# Elementary Functions and Calculus I

## Course Syllabus

**Autumn 2024** **Math 131**

## §A. Key Information

- **Instructor:** Each instructor will lead the class meetings and hold office hours for their section. Any questions about the course material should be directed towards your instructor. Your instructor is determined by your section enrollment. Please see table 1 on page 2.
- **Math 130s sequence coordinator:** Professor Davies is the sequence coordinator. He is in charge of all non-tutorial administrative tasks, such as uploading material to Canvas, and homework submissions and grading. If you have any questions regarding homework, exams, or the course, you should email him directly: (kjdavies@uchicago.edu).
- **Math 130s tutorial coordinator:** Professor Chowdhury is the tutorial coordinator. He is in charge of all aspects of courses' tutorials, including distribution of tutorial exercises and management of tutorial grades. If you have any questions regarding tutorials, you should email him directly: (subhadip@uchicago.edu).
- **Canvas:** Our course Canvas page (https://canvas.uchicago.edu/courses/58561) will function as a homepage for our course and contain all relevant information. It is recommended that you check Canvas daily for updates, announcements, and assignments.
- **Class Meetings:** You will have a 50 minute Class Meeting **every Monday, Wednesday, and Friday**. The time and place are determined by your section enrollment.
- **Tutorial Sessions:** You will have an 80 minute Tutorial Session **every Tuesdays and Thursdays**. The time and place are determined by your section and subsection. Please see table 1 on page 2. Subsections can be found via https://my.uchicago.edu/.
- **Office Hours:** Each instructor will be available for questions for at least 3 hours a week outside of class meetings and tutorials. The time and place will be posted on Canvas by your section's instructor. Note that a student should only attend the office hours of the instructor of the section in which you are enrolled.
- **Textbook:** Calculus, 9th Edition by Varberg, Purcell, Rigdon. ISBN-13: 9780131429246. You will not officially need the textbook at any point in the course; however, you should get a copy if you would like it as an extra resource. Any version that you are comfortable using (hardback, PDF, etc.) will suffice. If any content directly from the textbook will be required, a pdf scan will be provided.
- **Weekly Exercise Sets:** Exercises will be assigned weekly and graded for both completeness and correctness. The due date will be each **Monday at 6 pm**, unless otherwise specified. Weekly Exercise Sets will be submitted through Gradescope (see Gradescope tab on Canvas).
- **Exam schedule:** There will be five exams throughout the quarter. The date and type of exam are given below
  - October 11 (Friday, Week 2) - In-class exam
  - October 23 (Wednesday, Week 4) - Evening exam
  - November 6 (Wednesday, Week 6) - In-class exam
  - November 20 (Wednesday, Week 8) - Evening exam
  - TBA (–) - Final exam

| Section | Instructor | Class Meetings (MWF) | Tutorial Sessions (TR) | |
|---|---|---|---|---|
| 10 | Kale Davies | 8:30-9:20am<br>Eckhart Hall 206 | 8-9:20am | (T1) Eckhart Hall 117<br>(T2) Cobb Hall 103 |
| 20 | Victor Hugo Almendra Hernandez | 9:30-10:20am<br>Eckhart Hall 312 | 8-9:20am | (T1) Cobb Hall 104<br>(T2) Cobb Hall 106 |
| 22 | Carolyn Lee | 9:30-10:20am<br>Pick Hall 022 | 8-9:20am | (T1) Cobb Hall 119<br>(T2) Cobb Hall 112 |
| 24 | Thelxinoi Loukidou | 9:30-10:20am<br>Eckhart Hall 308 | 8-9:20am | (T1) Cobb Hall 116<br>(T2) Eckhart Hall 207A |
| 25 | Marko Medvedev | 9:30-10:20am<br>Eckhart Hall 203 | 9:30-10:50am | (T1) Eckhart Hall 117<br>(T2) Saieh Hall for Econ 141 |
| 28 | Subhadip Chowdhury | 9:30-10:20am<br>Eckhart Hall 207A | 9:30-10:50am | (T1) Kent 106<br>(T2) Kent 103 |
| 30 | Isabelle Steinmann | 10:30-11:20am<br>Pick Hall 022 | 11-12:20pm | (T1) Eckhart Hall 117<br>(T2) Hinds Lab Geo Sci 180 |
| 32 | Duarte Maia Nascimento | 10:30-11:20am<br>Kent 103 | 11-12:20pm | (T1) Saieh Hall for Econ 141<br>(T2) Harper Memorial 141 |
| 34 | Pawel Poczobut | 10:30-11:20am<br>Rosenwald Hall 301 | 12:30-1:50pm | (T1) Eckhart Hall 117<br>(T2) Saieh Hall for Econ 102 |
| 40 | Yuyang Feng | 11:30-12:20pm<br>Pick Hall 022 | 12:30-1:50pm | (T1) Kent 106<br>(T2) Ryerson Phys Lab 178 |
| 44 | Aisosa Efemwonkieke | 11:30-12:20pm<br>Ryerson Phys Lab 276 | 11-12:20pm | (T1) Classics Building 313<br>(T2) Gates-Blake Hall 401 |
| 46 | Junhao Fan | 11:30-12:20pm<br>Ryerson Phys Lab 178 | 12:30-1:50pm | (T1) Kent 103<br>(T2) Gates-Blake Hall 401 |
| 50 | Mateo Attanasio | 12:30-1:20pm<br>Pick Hall 022 | 5-6:20pm | (T1) Ryerson Phys Lab 178<br>(T2) Saieh Hall for Econ 102 |
| 52 | Noah Caplinger | 12:30-1:20pm<br>Ryerson Phys Lab 177 | 5-6:20pm | (T1) Eckhart Hall 207A<br>(T2) Hinds Lab Geo Sci 184 |

Table 1: Instructors and Meeting Times

**Registration Changes:** Once we begin classes if you wish to change your registration, you will need to contact mathadvising@uchicago.edu. Note that you have until Week 3 to finalize your math registration.

## §B. Course Description

Calculus can be viewed broadly as the study of change. In particular, if two quantities are related, then changing one will often result in a change in the other. The goal of calculus is to formally describe this change so that we can precisely quantify it. Such quantification then presents opportunities to analyze relationships based on rates of change, such as classifying change as increasing or decreasing or finding when a quantity is maximized or minimized through optimization.

Math 131, along with the first couple of weeks of Math 132, covers the content of a typical differential calculus course. We will provide a careful but comprehensive treatment of limits and continuity, which will lead us to define the concept of differentiability. We will learn how to compute derivatives of non-trigonometric functions (with trigonometric functions being covered in Math 132), and then explore the practical benefits of calculus through applied optimization.

### Course Schedule

A rough outline of the course content and corresponding textbook chapters is given below.

M1 - Ch 0.1 - Introductions and the real number line.
W1 - Ch 0.2 - Inequalities and absolute values.
F1 - Ch 0.3 - Cartesian coordinates and the equation of a line.

M2 - Ch 0.4/0.5 - Functions and common equations.
W2 - Ch 0.5/0.6 - Combinations of functions.
F2 - **Exam 1.**

M3 - Ch 1.1/1.6 - Intuitive exploration of limits and continuity.
W3 - Ch 1.5/1.6 - Infinite limits and classifying discontinuities.
F3 - Ch 1.3 - Calculating limits using limit laws and theorems.

M4 - Ch 1.2 - The formal definition of a limit.
W4 - **Exam 2.**
F4 - Ch 1.6 - The intermediate value theorem.

M5 - Ch 2.1 - Average rate of change and secant lines.
W5 - Ch 2.2 - The limit definition of a derivative.
F5 - Ch 2.3 - Computing derivatives for polynomial and power functions.

M6 - Ch 2.3 - The product and quotient rules.
W6 - **Exam 3.**
F6 - Ch 2.5 - The chain rule.

M7 - Ch 2.6 - Higher-order derivatives.
W7 - Ch 2.7 - Implicit differentiation.
F7 - Ch 2.8 - Related rates.

M8 - Ch 3.2/3.4 - Monotonicity and concavity.
W8 - **Exam 4.**
F8 - Ch 3.1/3.3 - Local optimization.

M9 - Ch 3.3/3.4 - Global optimization.
W9 - Ch 3.4 - Applied optimization.
F9 - Review of content.

TBA - **Exam 5 (Final Exam).**

## §C. Components of the course

Our course is graded using a methodology called the Mastery-Based Grading System, also called standards-based or learning-based grading, in which most graded work does not have a point value or percentage. Instead, you earn your grade by showing **appropriate engagement** with the course (including active participation and appropriate civil conduct in classes and tutorials, as described below) and **demonstrating evidence of skill on the course standards** that describe the major ideas covered by each exam. These standards are listed in section I and may be updated throughout the semester.

When you submit most of your work, the instructor will evaluate it relative to the quality standards made clear on each problem. If your work meets the standard, then you will receive full credit for it (marked as 'complete'). Otherwise, you will get helpful feedback and, in the case of exam standards (not homework), the chance to reflect on the feedback, revise your work, and then reassess your understanding.

This feedback loop represents and supports the way that people learn. Learning happens over time as we revisit ideas and reflect on them. In this class, your final grade will reflect how well you *eventually* understand each topic. You can make mistakes a certain number of times without penalty as long as you eventually demonstrate fluency in the topic.

### Class Meetings

Class meetings are the primary source in which you will be introduced to new course concepts. During these sessions, you should take notes on new ideas, be exposed to some preliminary problems, and actively participate in line with the class structure implemented by your instructor. These 50-minute meetings will take place every Monday, Wednesday, and Friday and are led by an instructor based on your section enrollment (see table 1 on page 2).

### Tutorial Sessions

Tutorial sessions will use a collaborative learning framework. In teams of four, you will work together to complete exercises that are specially designed for collaboration and strive to give deeper conceptual insight into the course material. The 80-minute meetings will take place every Tuesday and Thursday and are led by a lead junior tutor based on your section and subsection (see table 1 on page 2). Attendance and participation are mandatory and will contribute towards your course grade.

### Weekly Exercise Sets

As the name suggests, weekly exercise sets will be distributed on a weekly basis. These exercise sets are to be completed as homework, with the material covered directly associated with the content presented in class meetings. Further, these exercise sets are designed to prepare you for questions on the course exams. Weekly exercise sets will be distributed by 6 pm on Tuesday each week and will be due for submission by 6 pm on the following Monday unless otherwise specified.

Weekly exercise sets will be submitted through Gradescope (which can be reached via the course Canvas page). In your submission, you should complete all questions, showing working and using sentences where reasoning is required. Your work should be legible, and each question should be clearly labeled. Completion and correctness of your homework will contribute towards your course grade.

### Exams

Each exam will have questions that are directly associated with the course standards (see section I), and each standard will appear on all tests after the topic has been introduced in class meetings. Your goal will be to demonstrate your ability to complete each standard at least once throughout the course. If you complete a standard on an earlier test, you do not need to attempt it on later tests; if you do not complete or attempt a standard on an earlier test, you will be able to attempt it again on a later test.

To allow students ample opportunity to reattempt course standards, there will be five exams throughout the quarter, one every two weeks. The exam schedule is as follows:

- October 11 (F2) - In-class exam
- October 23 (W4) - Evening exam
- November 6 (W6) - In-class exam
- November 20 (W8) - Evening exam
- TBA (–) - Final exam

Notably, there are three types of exams, the details of which are given below. Please note that prior to each exam, a reminder with any relevant details will be posted on Canvas.

- **In-class exam:** These are 50-minute exams that will take the place of your usual class meeting. On these dates (Oct 11 and Nov 6), you should attend your class meeting as usual, with the recommendation of arriving slightly early. Your instructor will administer the exam. You must take your exam with the section in which you are enrolled.
- **Evening exam:** These are 50-minute exams that will take place from 7 - 8 pm on the assigned dates (Oct 23, Nov 20). These dates are assigned as part of your class enrollment; please ensure you are available on these evenings. Information regarding the exact test location for your section will be communicated through Canvas. On these dates, your regular class meeting will be canceled.
- **Final exam:** This is a 2-hour exam that will take place at a time and place determined by the registrar. This decision will be made sometime during the quarter and communicated to you all via Canvas.

It is the policy of the Department of Mathematics that the following rules apply to final exams in all undergraduate mathematics courses:

- The final exam must occur at the time and place designated on the College Final Exam Schedule. In particular, no final examinations may be given during the Ninth Week of the quarter.
- Instructors are not permitted to excuse students from the scheduled time of the final exam except in the cases of an Incomplete.

## §D. Assessment and Grading

Your course grade will be determined by three assessed components of the course: course standards, weekly exercise sets, and tutorial participation. The requirements to be successful in each component are outlined below, along with a description of how these components are used to determine your final grade.

### Course Standards

The five exams will assess your ability to complete the 20 course standards (see section I). A record of your completed standards will be maintained on Canvas, with your overall goal being to complete as many of the 20 standards as possible.

Standards will appear on all tests after the corresponding topic has been introduced in class meetings. If you answer a question incorrectly or do not complete it, it will recorded as needing revisions. Only the total number of complete standards contributes to your final grade, regardless of whether they need revisions on multiple tests.

### Weekly Exercise Sets

Each question on each weekly exercise set is graded on a scale of 0 to 3. The scale should be interpreted as follows:

- 0/3 - Question was not attempted, not completed, or had major errors.
- 1/3 - Question was complete. A reasonable effort but with significant errors, or correctly complete but with insufficient working.

- 2/3 - Question was complete with only minor errors and reasonable working. A minor error can be seen as one that still allows you to demonstrate your relative understanding of the problem as intended.
- 3/3 - Question was complete accurately with clear explanations and work.

Your overall score (as a percentage of the maximum possible) across all problems in all weekly exercise sets will contribute to your final grade. Notably, this means that an exercise set with more questions will contribute more toward your overall grade.

## Tutorial Participation

Each tutorial is graded on a binary scale: 'Complete' (recorded as 1) or 'Incomplete' (recorded as 0) based on your participation. Importantly, this requires not only your attendance but also your active engagement in the tutorial, as facilitated by the Lead Junior Tutor of your section.

You can receive your participation grade in tutorials by aligning your behavior with the following examples of positive engagement and collaboration:

- Actively collaborate with your fellow teammates.
- Perform the duties of your assigned role to the best of your abilities.
- Contribute to a supportive environment through respectful communication.
- Demonstrate reasonable effort and progress toward completing assigned tutorial exercises.
- Develop your understanding of how assigned exercises align with course standards.

Your total number of 'complete' grades from tutorials will contribute to your final grade. If you attend a tutorial but do not receive a 'complete' grade, you should contact the tutorial coordinator, Professor Chowdhury (subhadip@uchicago.edu), who will investigate further and provide feedback on how to receive this grade on future tutorials.

## Final Grade

The table below outlines the requirements for different grades in the course. In order to achieve a given grade, you must complete **all three requirements** in that grade's corresponding column. Furthermore, any student that does complete **all three requirements** in a corresponding column is guaranteed that grade as a minimum.

| Category | A | B | C | C- | D |
|---|---|---|---|---|---|
| Course Standards - Total 20 | At least 17 completed | At least 15 completed | At least 13 completed | At least 12 completed | At least 10 completed |
| Weekly Exercise Sets | At least 80% homework grade | At least 70% homework grade | At least 60% homework grade | At least 55% homework grade | At least 50% homework grade |
| Tutorial Participation - Total 18 | At least 15 completed | At least 13 completed | At least 11 completed | At least 10 completed | At least 9 completed |

The full list of possible "quality" grades is: A, A-, B+, B, B-, C+, C, C-, D+, D, F. If a student meets the requirements for a B but not an A, they may be awarded an A- or B+ grade based on their performance over each of the three categories. For example, if a student has completed all of the requirements for B, then

1. If a student completes at least two out of the three requirements for A, they get A-.
2. If a student completes at most one out of the three requirements for A, they get B+.
3. Else, they get a B.

⚠ Note that it is the policy of the Department of Mathematics that Math 13100 (and all other core classes in the Math department) cannot be taken with a Pass/Fail (P/F) grading scheme, regardless of your major or purpose in taking the course.

**W and I grades:** A student can choose to withdraw from a class, receiving a "W"(withdrawal) on their academic transcript, up to Monday of Week 9 (5 pm). A withdrawal grade is requested through your academic advisor.

If emergency circumstances prevent you from taking the final exam, you may be eligible to request an "I" (incomplete). Incomplete grades are rarely given, and only to those who have done the majority of the work in the course of passing quality, who, because of illness or other good reasons, are unable to complete all the course work by the end of the quarter. A request form must be signed by your academic adviser and your instructor.

Final decision regarding any changes to these guidelines will be that of the Director and Co-Directors of Undergraduate Studies in the Department of Mathematics and will be communicated to all in Canvas. Any such changes can only (if anything) loosen the requirements from what is given above.

## §E. Collaboration Policy on Homework

Collaboration on written homework is encouraged; however, you need to carefully balance learning with your fellow students and finding your own path through the material. You must follow the collaboration guidelines below.

1. Unless given prior permission, each student is expected to complete each weekly exercise set without substantive assistance from others (solutions from external webpages, other students, etc.), including AI tools. If you are unclear whether something is permitted, please check with your instructor. Unauthorized use of AI tools for any purpose in this course will violate the university's academic integrity policy.

2. Unless otherwise specified, you may use calculators or mathematical software (e.g., DESMOS) for written homework problems. Note that many of the computational problems demand that you show every step of an algorithmic process, so don't rely on software to skip any steps!

3. On your written homework, you must indicate who your collaborators are. (If you collaborate with different people on different problems, say so!)

4. Work on a problem by yourself until you have your own "idea" about the problem; after that, you may start collaborating. A valuable idea can be as simple as a sense of why you are stuck!

5. Keep written collaborative work separate from your written individual work. The same applies when you discuss problems with your instructor.

6. Do the actual write-up of your homework assignment without collaboration notes so as to reflect your own understanding of the problem. If you cannot write the solution without referring to your collaboration notes, then you have not yet understood the solution. In that case, go back to step (4).

Note that the last guideline above means that while you are collaborating (including with me at Office Hours!), you cannot be simultaneously working on the final draft of your homework! To ensure productive collaborations, you should not work in groups larger than four people on any given problem at any given time. Large groups of people "working together" are not really working together! **If anything is unclear, ask the instructor!**

# §F. Helpful Resources

Your overall performance in the course will benefit from consistent engagement and investment. A minimum requirement of yourself should be to attend and actively participate in class meetings and tutorial sessions, taking notes to support your studying, and successfully understanding all exercises that are assigned. Moreover, we encourage you to observe your thoughts related to classwork, homework, and other class documents. Calculus, a mathematical study of change, connects to many topics within a broad range of areas of study, so taking the time to explore connections between what we have studied and what you have studied previously will only enrich your experience in this course.

## Office Hours

Office hours are really Student hours! They are an opportunity for you to stop by your instructor's office and ask questions. Instructors have specifically set this time aside in order to give personalized help to individual students. Any and all questions are welcome, whether you are working on a homework question, have questions on a broader concept discussed in class, or potentially even questions beyond the scope of the course.

Typically, students misunderstandings in mathematics are initially small, but due to the constructive nature of math, a small misunderstanding can compound as concepts are utilized together. Students who frequently attend office hours and actively engage by asking questions are able to continually resolve their small misunderstandings, resulting in sustained improvement.

Each instructor's schedule for office hours will be communicated via Canvas. If you are unable to attend any of the office hours, please email the instructor to set up an appointment.

## College Core Tutor Program

The College Core Tutor Program (https://college.uchicago.edu/academics/college-core-tutor-program) is a peer-based tutoring program for UChicago undergraduates designed to provide one-on-one assistance and small group support to undergraduate students in scientific and quantitative subjects, including chemistry, economics, mathematics, statistics, computer science, physics, and biology. Their tutors are upperclassmen in the College with exceptional academic records or graduate students — many of them former Teaching Assistants in the Core science courses.

It should be noted that these tutors are not affiliated with this specific section of the course or the math department in general, so they may explain things differently than or use different conventions to how they were discussed in class. Always be sure to double-check with our authoritative sources: your notes from class, the textbook, and the instructor, either during class or during office hours.

No appointments are necessary; drop-in Sundays through Thursdays between 6 pm and 10 pm CST starting the third week of the quarter through the week of final exams.

**Note: this information was last updated on the college core tutor website in January. While this information may still be accurate, we will confirm and update it as soon as possible.**

## Academic Accommodations

If you need any special academic accommodations, please provide your instructor with a copy of your Accommodation Determination Letter (provided to you by the Student Disability Services office) as soon as possible so that you may discuss how your accommodations may be implemented in this course. If you are in the process of obtaining accommodations, please inform your instructor as soon as possible. More information can be found here: https://disabilities.uchicago.edu/.

## Religious Accommodations

The University of Chicago is home to students of all the world's major religions and, though firmly a secular institution, values the rich diversity of spiritual expression and practice found on campus. It is therefore the policy of the University that students who miss class, assignments, or exams to observe a religious holiday must be accommodated as

follows: (i) absences may not be counted as a missed class in any course in which attendance is a measure of academic performance; (ii) reasonable extensions of time must be given, without academic penalty, for missed assignments; and (iii) exams must be reasonably rescheduled without academic penalty. Students must inform their instructors in writing of their need to observe a religious holiday reasonably well in advance of the absence, preferably at the beginning of the quarter. More information can be found at the following; https://provost.uchicago.edu/handbook/clause/policy-religious-accommodation-missed-classes-assignments-and-exams.

### Wellness Resources.

Know that UChicago has counseling available both 24/7 and by appointment through http://wellness.uchicago.edu. Also know that medical care (beyond that related to Covid-19) is available, including 24/7 access to medical professionals to address your health care questions.

## §G. Classroom Norms

### 'Growth', not 'Ability'

There is a very prevalent belief that you are either "good" or "bad" at math, and if you are "bad" at it, then you will always be bad at it no matter how hard you try. This is extremely false, and the mathematics community bears a lot of responsibility for perpetuating this myth. In reality, mathematics is just like any other discipline or skill: you can improve more and more with practice.

We are all capable of growth in mathematics. You should measure your success in this class by how much your understanding of the concepts have improved over the course of the quarter. Also, math is very hard, so you should expect to struggle with the material! When you struggle, you are learning and growing. Not all people show their struggle in equal ways, so you should always be wary of judging your progress based on your perception of your peers' struggle. You are probably doing better than you think.

### Respecting Each Other

We are not all coming to this class with the same privileges, resources, time, and knowledge. It's really important to keep this in mind when working with each other on homework assignments and during class meetings. **It is our strong belief that as a community, mathematicians and scientists need to do a much better job of making our disciplines more accessible to people of all races, genders (including gender non-conforming folks), sexual identities, and class backgrounds.** While this is a priority for us in the classroom, we do not claim to know how to best honor this commitment, and so **we are very open to feedback from students when it comes to making the course more accessible and inclusive to all identities.**

It's also important to think about how to respect one another when working together in groups. It's not equally easy for all of us to speak up in a large group, and the voices of historically underrepresented/marginalized students are most easily drowned out in group work. So please keep this in mind when working together. Here are some concrete examples of positive collaborative behavior:

- Making sure everyone who wants it has the opportunity to speak frequently. This can mean checking in with each other to make sure everyone is following along and contributing when they have an idea.
- Respecting people's pronouns and other aspects of their identity.
- Making sure that everyone's ideas are acknowledged when writing up the final solution to a problem. When working in groups, solutions often evolve organically; an idea might pop into your head and you may think it's yours and yours alone, but perhaps you only arrived there because of something else that someone already said. Pay attention to what people are saying and try to learn from one another.

We will do our best to check in with folks periodically during the quarter. **If at any time in the quarter you want to be working in a group but do not have a group of students to work with, please let the instructor know and they will help you find a working group. If at any time in the quarter, you find yourself in a group of students for which the above behaviors aren't being practiced and people aren't feeling respected, please let the instructor know as well.**

## §H. Policies and Protocols

### Attendance and Absence

**Attendance is *crucial* to success in this class.** Your best chance to discuss new material, ask questions, and avoid confusion is during class. So, don't miss class! You are responsible for all material and announcements from class, even in case of absence. Much of this information will be available on Canvas. Please check in with your instructor and with your classmates when you are back.

That said, there may be times when you have to miss class. This could be due to illness, conflicting extra curricular events, or that your help is need by a family or friend. When this happens, do what you need to do. We trust that you are an adult and will make the best choices that you can. We appreciate it if you can notify the instructor in advance of an absence, if possible. While we do not track attendance during class, we will alert your academic advisor in the event of multiple missed classes, missed homework assignments, etc.

In the case of tutorials, where attendance is mandatory, reported and a component of your grade, you should contact Professor Chowdhury (subhadip@uchicago.edu) if you are unable to attend. In non-emergencies, requesting an absence in this way must be done at least 24 hours prior to your tutorial. Having said this, tutorials are a required and important component of the course; you should only be missing them if it is absolutely necessary.

### Lateness

Weekly homework will be officially due at 6pm each Monday, however submissions will be accepted until midnight. Any homework submitted after the midnight deadline will not be accepted, and all submissions will be taken as they are at this time.

Extensions will only be considered in extreme circumstances or emergencies. In these cases, you should contact Professor Davies (kjdavies@uchicago.edu).

### Add/drop

Add/drop for all courses ends **Friday Week 3**, this is the last day you can drop a class without it being present on your academic transcript. Beyond this, you can still withdraw from the course up to Monday Week 9, but it will result in a W (withdraw) grade on your transcript.

### Academic Integrity

Academic honesty is central to the spirit of a UChicago education. On individual work, take care to independently communicate your submissions (regardless of how many others you may have collaborated with along the way to developing a solution). On tests and the final, let your work be original to your mind and your thoughts.

Violations of academic integrity are serious and will be handled seriously. Resulting punishment could include (at least) taking a zero for an assignment where an instructor has probable cause that cheating or plagiarism has occurred. For more details, regarding academic honesty within the College, please visit the following link:
https://college.uchicago.edu/advising/academic-integrity-student-conduct.

## Calculator policy

Unless otherwise specified, calculators can be used for any component of the course, except for exams. This means, when working on weekly exercise sets or in tutorials, you are welcome to use a calculator to complete basic arithmetic. While you will not have access to calculators during exams, arithmetic errors may be overlooked if they do not fundamentally change the structure of the question and if there is no intuitive check to indicate an error has occurred.

## Technology in the Classroom

Encouraged for learning math; discouraged for distracting yourself or others! As a matter of courtesy, please turn off or silence cell phones, pagers, and other communication and entertainment devices prior to the beginning of class. At some points in the course, we may be explicitly using laptops or cell phones to better understand the mathematics we're studying. Please respect your fellow students by not using any of them in a way that is distracting or counterproductive to class.

## Sexual Misconduct Policy

The University of Chicago recognizes that members of the university community are responsible for ensuring that the community is free from discrimination and other forms of sexual misconduct based on sex or gender, including sexual harassment, sexual assault, stalking, domestic violence and dating violence. Faculty are considered "Individuals with Title IX Reporting Responsibilities" of the University and are obligated to report information to the Title IX Coordinator related to sexual misconduct. If you think your rights, or the rights of someone else in the university community, have been violated you can find information on resources and reporting at: https://cares.uchicago.edu/.

**Title IX Coordinator:** Bridget Collier, Associate Provost & Director (bcollier@uchicago.edu, 773-702- 5671)

## Recording and Deletion Policy

The Recording and Deletion Policies for the current academic year can be found in the Student Manual under Petitions, Audio & Video Recording on Campus.

- Do not record, share, or disseminate any course sessions, videos, transcripts, audio, or chats.
- Do not share links for the course to those not currently enrolled.
- Any Zoom cloud recordings will be automatically deleted 90 days after the completion of the recording.

*The instructor reserves the right to make changes to this syllabus as necessary. Any changes will be announced in class and on Canvas in a timely manner.*

# §I. Course Standards

## Pre-calculus material

$S1.$ **Solving inequalities:** I can solve an inequality involving a factored polynomial or linear function with absolute value. I can write and visually represent the solution using interval notation.

$S2.$ **Equation of linear functions:** I can find the equation of a line given two points or a point and a slope. I can graphically represent any given linear functions.

$S3.$ **Intersection of curves:** I can find the intersection of lines, parabola, and circles by constructing and solving a system of equations.

## Limits & Continuity

$S4.$ **Graph using given limits:** I can interpret limit expressions and functional values and can graph a function with those properties.

$S5.$ **Continuity:** I can define and determine the continuity of a function at a point. I can correctly characterize the types of discontinuity.

$S6.$ **Limits of rational functions:** I can evaluate limits of rational functions algebraically.

$S7.$ **Formal definition of a limit:** I can write a proof, with accurate logical structure, to demonstrate limits of linear functions.

$S8.$ **Intermediate value theorem:** I can state and use the intermediate value theorem. I can represent the theorem visually.

## Derivative Fundamentals

$S9.$ **Definition of derivative:** I can calculate derivatives using the limit definition. I can interpret the derivative of a rate of change in context.

$S10.$ **Differentiability** - I can recognize points where a function is (and is not) differentiable, with appropriate justification.

## Derivative Computations

$S11.$ **Essential Derivatives:** I can compute derivatives of sums and constant multiplies of power and polynomial functions.

$S12.$ **Product and Quotient Rules:** I can compute derivatives using the product rule and quotient rules.

$S13.$ **Chain Rule:** I can compute derivatives of composed functions using the chain rule.

$S14.$ **Combining Rules:** I can compute derivatives by combining derivative rules. I can identify what rules to apply when computing derivatives.

## Derivatives in Context

$S15.$ **Higher-order derivatives:** I can use higher-order derivatives to explain the relationship between position, velocity, and acceleration functions, and solve problems in these contexts.

$S16.$ **Implicit differentiation:** I can use implicit differentiation to find the tangent line to a curve. I can use implicit differentiation to solve related rates problems.

$S17.$ **Sketching using calculus:** I can use the first and second derivatives of a function to identify intervals of monotonicity and concavity. I can use the information about monotonicity and concavity to sketch the function.

## Optimization using Differentiation

$S18.$ **Unconstrained optimization:** I can use calculus to identify and classify stationary critical points.

$S19.$ **Constrained optimization:** I can determine absolute extrema for a continuous function on a closed interval.

$S20.$ **Applied optimization:** I can setup and solve applied optimization problems using calculus. I can interpret my result in the context of the problem.