Advice on Math Grad School Application Process

If you are thinking you might go for a PhD in math, read on. No, it is not too early to read this.

This document is not about what math grad school is like, or whether it is right for you. It is about the process of getting in, which has gotten somewhat daunting, if you don't go about it the right way and with your eyes open.

The bad news: Getting into math grad school is a lot harder than getting into college. Example: This year NYU-Courant (an excellent but not top-ranked place except in applied math) had 330 applications for 8 spots. Of course, they admitted more than 8, but you get the idea. The top programs admit at most 5% of applicants. Swarthmore admits around 20%.

Furthermore, most of the things that counted big in getting admitted to Swarthmore – your breadth of interests and activities – count for nothing in grad school admissions. All that counts is your potential to do math research. Not even a broad interest in the variety of roles within the mathematics community, and in the roles of mathematics in the broader community, count (alas).

Next, you are up against top foreign students from everywhere in the world (and some US university students) who have done nothing but math as an undergraduate and are well into graduate courses already and may know exactly what they want to do research in. Often half the admitted students are foreign students.

Finally, although there are grads of liberal arts colleges on the faculty of leading research departments (including our own Arthur Mattuck at MIT, Peter May at Chicago, and David Bayer at Columbia), many faculty, especially foreigners, just don't know anything about liberal arts colleges and think they couldn't possibly be good.

Does this mean you should give up? Of course not. It does mean you have an uphill fight to get into the best places, and that you will have to apply to a variety of places to ensure an acceptance with funding. This email is about how to optimize your chances. We want to help.

One piece of good news. Any university faculty who follow national data know that top liberal arts colleges are particularly good *percentagewise* in educating future PhDs. Look at the information about this on my office door. During 1995-2004, Swarthmore ranked 4th in the nation in percentage of its science and engineering graduates who went on to get PhDs (behind only Cal Tech, Harvey Mudd and MIT, ahead of Harvard, Yale, Princeton, Stanford, Berkeley). Several other liberal arts colleges were very high too. Interest and success in getting PhDs is in the air at places like Swarthmore, so you can do well too. Some faculty at graduate programs tell us that many of their best students come from liberal arts colleges. For myself, when I went to grad school at Princeton from here, at first I felt daunted (at the afternoon teas) by how much more many other students knew

(they could throw around names of theorems and talk of recent work) but eventually I learned that my depth of understanding of what I knew was as good or better than theirs.

All right, so what do you need to do?

   1. Read the statements we have in the office from math grad admissions officers about what they look for in admissions.

   2. Do as well as you can on outside measures of your math ability:

       GRE Math Test (the subject test, not the quantitative part of the general test)
       Putnam Exam
       Budapest Semesters in Mathematics
       REUs

The statements we have from grad admissions officers say that a really high GRE isn't an absolute necessity, but that's mostly if they know your recommenders and know your program. In the absence of that a high GRE really helps. I mean 890 or 900, the max score these days. Doing well in these other things helps too. For the GRE and the Putnam, the way you do better is to practice. We offer practice sessions.

3. Take the most advanced courses we have available. Absolutely take the second semesters of real analysis and algebra, and several other seminars. If you are a course major, do an advanced project for your senior conference or independently. If the opportunity arises, take an advanced course we don't offer at another Trico school or Penn.

4. Talk to us about where you should apply. You need to have a range of schools in terms of selectivity, starting with one or two that are a stretch for you. You can find rankings of math grad programs online, for instance, the latest Nation Research Council ranking at http://www.math.hmc.edu/misc/gradschools.html and a US News ranking at http://math.scu.edu/~eschaefe/grad.html. These are 10 years old, but they don't change very fast. For a link to more recent US News rankings, see http://collegeapps.wlu.edu/departments/departmentpage.asp?id=103&departmentname=Mathematics, but only the top 5 schools are visible for free. As one of these sites says, some lower ranked schools are actually tops in certain fields, or have key people you might want to study under. So again, talk to us about where to apply.

5. Apply for outside grants: NSF (National Science Foundation), NDSEG (National Defense Science and Engineering Graduate Fellowships). If you want to go abroad to study, there are also other things like Marshalls and Churchills. If you are a foreign national, your home country may have funding for you. We will provide more information on graduate school funding in another message. But the point: If you get grant funding, you are *much more likely* to be accepted by grad school, because they

won't have to pay for you. The very fact that you applied for fellowships makes you a serious student in their eyes.

6. Choose your letter writers carefully. Ask them how strongly they can recommend you and whether they will be able to describe in some detail what you have done, or if they can compare you favorably to other students they have recommended to similar schools. (Such comparisons count a lot in recommendation letters.) It's probably good to have at least one letter from outside Swarthmore, especially if the person is a respected researcher, but not if the person writes perfunctory letters or says his recommendation for you will be modest. Talking to possible recommenders about what they will write is a little tricky. You can't tell them what to write about you, but it is fair to ask for an idea of what they will say about you.

7. Toot your horn a bit in your applications. If you are particularly interested in some area of math, say a bit about how come. If you worked on a problem (in an REU, in a course, on your own), say a bit about your work. If you found yourself well prepared when you went to Budapest, say that and explain why you think that. If you went to any special math programs, even back in high school (e.g., the Ross program, or a governor's school), say so and say what you did. Say a bit about how Swarthmore seminars work and that you know how to think and do math independently. (We'll say that too in what we write. It's an issue because we have it in writing from one math graduate admissions director at a top university that liberal arts college math students are taught "too well" and expect too much help and support.) If you have a particular reason for applying to school X, individualize your application to X to say why. (It might be a particular professor there, or feedback from students you spoke to there, or even the part of the country.)

8. In fact, *if* you are quite certain you want to specialize in a certain area, and *if* you know of a professor Y at school X who works in that area (maybe you have read one of Y's papers, or browsed Y's website), you can write to Y to introduce yourself, say you are applying to X, and maybe ask a question or two. Sometimes individual faculty intercede in the grad admission process, and if they really want someone, that person is almost always admitted. However, don't make any of this up; only contact an individual professor (other than the graduate admissions representative) if you are really pretty sure about specialization. Most Swarthmore math students are still generalists.

9. Read the information we have collected in the office from former Swatties who have gone to math grad school. There are statements about how they handled the application process, and statements about how they coped with grad school once they got there. Grad school is very different from Swarthmore.

Starting in Fall 07, Math/Stat will be collecting information early in the fall from all students applying to math grad school, so that we the faculty can make sure our support of you is consistent and informative, and also so that we can advise you better on where to apply. *If you are interested in a top school, we want you to apply there.* The chance of

getting in is always low, but you can't get in if you don't apply. Years back, every year or two a Swat grad went off to math grad school at a top place (Harvard, Princeton, Chicago, MIT, Stanford, Berkeley). This hasn't been true in recent years and we want to change that. Once one of you goes to a school and does well, it makes it easier for students in the year or two following you to apply and get admitted. So we have an interest in helping you pick where to apply. (Note: It has always been the case, and this hasn't changed, that some of our math majors continue to go to top places in cognate fields – econ, engineering, physics).

Finally, how much does going to a top graduate program make a difference? It makes a difference initially. Going to a highly respected place, or having a distinguished PhD advisor, connects you with the right people and can get you in the door for interviews or postdocs. But in the long run in mathematics, it's your own work that counts. People who do outstanding research rise to the top wherever they got their PhD. People who take the lead in developing curriculum and textbooks and in leading the collegiate education community become noted for that, wherever they started. So you should always pick a graduate program you think you will thrive in. But among these, it helps to go to the best.

Questions? Please contact me.