

The (American plugger's) Guide to Part III of the Cambridge Mathematics Tripos

Disclaimer: I am no expert on the Part III, and this is an unofficial paper by a Part III graduate, nothing more (or less.)

What is the Part III?

The Part III (P3 from here on) is a taught Master's degree in either pure mathematics or theoretical physics. You can go to the homepage of either DAMTP (the Department of Applied Mathematics and Theoretical Physics) or DPMMS (the Department of Pure Mathematics and Mathematical Statistics) to find out more precisely what the courses are, and what subfields you can concentrate in.

What level is it at?

You probably want to come in with an undergraduate degree in a field closely related to the subfield you want to study. You'll have problems if you have a Mathematics degree and try to study very applied subjects, and vice versa, but if you want to study finance after Math, or astronomy after Physics, you'll be fine.

Depending on where you went for undergrad, the courses in P3 will look and feel like graduate level courses in your department. They're focused on getting you started in research in a particular topic, and there's little concession to the mathematical tourist. With notable exceptions, less time is spent on the fundamentals, and more time is spent getting you up to speed on doing calculations and reading papers recently published in the field. If you think about it for a second, that's pretty cool, but sometimes during the year you'll wish the lecturer spent more time on the (often more aesthetic) fundamentals.

Advice for Before

How can I get funding?

You need to secure funding *before* you get to Cambridge — there are some grants that you can pick up when you're here, and it's good to keep an eye out for that sort of thing, but they'll be of the order of one to three hundred pounds.

You can go on one of the many fellowships that send young men and women for cultural reasons (e.g., the Rhodes, Marshall, Rotary.) There are lots of fellowships of this type, so check with your guidance counselor. Looking at the people who came over in my year, there were far fewer scientists than humanities folk in the Rhodes/Marshall "well rounded" category of fellowship. There's also the Gates these days, which is big money. I went over on the first year of the NSF Graduate Research Fellowship, which you may not realize immediately will fund you overseas. It will, and they'll even give you \$1000 travelling money to get there.

In general, the money is out there if you have a good (Magna or Summa) degree in your subject, good recommendations and (maybe) some research over the Summers. Or, on the other hand, if you goofed off (on the newspaper, say) in productive ways during college, but still did well academically.

How do I choose a college?

There are two ways: randomly, and semi-randomly. It is advised that you choose the second option.

There are some Colleges that admit only graduate students (e.g., Darwin). You may like this

scene. Many found it unfriendly and antisocial, especially since everyone there has come from outside Cambridge and there are few activities to nucleate around. I may be biased, because the people from these colleges that I met were more social than most, and interested in talking about things other than their thesis. Darwin's bar is open an hour later than most in town.

In general, the grad colleges seem to make the most sense for those settling down for a Ph. D., and not those who, still feeling like undergraduates, are coming over for a year that is explicitly *not* the Ph. D.

There are the old colleges in the center of town. They have pretty architecture, lots of undergraduates, and lots of weird ceremonies that they carry off without any trace of irony. They also (sometimes) have lots of money, and lots of weird sources of funding. This was the situation I was in, and I enjoyed it immensely. The graduate students are (sometimes) in a union that does things, and you can always flirt with the undergrads, who will regard you with a mixture of respect and absolute ridicule.

There are the newer colleges. They can be very rich, but they're further from the center of town. Churchill is one that comes immediately to mind, as it takes a large portion of scientists. Since there are also undergraduates there, the social life is similar to the older colleges, though concrete and not limestone is the name of the game.

There is one college that has so much money they (nearly) guarantee funding for a Ph.D. If you come to Cambridge with the idea of staying on, this college would be good to check out. Its name rhymes with "infinity." It also has a great ball in May Week.

General Advice

How do I come first in the P3?

Go to every lecture. Do all the problem sets the week they're given out. Go to every supervision ("recitation," or "section," led by a graduate student.) Study hard over Michaelmas, Lent and Easter vacations. If writing an essay, start the day after talking to your essay advisor. Yup. The other option is to follow the advice below, and hope to get lucky on the exams.

How do I aim for a distinction in the P3? (Course followed by author, recommended)

Go to every lecture you plan to exam on. If you miss one, get photocopies. Read over your lecture notes. Do 3/4ths of the problem sets, preferably before they're discussed, and get to supervision. Cover the remaining 1/4th with the crib. Don't worry about things in Michaelmas, but kick into high gear, hard, in Lent and Easter. If writing an essay, start right away after Michaelmas break on reading.

How do I pass the P3?

Go to lectures some of the time, and make sure you've read a bunch of the photocopies of the lectures you missed. Get the answers to the problem sets and work through 3/4ths of them. Study over in Easter. Feel 2/3rds solid on 5/6ths of your exam topics.

Advice for During

Essay?

Yes, a good idea. It's a nice break. However, it will take a very large amount of time, and it will undoubtedly be far easier to just take an exam in its place. (You will, however, rock the exam most closely related to your essay.) So, pick a topic you really like — ideally something you might work on in later life. Be aware that the essays are pitched to a very high level, content-

wise — if they say AdS-CFT correspondence, they will expect you to get down and dirty and show a real understanding — and some are clearly easier than others. No, it's not fair.

Dr. Korner's article on writing an essay is very good, and in particular his advice to hand draft early parts of the essay is very well taken. This author did that, and got on very well. It's good. Buy a fountain pen and a bottle of ink, and have fun. Ta-da! You are now an inky scholar of Cambridge. Remember this when you start your first post-doc and frat boys at Delaware State pour beer on your head.

However, Dr. Korner is writing as a mathematician, and his advice for the essay is most relevant for math essays. Here are some notes on writing physics essays (I did mine on a topic in theoretical cosmology.)

The essay reader wants you to show that you (a) understand the topic at hand, and have played around with things on your own (i.e., done calculations, drawn pictures, maybe even used Mathematica) enough to have developed some intuition about it, (b) understand the general direction of the field — what came first, what came second, what ideas are new and what are part of the 'canon' in the field, and (c) understand the relevance of the topic to other areas of the subject.

Use your meetings wisely!

In the first meeting, make sure you come out with a list of relevant papers in hand. This is very important. Get your advisor to tell you a half dozen papers (or, maybe, just two or three) that you should start with. Don't let him drift and free-associate, or, rather, that's great, but make sure you have a solid ground beneath your feet on the walk home. It doesn't hurt to hear his opinions on the state of the field — it will help guide you in choosing what to read next.

In the second meeting, get an essay plan together. You have two options: if things are going well, get a detailed plan together. If things are going not so well, and you're confused about direction, prepare the night before a very thorough (and honest) assessment of what you understand and what you don't about the essay. I was a little panicked in my second meeting, so I went with the second option.

In the third meeting, either show a final essay plan to your advisor, show him the essay itself, or discuss any remaining confusions you might have about issues raised by your presentation of the material.

Don't get bogged down by the literature!

After you finish your essay, you will probably have a long bibliography — out of which you can cull perhaps three to five papers which are the only truly necessary ones. The trick is to know what those papers are beforehand. This is what professors and post-docs know intuitively how to do. By all means accumulate stacks of interesting material, but keep a keen eye out for what papers are really useful, and what are speculative or just plain ancillary.

Useful papers often use a minimum of new notation, unless they're very old, in which case they introduce the canonical notation itself. They have a minimum of jargon. They have a wide area of concern in the introduction, that quickly narrows down in the discussion section to a manageable piece. They are cited by other people, but be careful! Sometimes a new idea is reworked in a more manageable form later — people will refer to its first publication. Citation is not a guide to importance; often the most cited paper is a very general or abstract one on a related topic.

Thoughts on the Exams

It's hard to get a Distinction, but it's also hard to fail outright — you need to be willfully blind to

danger to do so.

Don't panic. Or, rather, panic in a controlled manner. Look over those past exams, and make sure you've tried a few just so you know how time pressure works (three hours can fly by.)

Memorize. Sorry, man, but you'll be glad you did. Don't memorize everything, but do memorize key derivations, equations, and examples. It will help you at the critical moment to be able to write down lots of sensible material even when you can't answer the question — your brain will start working in the background.

Be wary of letting an exam "go to seed." Even if you prepare for all your exams, one of them will kill you hard, like as if you never even went to lecture. Thus, to knowingly go into an exam you didn't prepare is (a) demoralizing and sad and (b) a waste of an important free lunch built into a 17-19 (or so) credit schedule.

Don't forget the last few lectures. In America, the final few lectures are often "fun things." Here, there is no fun. It is not unusual for 2/3rds of the questions to come from the final 1/4th of the course.

Practice once more on those long derivations and proofs, and make sure you can do every step — not just the bit with the difficult maths.

The exams will be harder than you think, if you work from past exams. There's a tendency to let them guide your studying, so that when you sit down to do an old paper, it seems really easy. Be aware that the exam you face may have a very different focus. If the essay question has been the same for four years, this is the year it will change. Be wary of extrapolating patterns.

If you understand the material, you will do well. If you enjoyed the material, you will do very well. If you enjoyed the material well enough to read ahead or around, you'll rock.

Envoi: you will be fine. You will be fine! I didn't know anyone who failed the Part III. (Hi, Dave!)