Math 113: Honors One Variable Calculus

31 August 2020 - 9 December 2020

Instructor: David Jaz Myers, "David", davidjaz@jhu.edu, he/him.

Office Hours: TBD

Course Meetings: (Subject to change) 1:30 - 2:45 MW on Zoom (link in Zulip)

Section Meetings: (Subject to change) 1:30 - 2:20 F on Zoom (link in Zulip)

Textbook: Spivak, *Calculus*, 4th edition. ISBN-13: 9780914098911.

Course Website: Course work and materials will be posted to the course Zulip chat jhu113fa2020.zulipchat.com. Discussion will also take place in this chat. Grades will be posted on the Blackboard website for AS.110.113.01.FA20 Honors Single Variable Calculus.

Departmental Syllabus: The linked webpage contains the syllabus for our course (110.113):
   http://mathematics.jhu.edu/undergraduate/courses/course-descriptions/

Overview: What is a quantity? What does it mean for a quantity to change continuously or smoothly? What do discrete quantities (how many) have to do with continuous and geometric quantities (how much, how long, how far)? Mathematicians of the 19th century were pestered by these questions, and their ruminating led to the development of mathematics as we know it today. In this class, we will give rigorous answers to these questions, and study the resulting calculus of a single real variable from basic principles. In the process, you will learn to read, write, and discuss mathematics like a mathematician.

Course Structure: This course will be run in as a modified Inquiry Based Learning (IBL) style. That means that instead of lectures, you will be working together during the classes to understand and prove the material.

The course will be divided into a series of week long modules. Each module begins *before* the Monday of the week, when you will read the assigned reading and take notes. In class on Monday, we will discuss the reading and go over any points of difficulty. Coming to terms with not understanding is an important part of thinking like a mathematician; you have to know what you don't know before you can learn it.

You will also receive your homework on Monday morning, and we will spend the remainder of Monday's class working through problems in small groups. You will work on the homework in groups after class over the remainder of the week. The homework will be due by the beginning of class on the next Monday.

By Wednesday, you will have solved (hopefully!) the first few problems on the homework. Class will begin with presentations of these problems. You be asked to present twice during the semester. It's important not just to understand the mathematics, but also to know how to communicate it to your peers. After all, the best way to learn is by teaching. I'll emphasize that this is a *collaborative* and not competitive environment. We expect to catch mistakes and identify problems with your approach — this is all part of the learning process. But do prepare beforehand. We will spend the rest of Wednesday on problem solving.

On Friday, we will have an optional section during which you can work on problems with your peers, ask me questions, and discuss the material further. While attendance at these sections is optional, you are encouraged to attend. Use this as an opportunity to take control of your learning in the class.

Logistics: Due to the pandemic, our class will take place online. There will be two main online components to the class:

1. Class (and section) meetings will take place on Zoom at a room which will be posted in the Zulip.

Your presence at class meetings is required.

2. Out of class discussion will take place on Zulip: jhu113fa2020.zulipchat.com.

   The homework problems will be posted to Zulip, and there will be threads for weekly discussion. You are encouraged to ask questions of your peers in these discussion threads, and I will also read them and respond.

You are also encouraged to work over video chat with your groups as you solve the problems. You can use any method of your choice. I will make suggestions on the Zulip.

Grades will be posted on the Blackboard website for AS.110.113.01.FA20 Honors Single Variable Calculus.

Coursework (50%): The main way you will learn in this class is through problem sets. The problems will emphasize the notions you learned through reading, and test and expand your comprehension of these notions. The problem sets are designed to be difficult!

Solutions to the problem sets must be written in clear and rigorous language, and typeset with LaTeX. A correct solution to a problem will involve more than just demonstrating your understanding; you will also need to express this understanding in precise mathematical language. In the early parts of the course, we will go over together how to prove things in a precise and mathematical way.

LaTeX is a typesetting software which allows for the beautiful typesetting of mathematics, like this:

$$f(x) = \int_0^{3x^2 - 2x} \log(t+1)dt$$

In the first week, we will go over how to typeset in LaTeX using Overleaf, an online platform.

The problem set will be posted to the Zulip before class on Monday. It will be due the next Monday before class. You will hand in the homework by attaching a pdf to a private message in Zulip, and you will receive a marked pdf in return as a private message.

Reflections (10%): Every week, you will write a brief (~ 200 word, no less than 100 word) reflection on your experiences as a mathematician that week. You can write about the parts of the reading you have enjoyed, the problems or concepts you found difficult or engaging, or anything concerning how you are learning to learn.

The reflection will be due on Sunday (by 11:59 PM) in the form of a private message on Zulip. It will be graded only on completeness.

Participation (15+5%): Because the class is run in an Inquiry Based Learning style, you will need to take an active part in your education in the class. Therefore, participation in the lectures and discussion is especially important. For that reason, participation in the classes, in discussion on the Zulip chat, and working together in your study groups is required and forms a reasonable chunk (15%) of your grade.

Additionally, you will be asked twice during the semester to give a short presentation (5%) of an introductory problem on the problem set for that week. You will make a handout for the rest of the class to follow along with your presentation, and post this on the Zulip before class on the day of your presentation. The presentation itself will be oral. Your presentation does not have to be entirely correct, but it should contain the main ideas of a correct answer presented clearly. This is about learning to communicate as a mathematician.

Final Exam (20%): There will be a take-home final exam due at the end of our exam time – more details to come closer to the end of the course.

Academic Accommodation: Students with documented disabilities or other special needs who require accommodation must register with Student Disability Services.

There may be a student in this class who requires the services of a note taker. This is an opportunity to share notes through the Student Disability Services Office. If you are interested in performing this service, please register as a notetaker with Student Disability Services.

Feedback: I am committed to providing a learning environment in which you feel respected and valued, by me and by your peers. If you have academic suggestions or feel like you've been mistreated in this course, please contact me; if you feel uncomfortable doing so or prefer to remain anonymous, you can reach out to the Director of Undergraduate Studies (Richard Brown) or the Department Chair (David Savitt).

If you have any concerns about the way the course is being run online in response to the pandemic, please contact me. Also, I understand that this is a difficult and uncertain time; if circumstances arise that make it difficult for you to participate fully in the course, please contact me so we can figure out a way to go forward.

Attendance: Attendance at all class meetings is expected and required. I will take note of absences, and excessive absences will negatively effect your participation grade.

If you are sick (COVID or otherwise) and feel you are unable to attend class, please notify me via email or private message on Zulip and I will excuse you from a class meeting.

Ethics and Collaboration: Mathematics is a collaborative endeavor. In this course, you will be expected to collaborate with your classmates on problem sets and develop your solutions together.

However, the finished work you hand in must be entirely your own write-up. Do not copy from your classmates, or write finished solutions together.

If you copy from a classmate (or from the internet), you will not really learn the material. If you are pressed for time the night before the assignment is due (and please start the problem sets nice and early so this doesn't happen), and you can't figure out a problem — don't cheat! Instead, just write as much as you know, and explain clearly what you don't understand and what you haven't been able to figure out. In doing so, you will learn more about what you know, and where to look for further knowledge. Also, I will go easier on an honest statement of confusion than a confused and messy write-up trying to pass as a clear solution.

"Undergraduate students enrolled in the Krieger School of Arts and Sciences or the Whiting School of Engineering at the Johns Hopkins University assume a duty to conduct themselves in a manner appropriate to the University's mission as an institution of higher learning. Students are obliged to refrain from acts which they know, or under circumstances have reason to know, violate the academic integrity of the University." For more information, see the guide on "Academic Ethics for Undergraduates" and the Ethics Board web site (http://ethics.jhu.edu).

Support: If you become stuck on a problem or concept, ask a classmate! This is what the Zulip chat is for.

Another good resource is the Math Help Room, which is open 9-9 MTWR 9-5 F (virtual location TBD). I'm available to meet during office hours, after class, during Friday's section meeting, or else by appointment.