A SURVIVAL GUIDE TO MATH 51 (AND OTHER EARLY COLLEGE CLASSES)

College level mathematics is very different from high school maths in that the emphasis is on conceptual understanding rather than applying known techniques (and I’m finding that graduate level maths is again very different). You will be expected to be very precise and rigorous, both in proofs and in solving problems. An online article once said that your first college level maths class is like having studied lots of music theory and then playing a note for the first time. It’s a steep learning curve, and the breakneck speed of the Math 51 class doesn’t help. (It really should be taught over 1.5 quarters, but a lowly graduate student can’t change that.) Having said that, students have said that it’s doable as long as you’re prepared to devote plenty of time to it.

Here is a work-in-progress list of study strategies that I hope will help you in these courses and beyond. It’s based on Math 51 because that’s the only class of this type that I’ve TAed so far, so I don’t know much about other classes. If you have any suggestions, let me know via amypang@stanford.edu.

The other thing you should be aware of is that we won’t do many “real world examples”. Think of the class as a chance to glimpse what maths is really like, rather than something that fills you with 100%-useful information.

Before the course.

- Browse Courserank.stanford.edu to see what past students think of the course, and get a better idea of what’s covered and how much time it’ll take. Google for a webpage of the course also. Make sure this is the course you want to take.
- Again based on Courserank opinions (and your timetable), choose a lecturer and TA. Search the instructors under “past course evaluations” in Axess to see whether they’ve taught this course before: past 50s series experience is a big plus. (I wouldn’t read too much into the scores in evaluations, because different students want different things from the course. The qualitative info on Courserank is more useful.) If you pick a first-timer (eg because of schedule constraints, or rave reviews on Courserank), pick their second lecture/section of the day, so they already know from their
first lecture/section where the common pitfalls are. One inexperienced lecturer actually admitted that he is “five times better in the afternoon than the morning”, and even an experienced lecturer will “always cover slightly more in the second lecture”. Being in a small section is also advantageous, as you can ask more questions.

- With your decisions made, spend a day reading the textbook. My undergrad advisor used to say that I should know enough in advance to always be one line ahead of my lecturer. I misunderstood this completely at the time: I’d spend a week scrutinising every line of the book until I felt like I fully understood it. Instead, what you should do is read the definitions, theorems, examples, without trying too hard to understand them, and ignore details like proofs. There’s plenty of time during the course to get the details right; at this stage, you just want an overview of what the course is about and how those concepts connect to each other. Make some notes if it helps you, as it can be difficult to keep track of all the definitions when you’re flipping through so quickly. If you’re anything like me, the experience will be very frustrating because you’ll feel like you don’t understand anything, but when the lectures start, you’ll pick up the material much faster. Having heard the technical words before makes a remarkable difference.

During the course.

- Talk to your instructor or TA if you have mathematical questions, administrative problems, or want study advice. In college, you are responsible for your own education, so no one will give you help if you don’t ask for it! And don’t worry if they initially seem annoyed, they might see you differently when they know you better after a few chats. Asking questions is a good way to show that you’re working hard on the course, and teachers probably give more help to those who try hard. In undergrad, I pestered a professor with questions after every lecture, and initially I felt he wanted to escape me; later he said he was very happy to receive questions because it showed someone was listening to and understanding his lecture. He ended up teaching me tons of hard maths beyond his course, and wrote me an excellent recommendation letter, both of which really helped me get into grad school. So you might get something amazing out of talking to your professors, you wouldn’t know if you didn’t try.
- Your lecture notes should be your own understanding of the material, not an exact copy of what was on the board. If you’re too focused on copying the board, you will miss important points that are said but not written down. In your notes, you should rephrase what the lecturer wrote and said, in a way that you find easy to understand (so it will make more sense when you reread it in preparation for exams). For a high-paced class like Math 51, it can be hard to digest the lecture and write it up neatly at the same time, so, if you like your notes neat, you can try scribbling down the key points during the lecture, and writing it up afterwards. This is quite time-consuming, but it forces you to understand everything that’s been covered in lectures.

- Try your best to understand each concept both intuitively and rigorously. That is, you should have plenty of examples of each new idea (so you know what strategies are likely to solve a problem concerning this object) as well as knowing the definition precisely (so you can make sure the solution you found is watertight). In exams and homeworks, you’ll have to “think in words and write in maths”.

- Do past exam questions on the material you learnt a week ago, don’t wait till the week before the midterm. Midterm problems require much more conceptual understanding than homework problems, and this isn’t the sort of thing you can cram at the last minute. The key to solving conceptual problems is experience; you need to try lots and lots of them.

- Get enough sleep! You can’t do hard maths when you’re tired. If you’re rushing off a problem set for the next day, consider going to sleep a little earlier and waking up early to finish it. This worked really well for me when I’ve had a long day, but have a nap window the next day.

- Send all administrative emails from your @stanford.edu address. This includes changing sections or lectures, asking for alternative exam times, asking for extensions or scores for homeworks... Of course, you can use gmaills for mathematical questions.

Doing homework. (see also “how to attempt a hard question” towards the end of my test-taking advice)

- When solving problems, have scratch paper or a blackboard ready so you can scribble down any ideas that come to mind. (In a test, you can use
the margins or back pages.) Doing maths is very visual, and somehow it’s hard to keep going with an idea unless you see it in writing.

- If you find yourself staring blankly at your scratch paper for more than 15 minutes, even after browsing your textbook for ideas, it’s time to try a different question, and come back to this problem the next day. Sometimes it takes a few days to hit on the right idea, which is why you must start your homework early. If you return to the question still without ideas, talk about it with a friend (see next point).

- Work with a friend of a similar standard, preferably someone from a different section. Maybe set up a regular group study session in your dorm. It might save time to get a hint from a TA or a smarter classmate, but you’ll learn more if you work at a problem with someone who’s also stuck (and eventually in life you might have to solve problems where there’s no “smarter classmate” who already knows the answer). Similarly, if you’re confused, it’s easier to resolve your confusion by discussing with someone than by thinking very hard on your own. Sometimes, as you try to explain your problem, you will stumble upon the solution, without any input from your friend. The advantage of working with someone from a different section is that they’ve probably been shown the material in a different way, so the two of you will bring different tools to solve the problem. You’ll learn from each other how to see the concepts from a variety of angles, and have more examples for reference, taking advantage of the full army of TAs. *In my first year of grad school, all my friends thought of different things when we saw the same problem, because we took different courses in undergrad, and sharing ideas was the only way I could do my assignments. It’s the same story in research - maths might look like a solitary activity, but in fact it relies on collaboration.*

- You should not be writing up your homework while you’re talking to someone else about the problem. At office hours or study group meetings, make some brief notes of the solution, then write it up alone afterwards. This will make you think about the problem again, which helps you remember the solution, and makes sure that you understand it. Also, you don’t want to be rushed while writing up.

*Amy Pang, 2011*