

Mathematics Department

Graduate Handbook 2016-2017

DEPARTMENT of MATHEMATICS, OREGON STATE UNIVERSITY
CORVALLIS OR 97331-4605

1 OVERVIEW

General information about Oregon State University is at <http://oregonstate.edu>.
Information about the Mathematics Department is at <http://www.math.oregonstate.edu>.
Mathematics graduate program information is <http://www.math.oregonstate.edu/graduate>.
Extensive information about Graduate School is at <http://gradschool.oregonstate.edu>.

2 INTRODUCTION

This Graduate Handbook summarizes the rules and processes that will govern the graduate career of students beginning their graduate studies with the Mathematics Department at Oregon State University during the 2016-17 academic year. Under normal circumstances, these rules and regulations will remain in effect until the graduate student leaves the program.

The first part of this document describes the academic graduate requirements, and applies to all graduate students in Mathematics. The second part contains information specific to graduate students who are supported. We start by defining certain key terms.

Graduate program: The notice of admission to the graduate program (Master's or PhD) in Mathematics comes from the Graduate School. A student in the program is in either the Master's or PhD program, or concurrently in both. Some students move from the Master's program to the PhD program, some add the Master's program to their PhD program, and some change from PhD program to the Master's program. or vice-versa.

Support – GTA, GRA, and other: Most but not all graduate students are employed as either graduate teaching assistants (GTAs), or graduate research assistants (GRAs), or they hold various Fellowships administered by the Department, College, Graduate School, or University. These students are referred below as “supported.” Appointments are typically annual, and are subject to renewal once a year, typically in Spring. Some students are not supported by any Oregon State University funds, and are referred to as “unsupported”, even though they may hold fellowships or scholarships awarded, e.g., by their own country. The status of “supported” and “unsupported” occasionally changes.

Exceptions and special circumstances: Occasionally, due to academic or personal circumstances, individual students require further interpretation, or request that an exception is made to the rules in this Handbook. Such requests are handled by formal petitions filed by the Graduate Committee. The Graduate Committee makes recommendations based on academic reasons, while the Department Head makes the decisions on GTA support based on the recommendation of Graduate Committee and other factors such as department needs and the student's teaching performance.

3 GRADUATE FACULTY AND GRADUATE COMMITTEE

Graduate faculty: The Graduate School maintains a list of all faculty at Oregon State University who are approved to serve as major professors, direct Master's and PhD degrees, serve on graduate committees, and serve as Graduate Council Representatives (GCR). The list of graduate faculty in Mathematics who can direct Master's and PhD theses is available on the website <http://www.math.oregonstate.edu/graduate-faculty-research>. Faculty who are not on this list can be granted temporary membership as graduate faculty in Mathematics upon the decision of Department Head.

The **Graduate Committee** has general oversight responsibility for the academic aspects of the graduate program, including graduate courses in Mathematics and timely progress of all current students. The Graduate Committee and its Chair can be consulted on various matters and in particular as concerns the interpretation and enforcement of the rules in this Handbook. The committee has an ombudsman's role with respect to the treatment and representation of the graduate students. Graduate Committee is also involved in the recruitment of new students, review of their applications to the program, and for GTAs. The Graduate Committee also advises the students before they find a major professor, and handles various appeals and petitions.

The **Graduate Coordinator** is a member of the department staff who assists the Graduate Committee and serves as a liaison with Graduate School staff.

Contact: Students can contact all of the Graduate Committee via e-mail to math_gradcomm@math.oregonstate.edu. The Chair of the Graduate Committee can be reached by email or during posted office hours as shown on their department website.

Adviser: Before a student has a major professor, every student has an adviser assigned by the Graduate Committee.

Major professor: All graduate students must find a major professor, and doing this enables timely progress towards completion of their degree. The major professor assumes the primary advising responsibility for their students. Master's students find a major professor typically by the end of their first year of study. PhD students should find a major professor in their second year, and (at the latest) soon after they have completed the qualifying exams. The major professor is also sometimes called adviser in this Handbook.

Minor adviser: A student declaring a minor must identify a minor adviser. Choosing a minor is optional.

4 COURSEWORK

There are a variety of keywords that apply to the coursework required for graduate degree. Graduate-level courses in Mathematics are numbered MTH 5XX or MTH 6XX. Most coursework taken by graduate students is taken for a grade. Occasionally students choose to take some non-blanket courses for S/U credit. S grade (Satisfactory) is equivalent to a passing grade (C or above). Courses with S/U credit cannot be included on a program of study.

4.1 Blanket courses

Blanket courses include MTH 501 or 601 (Research), MTH 503 or 603 (Thesis), MTH 505 or 605 (Reading and Conference), MTH 506 or 606 (Projects/Special Topics, and MTH 507 or 607 (Seminar). All other courses are non-blanket numbered courses. The 50x blanket courses are usually for Master's students; the 60x are for PhD students.

4.2 Slash courses

Some graduate-level courses are offered as slash courses, i.e., they are offered simultaneously as 4XX/5XX. The courses which are not slash courses are called "graduate standalone."

4.3 Special courses

- A. The class MTH 599, **Introduction to Mathematics Profession** is offered for S/U credit to all first year graduate students. This class offers guidance on teaching, ethics, and introduction to research. Completing the Winter section of MTH 599 class satisfies the ethics component of graduate degrees in Mathematics.
- B. Registration for **MTH 506 (Special Projects)** is a formal recognition of the service that the MLC provides to the OSU community, and of the fact that the department assigns the GTAs to provide this service while providing tuition waivers and GTA salaries.
- C. Some courses cannot be included on a graduate program in Mathematics; these include MTH 581, MTH 582, MTH 583.

4.4 Transfer courses

Some students come to our program with graduate credits in Mathematics from another program. Up to 15 credits can be transferred to MS program of study, and possibly more credits can be transferred to a PhD program. However, such a transfer does not happen automatically.

A student should discuss the possibility of a transfer first with their adviser. Next, any changes in the core course requirements including transfers must be obtained from the Graduate Committee prior to filing the program of study; typically Graduate Committee recommends replacing the transferred credits for a core class by those core obtained in our program in an advanced course. A documentation on the course is needed. A student should also verify the eligibility of the proposed transfer with Graduate School.

4.5 Core courses

Among non-blanket courses, the Mathematics department distinguishes core courses and non-core courses. Fifteen Mathematics courses are designated as core graduate courses. The first course of each sequence is intended to be accessible to a beginning graduate student with a standard undergraduate mathematics degree. Core courses typically have midterm and final examinations and problem assignments. The core courses include Group 1 courses and Group 2 courses.

4.5.1 Group 1 courses

MTH 511, 512, 611, and 543 must be taken by all graduate students.

Real Analysis I (MTH 511)	Real Analysis II (MTH 512)
Linear Algebra (MTH 543)	Complex Analysis I (MTH 611)

4.5.2 Group 2 courses and sequences

Abstract Algebra (MTH 644, 645)	Applied Math (MTH 621, 622)
Numerical Analysis (MTH 551, 552, 553*)	Probability (MTH 664,665)
Topology, Geometry (MTH 531, 532,674)	

***Note:** Numerical Analysis III (MTH 553) may be substituted for Numerical Analysis I (MTH 551).

The table below lists the terms when the core courses are typically offered.

15 CORE GRADUATE COURSES		
FALL	WINTER	SPRING
Analysis 1 (MTH 511)	Analysis 2 (MTH 512)	Complex Analysis (MTH 611)
Linear Algebra (MTH 543)	Algebra 1 (MTH 644)	Algebra 2 (MTH 645)
Applied Mathematics 1 (MTH 621)	Applied Mathematics 2 (MTH 622)	
Numerical Analysis I (MTH 551)	Numerical Analysis II (MTH 552)	* Numerical Analysis III (MTH 553)
Topology 1 (MTH 531)	Topology 2 (MTH 532)	Geometry (MTH 674)
	Probability 1 (MTH 664)	Probability 2 (MTH 665)

5 REQUIREMENTS FOR DEGREE AND STUDENT RESPONSIBILITIES

Graduate students must satisfy both the departmental requirements described in this Handbook as well as the institutional (general university) requirements for their degree program listed in the OSU catalog and posted on Graduate School website <http://gradschool.oregonstate.edu>. The program requirements include coursework, creative/scholarly activity, and an ethics component, detailed below.

Students are responsible for obtaining complete and up-to-date information on degree requirements. In particular, there are various deadlines and time restrictions imposed by the Graduate School; see <http://gradschool.oregonstate.edu/success/deadlines>, as well as program of study related restrictions listed on the Program of Study for MS or for PhD.

Students are also responsible for keeping track of their documentation such as transcripts, and program of study, and for bringing all the relevant paperwork to the exams and other formal meetings. It is the responsibility of the student to ensure that all committee members are informed of the date, time, and place of the examinations and other required meetings.

5.1 Requirements for the Master's degree

Our program offers both an MA and an MS degree in Mathematics. The degrees are identical except that the MA has the additional requirement of second-year proficiency in a foreign language, as required by the Graduate School.

The department has formulated Mathematics Graduate Learning Outcomes for the Master's degree <http://math.oregonstate.edu/ms-learning-outcomes>, which state:

1. Graduates will conduct research or produce some other form of creative work, as evidenced by the writing of a thesis, a paper, or of mathematical solutions and proofs of posed problems and propositions.
2. Graduates will demonstrate mastery of subject material, as evidenced by quality of performance in coursework, and on written and/or oral comprehensive examinations in mathematics.
3. Graduates will be able to communicate mathematical ideas, results, context, and background effectively and professionally in written and oral form.
4. Graduates will be able to conduct scholarly or professional activities in an ethical manner.

A student must complete the following steps to earn a Master's degree. These steps are not listed in order; in fact, many should occur concurrently.

A. Complete the required coursework.

- I. All courses from Group I (12 credits), with a grade of at least C.
- II. Four additional core courses from Group II, which must include at least one two-term sequence (at least 12 credits), with a grade of at least C.
- III. At least 15 additional credits of graduate coursework in Mathematics or outside Mathematics, with a grade of at least C.

B. Find a major professor, and a minor adviser if relevant.

- I. It is recommended that Master's students find a major professor no later than the end of the first year.
- II. Students are guided on how to find a major professor in MTH 599, Introduction to Mathematics Profession.

C. Satisfy the creative/scholarly activity component with one of the following.

- I. Thesis option: complete research and write a Master's thesis. This requires 6-12 hours of MTH 503 (Thesis). A thesis must be placed in OSU's Scholars Archive after the defense.
- II. Expository paper option: complete research, and write a Master's expository paper. This requires 3-6 hours of MTH 501 (Research). It is recommended but not mandatory to place the paper in Scholar's Archives.
- III. Exam option: pass the PhD qualifying examination and take three additional core courses.
- IV. Research and any other scholarly activity is usually carried out for several terms under the direction of the major professor. Students receive an introduction on what these steps entail in MTH 599, Introduction to Mathematics Profession.

D. Identify the rest of the Master's degree committee.

- I. The committee members other than the major (and minor) professors need not be selected until the degree work is nearing completion.
- II. Choosing a minor is optional.
- III. If the thesis option is chosen, a Graduate Council Representative (GCR), who must be a member of graduate faculty outside Mathematics, must be chosen from a list generated online by the Graduate School.
- IV. The Master's Degree Committee with no minor consists of:
 1. The major professor
 2. Second committee member
 3. Third committee member
 4. GCR (if thesis option is chosen)

The major professor and second and third committee members must be chosen from Mathematics graduate committee.

- V. The Master's Degree Committee with a minor outside mathematics consists of:
 1. The major professor
 2. The minor professor
 3. Third committee member
 4. GCR (if thesis option is chosen)

The major professor and the third committee member must be chosen from mathematics graduate committee.

E. Satisfy the ethics component.

- I. This can be satisfied by completing the Winter term of MTH 599, Introduction to Mathematics Profession, or by taking
- II. GRAD 520 or some other ethics class offered by Graduate School.

F. File the program of study (PoS).

- I. The PoS must contain at least 45 credit hours of coursework, of which (at least) 18 hours may be in a minor.
- II. The program must include the core coursework listed in A.I-II.

- III. The 39 credit hours on the PoS must be chosen from:
 1. Graduate-level non-blanket mathematics courses (including at least 24 credits for the core courses), and/or
 2. MTH 501, or MTH 503, and/or
 3. Other graduate-level courses in Mathematics or outside Mathematics which are essential for the student's program.
- IV. Restrictions on blanket credit hours:
 1. The thesis option requires MTH 503 (maximum 12 credits)
 2. The expository paper requires MTH 501 (at least 3 credits)
 3. No more than 9 total blanket hours other than MTH 503 are allowed on a Master's program.
- V. 50% of the graduate-level courses must be stand-alone graduate courses (as opposed to the "slash" courses).
- VI. The program should be filed no later than by a certain number of weeks prior to final oral exam as required by Graduate School. As of Fall 2016, this is 15 weeks.
- VII. The student records the chosen program on the Master's program form found on the Graduate School web site http://oregonstate.edu/dept/grad_school/forms.php#program.
- VIII. The program must be approved and signed by the major professor, minor professor (if minor is declared), and the Mathematics Department Head.
- IX. After the Head has signed the program, it must be submitted to the Graduate School for approval. Once approved by the Graduate School Dean, a copy is sent to the student, the advisor, and to the Mathematics Department.

G. Schedule the final oral exam (2 weeks in advance with the Graduate School).

- I. Schedule the exam with the online Graduate School form.
 1. The Graduate School audits the student's PoS, and prepares the Oral Examination paperwork that is sent to the student, major professor, and Graduate Council Representative (if relevant) prior to the exam.
- II. Reserve an exam room online or with the staff Scheduling Coordinator.
- III. (Thesis option): send the thesis to Graduate School.
 1. The pre-text pages from the thesis must also be submitted to the Graduate School for approval. This link explains the steps and formatting requirements for pre-text pages and your thesis. <http://gradschool.oregonstate.edu/progress/thesis-guide>.
- IV. Distribute the thesis or paper (if relevant) to committee.
- V. Submit a diploma application online.
- VI. (Thesis and Paper option, 1 week in advance): inform the Graduate Coordinator and/or advertise the defense to all mathematics faculty and graduate students.

H. Pass the final oral examination. The oral examination is based on the courses in the student's Master's program and additionally the work of the thesis or paper, if relevant.

- I. (Thesis option): defend the thesis
- II. (Paper option): present the expository paper
- III. (Exam option): present your knowledge in the coursework taken.

The rubrics verifying whether the Graduate Learning Outcomes have been met are distributed to the major professor prior to the exam and are filled out by the committee members during the exam.

- I. (Thesis option only) The final version of the thesis is submitted to the Graduate School for approval. It is also submitted to the Scholars Archive. The major professor signs a form which testifies that this is a version of the thesis accepted by the committee.

5.2 Requirements for the PhD degree

Graduate Learning Outcomes for PhD degree in Mathematics are at <http://math.oregonstate.edu/phd-learning-outcomes> and state:

1. Graduates will produce and defend an original contribution to knowledge, as evidenced by the writing and defense of a thesis involving significant original research.
2. Graduates will demonstrate mastery of subject material, as evidenced by quality of performance in coursework, and on written and oral examinations in mathematics.
3. Graduates will be able to communicate mathematical ideas, results, context, and background effectively and professionally in written and oral form.
4. Graduates will be able to conduct scholarly or professional activities in an ethical manner.

The detailed requirements for Mathematics PhD are as follows. Many of the steps are concurrent.

A. Complete the required coursework and exams.

- I. All courses from Group I (12 credits), with a grade of at least C.
- II. Eight additional core courses from Group II which must include at least three two-term sequences (at least 24 credits), with a grade of at least C.
- III. Additional graduate coursework in Mathematics or outside Mathematics with a grade of at least C.

B. Complete qualifying exam requirement.

- I. The qualifying examination is a written examination on the material typically covered in Group I core courses. Syllabi for the qualifying examination and copies of previous examinations are available on the department web page.
- II. The qualifying exam is administered in two parts. One part covers Real Analysis and the second part covers Complex Analysis and Linear Algebra.
- III. The qualifying exam is given twice each year, normally before classes begin in the fall and then during the first week of spring quarter. The two parts of the exam are usually given by more than one day apart.
- IV. The possible grades for the qualifying examination are:
 1. "pass"
 2. "pass in (specified part) only"
 3. "fail"
- V. The qualifying exam is organized and scheduled in a way that preserves anonymity of the students. In particular, the Qualifying Exam Committee does not know the identity of the students taking the exam. The exam results are communicated to the students by a letter written by the Associate Head. The students can request to meet with the Chair of the Graduate Committee to view the comments that were made on their papers by the members of the Qualifying Exam Committee.
- VI. A student may take neither part of the exam more than three times.
- VII. A pass of both parts of the exam is required by the end of the seventh academic term.

C. Find a research area of interest, and find a major professor, and a minor adviser if relevant.

- I. It is recommended that PhD students find a major professor in the second year, and soon after they complete the Qualifying exams.
- II. Students are guided to how to find a major professor in MTH 599, Introduction to Mathematics Profession.
- III. Before they identify the major professor, the students can request to take, e.g., MTH 501/601, or MTH 505/605, from various graduate faculty in Mathematics,

D. Form the PhD degree committee with the guidance of their major professor.

- I. The PhD degree committee with a minor outside Mathematics consists of at least five OSU graduate faculty:
 1. The major professor (from Mathematics graduate faculty)
 2. Minor adviser
 3. Third committee member
 4. Fourth committee member
 5. Graduate Council Representative (GCR), who is a graduate faculty from outside Mathematics, and is chosen from a list generated online by the Graduate School.
- II. Third, and fourth committee members must be the members of graduate faculty in Mathematics.
- III. The PhD degree committee without a minor declared does not require a minor adviser. Instead, the fifth committee member can be from Mathematics or outside Mathematics.

E. Develop the program of study (PoS).

- I. The PoS must contain at least 108 credit hours of coursework of which (at least) 18 hours may be in a minor.
- II. The PoS must include the core coursework listed in A. (at least $(4+8) \times 3 = 36$ credits, grade at least C).
- III. The PoS may include graduate-level non-blanket courses in Mathematics, or outside Mathematics which are essential for the student. All courses have to be completed with a grade of at least C.
- IV. The PoS may include blanket hors such as MTH 601, MTH 607, MTH 606, but no more than 15 credit hours of blanket numbered credit hours other than the thesis are allowed.
- V. The PoS must include at least 36 hours but no more than 72 credits of MTH 603 (Thesis).
- VI. 50% of the graduate-level courses must be stand-alone graduate courses (as opposed to the "slash" courses).
- VII. If a student completed Master's degree in Mathematics, it is common for their PhD program to include some credits that were used for the Master's degree.
- VIII. The student records PoS on the form found on the Graduate School web site.
- IX. The program must be approved in a program meeting. After it has been signed by all committee members, it must be approved and signed by the Mathematics Department Head.
- X. After the Head has signed the program, it must to be submitted to the Graduate School for audit and approval. Once approved by the Graduate School Dean, a copy is sent to the student, the advisor, and to the Mathematics department.
- XI. The program should be filed no later than a certain number of weeks prior to preliminary oral exam as required by Graduate School (currently 15 weeks).
- XII. PoS may change if the student and their committee agrees, and a petition to Graduate School is filed.

F. Program Meeting.

- I. The program meeting must include all committee members and the student.
- II. At the program meeting the PoS is discussed and approved. Next it must be signed by the student and all committee members, and routed further as described in E.

G. Schedule and pass the preliminary oral exam (prelim).

- I. The preliminary examination is a two-hour oral examination, conducted by the student's degree committee.
- II. The prelim must be scheduled with the Graduate School at least two weeks in advance.
- III. The prelim is taken near the completion of the course work on the student's PhD program.
- IV. At least half of the prelim is over the course work on the PhD program.
- V. The prelim typically includes an oral presentation by the student on the proposed thesis topic.
- VI. By Graduate School regulation, at least one complete academic term but no more than five years must elapse between the preliminary oral examination and the final oral examination
- VII. At the end of the prelim, the student temporarily leaves the room and the committee members discuss the student's performance and vote to determine whether the student has passed the examination. The candidate passes unless there are two or more negative votes.
- VIII. In the event of a failure, the Graduate School permits no more than two re-examinations.

H. Satisfy the creative/scholarly activity component by performing research towards PhD Thesis.

- I. Research and any other scholarly activity is usually carried out for several terms under the direction of the major professor. An introduction to what this entails is provided in MTH 599, Introduction to Mathematics Profession.
- II. The PhD thesis should contain a significant research contribution by the student, with original results publishable in a recognized mathematics journal.
- III. The thesis should be a well-written exposition describing the significance of the results and their relevance to related mathematical areas.
- IV. The research and writing efforts towards the Thesis are reflected in the PoS by at least 36 hours of MTH 603 (Thesis).
- V. The Graduate School mandates the format of the thesis which are deposited in Scholars Archives, and thus it must be formatted appropriately.

I. Satisfy the ethics component.

- I. This requirement can be satisfied by completing MTH 599 in Winter on Introduction to Mathematics as a Profession, or by taking
- II. GRAD 520 or some other ethics class offered by the Graduate School

J. Schedule and pass the final oral exam which includes thesis defense.

- I. The exam must be scheduled at least 2 weeks in advance with the online Graduate School form.
- II. The Graduate School audits the student's PoS, and prepares the final oral examination paperwork that is sent to the student, major professor, and Graduate Council Representative prior to the exam.
- III. Reserve an exam room online.

- IV. Send the thesis to the Graduate School.
 - V. The pre-text pages from the thesis must also be submitted to the Graduate School for approval. This link explains the steps and formatting requirements for pre-text pages and your thesis. <http://gradschool.oregonstate.edu/progress/thesis-guide>.
 - VI. Distribute the thesis to the committee.
 - VII. Submit a diploma application online.
 - VIII. Inform the Graduate Coordinator and/or advertise the defense at least one week in advance to all mathematics faculty and graduate students.
 - IX. The final oral examination is based on the thesis content and on the courses in the student's PoS.
 - X. The two-hour final oral examination is conducted by the student's degree committee. It usually consists of a public thesis presentation (defense) followed by the nonpublic part (examination).
 - XI. All interested parties are invited to the public part of the defense and have an opportunity to ask questions.
 - XII. After the thesis defense, the examination committee exclude all other persons and continue with the examination of the candidate's knowledge of their field.
 - XIII. The rubrics verifying whether the Graduate Learning Outcomes have been met are distributed to the major professor prior to the exam. The departmental rubric is returned to the Mathematics office, and all other paperwork is submitted to the Graduate School.
- K. The final version of the thesis is submitted to the Graduate School for approval. It is also submitted to the Scholars Archive. The major professor signs a form which testifies that this is a version of the thesis accepted by the committee.

5.3 How a PhD Student enters the Master's program

A PhD student who is considering getting a Master's degree should file the appropriate form with the Graduate School on either "changing PhD to Master's" or "getting a concurrent degree". The official notice of admission to the university PhD program in mathematics comes from the OSU Graduate School.

5.4 How a Master's student enters the PhD program

The change from the Master's program to the PhD program normally occurs when the completion of Master's degree is imminent but before it is completed. Otherwise, if the Master's degree has been completed, the student must reapply for admission and may not hold a GTA or GRA in the interim.

It is recommended that a Master's student applying to the PhD program has passed the PhD qualifying Exams, holds at least a 3.5 GPA in non-blanket graduate mathematics courses, and has completed all required MS core courses.

Students applying for admission to the PhD program should submit the following information to the Graduate Committee:

1. Two letters from departmental faculty supporting the student's application for admission to the PhD program. One of the letters should be from the student's prospective PhD adviser, who should indicate willingness to serve as adviser.

2. A brief letter of intent that outlines the student's plans, goals, and reasons for wishing to enter the PhD program.

If the application is approved, the student should submit the appropriate change of program form available from the Graduate School. The official notice of admission to the PhD program comes from the Graduate School.

5.5 Course loads and registration

The maximum load for a graduate student devoting full time to graduate study is 16 hours.

- A. For GTAs, GRAs and University Fellowship holders, the minimum course-load required by Graduate School is 12 term hours.
- B. The department requires that all supported students register for at least 15 credits.
- C. Students may be charged for credits taken in excess of the maximum 16 credit hours.
- D. A graduate student must enroll for at least 3 term hours in any term that the student uses university space or facilities, or is supervised by a major professor.
- E. A student can request at any time to be on leave from graduate study. During this time the student is not allowed to use university space or facilities, or be in contact with the faculty or department.

5.6 Post-baccalaureate students

A post-baccalaureate student is a student who is working for a second undergraduate degree. For academic purposes, they are undergraduate students, but they also must meet certain Graduate School requirements. Questions concerning Post-baccalaureate work should be directed to the Mathematics Head Undergraduate Advisor. Post-baccalaureate students should check with the Graduate School about restrictions on graduate transfer credit.

5.7 Graduate minor

A graduate minor supporting the Master's or PhD in Mathematics may be in another academic field, or in Mathematics but with a different area of concentration. It can also be an integrated minor which consists of a series of cognate courses from two or more areas, most of which should be outside the major department. Graduate minors are listed on the student's transcript. Master's program minors must include a minimum of 15 quarter credits of graduate course work; doctoral minors require a minimum of 18 credits.

A student working on a Master's or PhD outside Mathematics can choose a graduate minor in Mathematics. The first step is to find a minor adviser who is a member of graduate faculty in Mathematics. The minor adviser will recommend the graduate coursework in Mathematics that the student should include on their PoS.

6 SUPPORTED STUDENTS

Financial support allotted to mathematics graduate students is typically either a GTA, GRA, or university fellowship or scholarship. A GTA or GRA appointment is a working scholarship. Some students receive scholarships and various awards in addition to their basic GTA or GRA appointments.

6.1 Salaries and benefits of supported students

A student receives information about their salary rate in their appointment letter. The salary rate of the supported students increases as the student progresses through the graduate program.

Additionally, OSU provides a graduate health insurance benefit and a lump sum payment toward university fees each term during the regular academic year.

Graduate employees are represented by the Coalition of Graduate Employees in contract negotiations with OSU; see <http://cge6069.org/> for current information.

6.2 GTA appointments

GTA appointments are assigned to the students by Department Head based on Graduate Committee recommendation and are subject to the department needs. The standard appointment level for a Mathematics graduate assistant is .4 of a full-time equivalent, which corresponds to 16 hours of work each week during the three terms (nine months) of the academic year, with the bulk of the work occurring during the 10 weeks of a terms and the finals weeks. Additionally, the students are expected to assist in proctoring midterms and finals.

The Department attempts to assign a graduate teaching assistant corresponding to his or her interests and strengths. Specific duties are determined by the Department Head. Assignment requests should be addressed to the department course scheduler. A typical GTA duties involve 4-5 hours of contact time, 5-6 hours of preparation time, 3 office hours and 3 hours of tutoring time in the Mathematics Learning center. Mandatory proctoring hours are set by the Department Head and the appointment letter.

For contact time, a GTA may be assigned recitation sections of a large lecture class and will assist with quiz preparation and grading for the class. Some GTAs may teach their own classes, and advanced students may assist with grading or support of some graduate classes. Occasionally, a GTA's principal assignment may be to work in the Mathematics Learning Center, or to be a grader for an advanced undergraduate or core graduate course.

6.3 GRA appointments

A GRA appointment is associated with some funded project supervised by a faculty adviser (supervisor) who is typically a student's major professor. The project typically becomes part of their research towards a PhD or Master's degree. As funds become available, a faculty member may advertise available GRA positions to students in the program, and some who have had GTA positions may choose to apply to the faculty member. The Department Head, Graduate Committee Chair, and Office Manager should be informed of any such possible arrangements as soon as possible to aid in planning. The plans regarding the time when a new GRA might return to GTA status should be made in advance.

6.4 Evaluation and reappointment of GTAs and GRAs

GTAs and GRAs are evaluated at least once a year. As with the initial GTA or GRA appointment, reappointment depends largely on academic performance as well as on their performance in the work duties they were assigned. In particular, the teaching duties of a GTA are very important, and competent performance of these duties is necessary for reappointment. Maintaining a strong academic record and

making timely progress toward completion of the requirements for graduate degrees are essential considerations for reappointment.

Fellowship, scholarship, and award opportunities are administered by the Graduate School, College, or University, and are usually based on the Graduate Committee's recommendations. The benefits and responsibilities vary. These opportunities are periodically announced to graduate faculty and students, and are advertised via links on the graduate website <http://www.math.oregonstate.edu/graduate>.

7 GUIDELINES FOR EXPECTED ACADEMIC PROGRESS

Below are the general department academic expectations from students.

7.1 General

- A. In Fall term, each student should file a course plan for the year which is signed by their adviser. Any changes to a course plan during the year must be filed with the Graduate Committee in the term when the changes are made. The course plan is kept in the student's file.
- B. In Spring, each student fills out a review sheet as requested by Graduate Committee.
- C. Students must maintain an overall grade point average of 3.0 or higher.
- D. Students should find an adviser, file the PoS, and pass the required examinations in a timely manner appropriate to the program timeline.
- E. The timeline for Master's and PhD degree specified below refers only to the academic year support.
- F. Academic year is understood as three terms (Fall, Winter, and Spring).
- G. For a student who goes on leave, the support is not guaranteed automatically upon their return, because the department must ensure the continuity of the employment and may need to hire someone else in their stead. Students who want to resume being supported upon their return must discuss the conditions of this support prior to going on leave.

7.2 Master's timeline

1st Year: Complete Group 1 courses and take MTH 599. Complete as many core courses as possible and choose a graduate advisor.

2nd Year: Complete coursework, conduct research or pass the qualifying exam, submit PoS to the Graduate School, and complete all requirements for the Master's degree.

Supported Master's students maintaining a good academic record, making timely progress and are satisfactorily performance of assigned duties can expect 2 years of support as GTAs. Students who have passed the qualifying exams and are admitted to the PhD program may defer completion of the Master's degree until the third year.

7.3 PhD timeline

1st Year: Complete Group 1 core courses and take MTH 599.

2nd Year: Pass the Qualifying exams, complete at least one additional PhD core sequence. Find a major professor.

3rd Year: Find the committee, conduct program meeting, and file the PoS. Continue coursework. Initiate research.

4th Year: Pass the PhD Oral Preliminary Examination. Conduct research. Get involved in professional development.

5th Year: Make progress on research and complete PhD, or demonstrate likelihood of completing the PhD in the sixth year.

6th Year: Complete the Final Oral Exam.

Supported PhD students who maintain a good academic record, make timely progress toward the PhD, and satisfactorily perform their assigned duties can expect 6 years of support as GTAs.

7.4 Qualifying examinations and continued support

Occasionally, a student wishing to continue in the PhD program has not passed the qualifying exams by the end of the second year. Students in these circumstances who are interested in obtaining support as GTAs during fall term of their third academic year must appeal to the Graduate Committee and demonstrate that their overall record merits such support. Graduate Committee's positive recommendation is not automatic, and the GTA support is granted depending on the department needs. A student supported in these circumstances is expected to pass the qualifying exam at the outset of fall term to be eligible for further support.

7.5 Course loads for supported students

Here we specify course registration requirements for students who are supported as GTAs and GRAs. Students on fellowships or scholarships should follow the rules for GTAs/GRAs or may have individual requirements negotiated with Graduate Committee. Students who are unsupported but who wish to apply for support at some point of their graduate study should discuss their options with Graduate Committee.

- A. All GTAs and GRAs are required to register for 15 credit hours per term.
- B. Each GTA is required to register for a minimum of 6 hours of MTH 5xx, MTH 6xx per term and a minimum of 21 credit hours of such courses per year.
- C. GTAs whose duties include tutoring in MLC may sign up for MTH 506 or 606.
- D. Rules concerning non-blanket courses:
 - I. Each first year GTA and GRA must take three non-blanket numbered courses each term including two each term in the mathematics department.
 - II. Each second year GTA and GRA must take two non-blanket numbered courses each term including at least one in the mathematics department.
 - III. Each third and fourth year GTA and GRA must take one non-blanket numbered course each term in the mathematics department.
 - IV. Students who have not passed their prelim and are in their fifth or sixth year must take two non-blanket numbered courses **per year**.

- E. Courses not on the student's program may be taken on a Pass/No Pass or S/U basis.

Any deviation from this policy must have the prior approval of the Graduate Committee.

8 SUMMER TERM SUPPORT RULES

About 20 to 25 summer term GTAs and other research and department positions are available each year, and there are some research funds available from individual faculty. GTAs and GRAs must register for summer courses. Students supported by hourly wages do not need to register for summer courses.

8.1 Summer research support

The availability of GRAs depends on the grant support of individual faculty. A student on a summer GRA appointment need only register for 9 credit hours.

8.2 Eligibility for summer GTA

All summer term GTAs with appointments for both the preceding Spring Term and following Fall Term are eligible for up to 12 hours of summer term tuition remission. A GTA who completes a degree program during a given summer is eligible for up to 12 hours of summer term tuition remission during that term. However, a GTA who completes a Master's degree in the Spring and is not admitted to the PhD program is not eligible to teach as a GTA during the summer.

8.3 Applications for summer GTA

In Winter or Spring term, the department announces the application deadline for the students interested in summer GTAs. To be considered for a summer term GTA, a student must have satisfactory teaching experience as determined by the Departmental Teaching Committee and a satisfactory academic record as determined by the Graduate Committee. Candidates who meet these requirements will be ranked according to the following scheme:

1. Needs of the department and special cases as identified by the mathematics summer term director.
2. Non-first year GTAs who have not taught summer school at OSU before.
3. GTAs who last taught summer school at OSU three or more summers ago.
4. GTAs who last taught summer school at OSU two summers ago.
5. GTAs in their first year at OSU.
6. GTAs who taught summer school at OSU the prior summer.

Candidates who are in the same category may be distinguished on the basis of academic record and teaching record, on the basis of a coin toss, or on the basis of who can be contacted first in cases where appointments must be made on short notice. The Graduate Committee and the Department Head will assess qualifications.

8.4 Course registration for summer GTAs

Summer GTAs must register for at least 12 credits of graduate-level mathematics, and this must include MTH 507. Other blanket courses and regular courses in Mathematics, as appropriate, may be used to make up the remainder. Summer GTAs who wish to register in non-mathematics courses as part of the 12 credits must obtain prior approval from the Mathematics Department Head. Otherwise, the GTA may be billed for courses taken outside the department.

8.5 Responsibilities

Typical summer appointments are at .35 FTE. Summer term GTA duties, such as MLC hours, regular class hours, and office hours, are determined by the Department Head.

9 MISCELLANEOUS INFORMATION

The department graduate FAQ website <http://math.oregonstate.ed/current-graduate-faq> contains answers to the common questions about the graduate program. Links to all the forms mentioned in this document and other forms relevant to the Mathematics graduate program are all available on the Mathematics website at <http://math.oregonstate.edu/graduate-resources>. Graduate School forms can be found at http://oregonstate.edu/dept/grad_school/forms.php.

9.1 Petitions and appeals

A petition is a letter to the Graduate Committee in which a student appeals for a waiver from some Mathematics Graduate Program rule or from a decision of the Graduate Committee. Typically, grounds for a petition are some extenuating personal or professional circumstances.

The petition should explain the background and circumstances which motivate the appeal. It should also provide a plan for what should be done. A student's adviser or major professor should be consulted in making this plan, and should write a supporting letter.

9.2 Graduate Council Representative (GCR)

A graduate faculty member chosen from an area outside the student's department represents the Graduate Council on a student's committee which involves a thesis. The GCR is responsible for ensuring that the examinations are conducted in accordance with Graduate School guidelines. The GCR is a full voting member of the committee and must participate in the program meeting, the preliminary oral examination, and the final oral examination.

9.3 Inadequate background

Occasionally, students realize that additional undergraduate background is required in order to succeed in Group I core courses. Such a student should meet with the Chair of the Graduate Committee as soon as possible to discuss the situation and to devise a plan of study to propose to the Graduate Committee.

9.4 Thesis formatting

The Master's Thesis or PhD Thesis (sometimes called the dissertation) have to be formatted appropriately. Information on formatting and submitting the thesis is available at <http://gradschool.oregonstate.edu/progress/thesis-guide>. There are also LaTeX templates available for the thesis on department website <https://math.oregonstate.edu/graduate-resources>.