Exam technique for undergrad math students

Alex Barnett
Courant Institute, New York University

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Often students who understand much of the material and perform fine on homework are let down by exams. Here is some general advice for timed math exams, both studying for the exam, and during the exam itself. The principle in both cases is: you have a finite amount of time available, so how can you optimize your activity to give you the best grade?

Study for exams

- Spend *at most* 1/3 of your study time reading the book or lecture notes. Students have a tendency to lose a lot of their time reading the textbook and highlighting everything! This does very little to prepare you for the skills you will need in a timed exam. Spend at least 2/3 doing practise problems, then comparing to answers or worked solutions if you have them, only then finally going back to the theory in the book if solutions don't make sense. This includes homework problems you got wrong (for reasons other than arithmetic slips), past quizzes and exam questions.

- If your exam allows you to bring your own equation sheet ('cheat sheet'), do not spend most of your time making this sheet (it should be included within the 1/3 of your time mentioned above). Having such a sheet will not allow you to solve problems more reliably unless you already know how to solve the problems. This only comes by practising solving problems. The sheet is a crutch, to make you less nervous about blanking in the exam. You cannot walk with a crutch if you never knew how to walk in the first place!

- The homework, quiz and midterm questions you got wrong comprise the most complete record in existence of exactly what you need to work on from earlier in the course. If you like, they are a brain-dump of what you need to study. Rather than avoiding the mental pain involved in looking over stuff you got wrong (and there is pain), confront them head-on. Bring them to office hours or email the professor until you can do them.

- If the professor does not provide estimated grades as the course progresses, ask for one, or ask how you could calculate your own given your scores to date.

Decide how well you need to do on the timed exam to achieve the grade you want.

- Make sure you get a clear description from your professor about the weighting of various topics on the final. Study accordingly.
- Do not worry about advanced material until you can do the basic simple problems. Otherwise your study time on this is probably wasted.
- Give yourself timed practise questions. That is, choose review or homework questions and do them with a 20 minute (for example) time-limit. Repeat until you can do the question reliably in that time-limit. This practise is essential to build the skills for timed exams. Panic-free recovery from mistakes or from the inability to answer one part of a question is important.

During timed exam

- Assume that the question "Why?" or "Explain your answer" has been appended to *every* question in the exam. It is very hard for a grader to give any points to a wrong answer with no explanation. In the end it is understanding that is being sought when your paper is graded.
- If you suspect a typo, or don't understand what a question is asking, immediately ask the exam proctor. It may be a real typo. Better than wasting time trying to solve a question with a typo in it!
- Balance your use of time according to the points available for each question. When the exam begins, calculate how many minutes per point you have (leaving last 20% of time for checking, returning to parts you got stuck on). Stick to your timing schedule as much as you can.
- You cannot expect to get full marks for a question worth 5 points by writing only the word "Yes" or a single number. If 5 points are available, take it as given that 5 points worth of effort and explanation are necessary. Similarly, if 1 point is available, do not waste precious time writing a long explanation.
- If you don't have time to carry out a calculation, you can often get partial (or nearly complete) credit for scribbling a flow chart or description of what you would have done. Again, the grader is seeking evidence of understanding, rather than just the correct numbers.
- The exam-writer usually chooses the questions to cover the most ground possible. Therefore if you find the answers to be coming out in a similar way for several different question parts, you probably are missing something. For instance, in a question asking you if three different matrices are diagonalizable, the answer will not be "Yes" for all three, and certainly not for the same reason.

These are warning signs. You need to get inside the exam-writer's head and be aware of the kind of things that are probably being tested.

- Do a reality check on your answers: did you expect the answer to be a vector, matrix, scalar, function, negative, complex, really large, really small, zero, infinity, etc?

- If in a numerical calculation question the numbers are working out to be really horrible (*e.g.* $\sqrt{1706}+465/17$), then there is an extremely high probability that you have made a slip. Exam-writers usually make the numbers very easy so that the understanding can be tested simply. Go back and check the early stuff instead of wasting valuable time handling and writing out the messy horrible numbers you are getting. However, if you have already completed a question where you know there is a numerical slip, don't go back to redo until you've done everything else in the exam, since you will not lose many points for numerical slips.

- If you find yourself needing a calculator to work out horrible numerical expressions, see above.