Calculus   Math 1a, Spring 2011 Harvard College/GSAS: 8434

Course organization

My name is Oliver Knill. Office hours are Tuesdays and Thursdays and by appointment.

Lectures

Lectures take place Monday Wednesday and Friday from 10 AM to 11 AM in SC 309.

Course assistant

Julian Bouma (bouma@fas.harvard.edu) Jeanine Sinanan-Singh (jsinanan-singh@college.harvard.edu)

Problem Sessions

Weekly problem section will be arranged by the course assistant. Tuesday 6-7 PM, Monday 7-8 PM. Check with the course assistant.

Exam Group

This course is in the exam group 1.

General Education

This course, when taken for a letter grade, meets the General Education requirement for **Empirical and Mathematical Reasoning** or the Core area requirement for **Quantitative Reasoning**.

Prerequisites

A solid precalculus background is required. 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. However, even if you have seen some calculus we expect that Math 1a will provide you with a deeper, more conceptual understanding of the subject.

Synopsis

The development of calculus by Newton and Leibniz is a major achievement of the past millennium. The core of the course introduces differential and integral calculus. Differential calculus studies "rate of change", integral calculus treats "accumulation". The fundamental theorem of calculus links the two. The subject will be applied to problems from other scientific disciplines in homework and lectures.

Course Policies

Class attendance is expected. In case of religious holidays, conflicts like a sports competitions or concert, please send a brief email to the course head.

Computers

The use of computers and computer algebra systems or online tools to experiment with the mathematical structures is encouraged. We do not have a lab component however in this course. Also the use of laptops or tablets in class to take notes is fine. No kind of computers are permitted however during exams. If you get computer assistance for homework it needs to be acknowledged in the paper.

Pass Fail

The course may be taken pass/fail after talking to the course head. Note that there is no GenEd credit for Pass/Fail.

Textbook

"Single Variable Calculus: Concepts and Contexts, 4th Edition" by James Stewart (ISBN-10: 0495559725 ISBN-13: 9780495559726). The Cabot library has a desk copy available. It is recommended to read in a book but course material and homework is posted on the website http://www.math.harvard.edu/~knill/teaching/math1a_2011/

Grades

- 20 percent midterm 1
- 20 percent midterm 2
- 20 percent homework
- 40 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 is open Sunday through Thursday in SC 309a, 8:30-10:30 PM. The rooms are reserved from 7:30 PM on. This drop-in help service is staffed by calculus course assistants who will be available to work with you on your homework. You may also stop by the MQC to find other students in the course. While staffed from 8:30 on, the room is available from 7:30 on in the spring.

Bureau of Study Counsel BSC

The bureau of Study councel at 5 Linden Street is a resource outside the math department. The BSC offers one-on-one peer tutoring for a minimal fee study skills and test-taking workshops, counseling, and many other services. The website is http://bsc.harvard.edu

Exams

There are 2 midterm exams and one final exam. Here are the exam dates:
- 1. Midterm: Tuesday, March 1: 7-8:30, Hall D
- 2. Midterm: Tuesday, April 4: 7-8:30, Hall D

Exams will focus on the mathematics done in the course. Calculus is a huge area. We will follow an efficient and interesting path which focuses on stuff we really need.

Homework

Homework is due at the beginning of every class. This course has a "no late homework policy". But we discard the least 3 homework scores.

Academic Integrity

The policies on collaboration are the ones established by FAS. Collaboration is permitted or even encouraged for homework but not in exams.

Accessible education:

Students needing academic adjustments or accommodations because of a documented disability need to submit a letter from the Accessible Education Office (AEO) and speak with the professor by the end of the second week of the term. All discussions remain confidential.

Hour by hour syllabus

The following plan is subject to smaller changes. Please keep updated on the website

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1. What is calculus?                   Date   Day  References
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1. What is Calculus?                   Jan 24 Mon  Oliver
2. Functions                           Jan 26 Wed  Johnny  1.2
3. Limits                              Jan 28 Fri  Johnny  2.2

4  Continuity                          Jan 31 Mon  Johnny  2.4
5  Intermediate value theorem          Feb  2 Wed  Johnny  2.4
6. A fundamental theorem               Feb  4 Fri  Oliver

7. Rate of Change, tangent             Feb  7 Mon  Johnny  2.6
8. Critical points                     Feb  9 Fri  Johnny  4.2
9. Derivative as a function            Feb 11 Wed  Johnny  2.7

2. The derivative
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1. Differentiation rules                   Feb 14 Mon   Johnny  3.1
2. Differentiation rules                   Feb 16 Wed   Johnny  3.2
3. Extrema and optimization                Feb 18 Fri   Johnny  4.2

4. L'Hopital rule                          Feb 23 Wed   Johnny  4.5
5. Newton method                           Feb 25 Fri   Johnny  4.7

6  Review for first midterm  3/1/11        Feb 28 Mon   Oliver
7. Mean value and Rolle theorem            Mar  2 Wed   Johnny  4.3
8. Catastrophe theory                      Mar  4 Fri   Oliver
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3. The integral

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1. The definite integral                   Mar  8 Mon   Johnny 5.1-2
2. The fundamental theorem                  Mar 10 Wed   Johnny 5.4
3. Antiderivative                           Mar 12 Fri   Johnny 5.4

4. Computing areas                          Mar 23 Wed   Johnny 6.1
5. Volume of solids                         Mar 25 Fri   Johnny 6.2
6. Improper integrals                       Mar 21 Mon   Johnny 5.10

7. Applications of integration              Mar 28 Mon   Johnny 6.5
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4. Calculus Techniques

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1. Chain rule, related rates               Mar 30 Wed   Johnny 3.4
2. Implicit differentiation                Apr  1 Fri   Johnny 3.5

3  Review for second midterm 4/5/11        Apr  4 Mon   Oliver
3. Substitution                            Apr  6 Wed   Johnny 5.5
5. Numerical integration                   Apr  8 Fri   Johnny 5.9

6. Integration by parts                    Apr 11 Mon   Johnny 5.6
7. Partial fractions                       Apr 13 Wed   Johnny 5.7
8. Trig substitutions                      Apr 15 Fri   Johnny 5.7
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5. Calculus and the world

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1. Calculus and Music                      Apr 18 Mon   Oliver
2. Calculus and statistics                 Apr 20 Wed   Bryan
3. Calculus and economics                  Apr 22 Fri   Oliver

4. Calculus and computer science           Apr 25 Mon   Oliver
5. The lighter side                        Apr 27 Wed   Oliver
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