



**Math 425b Syllabus**  
Fundamental Concepts of Analysis (part II)  
Lecture 39647R (Leslie)

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**COURSE INFORMATION AT-A-GLANCE**

Math 425b: Fundamental Concepts of Analysis (part 2) (4.0 Units), Spring 2023

**Prerequisite(s):** Math 425a

**Required Textbook:** NONE. The instructor will provide notes (posted on Blackboard) that will serve as a textbook. It is not required to purchase any textbook (even the additional ‘recommended supplemental resources’ below).

Additional Recommended Resources (Not Required):

- Rudin, *Principles of Mathematical Analysis*, 3rd ed. This has been the ‘standard’ textbook for Analysis I courses for decades. Even though we are not using it for this class, it is worth being familiar with if you plan to take more math courses. However, it is notoriously difficult to read, and may serve better as a reference after you finish the course than as a resource while you are taking it.
- Pugh, *Real Mathematical Analysis*, 2nd ed. An excellent and fairly readable textbook. I’d almost want to use this book for the course, but there are some topics that it doesn’t cover that I want to treat.
- Munkres, *Topology*, 2nd ed. As the title suggests, this is a topology book, not an analysis book. However, one actually needs quite a bit of point-set topology to do analysis, and I can’t recommend Munkres’ book highly enough if you want to dig deeper into this subject. It’s very possibly the best-written textbook I have ever read, and the exercises are extremely well thought-out and worthwhile.
- Stein and Shakarchi, *Fourier Analysis: An Introduction*. We’ll touch briefly on some concepts from Fourier Analysis. This is one of the very few books on the subject that requires no measure theory to be readable.
- Michael Spivak, *Calculus on Manifolds*. We will cover a bit on differential forms. There are several ways to present this material. Spivak’s book provides a classic approach—which we will not be taking—but which might provide some useful perspective if differential forms are a subject of interest for you.

**Meeting Times/Location:** 9:00-9:50am MWF, Kaprielian Hall 140

**Instructor:** Trevor Leslie, [lesliet@usc.edu](mailto:lesliet@usc.edu). Assistant Professor (RTPC) of Mathematics.

*Office Hours:* 10–11am Mondays and Wednesdays, and by appointment. (Subject to change.)

*(Optional) Problem Sessions:* I will run a supplementary problem session most weeks. We will mostly talk about strategies for assigned (and recommended) homework problems. These sessions will be live-streamed and recorded. (However, if no one shows up in-person, then the session will be cancelled.) The schedule for these sessions will be determined at the beginning of the semester.

**TA:** Louis Coffin, [lcoffin@usc.edu](mailto:lcoffin@usc.edu)

**TENTATIVE Exam Dates (will be moved if possible—see below), and some ‘Drop’ Deadlines:**

Midterm Exam #1: Friday, February 17, during class.

(Note: Deadline to drop without a ‘W’ is Friday, February 24)

Midterm Exam #2: Friday, April 1, during class.

(Note: Deadline to drop the course is Friday, April 7)

Final Exam: Friday, May 5, 8am–10am.

Until further notice, you should plan on taking the exams on these dates and at these times. However, I would like to re-schedule all three of these exams. I would like to schedule **longer blocks** for the **midterm exams** (mostly to ease time-pressure) and I would like to move the **final exam** to **later in the day**. However, in order to move the final exam, I will need the **unanimous written consent of all students in the class**. I intend to obtain unanimous written consent for any out-of-class midterms as well, in light of the exam make-up policies (see below). I will be sending out a poll at the beginning of the semester to try to determine an optimal time. If we are unable to decide on mutually agreeable times, then the relevant exams will be administered during the times listed above. The poll will close at the end of week 2, and the times will be finalized at the end of week 3.

### University Holidays:

MLK Day: January 16 (no class)

Presidents' Day: February 20 (no class)

### Religious Observances:

I am aware of the following dates associated to religious observances that fall on days of class meetings. I am very open to making accommodations related to such observances—please see me if appropriate. If you feel a date is missing from this list, please bring it to my attention as soon as possible.

Passover: April 6th and 7th, April 12th and 13th

Good Friday: April 7th

Ramadan: March 22nd to April 21st

### Other Important Dates:

See the USC registration calendar: <https://classes.usc.edu/term-20231/calendar/>

## COURSE FORMAT AND INSTRUCTIONAL MODE

This course will run in-person. The instructional mode is subject to change according to university directives and instructor health.

Reasonable efforts will be made to live-stream lectures via Zoom, with recordings available on Blackboard; however, the following disclaimers are in place:

- Technical difficulties may occasionally prevent the live-stream or recording from being available.
- The instructor may or may not be able to hear questions asked by remote participants.
- The quality of available live-streams and recordings of class meetings is not guaranteed to be high.
- The instructor will not use class time to attempt to resolve technical difficulties (for example, if the recording stops working mid-lecture), or if the camera goes out-of-focus.

With the above in mind, students should plan to attend class in person if their health allows it. See below for more details.

### Attendance and Participation

Unless you have a compelling reason to be absent, my expectation is that you will attend class in person. Your attendance and participation will be worth a total of **5% of your total course grade**. You can count on receiving at least a 90% in the 'Attendance and Participation' category provided that you don't miss more than one class a week, and you arrive on time. I will take attendance at the beginning of each class by taking a picture of those students in attendance at 9am. If you need to miss more than one class a week for a legitimate reason, please run it by me, but it is very likely to be approved without penalty. (My definition of 'legitimate reason' is pretty accommodating.) The attendance policy is intended to keep students in the classroom (thus enhancing the possibility for meaningful class discussion) while still allowing for some flexibility, for students who need to miss class for one reason or another.

**'Cold' Calls** (really more like 'luke-warm' calls). It is important to me that everyone in the class gets a chance to participate in the discussion. With this in mind, I will ask for volunteers to answer some questions

I ask in class; for other questions, I will call on a specific student in the class, on a rotating basis. In order to make this process less intimidating, these semi-cold calls will be done in roughly alphabetical order by last name, so that you will know in advance whether you should expect to be called on. I will also announce the topics to be covered in a given week in advance, so that students who wish to read ahead in preparation for this may do so. If you prefer not to be called on during a given lecture, or if you are not able to come to class on a given day, just let me know, and I will postpone it to the next lecture.

### Online Course Tools

- Blackboard. Lecture notes and Zoom meeting links will be available through Blackboard. Blackboard access is available through `my.usc.edu`.
- Gradescope. You will submit homework assignments through Gradescope. You should have already received an email notification when I added you to the Gradescope roster for this course.
- Campuswire. We will use Campuswire as a discussion board for questions on homework, as well as course logistics. You will be sent an email invitation to join the Campuswire roster.

### COURSE CONTENT

In Math 425a, the first half of this course sequence, you learned tools necessary for putting the theory of single-variable calculus on rigorous footing, and some context for these tools. This process involved a lot of topological concepts that might not have been previously familiar. This semester, in Math 425b, our primary (but not exclusive) focus will be on the theorems of multivariable calculus. To do this correctly, we'll need tools not only from topology, but also from linear algebra.

A tentative list of topics to be covered is as follows. Some topics (especially the ones near the middle of the list) may be omitted if time is short.

- Power Series and Special Functions
- Improper Riemann Integration
- Convex Functions and Related Inequalities
- Vector Spaces
  - Equivalence of Norms on a Finite-Dimensional Vector Space
  - Function Space Norms
- Convolutions and Approximate Identities
- The Stone–Weierstrass Theorem
- Inner Product Spaces and Best Approximation
- Basics of Fourier Series
  - Mean-Square Convergence of Fourier Series
  - Pointwise Convergence of Fourier Series
- Linear Transformations
- The Derivative as a Linear Transformation
- Multiple Integration: Fubini's Theorem, Change of Variables
- Differential Forms
- Stokes' Theorem

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### ASSIGNMENTS AND ASSESSMENTS

**Written Homework** (28% of total grade): Roughly two assignments per week will be assigned and submitted via Gradescope. Your lowest two written homework grades will be dropped automatically. A list of assigned problems and a very detailed list of homework policies and procedures can be found in the document titled 'Homework', posted to Blackboard under the 'Content' tab.

**Exams** (70% of total grade): Two midterm exams (20% each) and one final exam (27%). See above for the dates.

A student who needs to miss one of the midterm exams for any reason has two options:

- (1) Take a harder version of the exam at a later date, within 10 calendar days of the original exam.
- (2) Re-weight the final exam to be 47% of the final grade instead of 27%.

If you miss both midterm exams, you will have to make up at least one of them.

Make-up final exams will generally not be given except under extreme circumstances.

I will emphasize that a student may miss a midterm exam (subject to the above policies) for any reason. In particular, it is permissible for a student to miss a midterm exam simply because they do not feel prepared for it, though this is not encouraged. (Of course, that student will need to take the harder make-up exam or re-weight their final exam.) This is *not* permissible for the final exam.

There will be a small amount of extra credit available on each exam, in the following manner: The total points available will exceed 100, but the exam will be scored out of 100. For instance, if the problem sub-scores total to 105, and you earn an 85/105, your exam score will be recorded as 85% rather than  $85/105 \approx 81\%$ .

The final examination will be comprehensive, covering all topics presented in the course. Some extra emphasis will be placed on the material covered after the second midterm.

**Final Project (Optional)** (Up to 15% of total grade). A student who wishes their final grade to be determined by a formula that is less exam-heavy has the option of completing a final project. This consists of the following:

- A typed report on some topic related to the course content (but not covered in class), and
- An oral presentation of highlights from their report, presented to the instructor at an agreed-upon time.

The length of each of these items will vary on a case-by-case basis, but a typical report will be on the order of 5–10 typed pages, and a typical oral presentation will last 30–45 minutes. (This is for a project worth 15% of the final grade. A student may choose to complete a project of a smaller scale, but worth a smaller percentage of their final grade.)

Students wishing to take advantage of this option should contact the instructor as early as possible in the semester to talk about possible topics of interest. A student who completes a final project may decide how much of their grade they wish to be determined by the project, and which exam or exam(s) they wish to apply the project to. For example, a student who does poorly on Exam 2 but completes a final project can choose to have their Exam 2 score count for only 5% of their total grade, the remaining 15% being displaced by the final project.

### Grade Cutoffs

The end-of-semester grade cutoffs will tentatively be determined using the following table. I reserve the right to change these cutoffs in your favor. You may be interested to know that the anticipated median grade in the course is a B+.

|    |              |    |             |    |             |    |             |        |
|----|--------------|----|-------------|----|-------------|----|-------------|--------|
| A  | $\geq 92.00$ | B+ | 84.00–87.99 | C+ | 63.00–67.99 | D+ | 40.00–49.99 |        |
| A– | 88.00–91.99  | B  | 74.00–83.99 | C  | 54.00–62.99 | D  | 30.00–39.99 | F      |
|    |              | B– | 68.00–73.99 | C– | 50.00–53.99 | D– | 20.00–29.99 | <20.00 |

### Grading Disputes

If you feel an assignment or assessment has been mis-graded, bring it to the attention of your TA and myself within two days of when it is returned to you. The appropriate person will re-grade the entire assignment or assessment—not just the problem in question. Therefore the overall score may go up or down. Grading grievances aired more than two days after they are returned may not be re-graded.

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## ADDITIONAL COURSE POLICIES

- DSP approved students should inform the instructor at the beginning of the semester for any requested accommodation.
- Work-related travel must be scheduled outside of the mid-term and final examinations periods. Accommodation to take exams on different dates will be made only for family emergencies, religious observance and documented illness or health-related emergencies.
- Final grades will depend entirely on course performance as outlined above. Financial support requirements (e.g., minimum grade requirement for tuition reimbursement) cannot and will not be taken into consideration.

## STATEMENT ON ACADEMIC CONDUCT AND SUPPORT SYSTEMS

The information below applies university-wide and is available at

<https://dornsife.usc.edu/ase/statement-on-academic-conduct-and-support-systems/>

### Academic Conduct

Plagiarism—presenting someone else’s ideas as your own, either verbatim or recast in your own words—is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” [policy.usc.edu/scampus-part-b](https://policy.usc.edu/scampus-part-b). Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, <https://policy.usc.edu/scientific-misconduct>.

### Support Systems

Counseling and Mental Health: (213) 740-9355, 24/7 on call.

<https://studenthealth.usc.edu/counseling>.

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline: 1(800) 273-8255, 24/7 on call.

<https://suicidepreventionlifeline.org>.

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP): (213) 740-9355(WELL) (press “0” after hours), 24/7 on call.

<https://studenthealth.usc.edu/sexual-assault>.

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED): (213) 740-5086 / Title IX: (213) 821-8298.

<https://equity.usc.edu>, <https://titleix.usc.edu>.

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment: (213) 740-5086 or (213) 821-8298.

[usc-advocate.symplicity.com/care\\_report](https://usc-advocate.symplicity.com/care_report)

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity /Title IX for appropriate investigation, supportive measures, and response.

The Office of Disability Services and Programs: (213) 740-0776.

<https://dsp.usc.edu>

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Campus Support and Intervention: (213) 821-4710.

<https://campussupport.usc.edu>

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC: (213) 740-2101.

<https://diversity.usc.edu>

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency. UPC: (213) 740-4321, HSC: (323) 442-1000. 24/7 on call

<https://dps.usc.edu>, <https://emergency.usc.edu>

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety. UPC: (213) 740-6000, HSC: (323) 442-120. 24/7 on call

<https://dps.usc.edu>

Non-emergency assistance or information.

Office of the Ombuds. (213) 821-9556 (UPC) / (323) 442-0382 (HSC)

<https://ombuds.usc.edu>

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.