*Repetitio est mater studiorum*
*(Repetition is the mother of study).*
*-Latin Wisdom*

*Interest comes with success,*
*and success comes with hard work.*
*-Professor Yaroslav Tagamlizki*

# Yale University
# MATH 118, Introduction to Functions of Several Variables
# REVISED (ONLINE) SYLLABUS 3/19/2020

## Instructor Information

**Instructor:** Bobby McDonald
**Office:** My son's room, Middletown, CT
**Class meet time:** Tu/Th 2:30 - 3:45p
**Email:** robert.j.mcdonald@yale.edu (use this only for logistical questions)
**Piazza:** piazza.com/yale/spring2020/spring2020
**Office hours (over Zoom):** to be determined, but flexible and by appointment, too
**How to Contact Me:** Use Piazza (see below)!

## Handouts, videos, and workshops (how we will be learning together)

I'll still be making the same handouts I have been, but instead of using class time to fill them, I will be breaking each definition/theorem/example into short 5-10-minute videos. These videos will be in the same style as what we've currently done, with the obvious exception of the fact that they will not be as interactive as they have been (which would be hard to do over Zoom, anyway). The hope is that this allows you to learn whenever you find the time and won't miss out if you can't make it to our meeting.

Class time will be a "workshop/problem session." During this time, we'll meet to discuss extra problems, have break-out sessions, and see some applications. You can watch the above-mentioned videos any time you like, but you should try to watch them by the time we have a workshop. I'll make a schedule to be clear about what topic we'll be covering. Workshops will not count against you, but please attend them if you can. I hope to make them interesting and fun.

## WebAssign

Cengage has generously donated a free membership to WebAssign for everyone in our course. This is *mostly* so you can access an online version of the book that I'm pulling our topics from. We'll also be using this for quizzes, moving forward (see this below).

## Yes, you have a free book, now

Most of our lecture notes will come from Stewart's calculus book, which you now have a digital version of for the duration of the course. There may be other ways to find a digital copy of this book that's more user-friendly than WA's version, but I'll leave it to you to ask an upper classmen how to do this.

## Piazza

Now, more than ever, we really need to be using Piazza. I believe everyone has signed up, and many have been participating. Since everything is online, now, we're going to be moving a large part of our discussion to Piazza. Here, feel free to discuss handouts, videos, workshops, homework and quizzes. Absolutely nothing course-related is off limits.

# Grade breakdown

Here's the adjusted grade breakdown for the course. I got the new numbers by dropping the second midterm and trying to keep the weights roughly the same. Descriptions of each component follow. Essentially, I've gotten rid of the second midterm and final, and tried to scale the grade to be based mostly on homework and quizzes (which, remember, have unlimited attempts).
***I checked all of your grades. This should have helped everyone.***

| Assessment | Due | Percent |
|---|---|---|
| Homework | every Monday night at midnight | 30 (was 12) |
| Project | Tuesday, April 21, at midnight (the last week of classes) | 5 (was 3) |
| Quizzes | The last day of classes, Friday, April 24, at midnight | 35 (was 15) |
| Midterm 1 | n/a | 15 (was 15) |
| Midterm 2 | canceled | 0 (was 15) |
| Capstone | the original day of our final, Monday, May 4, at midnight | 15 (replaces final, was 35) |

Your final numerical grade will be converted to letter grades using the following scale:

$$F \leq 50 \qquad 50 \leq D < 65 \qquad 65 \leq C-, C, C+ < 80 \qquad 80 \leq B-, B, B+ < 90 \qquad 90 \leq A-, A$$

# Descriptions of each assessment

**Homework** is the same as it has been, with a higher weight. Assignments will consist of written homework assignments and assigned readings. Each homework assignment will be worth 12 points. Your written assignment solutions will be graded 9/12 for completion and 3/12 for accuracy using the 3-point scale in the rubric below. Late assignments can be submitted for up to a week after the due date but will receive a one point deduction on the completion grade for every day they are late.

| 3 points | Work is completely accurate, essentially perfect. Ideas are fully developed. Work is neat and east to read. Complete sentences are used where appropriate. |
|---|---|
| 2 points | Work is good, on the right track, but development of ideas is incomplete. Work is hard to read or disorganized. |
| 1 point | Work is sketchy, with some correct ideas, but mostly on the wrong track. Work is messy or illegible. |
| 0 points | Work is minimal or non-existent. No explanations are given. Answer is completely incorrect. |

**Quizzes** will take place outside of class, through WebAssign. From now on, they'll be split into one quiz per topic. This means instead of a two-question quiz, you'll get two one-question quizzes. Quizzes will be due at the end of the semester, but ***you really should be doing them as we go.*** You will have to upload your work, which I'll take a look at and grade. Unfortunately, WebAssign will give you a grade only on the accuracy of your numerical answer. I'll be adjusting that score based off what I see in your work! Don't forget, ***you have unlimited attempts.***

**The project** is described below (there are two versions!), and in the assignments section on Canvas. Nothing except for its weight has changed. Note that even though it's a higher percentage, *the stakes are the same.* If you are the type of student that needs strict guidelines, a two-page paper (or something equivalent) should be enough. I'm just looking to see that you did some research and learned something. If you want feedback before you turn it in, feel free to reach out. This is not a make-or-break you kind of assignment, and hopefully, it should be as fun to do as these are to read!

**The first midterm** is 15% of your final grade (it was originally 30% for two, so this hasn't changed).

**All other exams** (including the final) have been canceled. There will be no second midterm or final. That's worth repeating. *There will be no second midterm or final.* Instead, we'll use your homework and quizzes for these sections to make sure you understand the concepts, and the capstone to gauge what you got from the course overall.

**The capstone** is the only completely new assessment. Originally, I had intended to give you a final consisting of only two questions (you know, because I'm awesome and nice), one on least squares solutions and one on Lagrange multipliers/optimization during our scheduled time. Now, this will be "take-home" (forgive the nomenclature in a time when so many of you may not be *home*) and open resource. It will still consist of only two scaffolded (i.e. multipart) questions covering least squares and optimization. It's not cumulative, but you'll need to know the machinery we've talked about.

## Special accommodations

Student athletes and students with disabilities should inform your instructor of your commitments as an athlete, any special needs that you have, etc. within the first three weeks of the semester. You will be expected to bring in a letter from the Athletics Department or the Center for Students with Disabilities. For conflicts with final examinations, students should, as usual, contact the Dean of Students.

## My advice for success in the course

- *FOCUS ON YOUR HEALTH AND YOUR FAMILY FIRST. Let me know if time becomes an issue. Feel free to discuss any challenges you may be facing. I'm on your side.*
- Work outside of class! These topics cannot be learned in 150 = 75 + 75 minutes each week. On average, students (not just in our class, but in general) are supposed to spend an average of two hours outside of class. That would be about six hours per class. That's why they call it full time!
- Make mistakes! Particularly on the homework, you might not know what to try first. Just try something. The process of mathematics is full of mistakes. I could fill a book with all of the mistakes I've made. They're an integral part of learning!
- Work with your peers. Bouncing ideas off of each other is the best way to learn. We'll trade contact information on the first day, so you can meet over Zoom if you're interested.
- *Participate in Zoom office hours!* It's free tutoring. From your instructor. You know, the one who writes the exams. Please come or make an appointment if you can't!

# Project (version 1) Description: *Minority Women in Mathematics*

It is well-known that gender and racial minorities are tragically underrepresented in Science Technology Engineering and Mathematics (STEM). In the US, women only make up approximately one-third of all recipients of STEM bachelor's degrees, and closer to one-fourth of mathematics/statistics PhD earners are women. More tragically, despite being 13% of the US population, less than 1% of professors within academia are minority women. Not surprisingly, minority women also earn significantly less.

February is Black History Month, and March is Women's History Month. Try a google search with "minority women in mathematics" or "history of black women in mathematics," pick a mathematician, and write about them! You are also **completely welcome** to choose someone in economics, or a topic of your choice. Math history interests me, so most of my suggestions below are about famous mathematicians! You're absolutely free to choose someone else, but some famous ones are

- Euphemia Lofton Haynes
    - first African American woman to earn a PhD in mathematics
- Evelyn Boyd Granville
    - second African-American woman to earn a PhD in mathematics (she went to Yale!)
- Maryam Mirzakhani
    - first woman to earn the Fields Medal (most prestigious prize in mathematics)
- Marjorie Lee Brown
    - third African-American woman to earn a PhD in mathematics
    - first African-American woman on advisory council of NSA
- Gloria Ford Gilmer
    - first African-American woman to publish a non-Ph.D.-thesis mathematics research paper
- Katherine Johnson
    - calculations critical to success of first US crewed space flight
- Dorothy Vaughan
    - human computer for NASA
    - taught herself and her staff at NASA Fortran

Here are some questions to keep in mind while you read:
- where/when they were born
- what their childhood was like
- what their education was like
- challenges they faced
- significant contributions to (or milestones achieved in) their field
- other facts you find interesting

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**NOTE:** *I suppose writing a paper seems to make the most sense for this project. That's by no means a requirement. If you can find some other interesting way to present what you've learned, please feel free! There's no strict requirement on how long this should be. I just want to see that you've done some research and learned something. No specific format for citations either, but I'd be interested to see your sources! Students have enjoyed this project in the past, and I hope you do, too!*

## <u>Project (version 2) Description:</u> *Multivariable Mathematics in the Real World*

Try a google search with "How are linear algebra (or multivariable calculus) used in…" or "constrained optimization in economics" to find articles on how our topics apply in your major, area of study, or something you're interested in. Some ideas with interesting results are:

- Computer science
- Business/Economics
- Engineering
- Video games
- Cell phones
- Sports analytics
- Google's search algorithm

Report why you chose the topic and how linear algebra applies using specific to examples. Some ideas of what you might talk about are below. These are *suggestions*, they may or may not apply to the topic you've chosen. Feel free to talk about anything that interests you.

**Reason for Choosing the Topic**
- Why did you choose your particular topic?
- How does the topic relate to you?
- Was it easy to find connections to our course?

**Connections to Linear Algebra**
- What applications do you find?
- How important are the subjects in our course to the topic you've chosen?
- Are there any other applications of mathematics to this topic?

**Connections to Class**
- What things have we learned in class that are similar to what you find online?
- What parts of the applications do you feel like you understand very well?
- It might be nice to provide a few numerical examples (ask me if you need help!).

**Other**
- Are there any specific people who use our subjects in the topic you've chosen?
- How does this use of mathematics affect us today?
- Talk about anything else you find relevant, interesting, or important.

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**NOTE:** *I suppose writing a paper seems to make the most sense for this project. That's by no means a requirement. If you can find some other interesting way to present what you've learned, please feel free! There's no strict requirement on how long this should be. I just want to see that you've done some research and learned something. No specific format for citations either, but I'd be interested to see your sources! Students have enjoyed this project in the past, and I hope you do, too!*