

Some thoughts on how to succeed in calculus at Yale

1. Do lots of problems.

The homework assignments are your best opportunity to learn the material of the course. In fact, in some sense, they're the only option; no matter how attentive a listener or how efficient a note-taker you are, you can't learn math without doing math. If you sit down to start a problem set and get stuck, this doesn't necessarily mean you didn't understand what happened in class, but rather that it takes different skills to do problems than it does to passively follow them. Unfortunately, no one can develop the former for you, and they take a certain amount of time and frustration to acquire. If you get stuck, look at the examples in the book for some guidance. And this brings me to the second tip:

2. Use the resources available.

Come to office hours. Form a study group. Look at the examples in the text. Visit the Math and Science tutors (www.yale.edu/mstutor). Set up appointment with me. Go to class. Come to office hours...

3. Learn to teach yourself.

One of the big differences between high school mathematics and college mathematics is the degree of independence required on the part of the student, and the courses in the calculus sequence are the bridge across that gap. Being able to extract useful information from a text is a sophisticated skill that will serve you well in a lot of contexts, and this course offers some opportunity to develop it. We don't have time in class to cover every type of problem, and in fact, it wouldn't be a good idea if we did. (The goal is to internalize the big-picture concepts and learn how to apply them to new situations, not to simply match any given problem with an example on a memorized list.) I don't mean this as a cop-out in terms of my role as your instructor, and I also don't mean that excellent teaching isn't a helpful aid to learning calculus. Learning math from a written source is probably not something you've been asked to do too often before, and it's not easy. It is, however, very useful and even empowering.

We'll skip some sections in the text, and it's worth taking a look at them. Can you extract the general idea? Can you relate the material to the topics in the syllabus? Everyone is busy, so I don't expect you to learn supplementary topics just for the experience of doing so, but if you find yourself checking out an extra section and want to talk about it, let me know. You may never be asked to find a partial derivative after the end of this class, but there's a decent chance that at some point you'll have to learn a tricky topic without anyone to ask, and learning to teach yourself will pay off in the long run.

4. Do more problems.

Every section has both assigned and suggested problems listed on the classes v2 server. The problems that are turned in give you an opportunity to grapple with the material, digest it, and spit it out in the form of a graded assignment. I recommend using the supplementary problems as a means of checking how well you understand the material you turned in; there's a big difference between doing a problem while looking at a parallel example in the text or with a study group and solving an identical problem with no external aids. Both types of solution are part of the learning process, but if you only do the graded assignments, seeing the same problem on a test gives it a very different feel.

5. Understand the objects and know the definitions.

If you're given a theorem or definition, make sure you know it. I don't mean, "Continuity is something about not having holes," but rather, "A function $f(x)$ is continuous at a point a if (1) a is in the domain of f and (2) the limit of f as x approaches a exists and is equal to $f(a)$." Math is a very precise subject and -particularly if you're asked to prove something- knowing the definitions and theorems is absolutely essential.

6. Prepare for exams realistically.

The best way to prepare is to do lots of problems, but *how* you do the problems matters, too. A familiar problem will seem a lot harder if you try it in an unfamiliar environment, so try to get used to doing calculus problems in a test-like setting. Try some without using the text, or take a practice test timed and with no notes. Another thing to try is writing your own test: start with a blank sheet of paper and try to figure out six or seven problems that you think represent the material. This forces you to think about what's important, organize the material by unifying themes, and consider different ways a single topic could be presented. Then get together with a partner who's done the same thing and take each others' tests. A familiar problem will seem a lot harder if you try it in an unfamiliar environment, so try to get used to doing calculus problems in a test-like setting.