stapled together. **No late homework or emailed homework will be accepted at all, with no exceptions.**

If you know you will have to miss class on a day a homework is due, ask a fellow student to submit it for you on the due day. Contact me in advance if you have to be excused for a homework for some extreme circumstances. **The lowest homework score will be dropped from the overall average**, so you can miss one assignment without harming your grade.

Your homework must be typeset using LaTeX.

What's LaTeX? You will write your homework using a word processing system called LaTeX, an absolutely indispensable tool for any scientist or technical writer. There is a little learning curve for LaTeX if you have never used it. Don't panic! I am available to help and it won't take as long as you think to learn it. Once you've used it for a few weeks, you'll love it (no, really).

You need to install some version of the LaTeX package on your computer and learn how to use it:

- Mac users: download MacTeX at `http://www.tug.org/mactex`.
- Windows users: download MiKTeX at `http://miktex.org`.

Many people (including me) learnt LaTeX from *The Not So Short Introduction to LaTeX 2ε*, available at `http://tobi.oetiker.ch/lshort/lshort.pdf`. The Wikipedia entry for LaTeX has links to many other introductory articles, including an excellent Wikibook at `http://en.wikibooks.org/wiki/LaTeX`. Once you have the basics, a good way to work out new things in LaTeX is simply to stare at other people's source code or just google your questions – almost certainly your latex question has been asked and answered before.

The LaTeX source files for the homework will be uploaded each week on Canvas for you to download and complete. As you prepare your solutions, I suggest that you play it safe by storing a copy on Google Drive (or similar), and also mailing a copy to yourself every time you make significant changes. Please make sure you leave enough time each week to TeX your solutions and print them. Especially for the first few homeworks it may take a little while to get it looking as you want it.

Midterms, final exam, and grade assignment

- There will be two in-class exams (midterms), held at your usual class time, and one final exam.

Midterm 1	3:00PM	Wednesday 20th February
Midterm 2	3:00PM	Wednesday 10th April
Final exam	12:30PM	Tuesday 7th May

- **Grade assignment**

  Homework 25%   Midterm 1 20%   Midterm 2 20%   Final exam 35%

  After the final exam, your four (raw, uncurved) numerical scores will be combined according to the above weights to make a number between 0 and 100. This number will be used to determine your final letter grade, according to departmental guidelines. No homework or exam score individually will be curved. *There is just one curve at the end.*

- **Makeup Exams:** Unexcused absence from an exam will result in a zero score for the exam. If you have a planned, legitimate reason for missing an exam, you must make arrangements with me to take the exam *before* the scheduled time of the exam. **If you are sick the day of the exam, or have a family emergency, etc., go to Health Services or your Dean's office; they will provide me with documentation of your illness or emergency.**

Participation: In the classroom, please respect the other students by arriving on time. Phones are not to be used during class. Laptops or tablets are not to be used during class unless you can convince me you have a good reason. Please come to classes.

This course is heavily proof-based and may feel pretty technical at times. On top of this, the subject matter will often seem familiar from Calculus and lull you into a false sense of security. These may combine so that you accidentally become lost before you notice it. To prevent this, I will often ask for input from the class as I am writing proofs, and input for constructing examples as we go along. Fully participating in these class interactions is essential to completely following the material and will be the most effective way to learn throughout the semester.

Analysis is all about attention to detail and rigour, so if you spot any ambiguity or mistakes in the proofs or ideas presented in class, then ask about it. Don't let me off easy! More generally, if you have any questions at any time, *please* ask me – if you're confused in a class, you can be sure you aren't the only one. Your classmates will be very grateful that somebody got me to slow down and clarify things, and I am very happy to do so.

Academic integrity: Working together with your friends can be the most efficient and the most fun way to do mathematics. However, **you must write up your homework solutions by yourself in your own words. No copy/paste from someone else's work or otherwise copying, transcribing, paraphrasing etc. from *any* source.** A good rule of thumb: don't turn in a solution you don't personally understand. Submitting work that is not your own, or otherwise violating academic integrity on a homework, will mean you immediately receive a zero score for that homework. **Cheating on a midterm or final will result in a failing grade for the course.** I take the violation of academic integrity very seriously, and ultimately the person who suffers most is you – read more about this at `http://www.bc.edu/offices/stserv/academic/integrity.html`.

Special accommodations: If you are a student with a documented disability seeking reasonable accommodations in this course, please contact Kathy Duggan, (617) 552-8093, `dugganka@bc.edu`, at the Connors Family Learning Center (CFLC) regarding learning disabilities and ADHD, or the Disability Services Office (DSO) regarding all other types of disabilities, including temporary disabilities. Advance notice and appropriate documentation are required for accommodations.

Common questions:

- **I'm going to miss a lecture. What should I do?**

  You don't need to let me know. It is your responsibility to find out what you missed by asking for notes from another student.

- **I want to discuss something confidentially, what should I do?**

  If you need to discuss something private, please email me and we can set up an appointment.

- **What's my grade right now?**

  I can remind you of your current numerical scores and give you a very rough idea of how you are doing relative to the rest of the class, but I won't be able to tell you exactly what score you need on the midterms/final/etc. to make X grade.

- **How do you curve grades?** In the spirit of maximal transparency, I try to give you an idea of this process after each midterm. I will announce approximately which numerical scores would hypothetically correspond to an A, B, etc. in that midterm. This will give you an accurate idea of how I approach grade assignment and also help you interpret your midterm score relative to the rest of the class. (I emphasise that this is not a letter grade assignment, it is only hypothetical; individual homeworks/exams are not curved. There is just one curve that occurs after the final exam. See "grade assignment", above.)

- **I think I lost too many points on my homework/midterm/final. Can you give me some back?**

  I'm always happy to explain mistakes, but unless there was an actual error in grading or totalling I cannot give you more points. One important thing to remember is that all the other papers were graded exactly the same way.