Elementary Analysis Syllabus
Math 325:003

1. Course Information

Instructor: Dr. Abigail Raz
You may refer to me as Abigail or Dr. Raz. (Please do not use anything else.)

Email: araz2@unl.edu

Website: There is a course site on Canvas. This is where I will post announcements and homeworks. It is your responsibility to check Canvas regularly and ensure that you are receiving the emails. All course materials will be organized in the modules tab. The modules will be organized by week, and each module will contain all of the materials distributed that week (homework, workshops, lecture notes, links to videos etc.).

Office: Avery Hall 238.

Office Hours: (Subject to change)
Monday 1:30-2:30
Thursday: 4-5:30
Friday 1:30-2:30
All office hours will be held online at the following Zoom link:
https://unl.zoom.us/j/98299066481?pwd=NWdDcW5qOVh1SndieHJHM1JsbStrdz09.
The password is Avery238.
Additional office hours are available by appointment. If you wish to meet with me you must email me no later than 5 pm on the day before you would like to meet. I will do my best to accommodate your schedule, but please send multiple times that you are available to meet for me to choose from.

Prerequisites: Math 208 is the prerequisite for this course.

Class Time and Location: MWF 9:30-10:20
Some classes will be held in person in Nebraska Hall W196. Others will be held virtually at the following Zoom link:
https://unl.zoom.us/j/98653320797?pwd=bnlRZHVoRzRWRUJsVDRCNjI4TEdkUT09
The password is NHW196.
You must log into the zoom room using your UNL account. During many online classes I will be utilizing preset breakout rooms for small group work. This will only work if you log in using your UNL email.
Each student will be assigned to Group A or Group B. Please see the calendar at the end of the syllabus for which days your group attends the in person class. The other days you can access the Zoom stream of the class through the link above.

Textbook: We will be using two textbooks for this course.

(1) Understanding Real Analysis by Paul Zorn. I will be using the first edition of this book; however, you are more than welcome to use the second edition if you would like. The second edition contains a few additional sections; however, we will not be covering any of them in this course.
(2) Book of Proof by Richard Hammack. We will be using this book for the first few weeks of the course as we introduce various proof fundamentals. I also recommend it as a general resourse for proof writing. A free pdf of this book can be found at `https://www.people.vcu.edu/~rhammack/BookOfProof/`. You can also purchase a physical copy if you wish.

This course is an introduction to mathematical reasoning and proof writing via elementary analysis. We will spend the first few weeks developing some of the fundamentals of pure mathematics and proof writing. We will then move into the rigorous study of many of the topics you learned in Calculus such as limits, continuity, and differentiation (see the calendar on the last page for a complete list of topics).

This course is a bridge between the more computational lower level math courses and the theoretical proof writing nature of higher level math courses. My goal for this course is for students to gain both a knowledge of elementary real analysis and a comfort with theoretical math and proof writing. If you find yourself falling behind with the proofs please come to office hours or schedule a meeting as soon as possible.

Accessibility: The University strives to make all learning experiences as accessible as possible. If you anticipate or experience barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can discuss options privately. To establish reasonable accommodations, I may request that you register with Services for Students with Disabilities (SSD). If you are eligible for services and register with their office, make arrangements with me as soon as possible to discuss your accommodations so they can be implemented in a timely manner. SSD contact information: 232 Canfield Admin. Bldg.; 402-472-3787

Academic Integrity: All students in the course are expected to be familiar with and abide by the academic integrity policy (https://studentconduct.unl.edu/academic-integrity). Violations of the policy are taken very seriously.

Face Covering: Please see the final page of this syllabus for the official UNL policy on face coverings in class. If you do not adhere to this policy you will be asked to leave the classroom.

2. Assignments and Grades

The breakdown of grades for the course is as follows:

Participation	5%
Workshops	10%
Homework	20%
Quizzes	20%
Final Portfolio	10%
Exams	35%

Participation: Every student will start with a base participation grade of 90%. You can gain points by being attentive, asking or answering questions in class, and attending office hours. You will lose points here for poor attendance or distracting behavior such as consistently checking your phone during class. These should be easy points.

Workshops: Almost every week I will post a workshop on Monday before class to Canvas with a variety of problems. You will be assigned a workshop group of 3 to 5 students with which to discuss these problems. Each workshop will have a corresponding discussion section on Canvas where you will record your groups thoughts and progress.

In order to get a full score on the workshop you (individually) must make some contribution to the discussion on at least two of the problems by the following Friday at 11:59 pm. You do not need to completely solve any or all of the problems (individually or as a group), but you do need to provide ideas and progress. I will periodically monitor the discussions to provide feedback and tips.

There will be time on most Mondays to work with your group on the problems during class. Some weeks this may be enough time to make progress on at least two problems, while other weeks you may also need to work on the problems outside of class.

The only way to learn math or any skill is to PRACTICE. These workshops are intended to provide you with extra low-stakes practice. Unlike homeworks they are not graded off of mathematical correctness but simply effort.

Quizzes: We will have ten 10-15 minute quizzes throughout the semester. See the calendar at the end of the syllabus for the quiz weeks and corresponding chapters. The quizzes will be given via Zoom at the end of class on Friday. I will display the quiz on zoom, and you have 10-15 minutes to complete it. You will then have 5 minutes to upload the quiz as a jpg or pdf to canvas.

The following rules apply:

(1) These quizzes are closed book/notes. No outside materials are permitted.
(2) You must have your zoom mic and webcam on. I should be able to see your paper, hands, and surrounding area via the webcam.

There will be no make-up quizzes, but the lowest two quiz scores will be dropped.

Homework: Typically there will be homework due every Monday night at 11:59 pm. Please see the calendar below for the exact schedule of homework. Homework will be due in two parts. Part 1 will be graded by a grader, while I will grade part 2. You can find the assignments in the modules, assignments, or files tab. You will submit your assignments as pdfs via Canvas. You may still hand write your homeworks; however you will need to take a picture or scan your homework and submit it as a pdf. Please be particularly careful that your writing and the scan is of high enough quality that your work is legible. Please let me know as soon as possible if you have any problems submitting via Canvas.

The grader and I will use the "speedgrader" function on Canvas to grade your assignments and provide comments.

Late homework will not be accepted. Each homework will be worth 40 points, and there will be 13 assignments throughout the semester. However, your total homework percentage will be:

$$\frac{\min\{480,\ \text{the total number of homework points you have earned}\}}{480}.$$

This means I will be "dropping" 40 homework points, the equivalent of 1 homework, but you cannot earn extra credit for receiving over 480 homework points.

As this is a proof based course you will be graded on the mathematical correctness as well the quality of proof writing. Please leave space on your homework for comments.

While you are allowed and encouraged to work with your classmates on the homework the write-up that you ultimately hand in should be completely your own. At no point should you copy a solution from another student or any other source. At the top of every homework please list the students with whom you worked on that assignment.

Portfolio: This class will include a portfolio. You will choose a number of topics from the course and include relevant definitions, examples, and non-examples that demonstrate an understanding of the topic and its relation to the rest of the material in the course. For this assignment I will be using a credit/no credit system. This means your portfolios will be required to follow certain specifications and no partial credit will be given. However, you will have up to 3 opportunities to submit a revised portfolio after I have provided feedback. Please see the Portfolio assignment on canvas for more details. I will discuss this assignment more as the course goes on. Please let me know if you have any questions.

Exams: This class will use a mastery-based testing policy. I have broken the material into 14 main topics (a list of the topics can be found in the exam topics pdf). There will be be three in class midterms. Each midterm will be posted on Canvas at 9:25 am and will be due at 10:25 am. Topics 1-5 will first appear on Exam I, topics 6-10 will first appear on Exam II, and topics 11-14 will first appear on Exam III. Make-ups will only be given in genuine, unavoidable, and clearly documented instances. This means there must be a doctor's note, notice of court appearance, etc indicating that you were unable to attend the exam. You should contact me as soon as you know you will not be able to attend the exam.

On each exam there will be one question per topic, and every question will be of the same form. I will write down a claim that may be true or false, and then an *incorrect* proof of the claim. You will have to

(1) Identify and explain, in one or two sentences, the error or omission in the "proof".
(2) Determine if the claim is true or false.
(3) Prove that the claim is true or false.

Each section will be graded as follows: No pass= 0%, Pass=75%, and Mastery = 100%. A student that demonstrates mastery on a topic will NOT have to complete that topic again. If a student fails to achieve mastery, they will have another chance to show mastery on the next exam. Thus Exam II will be the first time topics 6-10 appear, but a student may select to retry any of topics 1-5. The final exam will be an opportunity for students to attempt any topic they have not yet mastered. Thus students always have at least two attempts to exhibit mastery. There is NO PENALTY for mastering (or passing) a topic on the second or third attempt. The highest level achieved on any topic is what will be counted (i.e. if you receive a Pass on topic one on Exam I, and decide to reattempt topic one on Exam II but receive a No Pass then you will still be credited with a Pass for topic one).

Your exam score is computed as follows:

$$\frac{(\text{number of topics mastered}) + .75 * (\text{number of topics passed})}{14}.$$

As I am grading you on your mastery of a topic the grading will be tough. A "passed" topic will have at most one moderate error in the corresponding section, while a mastered topic will have no or very few minor mistakes. However, the benefit of this exam system is that you are not punished if you fail to master a topic on the first try - you will always have at least one more chance.

I will discuss more specifics of the exam structure as the course goes on. Please let me know if you have any questions.

The exams will all be take-home, but I will proctor them live on Zoom. During the exam you must have your webcam and microphone on. Any questions can be asked using the chat feature. Each exam will appear on Canvas as an assignment. You may start the exam as soon as it is posted and you must upload your solutions (again as a pdf) to Canvas.

You will be allowed to use only our two class textbooks and your class notes during the exams. You may not use any other internet resources or people. You are allowed to write your solutions using three possible formats: paper and pencil/pen, a tablet and a stylus, or a LaTeX editor. Again, regardless of the medium you use you must upload your solutions as a pdf.
Below is a recap of the only allowable uses of technology during the exams:

- downloading the exam from Canvas;
- the Zoom classroom;
- any class notes or virtual versions of either of our textbooks;

- if you are typing your solutions or are using a stylus you may have a window open with (only) your solutions.

The only items, physically or virtually, that you should have around you beyond any of your class notes and textbooks are those you would have during a regular in-person exam (water bottle, extra pencils etc), and nothing else (i.e. no phones). Most importantly you are not allowed to obtain answers from anyone else, in person or virtually, during the exam. Please ensure that you will have a quiet space to take the exams.

Cheating: As Zoom will still not allow me to completely proctor the exams I am relying on each of you individually to respect and adhere to the rules I have laid out above. However, if I suspect you cheated, in any way, on one of the exams I reserve the right to require a make-up oral exam via zoom. During this exam you will have to answer similar questions live on zoom. If I find that you are unable to do a particular portion of the exam you will lose all credit for that topic.

Final Exam Time: The final exam will be on November 24th. The exam will be posted to Canvas at 9:55 am and you must upload your solutions no later than 12:15 pm. The same rules as for the midterms on materials and Zoom proctoring apply.

3. Calendar

Important University dates:

- August 28: Last day to drop a full semester course and receive 100% refund, and the last day to file a drop to remove a full semester course from student's record.
- October 2: Last day to change a full semester course registration to or from "Pass/No Pass"
- October 28: Last day to withdraw from one or more full semester courses for the term

On the next page is the tentative calendar of assignments for the semester. Please see the exam topics pdf for information on what each topic covers. Please note that topics 6, 13, and 14 will not be covered on a quiz, but will appear on the exams. Each homework is due at 11:59 pm on the corresponding day, and each quiz takes place in class.

Week	Material and Reading	Quiz topic	Monday	Wednesday	Friday
1	Set Theory and Quantifiers Hammack: 1.1-1.6; 2.1-2.10	No quiz	Zoom class	Zoom class	Zoom class
2	Induction and Basics of $\mathbb{R}$ Hammack: 10.1-10.2 and Zorn: 1.1;1.7-1.8	Topic 1	Zoom class HW 1	Group A in class	Group B in class
3	Basics of $\mathbb{R}$ and Basics of Functions Zorn 1.3;1.6;1.9 and Hammack 12.1-12.2; 12.4-12.6	Topic 2	Zoom class HW 2	Group B in class	Group A in class
4	Sequence limits Zorn 2.1-2.2	Topic 3	Zoom class HW 3	Hybrid class	Zoom class Quiz 3
5	Sequence limits and Subsequences Zorn 2.2-2.3	Topic 4	Zoom class HW 4	Hybrid class	Zoom class Quiz 4
6	Cauchy Sequences and Limsup/Liminf Zorn 2.4;2.7	No quiz	Zoom Exam I	Hybrid class HW 5	Zoom class
7	Limsup/liminf and Function limits Zorn 2.7;3.1	Topic 5	No class*	Hybrid class HW 6	Zoom class Quiz 5
8	Function limits and Continuity Zorn 3.1; 3.2	Topic 7	Zoom class	Hybrid class HW 7	Zoom class Quiz 6
9	Continuity and Properties of Continuity Zorn 3.2-3.3	Topic 8	Zoom class class HW 8	Hybrid class	Zoom class Quiz 7
10	Properties of Continuity Zorn 3.3	No quiz	Zoom class HW 9	Zoom Exam II	Zoom class
11	Properties of Continuity and Uniform Continuity Zorn 3.3;3.4	Topic 9	Zoom class HW 10	Hybrid class	Zoom class Quiz 8
12	Derivatives Zorn 4.1-4.2	Topic 10	Zoom class HW 11	Hybrid class	Zoom class Quiz 9
13	Uniform Convergence Zorn 3.4;4.4	Topic 12	Zoom class HW 12	Hybrid class	Zoom class Quiz 10
14	Review	No quiz	Zoom class HW 13	Zoom Exam III	Zoom class

*There will still be a workshop for that week, and I will post a video lecture on Sunday for you to watch on Monday.

FACE COVERINGS SYLLABUS STATEMENT
Approved by the Faculty Senate Executive Committee
July 14, 2020

Required Use of Face Coverings for On-Campus Shared Learning Environments*

As of July 17, 2020 and until further notice, all University of Nebraska–Lincoln (UNL) faculty, staff, students, and visitors (including contractors, service providers, and others) are required to use a facial covering at all times when indoors except under specific conditions outlined in the COVID 19 face covering policy found at: https://covid19.unl.edu/face-covering-policy. This statement is meant to clarify classroom policies for face coverings:

To protect the health and well-being of the University and wider community, UNL has implemented a policy requiring all people, including students, faculty, and staff, to wear a face covering that covers the mouth and nose while on campus. The classroom is a community, and as a community, we seek to maintain the health and safety of all members by wearing face coverings when in the classroom. Failure to comply with this policy is interpreted as a disruption of the classroom and may be a violation of UNL's Student Code of Conduct.

Individuals who have health or medical reasons for not wearing face coverings should work with the Office of Services for Students with Disabilities (for students) or the Office of Faculty/Staff Disability Services (for faculty and staff) to establish accommodations to address the health concern. Students who prefer not to wear a face covering should work with their advisor to arrange a fully online course schedule that does not require their presence on campus.

Students in the classroom:

1. If a student is not properly wearing a face covering, the instructor will remind the student of the policy and ask them to comply with it.
2. If the student will not comply with the face covering policy, the instructor will ask the student to leave the classroom, and the student may only return when they are properly wearing a face covering.
3. If the student refuses to properly wear a face covering or leave the classroom, the instructor will dismiss the class and will report the student to Student Conduct & Community Standards for misconduct, where the student will be subject to disciplinary action.

Instructors in the classroom:

1. If an instructor is not properly wearing a face covering, students will remind the instructor of the policy and ask them to comply with it.
2. If an instructor will not properly wear a face covering, students may leave the classroom and should report the misconduct to the department chair or via the TIPS system for disciplinary action through faculty governance processes.

*Courses that have been granted an exception to the Face Covering Policy for pedagogical reasons are excluded. Exceptions to the Face Covering Policy are only granted after an approved health safety plan is developed.