

HOW TO SUCCEED IN CALCULUS

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I've given a lot of advice to students over the years about how to prepare for exams, how to do well in class, and in general how to get better at math. Most of that advice is collected here. If you're struggling with a calculus class and want to know how to do better, here is most of the advice I have to give.

A quick disclaimer: most of this advice is completely general and applies to anyone and everyone, but some of this advice is specific to those of you that actually have me as a TA. If you're reading this and you don't have me as a TA, take some of the specifics with a grain of salt! I'll do my best to highlight what I mean by this below.

Practice, practice, practice — but practice correctly!

The absolute best thing you can do to get better at math (or anything!) is to **practice as much as humanly possible**. In particular, I (almost) guarantee that if you work through and truly understand every single exercise in the calculus textbook for whatever class you're taking, you will get an A+ in the class. That's all it takes! Just do millions of problems and you'll become a god or goddess of calculus. The main reason why I'm so good at calculus is simply because I've been doing it for years; I'm not a genius or a math prodigy or anything like that. If you're reading this there is a good chance that you're just as smart as me, probably smarter — I've just done way more calculus than you!

With that being said, it's important that you practice correctly. Here are some tips to get the most out of doing practice problems.

- (i) **Get helpful feedback.** You can practice all you want, but if no one is telling you "good job" or "bad job" it's difficult to improve. In theory, this is what homework is for — but if you're reading this as a current UCLA student, homework feedback doesn't really count. The best person to get feedback from is a TA or professor. *I can't speak for other TAs or professors*, but if you have me as a TA or professor I am perfectly happy looking at solutions you write on homework or for practice and giving you feedback about what is correct, good, or could be better. You can email me solutions or show them to me in person and ask for my thoughts. This is a much more effective way to get feedback than from homework or exams!
- (ii) **Redo worked examples from lecture or discussion by yourself, treating them as practice problems.** Math is not a passive subject. It's easy to watch a professor or a TA or someone on YouTube work through examples, but the best way to learn from this is to go through the motions yourself afterwards. Go to lecture and discussion and take good notes, then a couple days later, sit down and attempt the examples yourself, hiding the solutions from class. The reason why this is helpful is because — if you took good notes — you have a model solution with which to compare yourself against. In this way, you can get indirect feedback on your own solution by comparing it against a solution written by a TA or professor.
- (iii) **Do practice problems under time pressure.** Time pressure can make or break you on an exam, especially in a 50 minute in person midterm. If you struggle with exam pressure and finishing quickly, practicing with simulated time pressure can be very beneficial. When you get a practice midterm, don't just mosey through the problems — put 50 minutes on the clock and simulate an exam environment. You'll probably struggle and won't figure out all the questions, but that's okay! You can

go back afterwards and work through them more slowly and with help. But a first pass to expose yourself to the pace of a test is not a bad idea. You can do this with homework problems, or other random practice problems as well: pick 3 or 4 problems and put 20 minutes or so on the clock.

This was one of the most effective study techniques for me personally. I have a long sob story of my own regarding time pressure and exams, so if you're curious to hear about my own experience with this, just let me know.

Mimic how your (good) TA or (good) professor writes solutions.

Getting the right answer is important in math, but it's just as important — if not more important — to have a well-written, fully justified and easy to follow solution. Math is about communicating information and arguments to your peers, not about getting the right answer!

With that being said, learning how to write a good math solution is hard. Knowing what to justify, knowing how to say things, etc., takes a lot of practice. A good tip is to mimic how your professor or TA writes solutions to examples. I can't speak for other TAs, but every solution that I write on the board in a discussion section is an example of a 10/10 A+ solution. If you mimic how I organize a solution, the language I use, and exactly what I write, you will likely net yourself a lot of points!

This is where taking good notes in lecture, discussion, office hours, and review sessions comes in handy. If you have pristine notes of everything I write on the board, you have a collection of perfectly written solutions with which to model your own.

Read the textbook.

Believe it or not, any decent calculus textbook has almost everything you need to know. Reading math is difficult, but textbooks (usually) explain all the relevant concepts and have good solutions to example problems. The textbook is another resource for model solutions: pick examples that are worked through in the textbook and do them for yourself, then compare with the book's solution for feedback.