

## Studying for exams in more advanced math classes.

Exams in the advanced undergraduate math courses (especially in proof based courses) are quite hard to study for. Here are a few tips that might help you.

**Do the homework!** I've noticed that amongst all courses I've taught (Chicago, Stanford, and CMU) the performance on the homework is always excellent. The homework is not usually easy to do, and good performance on it is something you should be proud of. Keep in mind however that you should use the homework as a tool to better understand the course material, and consequently help you prepare for exams. For instance, while I encourage you to work in groups, working in a group where you can easily "coast" might lead disasters when exams come around.

The way the homework are structured, a couple of questions (usually the first few) always involve a direct application of something in the book, or from class. You should be able to do these without taking help from anyone else. (It might help if you tried to do these without using the book, class notes, Google, etc.)

The next few questions usually are slightly more involved applications from your course material (book and class), and help you develop a deeper understanding of the material. It's OK to get stuck on these a little. However you should eventually be able to solve them with help. The *best* way to solicit help on these questions is to work with a friend, who is also stuck on the same problem. If your friend knows how to do it, then he'll tell you how and you won't develop the intuition required to figure this out for yourself. So if you're clueless about some problem, then it is almost always in your best interest to work with someone who is also clueless about the same problem. It is also OK to solicit my help on such occasions, as I usually avoid directly giving solutions away, but instead attempt to provide hints to help you along.

**When the going gets tough.** The last, or last couple of questions on the homework are almost always more involved. They might require you to do something "devious", and are not always something you, or a small group of your friends might come up with in the time allotted. Trying these problems really hard is extremely important! If nothing else, it will help you build intuition on what not to do ☺. If you don't manage to solve one of these questions, you should always look up the solution (which I usually type), and see if it makes sense to you.

**Boldly go where no man has gone before.** Well not quite. But view this as my legally binding blood oath that questions on the test will *never* be taken verbatim from something I did on class, or you did on homework. As a CMU student, you are certainly more than capable

of remembering and reproducing five definitions/proofs in an exam, and I will not bother you with such pointless exercises. Your exam questions will *always* be applications of concepts covered, designed to test your understanding (and not blind memorization) of subject material.

The tests are usually structured in a manner very similar to the homework. The main difference being that the questions on the test are a lot easier and shorter than your homework questions. This is because you only have a set limited amount of time for tests, and have no book or math guru to help you. Thus your exam questions will always have at least one solution which is very short, and will be "doable" in the time frame allotted.

**Begin at the beginning.** Like the homework, questions on the test will also vary in difficulty. The first one will be significantly easier than the last one. But depending on how you've studied, and your intuition, you may find a particular question easier/harder than others. For instance, there was one person in class who had a perfect solution to the last question of the first midterm, but got nowhere on the first question. However this sort of performance will usually be the exception.

**Curves.** My exams are designed so that 90% of students can solve at least one question perfectly (usually the first question), and no more than 10% of you can do all questions (most people usually fumble on the last question). Consequently what constitutes an 'A' varies from exam to exam, and if you came out only being able to do  $x$  questions, you should not panic.

Usually I have two standards: First, the top 20% of students must get an 'A', no matter what. Second, I have a preset amount (which varies from exam to exam) and I give anyone who gets over this an 'A'. My final grade assignment is the more liberal of the two standards. Namely, if you were in the top 20% of the class, *or* got more than my preset 'A' standard, then you will get an 'A'.

**Practice makes perfect.** The only way to prepare for such tests is practicing. Do the homework (I can't stress that enough). Memorizing proofs from class, or solutions from the homework won't help. However understanding them thoroughly will help you. For instance, one thing you could do would be look at a simple result from class/book. Cover up the proof, and see if you can figure it out yourself. If you can't, then maybe see how your notes/book starts the proof. Then cover up the rest of it, and see if you can complete it. The same goes for looking up homework solutions.