

Advice on Writing a Senior Thesis

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This document contains advice from students who wrote a senior thesis, and from faculty involved in the senior thesis process, from advising to reading theses and examining students on them.

Advice from students

How and when did you find your adviser and your topic?

- I did an REU on a particular topic I liked, so I looked up faculty members who might know something about this, and asked one.
- I asked faculty members at the end of my junior year.
- I took a graduate course junior spring that was cool and had a research component, so I wrote a thesis on that.
- I was really interested in a particular topic, so asked professors in that area and found someone.
- I asked faculty members how much time they could spend on me during the semester.

How did meetings go?

- I had weekly meetings with my adviser. I got to see her philosophy, the way she works, and got great advice from her about approaching problems and learning.
- It was a great opportunity for both of us to work on something we were interested in!
- You have to work with your adviser's schedule, so it can be tricky to find time.
- It was an amazing opportunity to see how my adviser thinks about math, where does their intuition come from, etc.
- Different advisers will want to see you more or less often.
- The adviser will ask you what you read, if you have questions.

How was the examination process?

- The examiner might ask you the intuitive meaning of some result.
- Have examples of the main result(s) worked out in advance, you'll probably be asked to work one out!

- You might have to state and prove the main result(s). They want to see what you do know, what you understood of what you wrote.
- The examiner might ask leading questions to get you to some place.
- Depending on the examiner, you might be asked about side results, or connections to other fields, or background material.
- Prepare for the meeting by reading through your thesis a few times.

What was the most difficult or scariest part of the process?

- The writing! You need to present the material as clearly as possible when it is not clearly presented anywhere!
- When you are pressed for time, things just get harder. So start earlier!
- Feeling lost! Feeling like I don't understand these things anymore!
- A scary thing was when I realized I needed more background before I could understand a proof, but I felt I should start writing instead of reading some more. You'll have some mini-breakdowns here and there during the process, but that's normal, just keep going, and ask for advice.

What was the best part of writing a thesis?

- The writing! If you like teaching, then you might really like the writing, especially trying to make it as pedagogical and engaging as possible.
- *Really* understanding this topic I was interested in!
- Being proud of myself! After all, this is something you have full ownership of, from conception to submission. And, someone will have read it!
- Meeting with my adviser!

What would you do differently?

- Ask faculty members earlier, before the summer break, if they might be my adviser and what topic they suggest.
- Share my writing earlier with my adviser, after each chapter.
- Ask for more feedback as I get along.
- Ask to meet more frequently with my adviser.
- Start writing earlier! If you know something will go in the thesis for sure, write it!
- I did go to the Writing Center for help on my writing, but having gone earlier would have been better!

What did you do when you got stuck?

- Read different books, and more books.
- Tried to work out an example.
- Taking a break, not looking at it for a while then coming back is often good.
- Talk to other people! Your roommate, your friend, they might be good sounding boards. Some grad students might have some advice too. It helps to understand something when you talk about it with others.
- Move on, read further, and come back later.
- Have lunch and get back to it.
- Write an email to your advisor explaining where you are stuck. Sometimes just that (without even sending it) will get you unstuck!
- Make a list of things that are unclear and bring it to your meeting. Take notes as you are reading a book or an article – when they say “this is obvious”, well it is only obvious to the ones who know it already, so don’t be afraid to ask!

At what time of the year did you spend the most time on your thesis?

- Time spent on my thesis grew exponentially as the submission deadline approached!
- I worked a lot over January, I came back to Harvard early to use the resources here, including the library.

Other advice?

- Start early.
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- Get support from your adviser as you are reading.
- Pick a general field, find an adviser, and then narrow it down to a subject.

How do you compare writing a thesis to taking an extra class?

- It’s so different! You need to find sources, put things together, it’s a lot of learning on your own. There’s no syllabus, no canonical source.
- Writing is so helpful, you don’t get to do that in a class.
- You can study whatever you like for your thesis!

How do you compare writing a thesis to taking an REU?

- If you wrote a paper for your REU then it’s probably very similar. But the breadth of topics you could consider for your senior thesis might be much larger than what they might suggest at an REU.

Advice from faculty

Who is it for?

- Everyone!
- Anyone who thinks they will enjoy the process of learning on their own, of self-motivated study.
- Anyone who wants a taste of grad school or a professional math career.

Why do a senior thesis? What does one get out of it?

- To learn more deeply about a topic you are interested in.
- To really get something straight, to get the details of it. To spend some time on something fundamental before going off to grad school, where you might feel in a hurry to learn stuff (not that you should).
- To understand this one paper by a great author.
- To see whether you might like grad school.
- To wean you off of classes, where you get a constant pat on the back with every problem set and exam.
- Enjoyment!

Why does the department offer this opportunity?

- Writing a senior thesis is an engaging intellectual experience, students should be given this great opportunity if they want to take it!
- Students are usually glad they did it, then enjoy the 1 on 1 process with their adviser, they like to dig in.
- For some students, having an honors degree is important.

Is the thesis supposed to contain original research?

- No! It's not supposed to. And if it does, the new results will probably not be more than one chapter of the thesis anyways.
- No. Also, the thesis should be an original *exposition* of material, it is not to be written as a publishable paper.
- Of theses that have won *highest honors*, some were certainly purely expository, without original research.
- The desire to obtain original results should certainly not be a starting point for a thesis.

Any advice on how to find a topic, and an adviser?

- Students should have in mind broad topics or branches of math they like or they want to learn about when they go to see an adviser the first time, this helps to start a conversation about potential topics.
- Be bold! Knock on doors during the spring semester of your junior year. If you can have your topic and adviser lined up before summer, you can spend your summer thinking about other things, and get back to it in the fall, ready to get started!
- Don't be offended if you get a no from someone, shop around. Ask post-docs, Benjamin Peirce fellows, preceptors.
- Don't feel bad if someone gives you a topic you're not interested in, tell them you're not interested and go talk to someone else.
- Maybe finding an adviser outside of the department is something of interest to some students. Just make sure you can still talk to someone (a "shadow adviser") in the department, to make sure the content of your thesis has enough math in it.
- Students are often too ambitious! I suggest you focus on a bite-size piece of math, and understand it really really well.
- Create the reference you wish you'd had when you started learning about this topic.
- Sometimes you might need to be reined in: students are often overly ambitious, and should focus more on a more manageable topic.

How do meetings go?

- Meetings should be once every week or two. The student might be asked to discuss what they read, present a proof on the board, ask their questions.
- The thesis is the student's project. It is not a collaboration, the faculty is not a co-author. So the faculty won't crack the whip at the student. It is up to the student to motivate themselves to work on this.
- The faculty might help you find appropriate reading, send you in interesting directions, help you understand the math, advise on your writing.

How much or how little should one write in the thesis? Does one need to prove every lemma?

- Think of a clone of yourself before you started out on this thesis project, and ask yourself what would have been helpful to this clone in order to learn the topic.
- Part of the process is for you to make your own decisions as to what you think you can leave out, and what needs to be in.
- Write math so the idea is transmitted clearly. If something is not explanatory, you can put it in an appendix.
- Think of teaching your topic to someone who doesn't know the subject.

Can a student write an applied thesis?

- Yes! Make sure you have a “shadow” adviser in math (this is true no matter how applied or pure your thesis is, if your adviser is outside of the Harvard Math Department), who can help you focus on the math content, and check that the content is appropriate for a math thesis.
- Yes, but make sure that, say you are using a particular mathematical method to obtain results relevant in some applied field, you explain in detail the mathematical method. This is what we want to see in your math thesis!
- Yes. Be careful of technical words from the other discipline though. Think of replacing any non-math technical word by “smurf”. If your sentences have too many smurfs, you probably need to explain a bit more!

How does the examination go?

- It is generally oral, and should last less than two hours.
- The faculty member wants to make sure you understand what you wrote about.

When should I start the process?

- Start talking to potential advisers in your junior spring, so that at the end of the spring you have your topic and adviser lined up. Then you can start reading in the fall, and start writing over winter break, January or February at the latest.