

# INTRODUCTION TO CALCULUS

MATH 1A

## Syllabus

### OLIVER

My name is Oliver Knill (you can call me "Oliver"). Please contact me any time by email, also to set up a one by one zoom appointment.

### LECTURES

Our lectures take place Monday Wednesday and Friday from 10:30 AM to 11:45 AM online You are required to come to the lectures.

### COURSE ASSISTANTS

Jackie Walzer, [jwalzer@college](mailto:jwalzer@college)  
Keith Simien, [ksimien@college](mailto:ksimien@college)  
Michaela Donato, [michaeladonato@college](mailto:michaeladonato@college)

### MQC

The Math question center will be open Sunday, Tuesday and Thursday

### GENERAL EDUCATION

When taken for a letter grade, this course meets the General Education requirement for Empirical and Mathematical Reasoning or the Core Area requirement for Quantitative Reasoning with Data QRD.

### PREREQUISITES

This course is recommended for students who score 18 or higher on the first part of the Harvard Math Placement Test. You are not expected to have taken calculus in high school. Even if you have seen some calculus, we expect that Math 1a will provide you with a deeper, more conceptual understanding of the subject.

## MATH 1A

### SYNOPSIS

While the first ideas of calculus already trace back to the time of ancient Greece, the subject exploded into powerful tool during last few centuries. It is now an important theoretical foundation for other mathematical areas and scientific fields. It is no exaggeration to say that calculus is one of most amazing scientific and cultural achievements of humanity. Calculus consists of differential and integral calculus. Differential calculus studies **change**, integral calculus deals with **accumulation**. The fundamental theorem of calculus links the two. The subject is very applicable to problems from all scientific disciplines. Calculus is not only important because of its content and applications like life sciences (example: tomography), data science (example: compute correlations), internet (example: networks), artificial intelligence (example: machine learning), geography (example: data visualization), movie and game industry (computer graphics), the ideas of calculus also enter in disguised form, in statistics, economics, computer science, in art or music theory. While an important point is that calculus can appear in different forms, we primarily also want to learn the nuts and bolts and down-to-earth techniques.

### COURSE POLICIES

Class attendance is required. Please inform the instructor if you can not attend a particular lecture.

### COMPUTERS

The use of computers and computer algebra systems or online tools like Desmos to experiment with the mathematical structures is encouraged. The use of tablets in class to take notes is a good idea. We will also collaborate using jams but this can also be done without tablets. No computer algebra systems or calculators are permitted during exams. If you get computer assistance for homework, acknowledge it in the homework. We do recommend that you work out most of the work on paper which of course includes electronic paper. The material sticks better when you write things up by hand. It also will prepare you better for exams.

### PASS FAIL

The course may be taken pass/fail or for graduate credit. Contact Oliver if something needs to be signed.

### TEXTBOOK

I do not follow a particular book. A popular choice for calculus is the book "Single Variable Calculus: Concepts and Contexts, 4th Edition" by James Stewart (ISBN-10: 0495559725 ISBN-13: 9780495559726). Course material and homework is posted on the website <http://www.math.harvard.edu/~knill/teaching/math1a2021>

### GRADES

- 15 percent midterm 1
- 15 percent midterm 2
- 30 percent homework

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- 10 percent group data projects
- 30 percent final exam

As in every course, the numerical score needs to be converted to a letter grade. The cutoffs are determined when the final distribution is known.

## MATH QUESTION CENTER

The mathematics question center MQC takes place online

## EXAMS

We have 2 midterm exams and one final exam. The exam dates are planned for

- 1. Midterm: Tuesday, March 5:
- 2. Midterm: Tuesday, April 9:

Exams focus on the mathematics done in the course. Calculus is a large area. Our course takes an efficient and interesting path which. It focuses on material and topics which are actually needed in the sciences.

## HOMEWORK

Homework is submitted on Canvas every time some homework to class. We have a "no late homework policy". This makes it possible for the course assistants to return the homework in a timely manner. To compensate for eventual emergencies, we discard the least 3 homework scores.

## ACADEMIC INTEGRITY

Collaboration policies are the ones established by FAS. Collaboration is permitted or even encouraged for homework but of course not in exams. Homework needs to be written down individually however. We recommend to attack each homework problem first on your own. This helps you to develop independent thinking and problem solving skills and prepares you for the exams.

## ACCESSIBLE EDUCATION:

Students who need academic adjustments or accommodations, please contact me.

## HOURLY SYLLABUS

1	What is Calculus?	Jan 25	Mon
2	Functions	Jan 27	Wed
3	Limits	Jan 29	Fri
4	Continuity	Feb 1	Mon
5	Intermediate value theorem	Feb 3	Wed
	Wellness day no class	Feb 5	Fri
6	A fundamental theorem	Feb 8	Mon
7	Rate of Change	Feb 10	Wed
8	Derivative as a function	Feb 12	Fri

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Presidents day	Feb 15 Mon
9 Product and Quotient rule	Feb 17 Wed
10 Chain rule	Feb 19 Fri
11 Extrema	Feb 22 Mon
12 Global extrema	Feb 24 Wed
13 Hopital rule	Feb 26 Fri
Wellness day	Mar 1 Mon
14 Newton method	Mar 3 Wed
Exam	Mar 5 Fri
15 Catastrophes	Mar 8 Mon
16 Definite integrals	Mar 10 Wed
17 The fundamental theorem	Mar 12 Fri
18 Anti-derivatives	Mar 15 Mon
19 Computing areas	Mar 17 Wed
20 Computing volumes	Mar 19 Fri
21 Improper integrals	Mar 22 Mon
22 Applications of integration	Mar 24 Wed
23 Substitution	Mar 26 Fri
24 Integration by parts	Mar 29 Mon
Wellness day	Mar 31 Wed
25 Numerical integration	Apr 2 Fri
26 Partial fractions	Apr 5 Mon
27 Trig substitutions	Apr 7 Wed
Second midterm	Apr 9 Fri
28 Calculus and statistics	Apr 12 Mon
29 Calculus and economics	Apr 14 Wed
30 Calculus and computing	Apr 16 Fri
31 Calculus and music	Apr 19 Mon
32 Calculus and data	Apr 21 Wed
33 Calculus and Chemistry	Apr 23 Fri
34 Review	Apr 26 Mon
35 Review	Apr 28 Wed
Reading period	Apr 29- May 5
Exam period	May 6 - May 15

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CALENDAR

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