

# Math Ma: Introduction to Functions and Calculus I

## Fall 2024 DRAFT Course Information and Syllabus (Subject to Change)

What's in this syllabus		Welcome to Math Ma! Math M merges calculus and precalculus to study functions and the impact of change. In Math M, we start discussing the ideas of calculus immediately, weaving in precalculus material as we go. This gives us an entire year to reinforce the most important concepts and skills that will enable you to apply calculus to all sorts of situations in science, medicine, economics, engineering, and other fields.
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Homework Structure		Our goal in Math M is to help you gain a solid, deep, and portable understanding of functions and single variable calculus that will prepare you for Math 1b, other quantitative courses, and quantitative work you want to do in the future. This involves learning mathematical content, mathematical communication, mathematical habits of mind, and strategies for learning math.
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<b>Resources</b>	4	<ul style="list-style-type: none"> <li>You should be able to use mathematics as an aid to understanding the world we live in. In particular, you should be able to use functions to model relationships between different quantities and to use calculus to measure and understand the impact that a change in one quantity has on another.</li> </ul>
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<b>Time Commitment</b>	6	<ul style="list-style-type: none"> <li>You should be able to communicate about mathematics through speech, writing, and graphics. This includes understanding and explaining the "why" and "how" behind mathematical procedures.</li> </ul>
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<b>List of Major Topics</b>	6	<ul style="list-style-type: none"> <li>You should develop mathematical habits of mind, problem-solving skills, and strategies for learning math. These include:</li> </ul>

- ☆ The ability to see the underlying structure of a problem and break a problem down into smaller pieces.
- ☆ The ability and confidence to tackle unfamiliar problems strategically and flexibly. ("What's the best tool to use here?" "That didn't work; let me try this other approach.")
- ☆ The ability to ask good questions and make connections. ("Is this like...?" "How does this fit with ...?")
- ☆ The ability to evaluate your reasoning and the reasoning of others ("Is this answer consistent with my other work?" "Have you considered the possibility that...?" "Is this assumption valid?").

### Course Format: Required Course Meetings

#### Class

We teach Math Ma in small classes so that you can get to know your TF (the person who teaches your section) and classmates, and so that you have lots of opportunity to **actively do math in small groups**. Research has found that this way of learning is particularly effective: a meta-analysis of 225 studies found that "Active learning increases student performance in science, engineering, and mathematics", and another

meta-analysis of undergraduate STEM courses found that “students who learn in small groups generally demonstrate greater academic achievement ... than their more traditionally taught counterparts.”

Class meets 3 times a week (Mondays, Wednesdays, and Fridays), and your class will also have a course assistant (CA) who will facilitate your learning in class and grade your homework assignments.

### Workshop

You will also participate in a weekly 75-minute workshop. Each workshop is built around a set of problems designed to help you reinforce and expand your understanding of course material, build communication and collaboration skills, and build your confidence in your ability to explore and solve more complicated problems. In addition, workshop will introduce you to metacognitive strategies for learning math more effectively. **Over the course of the semester, most workshops will be required. They run on Tuesdays.**

### Regular Homework (Problem Sets)

The only way to learn math is by doing math, so homework is an essential part of Math Ma. **Mathematics is an active, creative, and sense-making activity.** It is virtually impossible to learn the material and to do well in the course without working through the homework problems *thoughtfully*. Don't just crank through computations and write down answers; *think* about the problems posed, the strategies you employ, the meaning of the computations you perform, and the answers you get. It is often in this reflection that the greatest learning takes place.

One of the major goals of college-level mathematics education is to move students from computational processes to conceptual thinking. Your instructor will *prepare* you to do the homework but will not *show you how* to do your homework. **Learning occurs when you can move yourself into unknown territory. Therefore, you should expect homework problems to look different from the problems discussed in class.** This is intentional; the only way to develop a deep and flexible understanding of the material is to constantly practice applying it in different contexts. Homework also gives you a chance to practice communicating your reasoning, a skill that faculty in other departments have told us they value highly. When writing up your work, we expect you to explain your thought process; your final answer is less important than the reasoning you used to reach it. As a rule of thumb, if you're not using any words when writing up the problems, you probably aren't giving enough explanation. It may help to imagine that you're writing to a fellow student to explain how to solve the problem; this will help you include the right level of detail.

### Homework Structure

Problem sets will be handed out in class and posted on the course Canvas site. You'll have an assignment due at 8:30 am each day of class. Assignments will usually have two sections:

- A short one to be done in [Edfinity](#), an online system that gives you immediate feedback on whether your answer to a problem is correct; if not, you can try again.
- A more substantial written portion that you'll submit through [Gradescope](#), an online grading platform. The first problem set will include details about how to format and submit your work to Gradescope.

### Late Days for the Written Portion

We understand that occasionally things may come up that prevent you from giving full attention to homework. Therefore, we'll incorporate some amount of additional flexibility in our final version of the syllabus. Final details will be released over the summer, but know that you can anticipate some flexibility that can balance keeping you on track with managing unexpected circumstances.

## Collaboration & Academic Integrity

We encourage you to collaborate with other students currently taking Math Ma; you're welcome to discuss, brainstorm, and work through problems together. However, **you must write up your work independently and in your own words, and you should only submit work that you feel comfortable explaining to another student or to a TF.** Writing up homework independently gives you a chance to probe your own understanding of the strategies used. If you receive help from any source other than the course TFs and CAs, you must acknowledge that help; your homework score will not be affected by this. Of course, **it is always unacceptable to copy a solution from any source.**

Generative artificial intelligence (GenAI) tools such as ChatGPT can be a useful tool for developing your understanding of a concept, but you should not ask such tools to solve your homework problems.

Here are some examples of acceptable and unacceptable things to ask a source (whether that's a GenAI tool, person, website, etc.):



Examples of acceptable questions:

- What's the definition of the derivative?
- How do you calculate a derivative using the definition?
- How do I visualize the definition of the derivative?
- Why is the derivative defined the way it is?



Examples of unacceptable uses of support:

- Asking a person, GenAI tool, or other source to solve a specific homework problem for you.
- Asking another student to show you their homework
- Copying a solution from any source

Finally, you may not share any course materials (worksheets, homework, and so on) with anyone not enrolled in Math Ma, with the exception of a peer tutor.

## A Word About Algebra

If you've ever learned a sport or a musical instrument, you know how important it is to be comfortable with basic skills. The same is true in mathematics; to be able to learn and use the material in Math M, you need to be fluent with algebra. Algebra is also an important skill in almost every quantitative field, from life sciences to economics to engineering.

It's **completely normal** to have holes in your background (it's almost impossible *not* to!), but it's important to actually address these holes early in the semester so that you can understand and use the material we're learning. Calculus is a set of tools for converting real world problems into algebra problems, so calculus is only useful when paired with algebra. Because of this, you can expect all of your exams to include substantial amounts of algebra.

**To help you begin building your algebra skills, we will have a required diagnostic test before classes begin.** This will not count toward your course grade, but it will give you and us a chance to see what algebra skills you need to practice. Workshops and problem sets will include algebra practice, and if you need more practice, we will connect you with those resources.

## Assessments in This Course: Exams and Skills Checks

Taking a test on material strengthens your ability to use that material; therefore, tests are a crucial part of the learning process.

**We will have 4 cumulative written exams;** the focus of these is assessing your ability to use the material, which includes explaining concepts and solving unfamiliar problems.

**We will also have 2 skills checks,** which focus on basic computational skills. You will take the skills checks in Edfinity. In addition, after each skills check, you will have the opportunity to take a second skills check (a “skills recheck”) on the same material, and we’ll keep the higher of your two scores.

**Calculators are not allowed on exams or skills checks.**

### Tentative Test Dates

**Tentative** dates for the exams (2 hours) and skills checks (1 hour) are below. Times are yet to be confirmed, but we hope to start in the evenings at 6 or 6:30pm:

Math Ma/1a skill check (Edfinity)	late August on-campus
Mini-exam (written)	Thursday, September 19
Mini-exam revisit (written)	Thursday, October 3
Exam 1 (written)	Thursday, October 10
Skills check 1 (Edfinity)	Thursday, October 24
Skills recheck 1 (Edfinity)	Thursday, October 31
Exam 2 (written)	Thursday, November 14
Skills check 2 (Edfinity)	Tuesday, December 3
Skills recheck 2 (Edfinity)	TBA During Reading Period
Final Exam (written)	TBA by registrar

To schedule an out of sequence assessment, you will fill out a request one week before the scheduled assessment to arrange an earlier time to take the assessment. We’ll post the relevant information on Canvas before each assessment.

## Resources

Problem solving is challenging, and you shouldn’t expect to immediately solve every homework problem. Often you learn the most from things you try that don’t work! So, give yourself time to try some different approaches to a problem and to discuss the material with others. Here are several resources for doing so.

- **Your fellow students.** We strongly encourage you to form study groups to discuss homework problems and prepare for assessments. Discussing the material helps you solidify your understanding and develop your ability to communicate mathematical ideas. And [teaching the material to someone else is one of the best ways to learn it well!](#)
- **Office hours** are times when you can drop in and ask a TF or CA questions, work on your homework, or review material. You’re encouraged to go to any TF or CA’s office hours, and you don’t need to make an appointment; just show up! Office hours are also a great place to meet other students. A schedule will be posted on the course Canvas site.
- The **Math Question Center (MQC)**, 7:30 pm - 10:30 pm Sundays through Thursdays, is a place where you can work on your homework with other Math Ma students. In addition, CAs will be there part of the time to facilitate your discussions; we’ll post more information on the course Canvas site once the semester starts.

- The [Academic Resource Center](#) offers free peer tutoring, academic coaching, workshops on topics like time management and problem set strategies, accountability groups, and more.

## Materials You'll Need

You'll need to purchase access to [Edfinity](#), an online system that costs \$25 for the semester. If the cost is a financial burden, please email Kate Penner ([penner@math.harvard.edu](mailto:penner@math.harvard.edu)) for financial support.

The textbook for this course is *Calculus: An Integrated Approach to Functions and Their Rates of Change* by Robin J. Gottlieb, which we'll post as a PDF on our Canvas site. We'll post relevant reading for each class; we recommend skimming the reading before class and then coming back to it after class to solidify the details of what you've learned.

You won't need a calculator for this course. (Calculators are not allowed on exams or skills checks.)

## Grading

Your participation in each class and workshop will be graded on this scale:

Full credit	You arrive on time and prepared, and you stay on task and engaged in class activities for the entire class period.
Half credit	You are on task and engaged for most but not all of the class (for example, because you arrive late, leave early, or aren't focused on class material for part of the time).
No credit	You are on task and engaged for less than half of the class period.

We have built in policies that allow for some flexibility on attendance. These are currently under review and will be finalized in Summer 2024.

**Our grade breakdown for Fall 2024 will be similar to Fall 2023, but is currently under review.** You can expect your grade will be calculated using a blend of your grades on homework, participation, and exams. Here is what we used for Fall 2023. Fall 2024 will be similar. We used the highest of the below schemes to calculate student scores.

Component	Scheme 1	Scheme 2	Scheme 3	Scheme 4
Class participation	10%	10%	10%	10%
Workshop participation	2.5%	2.5%	2.5%	2.5%
Homework	20%	20%	20%	15%
Skills checks	7.5%	7.5%	7.5%	7.5%
Mini-exam	5%	5%	5%	5%
Exam 1	15%	10%	15%	10%
Exam 2	15%	17.5%	10%	15%
Final exam	25%	27.5%	30%	35%
Total	100%	100%	100%	100%

We will use the following table to convert your numerical score to a letter grade, with the caveat that you must score over 50% on the final exam to guarantee yourself a C- or above.

You will guarantee yourself a grade of at least. . .	...by earning a numerical score of at least. . .
A	93
A-	90
B+	87
B	83
B-	80
C+	77
C	73
C-	70
D-	60

## Time Commitment

A key goal of Math M is to prepare you to take more quantitative courses, which means we cover a lot of important foundational material and prioritize developing new learning strategies for college coursework. Because of this, Math M will be a time-intensive course this year, and we encourage you to take this into account when selecting your courses and extracurricular activities. As a starting point, we suggest that you budget 3-4 hours per problem set, as well as additional time each week to review.

Everyone learns and works at a different rate, so you may find you need to commit more time. That's okay; math isn't a race! The goal is not to learn quickly, but to learn in a way that enables you to use the material in the future. Many students find the level of mastery necessary in our courses is different from their prior math experience, and supporting you during this adjustment is one of our goals. Certain topics require more or less time to work through, and you will become more effective learners as you develop new strategies. The best thing you can do is to anticipate the time commitment and set aside regular daily time to work on mathematics, whether that's on your own, with classmates, or at office hours.

## Inclusion

We are all responsible for creating and sustaining a learning environment that is respectful and welcoming for everyone. We all bring different perspectives, experiences, and mathematical backgrounds, and we ask that you engage in discussion with care and empathy for each other.

If you ever have concerns, please don't hesitate to talk with the teaching team.

## Course Accessibility

If you need accommodation or assistance for a documented disability, please get in touch with the [Disability Access Office](#) as soon as possible so that they can arrange accommodations for you in all of your courses.

## List of Major Topics

Here's an overview of the main topics we'll cover this semester:

- Functions:
  - Representing functions graphically, algebraically, numerically, and verbally
  - Key classes of functions: linear, exponential, logarithmic, polynomial
  - Modeling with functions
- Rates of change, average and instantaneous
  - Definition and interpretation of the derivative
  - Calculating derivatives
  - Using derivatives: linear approximation, optimization, and more

- Limits

*Enjoy the course!*