Information for Graduate Students

Dartmouth College Mathematics Department

Graduate Program Committee

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1.1 Year 1

Your introduction to graduate school begins with basics: getting an ID card, an office assignment and keys, and perhaps a cup of coffee or tea in the graduate lounge where you can reacquaint yourself with some of the people you met last spring. Your first real stop should be 102(C/D) Kemeny where you will meet Tracy Moloney (the Department Administrator) and Stephanie Kvam (the Graduate Program Administrator); you cannot survive in the program without their efforts on your behalf. Stephanie should have keys and either of them will push you out the door (presumably in the right direction) in search of the ID office. Note that you will need your ID card to get into Kemeny late at night or on weekends, borrow books from the library, as well as to gain access to places like the gym and fitness center.

You now officially exist at Dartmouth; what's next? You need to start planning your career as a graduate student. To do this you need to meet both with your individual advisor as well as the departmental advisor to graduate students [Barnett(X,S), Winkler(F,W) in 12-13]. The idea is for you to have a long discussion about your background (including advanced courses you may have taken or background material you lack), and then to make an initial plan for courses to take for the year. This plan of courses needs to be approved by both advisors, so it is ideal if you can schedule a joint meeting with them.

You should meet with your individual advisor minimally once or twice per quarter, and of course as often as you feel the need. You can talk with your advisor about any problems or questions you may be having, in class or out of it. Your advisor can not only give you advice and encouragement, but help find resources to help you with any difficulty. You should talk to the graduate advisor at least once per term, to update your plans and discuss any mid-course corrections which are needed. Before advancing to candidacy students are expected to have taken the following courses: in analysis (73, 103, 113); in algebra (81, 101, 111); in topology (74, 114, 124) as well as three or more topics courses of choice. Note that while 73 is technically an analysis course, it is not part of the analysis syllabus. In general 73 is an important prerequisite to geometry courses and sometimes to the differential manifolds course (124). A typical schedule of first-year courses would be

Fall: 101, 103, X; Winter: 81, 113, X; Spring: 73, (74 or X), 111

where X can be another classroom course covering a topic outside of the three core areas of algebra, analysis, and topology, or can be a supervised reading course (127) in which the student pursues a topic to advance their progress toward certification in four areas of mathematics. A student with adequate preparation may choose to take 124 in the fall of their first year instead of their second year. This can be especially helpful if geometry is desired as a fourth area of concentration. In the first three terms, students should strive to take at least two classroom courses per term even if they have been exempted (by the

advisor to graduate students) from some of the standard courses listed above. **As a fourth course**, every student in their first two years needs to register for one offering of Math 107 (supervised tutoring) in the second term that they tutor that year.

An important discussion which sometimes takes place is whether the entering student might or will require **zeroth year status**. Consideration of this status is made by the Graduate Program Committee (GPC) in consultation with the graduate advisor and the student's instructors **by the end of the first term**, based on perceived need for the student to take some additional background courses coincident with or even prior to taking the standard graduate level courses. If there is a need for additional courses, there will almost certainly be an impact on the standard timetable for passing qualifying exams, and a new schedule of deadlines is worked out. Zeroth year status is only intended for students with deficiencies in their background, not for students who may simply have difficulty in their courses, though certainly extreme difficulty early in the term may be a signal for the course instructor to engage the graduate advisor in a discussion of zeroth year status.

What else is on the horizon? In the near view are your courses, and in the mid view are your qualifying exams. There is an entire section of this document devoted to qualifying exams, so we shall be brief here. The typical course schedule listed above puts you in good stead to take two quals in your first year. The analysis qual covers material in 103 and 113 (taken fall and winter), while the algebra qual covers material in 101, 81, 111 (taken fall, winter, and spring). An ideal schedule would have you take your first qual by early spring, and your second by early summer. This scheduling will put you essentially one term ahead of the deadlines and positions you well to get ready for your third and fourth quals which often take more planning.

Other topics in upcoming sections include:

- TA responsibilities (two courses each year)
- Seminars and Colloquia
- Topics courses and a fourth area of specialization
- Grades: Are they important?
- Time management and perspective

Let's talk a little about time management and perspective. While you no doubt developed some time management skills as an undergraduate, graduate school presents new demands including new perspectives. As an undergraduate, you took a series of courses and via final exams were responsible only for their individual contents. As a graduate student, you take a series of courses in each of four core areas, and are responsible not only for assimilating their combined discrete facts, examples and proofs, but also the integration of ideas that span these courses.

Learning mathematics is an iterative process. Each new topic must be integrated with old ones, and each pass at an old topic reveals a deeper layer enriching your understanding by making new connections to other ideas you already know something about. Many notions are very confusing the first time through. As an undergraduate you may have found linear

independence of vectors confusing, but later came to view linear algebra of finite dimensional vector spaces as completely elementary. Then you meet free modules and all the standard linear algebra theorems seem to go wrong. Of course you couldn't appreciate how pathological free modules could be unless you understood vector spaces in the first place. As another familiar example, we learn calculus first, then real analysis, then study differentiable manifolds, absorbing first the bare mechanics of calculus, then the reasons, proofs, and larger vista of euclidean metric topology, and finally move on to an even more general setting.

Students will sometimes ask to be exempted from courses like 101 (groups, rings) or 81 (Galois theory). Unless you are planning to take the corresponding qual that term, it is probably a poor idea. Even if you have covered the material once, a second pass will afford the opportunity to peel back another layer and obtain a better understanding of the connections qual examiners like to probe. The person teaching the course may well be one of your examiners, so you can see his or her perspective on the subject and get a sense of the kind of questions that might be posed. Not taking (or not retaking) the course puts you entirely on your own for learning or review, which generally means obtaining only an understanding of the basic facts and mechanics.

In your first year, the responsibilities you have to juggle include:

- Course work (understanding material, homework, exams)
- TA responsibilities (2 terms; 10-15 hours/week)
- Seminars: Colloquia, Graduate Student Seminar, Research Seminars (2 - 4 hours/week)
- Qual preparation

As you can see, in terms when you are TAing or beginning to prepare for a qual, the time available for course work is diminished, so careful planning is required. As a first-year student, the only hard deadline you face is successful completion of your first qual by the second week of the summer term after matriculation, though a reading of the section on quals will suggest a much earlier target date. If you're thinking it will be difficult to make the deadline for your first qual, you need to be talking to lots of people to help you reprioritize.

Remember: Your instructors are here to help you; see them in office hours to resolve issues with lectures as well as homework problems. The Graduate Advisor, the Graduate Representative and GPC are here to help you with broader issues; talk to them. While your fellow graduate students can be supportive and this support also can be instrumental to your success, they are not the ones who are assessing your progress in the program, so make a point to talk to the faculty associated to the graduate program.

1.2 Year 2

It is now summer; the snow has finally melted, the mud hardened, and the black flies are finally losing ground against the Red Cross in soliciting blood donations. It's crunch time in the graduate program.

In terms of courses, you have 114 in the summer and 124 in the fall. You need both of these for your topology qual. Hmm, let's review (you did read the section on quals in your first year, right?) the deadlines again:

- First qual: by the second week of summer term
- Second qual: by the second week of fall term
- Third qual: by the second week of winter term
- Fourth qual: by the fifth week of spring term

Where are you? If you followed the recommended first year advice, you should have passed your first qual last spring, and are preparing to take your second qual early in the summer term. If you haven't followed that advice, you are now up against your deadline for the first qual. Hopefully you have done all the things suggested in the section on qualifying exams, like getting your committee approved, meeting with them to discuss problems, taking prequals if needed, and are just doing some last minute fine-tuning in preparation for this first qual. Naturally, it would be wise to try to get the second one out of the way this summer since fall terms always seem busy.

You should take some time to reread the section on qualifying exams at this point, but one important issue to consider is that the timing of third and fourth quals takes advanced planning. If you have not seen the material in 114 and/or 124 before, taking topology as your third qual will be difficult since you will have completed the requisite courses only weeks before the deadline for the third qual, so instead, you have taken courses which have prepared you to take your fourth area as your third qual, intending to take the topology qual as your fourth.

You have a great deal more flexibility in your choice of courses, though you should strive to take at least one classroom course each term, supplemented by up to two reading courses (127 and 137 as a second course), which can be used as a mechanism for structured and supervised preparation for your remaining quals and for investigation of your fourth area. Reading courses not only expose you to new areas of mathematics for enrichment and as potential areas of research, but also allow you one-on-one time with potential advisors.

Indeed, even the first year is not too soon to be thinking about potential advisors and research areas. Perhaps your courses are helping you find areas of interest and faculty in those areas with whom you would like to work. Perhaps you should broaden your attendance at research seminars both in areas of interest and in areas of potential interest. Finding an advisor is a two-way street; your advisor is going to want to have some sense that you are interested, motivated, and hopefully would be a good fit with whom to work. You also will need a secondary advisor; he or she need not be in the same research area (though often is), but should be someone who you want to be a part of your annual meetings with your advisor, and can understand expectations between you and your advisor. The secondary advisor will also be a natural choice to ask for a letter of recommendation when applying for jobs.

It is probably a good idea to talk early to potential advisors even with basic questions such as "Do they plan to take on new students?" or "How many students will they take on at

a given time?" You may want to make them aware they are on your short list of potential advisors should your own interests continue to develop. Maybe this interaction alone will spawn suggestions for reading courses.

TAing should be old hat by now, though you may be mentoring a first-year graduate student in the role, and don't forget to register for Math 107 (as a fourth course) in the second term you tutor.

Time management skills are crucial this year, but when you can spare a few moments, now might be a good time to do a light reading of Mark Tomforde's guide (`http://www.math.dartmouth.edu/gr` which offers a great deal of insight into the entire process of choosing an advisor, successfully writing your thesis, and thoughts for how to sustain a research program.

By the end of spring term, you need to have passed four quals at the Ph.D. level (actually by the end of the fifth week), and received at least two thesis-ready passes. You then need to obtain the advisor approval form and get your advisor and secondary advisor to sign it. Once returned to Stephanie, you should be in good shape for advancement to candidacy.

1.3 Year 3

It's summer again; maybe this year the snow hasn't yet melted or the black flies have reportedly carried off unwary first-year students lounging on the lawn, but you have advanced to candidacy, and for a brief moment all is right with the world. You have passed one of the two major hurdles in your quest for a Ph.D. Now the only hard task remaining (grin) is to write an acceptable thesis.

First up; the teaching seminar. Assuming you have successfully advanced to candidacy, you are eligible (and required) to take the teaching seminar. Formally you register for both 147 and 148, and a third course (156 or 157) as appropriate. In recent offerings, the seminar has been condensed to an intensive course lasting six out of the ten weeks of summer term. While the teaching seminar will keep you quite busy, most advisors (you will have an advisor before advancing to candidacy) will still expect some degree of interaction with you during this period.

The teaching seminar is a highly visible centerpiece to our graduate program which distinguishes our program from the vast majority. It is taken seriously by the department, and hopefully by you as well. As with many things in life, its value will increase as you begin to teach courses on your own and grapple with the dynamics in the classroom while trying to carry out your plans.

You will have two teaching opportunities as part of the graduate program, one in each of your third and fourth years, and a flexible fifth-year teaching experience described below. As with all temporary and junior faculty in the department, you will have a course supervisor for each course you teach, with whom you must discuss and obtain agreement on your choice of textbook, syllabus, and grading scheme. In addition, you must show your course supervisor drafts of all exams (prior to them being given), and consult with him or her about the

assignment and distribution of final grades. Hopefully you will also take advantage of your supervisor's experience to engage in broader discussions should unexpected issues arise with the class. Beyond the formal oversight by the course supervisor, you will also have a teaching mentor whose job is to advise and assist you as an instructor regarding both teaching and development as a teacher. For students teaching their first course, the teaching mentor will at a minimum review the first week's worth of lesson plans and visit at least three classes throughout the term. Classroom visits will be preceded by a review and discussion of the objectives and lesson plan for the day and followed by a discussion of how the class went. The teaching mentor may also (if they and the course supervisor wish) replace the course supervisor in reviewing drafts of syllabi, exams and so forth. You should also make a point to ask the Teaching Evaluation Committee to visit your class (optimally in the second week), both for feedback for you, and to write a formal review which can be used for part of a teaching letter when you apply for jobs.

While the teaching seminar and your first teaching assignment seem like they fill a large part of your third year, it is important to remember that the most significant requirement separating you from a Ph.D. is your thesis. You should meet at least weekly with your advisor. You will no doubt be doing a lot of reading and it is important to discuss it and gain your advisor's insight on what you read. Your primary goal is to get a problem, assimilate the tools necessary to begin to chip away at it, and to start that work as soon as you can. You may also want to have discussions with your advisor about what kinds of jobs you are interested in — especially if you are not that excited about an academic career — and what you can do to strengthen your background and future job applications. Your advisor may suggest different strategies if you are interested in industry, post-doctoral positions, or a tenure-track teaching position. For starters, you might consider DCAL workshops `http://www.dartmouth.edu/~dcal/`, specialized conferences to attend or speak at, and various fifth-year teaching options.

Remember, that in years 3 - 5, you are required to take three classroom courses per year, and no, neither teaching your own course nor the teaching seminar counts as one of them. This is a time for enhancing your mathematical background. The broader your background, the more opportunity you will have for seeing connections between different areas of mathematics. And let's face it, someday you may have to teach a version of the course you are taking; it is very nice to have a detailed set of notes to serve as a starting point.

In late summer or early fall, you have your first annual meeting with your advisor and secondary advisor. You write up a statement indicating your current plans, and what you have done. The three of you discuss the document and your advisor offers his or her perspective on how you are coming and perhaps his or her expectations. A summary is produced, which is included in your file and forwarded to the GPC for the general department discussion of graduate students' progress and continuation of their funding.

Your first teaching experience will take a lot of your time, but research will take a great deal more. Your (minimal) goal should be to have your results completely in hand by the end of the summer going into your fifth year. This way your letter writers have real content to talk

about in describing your potential as a researcher.

You should be attending research seminars and beginning to speak in them. If you haven't obtained a working knowledge of LaTeX, now is a good time. You can hone your skills by typing up small snippets which will eventually form pieces of your thesis. When time for writing up the thesis finally comes, you can get a template for your thesis from older graduate students. This template conforms to current rules from the graduate office concerning format.

1.4 Year 4

It's summer again. Your advisor is pushing you; you don't sleep at night; you can't feel the black flies bite anymore. This is the most important year of your graduate career. This is the year when you make significant strides towards the resolution of your thesis problem(s).

You are meeting regularly with your advisor, telling him or her each week what successes you have had, or approaches you have tried, but which failed. You discuss your progress, bandy about new ideas and approaches, and leave each meeting ready to go at it again.

Once again in late summer or early fall, you need to arrange a meeting with your thesis and secondary advisor. As before, you prepare a document indicating your progress and plans, and where you feel you are in the process. The three of you discuss your progress, express expectations, and once again you write a summary which is included in your file and forwarded to the GPC for the general department discussion of graduate students' progress and continuation of their funding.

Somewhere along the line, you will probably feel some mild frustration. This is a great time to get that language requirement out of the way. The deadline is the end of winter term, but the goal is to enable you to read source materials in your research field while you are actively working on your thesis problem. Get this out of the way!

Going to seminars, giving a few talks, maybe going to some relevant conferences (where you can talk about your work in progress, meet some other people in the field, and renew your enthusiasm for research) are all worthwhile activities.

You will teach your second course for the department. In spring, your advisor will forward an assessment of your progress to the department for consideration of fifth-year funding. Students who have been making reasonable progress are funded.

You need to think about your fifth year teaching experience which might start as early as summer term! You need to make a proposal, get a faculty sponsor who can oversee it, have them approve it and submit the proposal to the GPC for final approval. See the section of fifth year teaching for options and ideas.

If you have not yet established a personal web page on the math server, now is the time to do so. You have a budding professional image which you need to advertise. You have taught one or two courses; you have a research topic and advisor; you may have some publications. Keep this site reasonably professional; you want prospective employers to look at it, and you

want Google to return a link to this page with a higher priority than your latest YouTube video.

1.5 Year 5

It's summer again. A glimmer of light impacts your eyes blood-shot from long days and nights of working on your thesis; progress has been made. You have some results. Maybe you are starting to write things up; maybe you still have some hard pushing yet to do, but there is that glimmer of light.

You schedule your final official joint meeting with advisor and secondary advisor in late summer or early fall and get a serious assessment of your progress towards finishing in the spring.

You need to start thinking about jobs, cover letters, teaching statements, research statements, interviews. You should draft these documents when you need a break from your thesis and show them to faculty who can critique them. You have thought about your thesis committee; after all, probably many of them are writing letters of recommendation for you. You need a committee member from outside of Dartmouth; consult the graduate office for current rules, and consult your advisor. You did ask people to write letters for you? You have reminded them? You have verified that copies exist in Stephanie's folder?

Fifth year teaching experience is under control.

You did pass that language exam, right?

Note: It is now department policy, that no student may even schedule their thesis defense until all other requirements for the Ph.D. have been satisfied.

You have submitted an abstract for the joint meetings, and perhaps have filled out the forms for the employment register. Your cover letters for jobs did say you would be at the meetings and happy to meet with interested parties, right?

You are now TEXing your thesis (actually you have been all along), and your advisor is vetting it. You are filling in the gaps that have recently been found. You have scheduled your thesis defense when everyone can come. You will provide a final draft of your thesis to all committee members no later than three weeks before your scheduled defense.

Oh, and remember to breathe.

1.6 Timeline Summary

Year 1	Year 2	Year 3+
Late Summer • Settle in; get your keys and an ID • Meet with graduate advisor and graduate representative; make choices for fall and plans for subsequent terms	**Summer** • Meet with graduate advisor; review course plans • Revisit qual plans: **Deadline for having passed first qual** is the end of the second week of term.	**Summer** • **Year 3:** Teaching Seminar and advisor meetings • **Year 4:** Regular meetings with your advisor • **Year 5:** Crunch time for thesis. You need results if you want people to write for you; Personal web page; Start planning your teaching and research statements for jobs.
Fall Meet with graduate advisor and representative • Zeroth year status discussions • Course plans and revisions • Topics Courses and Seminars • Fourth area of specialization	**Fall** • Meet with graduate advisor; review course plans • Revisit qual plans: **Deadline for having passed second qual** is the end of the second week of term. • Seminars, potential thesis advisors	**Fall** • **Years 3,4,5:** Annual meeting with advisor and secondary advisor • **Years 3,4,5:** Attending research seminars and giving talks • **Year 5:** Job applications: teaching and research statements written and vetted; cover letters; AMS Winter meetings (submit abstract for talk); Start thinking about thesis committees
Winter • Meet with graduate advisor; make or review course plans • Fourth area? Topics courses? Seminars? • Register for Math 107 if you tutored fall and winter • Thinking about your first qual yet?	**Winter** • Meet with graduate advisor; review course plans • Revisit qual plans: **Deadline for having passed third qual** is the end of the second week of term. • Seminars, potential thesis advisors • Register for Math 107 if you tutored fall and winter	**Winter** • **Years 3,4,5:** Attending research seminars and giving talks • **Year 4:** Deadline for language exam
Spring • Meet with graduate advisor; make or review course plans • Fourth area? Topics courses? Seminars? • Register for Math 107 if you haven't yet this year • Goal for first qual this term; planning for second qual	**Spring** • Meet with graduate advisor; review course plans • Revisit qual plans: **Deadline for having passed fourth qual** is the end of the fifth week of term. • Register for Math 107 if you haven't yet this year • Form signed by advisor and secondary advisor given to Stephanie	**Spring** • **Years 3,4,5:** Attending research seminars and giving talks • **Year 4:** Find faculty sponsor and submit proposal to GPC for fifth year teaching experience. • **Year 5:** Thesis defense. You may not schedule it until all other degree requirements are complete. Corrected thesis submitted on time and in proper format.

2 Advising and Advisors

2.1 The first two years

There is no shortage of people to whom to turn to receive good advice on all aspects of your graduate career, and advice targeted towards students prior to advancement to candidacy is particularly abundant and focused. There are various committees which interact with the graduate program and whose membership changes from year to year. Membership of all committees can be found on the department website via the Department Documents page: `https://www.math.dartmouth.edu/intranet/dept_docs/`

- **Graduate Program Committee (GPC)** [GPC Chair: Groszek in 12-13] An advisor in the broad sense, the GPC is the one place all graduate students should turn for questions on policy. In particular, if you have a question about whether an action or inaction on your part will have repercussions for your graduate career, the Graduate Program Committee (GPC) is the definitive source for answers.

  The GPC formulates policy, which is considered, modified, and then approved by the department, and the GPC then carries out that policy. The GPC controls your stipend, grants (or not) extensions to deadlines, and sets the terms for you to regain normal status should you have problems meeting stated requirements and deadlines.

- **Advisor to Graduate Students:** [Barnett(X,S), Winkler(F,W) in 12-13] The departmental advisor to graduate students monitors all precandidacy students. Students meet at least once per term with this advisor to discuss course planning, progress in courses and towards certification, as well as perhaps zeroth year status considerations. The graduate advisor frequently brings potential policy issues to the GPC, but as a student you are always welcome to bring issues to the GPC.

- **Individual Advisors:** Starting with Fall 2009, each entering student is assigned an individual faculty advisor who will supplement the oversight of the departmental advisor to graduate students. The individual advisor will meet minimally once or twice per quarter with his or her assigned student(s), and of course as often as the student requests. You can talk with your advisor about any problems or questions you may be having, in class or out of it. Your advisor can not only give you advice and encouragement, but help find resources to help you with any difficulty. Perceived or potential problems can then trigger information being passed both to the advisor to graduate students and to the department's Graduate Program Committee (GPC) who have a broader view of the graduate student population.

- **Graduate Representative:** [Gordon in 12-13] In terms of advising, the Graduate Representative serves as a backup to the graduate advisor, though he or she is the official department liaison with the Graduate office and is responsible for a broad collection of tasks from TA assignments to oversight of stipend and grant support for

students. The graduate representative is also the person to talk to about funding to support travel to conferences.

- **Qualifying Exam Committees:** A student preparing for certification must have their qual committees approved by the advisor to graduate students (well) in advance of each exam. The student is advised by their chosen certification committees concerning preparation for the qual (for details, see the section on quals). The student brings certification forms to the qual (obtained from the graduate program administrator) and at the end of the exam, each faculty member fills out the form describing the student's achievement in that area. These forms are then returned to the graduate program administrator who will enter the relevant information into the department database for tracking progress towards candidacy.

Sometime early in the fall of the first year, the student will meet with the advisor to graduate students and their individual advisor to discuss plans for the first year and beyond. The idea is to set up a course of action (which will be modified as necessary) which looks forward through the first two years. Courses, including qual courses, topics courses, and reading courses, will be considered and a timetable discussed which will consider the dovetailing of qual deadlines and available courses. In particular (see the section on quals for details), the coordination of course work supporting the third and fourth quals requires some advanced planning. The student will summarize this plan in writing, which will be signed by the student and the graduate advisor and filed with the Graduate Program Administrative Assistant, Stephanie Kvam. It should be revisited each term, and updated as necessary.

The Advisor to Graduate Students and the Graduate Program Representative as well as the departmentally assigned individual advisor remain available to graduate students throughout their time at Dartmouth, for consultation and advice. Of course, as part of the process of advancing to candidacy the student will choose both a primary and secondary advisor whose efforts will largely supplant those of the departmental advisors after advancement to candidacy.

2.2 The years following advancement to candidacy

As part of the process of advancement to candidacy, a student must choose not only a thesis advisor, but a secondary advisor as well. Generally, the secondary advisor will be a member of the student's formal dissertation committee, though this is not required. What is important is that the student feels comfortable talking to this advisor as a principal role for them is to act as an intermediary should there be some confusion concerning expectations of either student or thesis advisor.

The student should meet with their thesis and secondary advisors regularly (but not less than once per year) to discuss their plans and progress. Each fall term, there must be a meeting after which the student will write a report summarizing the meeting, which will be

signed by the student and both advisors and filed with the Graduate Program Administrative Assistant. The thrust of this meeting is to provide an expression by advisor and student of where each believes the student is on the road to completing a thesis. It is generally useful for the student to prepare a written summary of their work to date and their plans for the future prior to this meeting.

It is clear that each subsequent meeting is increasingly important: the third year meeting will probably present a broad road map; the fourth year meeting should reflect work underway with clear focus; and the fifth year should hopefully reflect end-game strategy.

Any unresolved disagreements or conflicts of opinion concerning academic expectations that arise within an advising committee should be referred informally to the Advisor to Graduate Students, the Graduate Program Representative, or the Department Chair. If a resolution cannot be reached via informal channels, contacting the Graduate Program Committee would be the next step. For other serious problems, there are formal grievance procedures discussed later in this document.

3 Qualifying Exams

Taking the large view, there really are only two major tasks to accomplish in graduate school: advancing to candidacy, and writing an acceptable dissertation. While the second is the more formidable, it is the first that seems to preoccupy the minds of most graduate students, and the largest component of the first task is passing your qualifying exams.

You have two years in which to acquire a knowledge of and facility with core tools in each of four areas of mathematics. That period of time often is stressful and interlaced with periods of introspection. An academic career can be an extraordinarily rewarding one, but it is certainly a highly demanding one, and it is important to assess your commitment to the profession as you start the five-year journey to a Ph.D. This introspection will either help in your resolve to succeed in the qual process, or in a few cases help you reprioritize your goals in life.

The good news is that everyone who has advanced to candidacy has passed their quals, and most who start the program do so. Most probably look back on the process with a bit of wonderment as to what all the fuss was about, albeit cognizant that it was not a trivial journey.

- **What courses should I take?** As stated in numerous published sources (e.g., the ORC), students must take at least 8 courses of graduate quality to qualify for a masters degree. Additionally, they must register for (and successfully complete) three courses per term in order to be considered a full time student (and hence receive a stipend). Before advancing to candidacy students are expected to have taken the following courses: in algebra (81, 101, 111); in analysis (73, 103, 113); in topology (74, 114, 124) as well as three or more topics courses of choice. A typical schedule would be

– Year 1: Fall: 101, 103, X; Winter: 81, 113, X; Spring: 73, (74 or X), 111;
– Year 2: Summer: 114, X, Y; Fall: 124, X, Y

N.B. Math 74 (Topics in Topology) is required, but currently only offered officially on a biannual basis. In the off years, students should pick up these topics through a reading course, or the material may be available via a fifth-year teaching experience from a graduate student working in topology. As a fourth course, every student in their first two years needs to register for one offering of Math 107 (supervised tutoring) in the second term that they tutor that year.

In each case X or Y can be another classroom graduate course covering a topic outside of the three core areas of algebra, analysis, and topology, or can be a supervised reading course (127) in which the student pursues a topic to advance their progress toward certification in four areas of mathematics. In the event that two reading courses are needed to fill the course load, 127 and 137 should be selected. Note they are both essentially the same course with distinct numbers to make it clear to the Registrar's office that two different courses are being taken. In the first three terms, students should strive to take at least two classroom courses per term even if they have been exempted (by the advisor to graduate students) from some of the standard courses listed above.

- **What about the timing of exams?** The formal deadlines for passing (that is not to say taking) qualifying exams are listed further below, but for simplicity they are early in each of the summer, fall, winter, and spring terms of your second year. Your job is to stay on pace for a successful completion of all four quals within those dates, and this takes some foresight and planning.

  It is the general consensus of the faculty that after all relevant course material has been taken, it should be only a matter of weeks, not months before you are ready to take the corresponding exam. This means the target date for the analysis exam should be no later than the first half of spring term (first year), and that for the algebra exam no later than the first half of the summer term. Note that this puts you one qual ahead of schedule and is a good strategy in case difficulties arise later. The timing of the third and fourth quals are a bit more variable, topology requiring 124 which students (typically) will have completed only weeks before the third qual deadline.

  So the remaining quals are a bit of a balancing act. If you have taken 124 earlier than the fall, you are clearly good to go with topology third. If not, you should plan (in your first year) to take courses supporting your fourth area so that the fourth-area exam is appropriate to take as your third qual.

- **How should I prepare for a qual?** What do you need to do to get ready for a qual in X or Y? If you think the GPC or the advisor to graduate students knows, you're wrong. It's your job to find out. This process begins — well before you plan to take the exam — by choosing a committee, getting it approved by the advisor to graduate students, and then confirming a syllabus with that committee. All qualifying exam

syllabi are supposed to be reviewed every five years and updated as necessary. This means the syllabus a fellow graduate student gave you may be out of date. Confirm the syllabus with your committee. Even with the topics fixed, faculty expectations of how you demonstrate mastery of them can vary substantially. You should do this as a first step towards starting your review for each qual.

All faculty have been asked to put sample problems on the web for you to try. The sample problems are neither intended to be a comprehensive list, nor are they intended as a study guide, but more as a means to assess your preparedness. It is certainly the case that working through these problems and asking to present selected solutions to your committee is an excellent way for you to get accurate feedback on your level of preparation. Some faculty now insist on prequals. Who? Well if you already have set your committee, you should know. Of course if you are in the mood for avoidance, ask around. For one examiner, the prequal in algebra consists of presenting correct solutions to two problems chosen at random from the posted practice problems. Since you are free to ask about solutions to any problem in advance of the prequal, and expected to review all these questions in advance of a qual, the prequal should not present much of an obstacle, but often does.

Graduate students seem fond of the "unofficial qual book" which contains the remnants of students' memories of quals. This can be the source of additional review material, but caution is required. For example, questions are often misremembered by students, making them false or impossible. Other times they can afford an incorrect impression about the types of questions that are typically asked in a qual. A common example is a series of questions which seems to be getting easier. This is actually an indication that the student was in trouble in the exam and the examiners were back-pedaling to find some aspect of the original question the student could answer; it is not an indication of what the expectation of the examiners was, which no doubt is more accurately assessed by looking at the first question in the series.

- **How should I plan for deadlines?** Too often students think of the qual deadlines as the date by which an exam must be attempted, not as the department views the date, one by which the exam must be passed. Aside from the misperception above, there are many ways and reasons to fail meet deadlines. A failed prequal imposes a two-week waiting period before the next prequal. A failed qual imposes a six-week waiting period before the next attempt at the qual. A student planning ahead should plan to take a qual in sufficient time so that a setback will not cause them to fail to meet the department deadlines.

  Of course even if you anticipate deadlines effectively, it could be that you find yourself up against them. Most of these deadlines are just two weeks into a new term, so there is an expectation that most students will use a good deal of the time between terms to fine-tune any last minute preparations for quals. To reiterate, this is an expectation, which is to say that graduate school is not based upon the same model as undergraduate school. As an undergraduate, you are effectively free of academic responsibility from

the moment you finish your finals to the moment classes begin for the next term. As a graduate student, this is no longer the case, and frankly the time between terms is often when people get a great deal of work done. To add some official perspective, the Associate Dean for the Sciences recently addressed this matter directly. His statement was quite blunt: Students on Dartmouth Fellowships have a twelve-month contract, and receive a total of four weeks vacation during the year. That is, four weeks per year (outside of staff holidays, e.g., Christmas, New Years) that you are not doing your job. For students in a lab, that means four weeks away from the lab. For mathematics graduate students, there is more flexibility in where your mathematics is done, but not in how much time is devoted to it.

- **What if I fail to meet a deadline?** So you think you are going to miss a deadline. What should you do? How will the GPC react? Is your stipend in jeopardy?

  Let's start with the issue that is dearest to your heart, your stipend. You receive a (12 month) Dartmouth Fellowship (or equivalent grant) which is reconsidered for renewal each year. It is a performance contract, and if you fail to perform satisfactorily, it can be suspended at any time or terminated completely coincident with your separation from the program. A hundred or more students apply each year for this program, and only a handful are admitted. The awarding of fellowships is a competitive process and failure to maintain the expected standards of performance is always grounds for reconsideration of support. Moreover, most of the graduate student support for our department comes from College money, and in supporting our program, there is the continual need for the department to demonstrate the value of the graduate program, and so justify continued financial support. That justification is typically measured by how successful we are in producing Ph.D.s who will add to the profession as a whole. Supporting a student unlikely to finish is not in the best interest of the student nor in the best interest of the program.

  In the first two years, what keeps you in the good graces of the department? Obviously passing your courses and your quals in a timely fashion is a very good start. If things go awry, much hinges on when and how they go awry. As stated earlier, there is enough slack in the early qual deadlines that it is perfectly reasonable to complete each of your first two quals one term ahead of schedule. Doing this buys you some currency and credibility with the GPC should problems arise with subsequent quals.

  Failure to make the first deadline means you have taken all the requisite courses for at least two quals (analysis and algebra), yet have not passed either one. This is not a good start. Can there be extenuating circumstances? Sometimes, but there are not necessarily any rules for what will be acceptable. Clearly a significant concern of the GPC is how a delay so early in the process will be compounded, and whether there is any realistic hope the student can catch up. With missed deadlines early in the game, there is no evidence to offer which suggests that catching up is likely if at all possible, so the reasons extended to the GPC as well as a plan of remediation must be detailed as well as reasonable. The following is a minimal list of questions to which the GPC

would want detailed responses to support any petition for an extension of deadline.

1. What circumstances led to this request? Why are you unable to meet the current deadline?
2. When did you officially form your committee for this qual (i.e., provide a copy of the signed approval form)? How often have you met with the committee members in preparation for this qual? Are either or both of the members willing to support your petition for an extension?
3. Have you attempted a prequal (if required) or the qual yet? What is the current assessment of the committee? If not, how much of the required syllabus have you mastered, and does your committee agree with your assessment? Where are the filled-out qual forms if the qual was attempted?
4. Granting an extension (or further extension) will place increased time pressure on your subsequent quals. Can you give a plan of action which allows you to complete these on time? Be sure to identify those factors that delayed your earlier qual(s), and explain how they will be mitigated in the future.

- **What are the consequences of obtaining an extension?** Almost certainly most first-time petitions for an extension of deadline will be granted by the GPC, but there will always be conditions attached to the approval. Precisely what the conditions are depends highly upon the conditions going in. Some examples:

  – A student receives a NC or (cumulatively) two low passes in previous terms. This status is known to the graduate office and automatically places the student on probation by the graduate office. As a consequence, the department must be able to provide concrete evidence that the student has made significant progress towards remediating these deficiencies. For the department's part, this means passing the late qual by the extended deadline and getting back on schedule for your other quals. Failure to do this could easily result in a suspension of stipend and new conditions and deadlines to avoid separation from the program.

  – A student is progressing normally by passing standard courses with acceptable grades, and realizes they will not meet the deadline for their first or second qual. There is a large spectrum of responses one could receive from the GPC.

    Suppose the student has been making good progress towards taking the qual: for example as evidenced by the committee being established well in advance, and the student has been meeting with them so that an appraisal can me made; or that scheduling conflicts among the committee members precludes the exam from taking place before the deadline. Then one can expect the extension to be granted with at most a mild admonishment to get back on track, but without serious concern for the student's standing in the program.

    On the other hand, if the qual committee has not been (or was only recently) formed, or if there is no assessment aside from the student's assurance that they

are working hard, the GPC will likely be quite firm in their response. It is likely the GPC will issue a warning that this pattern of performance places the student's standing in the program in jeopardy, and failure to meet the extended deadline could result in a suspension of stipend until such a time that the student has resolved any delinquent issues.

- **What if I fail a qual?** The first thing that happens is that a six-week waiting period is invoked before you may attempt the qual again. This policy was established by the department to ensure that students take sufficient time to review deficiencies and to encourage students to be well-prepared for a qual. Will the six-week waiting period push you past the deadline? If so, you will need to petition the GPC for an extension documenting your good progress to date (see above).

- **Are there alternative formats for quals or for retaking failed quals?**

  The typical mechanism for assessing a student's knowledge of and facility with material on qualifying exam syllabi is through an oral exam. This format is both flexible and supportive, despite the trepidation that students often feel. In particular, it affords the opportunity for the examiners to intervene with hints or by recasting the problem when a student is stuck; obviously this flexibility is lost in a written exam.

  However, there are alternatives which often can be worked out among the student and the committee members. Sometimes an entire exam needs to be retaken; sometimes examiners are content with parts of the exam and want only to reexamine a subset. This subsequent exam may be oral, written, or in the case of attempting to gain a "thesis-ready" pass (for a student who already has a PhD pass), may be evidenced by activities such as assimilating the results of a research paper and presenting the results in a (series of) seminar talk(s).

  As an example suppose that the student displays a thorough understanding of algebraic topology, but can't distinguish an exhaust manifold from a differentiable one. In this case the student has failed the qual — and the committee members should submit forms to that effect, noting their assessment — but the student may only be reexamined on the differential topology after the mandatory six-week waiting period. A petition to the GPC may need to be filed if the delay pushes you beyond your deadline.

  On the other hand, suppose the student appears well prepared, but suffers a panic attack and the qual grinds to a halt. The examiners may choose to "suspend" the exam for a period of days or a week, until confidence is restored and the committee members have another opening in their schedules. Again the GPC may need to be informed.

- **Can I change my qual committee?** The answer is generally yes, but not always. Certainly if you have not yet taken a qual or failed a qual and will be retaking it in its entirety, you may change your existing committee for a new one, assuming approval by the advisor to graduate students. You should of course reconfirm the syllabus and

the new committee's expectations, and out of courtesy inform your old committee of the change.

From the other perspective, some faculty may refuse to continue to be on your committee. For example, if you have failed twice, some faculty will recuse themselves to avoid any appearance of bias.

The place in which a change of committee is clearly not allowed is if you have attempted a qual, and the committee members are content with topics X, Y, but require reexamination of W, Z. You must finish with the existing committee for an examination of W, Z, unless of course you wish to start from scratch with an exam on all topics.

- **How do quals affect my participation in the teaching seminar?** Students who have advanced to candidacy take the teaching seminar during the summer between their second and third year; students who have not advanced to candidacy do not. Students who have not passed their quals by the deadlines certainly have not advanced to candidacy.

  Someone not advanced to candidacy by the end of the second year is in jeopardy, and has had no doubt been issued a letter from the GPC indicating conditions (if any) under which they may resolve any outstanding deficiencies. Presuming those conditions are met, the student will tutor in the third year of graduate study and take the teaching seminar the following summer.

4 TA Responsibilities

See the document
`http://www.math.dartmouth.edu/graduate-students/dept_docs/TAresources.pdf`.

5 Course Grades

Graduate students receive two grades in courses in which they are enrolled. There are the formal grades turned into the Registrar consisting of HP, P, LP, NC. A grade of P (pass) is a standard grade; many instructors rarely use HP (high pass) as there is no notion of a GPA for graduate courses, and it is your certification process and thesis which carry the significant weight. On the other hand, grades of LP (low pass) and NC (no credit) are taken very seriously by the Graduate Office. Two LPs (cumulatively) or one NC automatically places the student on probation and under scrutiny by the Dean of Graduate Studies, and this means that there must be significant measurable positive progress in the next term to be removed from probation. Failure to do so jeopardizes your receipt of a stipend.

The second grade is an internal grade for the department and is given only for first and second year courses that are immediately related to the qualification exams. This grading system is

distinct from the College grading system as it measures progress toward certification rather than performance in the course. These grades are destroyed after the student advances to candidacy or leaves the program. The Grading Scheme:

Grade	Meaning
5	Comprehension of all material at qualification level
4	Comprehension of some material at qualification level
3	Moderate comprehension of material, but short of qualification level
2	Minimal comprehension of material
1	No comprehension of material

More precisely, faculty will only give a 5 in a course if they would recommend that a qualification exam committee consider waiving the portion of the exam covered in the course for that student (This is not to say that such a portion will be automatically waived, but is a signifier of the weight of a 5 in a course). More refined grades are, of course, possible. For example, a grade of 5- would indicate solid comprehension of all material but where the comprehension in some areas is not quite at the level where a qualification waiver is recommended.

6 Seminars, Colloquia

There are numerous seminars in the department supplemented by weekly colloquia and special lectures series at various times in the year. The obvious starting point for learning about them is the activities link on the department web page. There you will see links to the aforementioned items.

All graduate students should attend the graduate student seminar. This seminar consists of talks by graduate students for graduate students; faculty are not in attendance. Oh, there is also free food.

You should get in the habit of attending colloquia. When you are a newbie, sit in the back and bring something to work on for when you get lost. Sometimes you will get lost in the first ten seconds, sometimes the first ten minutes, sometimes not at all. As you learn more, it will (usually) take a longer time to get lost.

What's the point of coming if you get lost all the time? A very good question with at least three answers. The first is that mathematics is about making connections, and really interesting mathematics comes from making connections among ideas that appear quite disparate. All of a sudden in a colloquium (which are supposed to be aimed at a "general" audience) you find the speaker talking about something which you have seen in a very different context. Following that connection often leads to an interesting research problem.

Second, you will be giving many talks in your life (seminar talks, thesis defense, job interview talks), and attending colloquia allows you to form strong opinions about what constitutes a good or bad talk. And last, but not least, is that these speakers have been invited by someone in the department to speak to us. Common courtesy suggests the hosts show up! A good turn out reflects well on how the department is viewed by the outside which can have all manner of positive effects.

Research seminars are often more specialized, but equally often will have periods in which talks intended to introduce a more general audience to aspects of the field are given. Usually the web pages for these seminars gives information about the subject. Find out who the speaker is and see if they think you will understand. If you are not sure on what area you would like to work in, a seminar can be an excellent vehicle to observe not only the types of problems people in the department like to work on, but also the personalities of prospective advisors.

7 Topics/Reading Courses

Both topics courses and reading courses are vehicles for acquiring knowledge outside the standard required courses. Topics courses are offered in areas such as applied mathematics, combinatorics, geometry, logic, number theory, probability as well as advanced courses in algebra, analysis and topology. The topics offered vary from year to year, and to an extent support areas with large numbers of graduate students, but students can make recommendations to the chair, the graduate advisor or representative suggesting topics of interest to a core of students. Also note that upper level undergraduate courses are often suitable courses for graduate students; for example, some can help with qual preparation in fourth areas.

Reading courses are usually more tailored to specific needs and always have a faculty supervisor. A syllabus is jointly constructed by student and faculty, and a schedule meetings and expectations established. Often they are used to cover gaps in student knowledge for a qualifying exam, but they also can be used to explore a specialized topic of interest for which there is insufficient graduate student interest to warrant offering an official course.

8 Fifth-Year Teaching Requirements

Graduate students have a flexible fifth-year teaching experience which in recent years has been quite broad in scope. In some cases, a fifth-year graduate student will be asked by the chair to teach a course, but this can vary greatly from year to year, and typically is not the case. More often students will engage in one of a wide range of activities, some samples of which are listed below.

Fourth year students will certainly know by the spring term whether they will be teaching in their fifth year. If so, they need only register for Math 149 in the appropriate term. For

those not teaching, your fifth-year teaching experience requires a proposal, a faculty sponsor, and approval by the GPC. We expect this proposal to be a detailed plan (approximately one page) which indicates the details and depth of your involvement. It should represent at least as much time and effort as TAing a course in your first two years, at a more advanced mathematical and pedagogical level. You need the written endorsement (signature) from your sponsor that your proposal has their support and will add pedagogical value to their efforts.

Deadlines:
By the end of spring term of the fourth year, the student needs to submit to the GPC a short (one-line) indication of their tentative plan, with the agreement of the proposed faculty sponsor. This is not a commitment, just a demonstration that the student does have at least one option.

At least two weeks before the end of the term preceding the term in which the teaching experience is to take place, or the beginning of winter term of the fifth year, whichever is earlier, the detailed, endorsed proposal needs to be submitted to the GPC for consideration. This allows time for the GPC to review the proposal and ask for modifications, and time for the student to find another option if the proposal as a whole is rejected. (Note, this deadline precedes the earlier one for a student who proposes a summer term activity.)

Sample fifth-year projects:

- Teach a mini-course in the x-hours (or equivalent) of an upper-level (undergrad or grad) math class to enhance or complement the regular course material.
- Help to organize/run a pre-grad school summer workshop for Dartmouth and non-Dartmouth students planning to enter grad school. Teach short courses on fun topics or an introduction to qual-level material. (Possibly a very big project for several grad students with faculty involvement, maybe submit a grant for NSF funding.)
- Teach a portion of a regular faculty-taught course.
- Work on a high school outreach program.
- Conduct math education research.
- Be an active TA for a higher level math course. Assist with writing exams, guest lecture, etc.
- Develop a suite of computer demos to illustrate ideas in a course.
- Run tutorials on computer programming (e.g., Matlab) relevant to a course.
- Run problem sessions for grad courses.
- Grade for grad courses.
- Teach a class outside of Dartmouth.
- Take an active role in Putnam events and Math Club activities.
- Run a proof-writing workshop for math majors.
- Run an undergraduate seminar on a fun advanced topic.

9 Frequently Asked Questions

Please refer to the web page `http://www.math.dartmouth.edu/graduate-students/FAQ/`.

10 Appendices

10.1 Formal Departmental Degree Requirements

(`http://www.dartmouth.edu/~reg/courses/desc/math-req.html`, last verified July 2009)

REQUIREMENTS FOR THE MASTERS DEGREE (A.M.)

With rare exceptions, the A.M. in mathematics is offered only to those enrolled in the Ph.D. program. Normally the requirements for the A.M. must be fulfilled within two years after entering and enrolling as a graduate student in the Mathematics Department at Dartmouth. In addition to the general College requirements for the masters degree, the requirement is departmental certification in algebra, analysis, topology, and one other area.

Note (1): Continuation in the program for a second year is contingent on a review of a students work by the Mathematics Graduate Program Committee, the review to take place early in the spring term of the first year.

Note (2): The general College requirements referred to above are three terms in residence at Dartmouth and credit in eight courses of graduate quality; these courses may sometimes, up to a limit of four, be replaced by approved research or special study.

REQUIREMENTS FOR THE DOCTORS DEGREE (PH.D.)

The requirements for the Ph.D. degree in mathematics are as follows:

1. Departmental certification in algebra, analysis, topology, and one other area.*

2. Admission to Ph.D. candidacy by the departmental Graduate Program Committee as a result of its second review, which takes place at the end of the spring term of the second year of graduate study. This review will take account of all the relevant information that the Graduate Program Committee can gather, such as the students record in courses and seminars, the students performance during the certification process, and an estimate of the students ability to write an acceptable thesis.

3. Demonstration of a reading knowledge of a foreign language normally chosen from French, German, and Russian. The Graduate Program Committee will monitor students progress in its annual review.

4. Completion of a doctoral thesis of acceptable quality, and its defense in an oral examination.

5. Preparation for the teaching seminar through such activities as tutoring in the years before admission to candidacy, completion of the teaching seminar, and the opportunity to

teach twice in the three years following admission to candidacy. This requirement is met by receiving credit for Mathematics 107 once during each year preceding admission to candidacy, credit for Mathematics 147, and credit for Mathematics 149 once during each year following admission to candidacy. The Graduate Program Committee may approve substitutions subject to the minimum requirements: each student must earn credit for Mathematics 107 at least once, credit for Mathematics 147, and credit for Mathematics 149 at least twice.

* The syllabus for certification in each area is available from the Mathematics Department.

10.2 Departmental Amplification of Requirements

The following statements represent current department policy. While they do change from time to time based upon votes of the faculty, any exceptions to these policies must be explicitly approved by the GPC.

1. Every graduate student is required to register and complete three courses per term. Before advancing to candidacy, students are expected to take 73, 74, 81, 101, 103, 111, 113, 114, and 124 as well as 3 or more topics courses of their choice. In addition, each student should register for 107 during the second term of each year in which they serve as a teaching assistant. Upon advancing to candidacy, students are expected to take 147 in the summer term of their third year.

   Students who supplement standard coursework with reading courses (127, 137) must have a supervisor for each such course. Students using reading courses to aid in their preparation for a qualification exam are encouraged to pick one of their (potential) committee members as the reading course supervisor. While these are expectations for typical graduate students, the Advisor to Graduate Students may grant alternate course plans at his/her discretion (see below for information regarding advisor meetings). [Approved May 2008]

2. The department has syllabi on file for algebra, analysis, topology and various fourth areas of certification including combinatorics, differential geometry, logic and set theory, and number theory. A fourth area need not be one of these, but the Graduate Program Committee must pass on the suitability of a fourth area for which there is no syllabus and arrange to have a syllabus made. In the Spring term of 2008, the faculty passed the following motion:

   Any syllabus which has not been updated in the last 5 years should be updated by the relevant faculty and posted on the department website. Every syllabus should be revisited and updated (if necessary) at least every five years. If a particular qualification area allows or encourages students to collaboratively create a syllabus in consultation with a committee, this should be explicitly stated on the syllabus.

   Students looking at syllabi should be wary that faculty members in that area may be revising a syllabus at any time. Consequently, students should, at an early point in their

studies, form a committee and set a fixed syllabus for the qualification exam. A shared understanding of the syllabus requirements is essential to the successful completion of a qualification exam.

3. Advancement to Candidacy: On the basis of all available information, the Graduate Program Committee decides whether it is in the student's best interest and Dartmouth's best interest for a student to continue studying towards a Ph.D. degree at Dartmouth. The typical requirements for advancement to candidacy, in addition to certification in four areas, are certification by two examiners as being "thesis ready" in their area (the two examiners may be in the same area or in different areas), selection of a thesis advisor who has agreed to act as thesis supervisor, a secondary advisor, and the approval of the Graduate Program Committee. The primary and secondary thesis advisor must indicate their acceptance of the student by signing the advisor form obtained from and returned to Stephanie prior to GPC consideration.

4. Other languages, including but not limited to the native language of graduate students when this is not English, may be approved by the Graduate Program Committee for good professional or mathematical reasons. Students whose native language is not English may be required to take an ESL (English as a Second Language) course offered through the Graduate Studies Office.

   The deadline for passing the foreign language exam is the end of winter term of the fourth year.

5. The Graduate Office establishes requirements for the composition of a dissertation committee and for the presentation and submission of the thesis.

   No student may schedule their thesis defense until all other requirements for the degree have been satisfied.

6. Students prepare for the teaching seminar through activities such as tutoring in the years before admission to candidacy. Students receive credit for Math 107 for acceptable performance in two quarters of tutoring each year before admission to candidacy, Math 147 and Math 148 for passing the teaching course, and Math 149 for acceptable performance in one quarter of teaching each year after admission to candidacy. The Graduate Program Committee may occasionally approve substitution of other professional activities to meet tutoring or teaching requirements, subject to the proviso that each student must earn credit for Math 107 at least once, credit for Math 147, and credit for Math 149 at least twice.

10.3 Grievances

Here are departmental guidelines about what you should do if you have a grievance.

First of all, what is a grievance? You may have a grievance if you feel that you are being treated unfairly or inappropriately, whether by a faculty member, a fellow student, or anyone

else with whom you interact as a graduate student. These grievances can be anything from alleged violations of the terms of agreements and guidelines, to more subtle disputes about the fairness of an advisor's oversight, perceived issues of departmental favoritism, remuneration, joint publication, bias concerning gender, race, sexual orientation, et cetera, or concerns about personal conduct.

The first thing to do with a possible grievance is to try to solve it informally within, or with the help of, the department. Two important points about this are:

1. We will maintain your confidentiality to the utmost of our abilities.
2. If you try for an informal resolution and are not satisfied, you can then go on to formal procedures.

Here are the steps we suggest you follow:

1. Try to resolve the issue with the other person or people directly involved. If you can't do this, or it seems too risky to attempt it, then go on to the next step.
2. Consult your advisor, the Advisor to Graduate Students [Barnett(X,S), Winkler(F,W) in 12-13] or the Graduate Program Representative [Gordon in 12-13]. You should feel free to talk to any of these people with whom you feel comfortable and who you feel has enough distance from the problem to be an effective advisor. If this person can't help you reach an effective resolution, go on to the next step.
3. Talk to the Department Chair [Rockmore in 10-13] or to the Graduate Program Committee [GPC Chair: Groszek in 12-13]. The department chair or the GPC may be able to suggest some appropriate action by the department that will resolve the situation. This is still an informal resolution, and if you are still dissatisfied, it is time to take matters out of the department.
4. Talk to the Assistant Dean of Graduate Studies (Gary Hutchins.) He will try once again to help you reach an informal resolution, and if that fails, will be able to tell you what formal action to take. This may be to request a hearing from the Dean of Graduate Studies, to approach the Office of Institutional Diversity & Equity, or to follow some other formal procedure.

Addendum from the Office of Graduate Studies

If the Dean, working together with the aggrieved student and appropriate faculty member(s) or representatives of the mathematics graduate program, is unable to reach a satisfactory resolution, the student can request in writing a formal hearing and ruling by the Dean of Graduate Studies and the Committee on Student Grievances. Formal hearings are conducted as described in the Graduate Handbook (see sections titled "Committee on Student Grievances" and "Formal Hearing" under Academic and Conduct Regulations).

Please note that reports of scientific misconduct, violations of the academic honor principle, and certain issues of professional and personal conduct (sexual harassment, discrimination, and others described in the graduate handbook under code of conduct—non-academic regulations) are handled in the Graduate Office as described in the graduate handbook. Graduate students are encouraged to use the informal channels described in their program's grievance policy to discuss these issues, to clear up possible misunderstandings, to clarify potential grievances, and to decide whether further steps are necessary. A student who after such discussion feels there may be a violation or a grievance requiring some action should report this to the Graduate Office.