Re: advice on how to study math in grad school

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From: Chan−Ho Suh (*suh_at_math.ucdavis.nospam.edu*)
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In article <6cb3c84c.0408290952.2d05a324@posting.google.com>, Mike I. Thompson <mit12354@yahoo.com> wrote:

> *Hi,*
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> *I was wondering how to approach studying math in graduate school. I'm*
> *starting my second year in math grad school, I'm in what is called the*
> *pure math program, and I've passed 2 of the 3 qualifying exams (the*
> *remaining exam is analysis, and i'll be taking it in a few weeks) but*
> *I feel there's a lot of basic math, especially analysis, that I don't*
> *know.*

A lot of things depend on how you've been studying thus far. The fact that you're even asking the question implies (but not necessarily) that you've, up til now, been basically studying to pass the tests.

Studying to pass quals is quite different than actually studying the material you've been exposed to. The former typically involves studying previous tests and paying close attention to material presented in class, particularly the *way* it is presented and making sure to focus *mostly* on that material, instead of exploring other materials on your own. Typically a person doing this will only carry around the textbooks (recommended, required, etc.) that the tests are supposedly based on.

The contrast to this approach is studying simply because you enjoy certain things and you want to understand what strikes your fancy at the moment. This is not as frivolous as it may seem, since given a typical student's limited exposure to mathematics, what "strikes your fancy" is oftentimes highly relevant to what is considered "core" material and will be related to what appears on tests.

This latter approach can lead to great insights and synthesis of knowledge but unfortunately it is not a good way to get top−notch grades. Also, most people doing this will undoubtedly have to spend a few weeks before the test, studying previous tests and so forth.

There are, of course, degrees between the approaches, but from observation, almost everyone is much closer to the first approach.

So, my advice is, if you haven't been doing the second approach, try harder to get closer to it.

Another reason I suspect you've been studying for tests only is your comments below, where you seem stuck in a sort of strange, mistaken mentality about what mathematics is. More below.

> I was wondering if a good approach to studying math is to set
> the goal of trying to learn all of "pure" mathematics. (Obviously,
> this is an impossible goal, but one can set impossible goals, and
> while they won't reach them, they would still get far.)

Get far? Not really. You can set impossible goals that are foolish to set, and end up wasting lots and lots of time, instead of doing something more productive. How's that?

> So with this
> goal, I'd take time to thoroughly learn analysis (e.g. via various
> comprehensive texts in analysis), group theory, general topology,
> algebra, combinatorics, etc. all by working through various
> comprehensive texts on these subjects.

Wow, what a task you're setting. Bad idea. Ideally, it would be great indeed if you could somehow learn "all the basics" before you get to the "advanced" stuff. As my quotes indicate, there's some serious misconceptions here.

First off, many ideas in different "subjects" are actually the same. You can spend years just studying one thing, and find that other things you've not studied are now trivial to you. There's a category of kind of meta−concepts that once you learn in one incarnation, is easily seen and applied in other disguises.

Oftentimes, you need to see how far a simple idea is pushed, used in "advanced" contexts, to really understand the meta−idea. By spending a lot of time on introductory books, you may never see the bigger context and never get the big idea. Introductory books also mostly introduce material in an introductory manner. So they present things in a way that may make it hard to see connections to other things.

Perhaps that's the real difference between advanced books and introductory books: presentation of the same ideas in a way that is conducive to making broad connections.

As for "advanced" material, just as often you find they're trying to resolve something simple that you overlooked or brushed over when you were studying the "basic" stuff.

Lastly, you need to get out of this mentality you have of lining up a bunch of books and plowing through them one at a time. That's just plain bad. That's something that's really hard to fight, at least for me it comes up in different variations, but it's how you grow and broaden your understanding.

> I would eventually like to do
> research involving algebraic geometry, but I feel that maybe when I'm
> at that point, I'll come across a problem which I'll be able to solve
> only by knowing some trick I learned because I thoroughly studied some
> more basic math. Comments?

Hehe. That's not going to happen :−) You realize there's a lot of smart people in mathematics right? If you could indeed use a trick that you learned from studying the "basics", it will inevitably turn out to be something everyone already knows. Assuming you're not a genius or something. [this is always a default assumption in this kind of post]

Besides, in order to really study all that thoroughly, it would take years and years. Good luck finding time to do a Ph.D. thesis. Getting things done thoroughly, down to an exacting level of detail, is one of the things you do for a thesis. And that's when many learn to do it. Some good theses ask very basic questions (that are unanswered) that take a lot of work to resolve.

If you waste a lot of time doing this, you're not going to know anything about the status of problems and so forth in your field. Just keeping up on that and thinking about developments is hard work enough.