Math 296: Honors Math II

University of Michigan
Winter 2024

Administrative Information:

Instructor: Sarah Koch; please call me 'Sarah'
Office: 3855 East Hall
E-mail: kochsc@umich.edu
Office Hours:
Monday, 5:30-6:30pm in EH3866
Wednesday, 6-8pm in EH3866
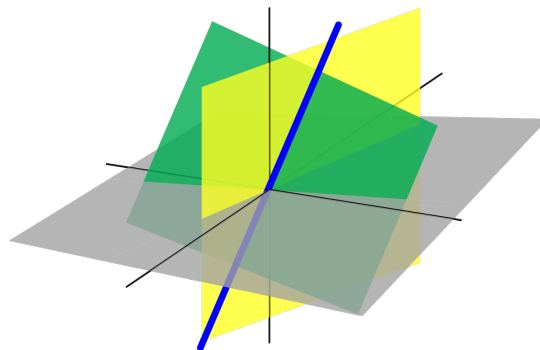Friday, 4:30-5:30pm in EH3855

Course Assistants:
Tuong Le, tuongle@umich.edu
Zhixuan (Alina) Wu, zhixuanw@umich.edu
Discussion Section: TBD
Tuong's Office Hour: TBD
Alina's Office Hour: TBD

Course Information: It is still assumed that you can integrate, differentiate, and divide by 67. Moreover, it is assumed that you have acquired a solid foundation in the theoretical aspects of one-variable calculus, as in Spivak's *Calculus* text. This includes familiarity with serious ε, δ style arguments, uniform continuity, properties of definite integrals, infinite sequences, some point set topology (!!), and an appreciation for the importance of the completeness and ordering of $\mathbb{R}$.

Math 296 will begin by developing the theory of infinite series and Taylor series, as well as uniform convergence for sequences of functions, and along the way will recall some basic topological properties of the real line. After finishing these analytic preliminaries, we shall shift our attention to the theoretical development of linear algebra, moving far beyond the mechanics of solving systems of linear equations. There will be a mixture of the general theory which is valid over *arbitrary* fields, and the theory of normed vector spaces that arises over the fields $\mathbb{R}$ and $\mathbb{C}$. Emphasis will be placed on thinking conceptually and geometrically, as well as understanding the intrinsic "meaning" of various explicit methods of computation. We will wrap up by using linear algebra to understand differentiable functions $f : \mathbb{R}^m \to \mathbb{R}^n$

Although it will rarely be discussed in class, you will learn some elementary group theory. Your knowledge of group theory will be useful in several contexts: in discussing vector spaces and linear maps, in verifying the existence of the determinant, in studying Lie groups (396), and on exams. Most *Sunday Homework* sets will probably include one basic group theory exercise; it is important that you both attempt and understand each of these problems. Sunday Homework sets may also include problems about 295 material.

Your prime number: 67

Course website: We will use the U(M) Canvas page for 296.

Textbook: Spivak's *Calculus*, 4th edition

Textbook: Spivak *Calculus*, 4th edition, and Hoffman and Kunze, *Linear Algebra*, 2nd edition. These are not optional; let me know if you have trouble finding the linear algebra book.

Homework: Homework will usually be assigned every week. The main part will be due the following Thursday (this is homework A). The group theory/topology/geometry/review part will usually be due on the Sunday that falls ten days after it is assigned (this is homework B). The two lowest homework grades (of each type A and B) will be dropped. Late homework will not be accepted (it receives a zero). Waiting to begin your homework until the evening before it is due is a bad idea. *Homework is BY FAR the most important part of this class!*.

Visitors. We might have some prospective high school students visit Math 296. Chat with them, invite them to coffee/lunch (keep your receipts), and generally be yourself. Some of you might remember sitting in on this class when you visited the math department!

Exams: We will have two midterm exams and a final exam in this course. There are no alternate or makeup exams (except in cases of extreme human tragedy). The proofy problems on exams will be *very similar* to homework problems. In other words: do your homework and understand it!
Exam 1, in class: tentatively scheduled for Feb 16
Exam 2, in class: tentatively scheduled for March 29
Final Exam: scheduled for Tuesday April 30, 4-6pm

Testing and Disability: If you think you need an accommodation for a disability, please let me know as soon as possible.

Grading: The only letter grades students can earn in this course are A+, A, A-, C+, C, C-, and E. In the final full week of class (April 15 – 19), students will be assigned one of five bands. The band they belong to will be determined by graded homework counting 50%, and two midterm exams, the first counting 20%, and the second 30%. Based on historical data, the cutoffs for the bands will be approximately 85%, 70%, 55%, and 40%. Students in Band I will receive some flavor of A while those in Band III will receive some flavor of C; the students in Band II can move into the A or C range, and those in Band IV can move into the E or C range. The precise final course grade will be determined by their performance on the final few homeworks and the final exam. Students in Band V will receive an E.

You: Each of you deserves to learn in an environment where you feel safe and where you are respected. The climate in the mathematical community at Michigan is heavily influenced by the students in it; this now includes you. Our choices directly affect, for good and/or bad, the health of the communities in which we live and work. Please choose to build and maintain a welcoming, thriving mathematical community.[1] Finally, mathematics requires the courage to take risks – intellectually, socially, emotionally. In particular, many of us find it unnerving to share our mathematical ideas, especially those we are not sure are correct, with others. In order to develop our capacity for taking these risks, we must respect and support each other.

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[1]A recent U(M) Math undergraduate described their experience here in this way: "I found that, in general, the honors math majors are overly competitive and unwilling to help each other. I think the students that I took classes with were generally competitive rather than collaborative. From what I can tell, the current students seem to be much friendlier with each other, which goes a long way to having a strong community."