

FUNDAMENTAL PROPERTIES OF SPACES AND FUNCTIONS I

MATH:3770:0AAA

SPRING 2024

The University of Iowa

The College of Liberal Arts and Sciences

Department of Mathematics

This syllabus contains the policies and expectations for this course. This course is offered by the [Department of Mathematics](#).

Course ICON Site

To access the course site, log into [Iowa Courses Online \(ICON\)](https://icon.uiowa.edu/index.shtml) (<https://icon.uiowa.edu/index.shtml>) using your Hawk ID and password. Assignments, links to videos, handouts, announcements and grades will be posted on ICON. It is important that you check ICON regularly.

Course Home

The College of Liberal Arts and Sciences (CLAS) is the home of this course, and CLAS governs the add and drop deadlines, the “second-grade only” option (SGO), academic misconduct policies, and other undergraduate policies and procedures. Other UI colleges may have different policies.

Course Instructor: Dr. Cindy Farthing

Email: cynthia-farthing@uiowa.edu

Office: B1J MacLean Hall

Phone: 319-384-4348

Drop-in Office hours: Mondays 1:30 to 2:30 pm; Wednesdays 1:30 to 2:30 pm; Thursdays 11:30 am to 12:30 pm; other times by appointment.

Lecture Information

Each student is enrolled in the following lecture: **Lecture 0AAA:** 12:30 to 1:20 pm MWF, 113 MLH

Discussion Section Information

Each student is also enrolled in one discussion section. These discussion sections are taught by graduate student instructors who are graduate students in the Department of Mathematics.

The meeting time, classroom information, and instructor information for each section follows. Instructor office hours and Math Lab hours will be posted on ICON.

| | |
|--|--|
| Section 0A01: 2:00 to 2:50 pm Th, 150 SH TA: Steven Un TA Email: steven-un@uiowa.edu | Section 0A03: 3:30 – 4:20 pm Th, 132 MH TA: Nicholas Cecil TA Email: nicholas-cecil@uiowa.edu |
|--|--|

DEO Contact Information: Prof. Ryan Kinser, 14 MLH, email: ryan-kinser@uiowa.edu

Course Description

From the university course catalog: *This course starts with a discussion of the real number system, especially the completeness axiom, covers convergence of sequences, and explains the basic theory underlying the differential and integral calculus. Particular attention is given to solving problems and writing proofs; regular written assignments are required. Students are expected to attain a more exact knowledge of theoretical concepts than in previous courses.*

For some of you, this course will be different from previous math courses because the focus will be on understanding material from a theoretical standpoint. The focus of the course will be on constructing examples that satisfy given definitions and proving statements rather than solving computational problems. In this course we will look at what you learned in calculus from a theoretical and mathematically rigorous perspective. You know calculus! So use the intuition you learned in there to help you understand it from a different point of view.

Course Prerequisites

MATH:1560 or MATH:1860

Learning Objectives

At the end of the semester, you will be able to do the following.

- Define a sequence of real numbers, the limsup and liminf of a sequence, the limit of a sequence, a Cauchy sequence, the limit of a function, a continuous function, a uniformly continuous function, and the derivative of a function.
- Provide examples and counter examples of sequences and functions that demonstrate certain properties.
- Construct logical proofs showing properties of sets.
- Construct logical proofs using $\epsilon - N$ and $\epsilon - \delta$ arguments.
- Negate mathematical statements.
- Evaluate whether a given argument is logically valid.
- Use direct and indirect proof techniques to prove statements.
- Construct proof using proof by induction.

Course Format

This course will meet synchronously four times each week. All course meetings will be in-person.

On Mondays, Wednesdays, and Fridays, you will meet with Dr. Farthing in lecture. This time will be spent discussing new definitions, sketching proofs of theorems, and exploring examples. You will be asked to complete exit tickets one day each week. You may also be asked to present some of your work from homework problems that were not collected.

On Thursdays, you will meet with your teaching assistant in a discussion section. During discussion sections, you will explore the concepts from lecture in more detail. You will have plenty of time to ask questions on new material and homework problems, so make sure you come to discussion sections prepared with your questions.

It is important that you come to class each day prepared and ready to participate. Participating in class can take on many different forms (asking questions, working with partners on smaller activities,

providing ideas, correcting Dr. Farthing's typos, actively taking notes, etc.), so you should be able to find a way to participate that is comfortable for you. Class time will be more beneficial for you if you can fully engage.

Required Texts and Programs

1. *Analysis with an Introduction to Proof* by Steven R. Lay, 5th edition, eText, ISBN: 9780321747471.

You will be given access to this book for one semester through the ICON Direct program.

Your U-Bill will be charged automatically by the Iowa Hawk Shop after your course has started, unless you opt out prior to the last day for tuition and fee reduction course deadline. (If you want to opt-out of this program, you will need to do so before September 1, 2023. You will lose all access to the eText features in ICON. More information about opting out is available at the [ITS opt-out site](#).)

2. *Gradescope Account*. Gradescope is a homework/test grading program that we will use. You will have access to this program through ICON, and it will be linked to your university ID. There is no charge for you to use this program.

Course Materials

Most of Chapters 1 through 6. Chapters 7 and 8 as time permits.

Required Technology

1. A reliable Internet connection.
2. Access to the University of Iowa computer system and your Learning Management System, ICON.
3. A scanner or scanning app that will allow you to scan multiple pages into a single pdf document. Microsoft OneDrive has a scanning feature and is available to all UI students through Office 365. (Feel free to use other apps or programs.)
4. MikTeX and a LaTeX editor to type some proofs. More information will be given in class.

Tech Support

- Go to [ICON Help](#) for more information on finding help with ICON.
- University of Iowa Help Desk: 319-384-HELP (4357), phone; its-helpdesk@uiowa.edu

Additional Resources

- The **Math Tutorial Lab** in 125 MacLean Hall offers free, drop-in tutoring for students enrolled in this class. Schedule and information about the Math Tutorial Lab is available at <https://math.uiowa.edu/math-tutorial-lab>.
- There are a variety of other places on campus where you can go for help with this course. Visit <http://tutor.uiowa.edu> for more information.

Exam Dates

| | |
|--------------------|-------------------|
| February 15 and 16 | Exam 1 |
| March 28 and 29 | Exam 2 |
| April 25 and 26 | Exam 3 |
| Week of May 6 | Final Retake Exam |

Other Important Dates

| | |
|-------------------|---|
| January 22 | Last day to add courses or change existing registration through MyUI without authorization. |
| January 23 | Registrations changes in MyUI require permission beginning today. |
| January 29 | Last day for undergraduates to add courses without a dean's approval or drop courses without a "W". Last day for undergraduates to add or change P-N or audit status and late register |
| February 15 | Attendance class lists due. |
| March 9 to 17 | Spring Break – No Classes. |
| March 21 | Midterm class lists due. |
| April 15 | Last day for undergraduates to drop semester-length courses without dean's approval. |
| May 3 | Close of classes. |
| May 6 to 10 | Final Exam Week |
| May 15 | Final Grades Due |
| August 27 | Last day to add courses or change existing registration in MyUI without authorization. |
| August 28 | Registration changes require permissions in MyUI. |
| September 1 | Last day for undergraduates to add courses without collegiate approval. Last day to change registration through MyUI. Last day to drop courses without a "W". Last day for undergraduates to add or change P-N or audit status and late register. |
| September 21 | Attendance class lists due. |
| October 19 | Midterm class lists due. |
| November 13 | Last day for undergraduates to drop semester-length courses without collegiate approval. |
| November 18 to 26 | Fall Break – No Classes. |
| December 8 | Close of classes. |
| December 11 to 15 | Final Exam Week |
| December 20 | Final Grades Due |

Grading procedures

This course uses criterion-reference grading. This means that your grade is determined by how well you demonstrate that you have mastered the learning objectives of the course – not on how well you do in relation to your peers. With criterion-reference grading, it is possible for everyone to get an A in the

course! The final grade will be based weekly homework assignments, four quizzes, three exams with retake opportunities, and weekly exit tickets. Please see the [Grade Components section](#) for further descriptions. Total possible points for each component are assigned as follows.

| Category | Points |
|---------------------------------------|------------|
| Weekly Homework Assignments | 150 |
| Quizzes | 45 |
| Exams (3 total) | 225 |
| Exit Tickets | 10 |
| Class Participation and Presentations | 20 |
| TOTAL | 450 |

Grading Scale

The following grading scale will be used to determine grades.

| Grade | A+ | A | A- | B+ | B | B- | C+ | C | C- | D+ | D | D- | F |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| Minimum Percentage | 99 | 93 | 90 | 87 | 83 | 80 | 77 | 73 | 70 | 67 | 63 | 60 | 0 |
| Minimum Points | 445 | 418 | 405 | 391 | 373 | 360 | 346 | 328 | 315 | 301 | 283 | 270 | 0 |

Possible Changes to Course Policies or Structure Due to COVID-19 or Other Outside Forces

Depending on the state of the campus community's health, we may need to make changes to the course structure and instructional method. The instructors hope that you will be patient with them and as flexible as possible. In exchange, we will try to do the same.

Your Physical and Mental Health and Well-Being

The course policies outlined below have been made to provide you with incentive to engage fully in the class. We understand that you have a busy life beyond this class and that physical or mental stress, illness, and other circumstances can impact your work in this class. Please let your instructor know if you feel like your performance in the course is being affected by what is going on. We cannot provide help if we do not know there is a problem.

The health and safety of you and those around you is the most important. If you do not feel well, or if you are concerned that you have been exposed to the coronavirus (or any other contagious disease), please stay home. Please see the [Attendance](#) section below about who to contact if you will be missing an assignment that will need to be made up. We will work with you to alter deadlines or help you keep up with the course. Please keep in mind that because we drop some scores, we may not offer a make-up quiz or assignment; however, this will not affect your final grade in a negative way.

We also realize that you have other obligations (family, work, etc.) that may interfere with your course work. Learning to juggle these responsibilities will be important for you in school and in your future career. At the same time, though, we are willing to work with you as long as you communicate with us when your participation in the course is affected.

Please be mindful of your mental health and seek help as a preventive measure or if you are feeling overwhelmed and/or are struggling to meet course expectations. Students are encouraged to talk to their instructor for assistance with specific class-related concerns. For additional support and counseling, students are encouraged to contact University Counseling Service (UCS). Information about UCS, including resources and how to schedule an appointment, can be found at counseling.uiowa.edu. Find out more about UI mental health services at mentalhealth.uiowa.edu.

Student Care and Assistance provides assistance to University of Iowa students who are experiencing a variety of crisis and emergency situations, including but not limited to medical issues, family emergencies, unexpected challenges, and sourcing basic needs such as food and shelter. More information on the resources related to basic needs can be found at basicneeds.uiowa.edu/resources/. Students are encouraged to contact Student Care & Assistance in the Office of the Dean of Students (Room 135 IMU, dos-assistance@uiowa.edu, or 319-335-1162) for support and assistance with resources.

Grade Components

Homework

Each Monday, you will be assigned several problems that you will write complete solutions. These problems will be due on Tuesday of the following week. You will scan your written homework as a pdf file and upload the homework to Gradescope. Several of the homework problems will be graded based on correctness and clarity, while other problems will be graded on completion. Each homework assignment is worth 15 points. At the end of the semester, the lowest homework score will be dropped.

Homework will be due at 11:59 pm on Tuesdays. Late homework will be accepted up to one week after the original due date. However, a 10% penalty will be deducted from any late work.

In addition to the collected homework, other problems from the textbook will be assigned. These problems will provide excellent practice and preparation for the exams. These additional problems will be discussed during lecture and discussion sections.

Quizzes

There will be three quizzes throughout the semester. They will occur approximately at the midpoint between each exam (with one quiz occurring before the first exam). These quizzes will be given during discussion sections. Each quiz is worth 15 points. These quizzes will consist of a variety of questions: stating definitions, true/false, providing examples, and short proofs. The quizzes will cover the material covered in class during the previous weeks. The quizzes will provide a good way to assess your understanding of the course material before each exam.

Exit Tickets

During most weeks at the end of class (discussion section or lecture), you will be asked to complete an exit ticket. This is a short assignment that will take about 5 minutes to complete. The exit tickets will range from true/false questions to providing examples to stating definitions to asking questions to telling us how the course is going for you, etc. These are graded on completion; the goal is to give each of us a way to check in on understanding of key ideas from the course.

Class Participation and Presentations

At the end of the semester, you will earn points based on your participation in class and presenting some of the additional questions assigned. Each student is expected to present to the class at least once either during lecture or during discussion sections. While there is no formal attendance policy, you cannot participate in class if you are not present.

Exams

There will be three exams throughout the semester. Each exam is worth 75 points. Exams will consist of one part given during discussion sections and a second part given during lecture. On the exams, you will be asked to state definitions and main theorems, provide examples, answer multiple choice questions, and write short proofs.

Exam Retakes

Each question on the exam is designed to test you on a key concept of the course material. As a result, you will be given the opportunity to retake on each exam. To do this, you will be asked to complete a different, yet similar question. Opportunities to retake will be given approximately two or three weeks after. During exam week, one final retaking opportunity will be given to allow you a chance to redo questions from Exam 3.

Date and Time of the Final Exam

The date and time of every final examination is announced by the Registrar generally by the fifth week of classes. There is no final exam for this course, but you must be available for the final exam period in order to have the final retake opportunity. All students should plan on being at the UI through the final examination period, which is December 11 through 15, 2023. Once the Registrar has announced the date, time, and location of each final exam, the complete schedule will be published on the Registrar's web site and will be shared with instructors and students. It is the student's responsibility to know the date, time, and place of the final exam.

Course Policies

Make-up Quizzes

Make-up quizzes will only be offered for an excused absence (illness, religious holidays, etc.); you must inform your instructor BEFORE the quiz takes place (except in extreme cases), and arrangements to make up the quiz must be made within 24 hours.

Make-up Exams

Make-up exams will only be given for excused absences. We request that you notify your instructor as soon as possible (and preferably before the quiz/exam) that you will not be able to complete the quiz or exam by the due date. You should arrange a time for completing the exam within 24 hours of the original due date in most circumstances.

Technology

This is primarily a theoretical course, so calculators are not required – nor are they permitted on exams. You may find graphing technology like Desmos, Mathematica, or a graphing calculator helpful to create and understand examples.

Cell phones, tablets, or watches with internet capabilities may not be used during quizzes or exams.

Collaboration

You are encouraged to work with others on homework and all in-class activities unless you are specifically instructed not to do so. You may also visit the Math Tutorial Lab or consult online resources. However, you are expected to write your solutions to the homework problems on your own and in your own words, and you should cite any help you receive on individual problems. Please be aware that to master the skills needed for this class, a lot of practice is required. To do well on quizzes and exams you will need to work many of these problems multiple times without help. Be sure to test your knowledge by doing much of the homework on your own.

Academic Honesty and Misconduct

We trust you to do your own work, and cheating on exams and quizzes will not be tolerated. Your grade should reflect your level of understanding of the material in this class. By asking others to do work for you, you are only cheating yourself of an opportunity to learn and receive feedback.

All students in CLAS courses are expected to abide by the [CLAS Code of Academic Honesty](#). Undergraduate academic misconduct must be reported by instructors to CLAS according to [these procedures](#).

Student Complaints

Students with a complaint about a grade or a related matter should first discuss the situation with the instructor and/or the course supervisor (if applicable), and finally with the Director or Chair of the school, department, or program offering the course.

Undergraduate students should contact [CLAS Undergraduate Programs](#) for support when the matter is not resolved at the previous level. Graduate students should contact the CLAS [Associate Dean for Graduate Education and Outreach and Engagement](#) when additional support is needed.

Drop Deadline for this Course

You may drop an individual course before the deadline; after this deadline you will need collegiate approval. You can look up the [drop deadline for this course](#) here. When you drop a course, a "W" will appear on your transcript. **The mark of "W" is a neutral mark that does not affect your GPA.** Directions for adding or dropping a course and other registration changes can be found on the [Registrar's website](#). Undergraduate students can find policies on dropping and withdrawing [here](#).

Other Student Expectations

- **Workload:** Expect to spend *at least* 8 to 10 hours weekly outside of the classroom working on homework and understanding the material from the course. More time may be needed to prepare for exams.
- **Classroom Behavior:** We expect that you will treat the others in the class and your instructors with respect.
- **Participation and Preparation:** Please come prepared for class and ready to participate each day. If you must miss a class, it is your responsibility to determine what you missed and what you need to make up. Students learn in different ways, so it is natural that you may feel like you benefit from certain parts of the course more than others. However, it is expected that you participate in activities inside (group collaboration on workbook material) and outside (ALEKS

modules) of the classroom equally. The course is designed so that these components complement – not duplicate – each other.

- **Personal Devices:** We understand that using personal devices in class may make sense in order to access classroom materials. You will get the most out of lecture and discussion section if you give it your full attention. It is your choice how you want to divide your attention between classroom activities and devices. However, please avoid using these devices with sounds, and refrain from using them in a way that might distract other students. (i.e. watching videos or looking at webpages not related to the course in the line of sight of other students).
- **Communication:** This class is designed to prepare you for your future career, and for many of you, taking classes is either a part-time or full-time “job” at this point. Therefore, you should begin practicing professional communication with your instructors.
 - In person communication: Address your instructors with an official title (Dr. or Prof.) unless they have given permission otherwise. Many TAs do not have titles yet, so be sure to ask them how they would like to be addressed.
 - Email: Use a meaningful subject (example: MATH:3770 homework question), and a proper greeting in the email (example: Dear Dr. Farthing). Include as much information as you can. If you are requesting a meeting outside of usual office hours, please provide a few time slots that will work to meet with your schedule. This will help to set up the meeting more efficiently. Instructors will do their best to respond within 24 hours. Keep in mind that answering homework questions via email is generally pretty difficult. It is usually best to ask questions about homework in class, in discussion sections, or during drop-in office hours.
- **Technical Difficulties:** You are responsible for starting problems far enough in advance in order to complete the assignment by the due date. Computer problems and other technical difficulties are not a valid excuse for missing a due date.

Changes to the Syllabus

We reserve the right to make slight adjustments to the syllabus. Any changes will be announced in class and posted on ICON.

College of Liberal Arts and Sciences (CLAS) Course Policies

[Attendance and Absences](#)

University regulations require that students be allowed to make up examinations which have been missed due to illness or other unavoidable circumstances. Students with mandatory religious obligations or UI authorized activities must discuss their absences with me as soon as possible. Religious obligations must be communicated within the first three weeks of classes.

[Exam Policies](#)

Communication: UI Email

Students are responsible for all official correspondences sent to their UI email address (uiowa.edu) and must use this address for any communication with instructors or staff in the UI community.

University Policies

[Accommodations for Students with Disabilities](#)

[Basic Needs and Support for Students](#)

[Classroom Expectations](#)

[Exam Make-up Owing to Absence](#)

[Free Speech and Expression](#)

[Mental Health](#)

[Military Service Obligations](#)

[Non-discrimination](#)

[Religious Holy Days](#)

[Sexual Harassment/Misconduct and Supportive Measures](#)

[Sharing of Class Recordings](#)