
**Emory University
Mathematics Program
Graduate Handbook**

**Department of Mathematics
2020-2021**

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Handbook Overview

This Graduate Handbook is intended to orient new students to the mathematics graduate program at Emory University and to provide a summary of its policies and procedures regarding graduate study. The manual complements the Laney Graduate School (LGS) Handbook, which contains general degree requirements and graduate school policies. Both handbooks are modified yearly to account for policy changes. Before consulting this manual, students should be certain that they have the latest version (dated by school year). If unsure about some policy or rule, students should consult with their advisor, the Graduate Program Coordinator, or the Director of Graduate Studies (DGS).

NOTE: The COVID-19 situation has affected certain policies described in this handbook, related to graduate student offices, mail delivery, etc. These changes are not reflected here, because the virus-related policies are likely to change over the course of the year. Students should consult university and department websites for updates related to the virus.

1. Department Information

1.1 Graduate Program Coordinator

The Graduate Program Coordinator is Terry Ingram. She handles the day-to-day functions of the graduate program and serves as a liaison between the graduate students and the LGS. Her office is MSC W436, and her telephone number is 404-727-6114 (7-6114 from campus phones). Her email is terry.ingram@emory.edu. See her with any problems or questions.

1.2 Registration

Registration is typically held the week before classes begin. First time registration for new students is done by Terry Ingram. In subsequent semesters, students will register online through the OPUS system (<https://opus.emory.edu>), which can also be accessed from the Emory home page (<http://www.emory.edu>). Students must consult with either the DGS or their faculty advisor on matters related to registration (e.g., pre-registration, registration, drop, add). Any student who does not consult his or her faculty advisor will be held responsible for any academic issues that may arise. Once registration has been completed, any outstanding fees will need to be paid at the Bursar's Office.

PLEASE NOTE:

- Schedule changes are not allowed after the official add/drop period (normally the first week of class). It is not possible to retroactively enroll in, drop, or change the grading basis of a course. It is the student's responsibility to check and verify his or her registration.
- Directed study and research sections require explicit approval of the student's mentor/advisor. Enrollment will only happen after permission has been granted.
- Enrollment in classes outside of the Mathematics Department is possible only by special request. To request enrollment into such courses students must obtain the following: (1) permission from their faculty advisor, (2) proof that the course is part of their degree requirements, and (3) permission from a representative of the department teaching the

course. Any problems with scheduling **must** be addressed during the add/drop period.

1.3 Email

To obtain an Emory email account, please go to <http://opus.emory.edu/> and select the “Obtain a Network ID and Password” link. If you have any issues, please contact Emory University’s Technology Services (UTS) at 404-727-7777. Once the university network ID and password is set up, please see the departmental systems administration to activate your Math account.

1.4 Mail Service

The department provides mailboxes for all faculty, staff, and graduate students. The mailroom is located beyond the main reception desk in MSC W405. Each student’s name appears below his or her box. The department has two outgoing mail trays located inside the cabinet underneath the middle section of faculty mailboxes. One is for campus mail only, and the other is for mail going out by the United States Postal Service. Personal letters should bear the appropriate postage and can be placed in the US mail tray. The department does not pay for the postage of personal items. There is a branch of the USPS located on campus in Few Hall where stamps may be purchased. Mail goes out twice daily: once in the morning (around 10:30 AM) and once in the afternoon (around 3:30 PM).

1.5 Graduate Student Offices

PhD students receiving financial support from LGS, faculty grants, or an external fellowship, will be assigned a desk in one of the graduate student offices. Each PhD student will be given a key to the main door of the office and to his or her assigned desk. Office door keys and desk keys may be obtained from Terry Ingram; a \$10 cash refundable key deposit is required at time of issuance. For the safety and consideration of all students, the main door should be locked at all times, especially when there is no one else in the room. Students are cautioned not leave anything of great value unlocked or exposed.

1.6 Copy/Work Room and Office Supplies

The copy machines and office supplies are for department faculty and staff use only. Exceptions to this are students currently teaching a course, students asked to make copies by an advisor or other faculty, or students making related to university or department business. No other personal copies by graduate students are permitted except for the above-mentioned reasons.

Office supplies are for the use of faculty, staff, and graduate students who are currently teaching or assisting a faculty member. **Supplies are not available to graduate students who do not meet one of the above criteria.**

1.7 Expense/Travel Reimbursement

The LGS makes funds available to PhD students through a professional development support program (PDS). Students are eligible for \$2500 over the course of their graduate career, to support travel in the categories of training, research and conferences. These funds are not guaranteed, but are subject to application and review. To receive an award a student must be in good standing, both in the LGS and in the program. Travel support beyond the \$2500 limit may be possible, subject to a competitive application process.

Students are responsible for submitting their request no later than the 10th of each month. This will allow Mrs. Ingram to approve the application before review by the LGS. Early application is. If a student applies after the conference and is denied funding, they will not be given a second chance to apply.

Any travel supported by Emory funds requires compliance with Emory University's travel policies. Air travel bought with Emory funds must be purchased through Emory's air travel provider. This requirement includes travel expenses that are paid with personal funds and later reimbursed using Emory funds. The Emory travel provider may be accessed through a link found on the LGS website.

For further details on the PDS program consult the PDS handbook available on the LGS website.

Occasionally, students may incur expenses on behalf of the department, including meals with prospective students and seminar guests. Documentation of the expense, consisting of (1) original, itemized receipts, (2) event name, and (3) names of all of those who attended the meal should be submitted to Terry Ingram for reimbursement. Receipts and any accompanying documentation must be **taped** neatly, without overlaps, to 8 ½ x 11 sheets of papers. Disorganized, cluttered, or unclear paperwork will be returned to the student for revision.

Allow 2-3 weeks processing time for all forms of reimbursement.

2. Degree Requirements for Mathematics PhD

This section provides information on the requirements needed to complete a PhD in Mathematics at Emory. The PhD program offers four possible research specializations:

- *Algebra and Number Theory.* Division algebras and the Brauer group, Galois cohomology, real algebraic geometry, algebraic groups, algebraic number theory, computational methods.
- *Analysis and Differential Geometry.* Complex analysis, conformal and quasiconformal mappings, global analysis on manifolds, microlocal analysis, geometric analysis, partial differential equations.
- *Combinatorics/Graph Theory.* Graph theory, random structures, ordered sets, projective planes, theory of computation.
- *Computational Mathematics.* High performance computing, computational fluid dynamics, image processing, inverse problems, numerical analysis (linear algebra, PDEs, optimization), scientific computation.

The PhD program is designed so that students may complete the basic course and exam requirements during the first two years. During this period, students are also encouraged to establish relationships with individual faculty members and begin the process of selecting an advisor. Thesis research with the PhD advisor usually begins in the second or third year.

2.1 Summary of Degree Requirements

In addition to the general PhD degree requirements listed in the LGS Handbook, there are specific course and exam requirements. Details regarding these requirements are given in Section 2.2.

| Pure Mathematics | |
|-------------------------------|---|
| Core courses: | <ul style="list-style-type: none"> • Math 511-512: Analysis I & II • Math 521-522: Algebra I & II |
| Additional coursework: | Four additional courses in at least three different areas. The distribution of these electives is subject to approval by the DGS. |
| Advanced coursework: | At least two advanced courses or seminars in the student's research area. |
| Qualifying exams: | <ul style="list-style-type: none"> • Subject exams based on coursework in Analysis (Math 511-512) and Algebra (Math 521-522) • Research area exam. This will be either an oral examination based on a reading list, or an exam (written or oral) based on a full-year course sequence in the proposed area of research. |
| Teaching requirements: | <ul style="list-style-type: none"> • Math 590: Pedagogy and Professional Development • TATTO 600 • TATTO 605 and 610: at least four sections, including teaching at least two course and listed as instructor of record |

| | |
|----------------------------------|--|
| Jones Program in Ethics: | <ul style="list-style-type: none"> • JPE 600 Scholarly Integrity workshop • In-program ethics training • JPE 610: A minimum of four workshops |
| Proposal defense: | Oral presentation to the dissertation committee |
| Dissertation and defense: | Acceptable dissertation and public presentation |

| Computational Mathematics | |
|----------------------------------|--|
| Core courses: | <ul style="list-style-type: none"> • Math 511-512: Analysis • Math 515-516: Numerical Analysis • Two of the following: <ul style="list-style-type: none"> • Math 517: Iterative Methods • Math 550: Functional Analysis • Math 561: Matrix Analysis • CS 551: Systems Programming • CS 555: Parallel Processing |
| Additional coursework: | <p>One sequence from below, not counting courses taken for the core requirement.</p> <ul style="list-style-type: none"> • Math 557-558: Partial Diff. Equations • Math 571-572: Numerical PDE, Numerical Optimization • CS 551 & 555: Systems Programming, Parallel Processing |
| Advanced coursework: | At least two advanced courses or seminars in the student's research area. |
| Qualifying exams: | <ul style="list-style-type: none"> • Subject exams based on coursework in Analysis (Math 511-512) and Numerical Analysis (Math 515-516) • Research area exam. This will be either an oral examination based on a reading list, or an exam (written or oral) based on a full-year course sequence such as Math 557-558, 571-572, or another sequence approved by the advisor and DGS. |
| Teaching requirements: | <ul style="list-style-type: none"> • Math 590: Pedagogy and Professional Development • TATTO 600 • TATTO 605 and 610: at least four sections, including teaching at least two course and listed as instructor of record |
| Jones Program in Ethics: | <ul style="list-style-type: none"> • JPE 600 Scholarly integrity workshop • In-program ethics training • JPE 610: A minimum of four workshops |
| Proposal defense: | Oral presentation to the dissertation committee |
| Dissertation and defense: | Acceptable dissertation and public presentation |

2.2 Remarks on Degree Requirements

2.2.1 Course requirements

- **Required courses.** In most cases, the two required full-year core course sequences should be taken in the student's first year. Most of the additional coursework should be completed by the end of the second year. These requirements represent a minimum set. Depending on the student's research interests, more courses may be required by the student's PhD advisor.
- **Advanced coursework.** These courses should be in an area related to the student's research interests. The student must consult with and obtain approval from their research advisor regarding the fulfillment of this requirement.

2.2.2 Qualifying exams

- **Timing.** The two required qualifying exams should normally be taken in the summer following the first academic year. All three exams should be completed no later than the summer following the second academic year. Exceptions may be given, with approval of the DGS.
- **Content.** Coursework exams can be either oral or written. Oral exams will be supervised by a committee of at least two faculty members. The student is expected to have identified and consulted with an advisor before undertaking the research exam. The format and content of the research area exam is proposed by the advisor and subject to the approval of the DGS.
- **Results.** Each qualifying exam is evaluated as either pass or fail. The DGS must approve absence from a scheduled exam; an unapproved absence of a scheduled exam will be considered a fail. If a student receives a fail on an exam, then the student will have one opportunity to repeat the exam, within one year of the first attempt. Failing on a second attempt is normally considered grounds for dismissal from the PhD program. The departmental Graduate Committee will review the case at that point to determine the appropriate action, which might include allowing the student to pursue an MS degree.

2.2.3 Teaching and Ethics training

- **Teaching requirements.** The department is committed to preparing students for possible academic careers, and thus teaching is an integral part of the PhD program. The details of these requirements are given in Section 2.4 below.

All departing graduate students must provide copies of their grade books (or spreadsheets) for the courses they taught in the preceding year, before the department will sign off on your degree application. If there is an outstanding or incomplete grade in a class, the graduate instructor must also leave a statement to the program coordinator stating what is left for the student to complete in order to change the grade.

- **Jones Program in Ethics (JPE).** The Scholarly integrity workshop (JPE 600) is a one-day graduate school workshop (JPE 600), typically scheduled one week prior to the start of the fall semester during the student's first year of study. Graduate school ethics seminars (JPE

610) are completed over the course of the student's PhD study. Students must present their ID card at each seminar in order to get attendance credit.

Students will receive notifications from the LGS regarding the JPE workshop and seminars. The JPE requirements include instruction on mathematics-related topics such as mentoring, authorship, peer-review, and scholarly misconduct which are provided in Math 590 and reviewed annually in a mandatory department meeting on teaching.

2.2.4 Dissertation

- **Committee and proposal defense.** The dissertation committee should include the student's advisor, and at least 2 other experts in the area. Experts from outside the department or university may be selected where appropriate, however 3 Emory faculty members must be on the committee. See the Laney Graduate School Handbook for further details regarding committee members from outside the university.

All students must file a dissertation committee form to obtain LGS approval for their committee. This approval must be obtained no later than March 15 of their 4th year. Students who do not meet this deadline will be placed on academic probation, are not eligible for PDS funds, and may forfeit financial support.

Each student is required to make a formal presentation to the committee regarding the progress of their thesis research. This presentation should be done no later than the summer following the student's 4th year, or the semester prior to the dissertation defense.

- **Defense.** The dissertation committee is responsible for reading the student's dissertation and attending the oral defense. The committee must give final approval of an acceptable dissertation and an acceptable oral defense. The defense is open to all, and must be advertised in advance.

2.3 Candidacy

Candidacy status is an indication that a doctoral student has developed sufficient mastery of a discipline to produce an original research contribution in his or her field.

Eligibility

To be eligible for candidacy, a student must meet the following requirements:

1. Complete the coursework requirements as outlined in Section 2.1.
2. Complete TATTO 600, TATTO 605, and the required JPE 600 and math graduate program JPE training as part of Math 590.
3. Complete qualifying examinations as outlined in Section 2.1.
4. Resolve any Incomplete (I) grades.
5. Be in good standing with a minimum cumulative 2.70 GPA
6. Have earned at least 54 credit hours at the 500 level or above

Other degree requirements, including TATTO 610, JPE 610, and the proposal defense, may be

completed after entering candidacy.

Students should enter candidacy as soon as all requirements have been completed, and at least one semester before submitting a degree application. The candidacy application available on the LGS website. Note that students cannot apply for candidacy and graduate in the same semester.

Students must reach candidacy by September 15 of their fourth year. Students who do not meet this deadline will be placed on academic probation, and are not eligible for PDS funds, and may forfeit financial support.

Previous policy (for students entering Fall 2016 or earlier): The same candidacy requirements apply, but the timeline is different. Under the old policy, students must apply for candidacy by August 1 of their fifth year, and at least one semester before submitting a degree application. Students who started their programs before the fall of 2017 will not be placed on probation if they fail to meet the candidacy deadline.

2.4 Teaching Requirements

This section provides more detailed information about Teaching Assistant duties, teacher training, and teaching requirements of PhD students.

- **Professional Conduct:** Graduate students involved in any form of undergraduate instruction (e.g., classroom instructor, TA, lab assistant, grader) are expected to behave as dedicated professionals and representatives of the University. Reports of lack of preparation and/or unprofessional conduct or appearance will be investigated by the DUS and the Chair. Substantiated cases will be referred to LGS and may result in actions ranging from rescinding of stipends to other LGS or graduate program sanctions.

Before teaching in the classroom, PhD students must complete the summer workshop (TATTO 600) and 2 semesters of the departmental teaching seminar (Math 590). Once these requirements have been completed, the program requires at least 4 semesters as either teaching assistant or teaching associate, with at least 2 as instructor of record. These requirements are described in detail below.

2.4.1 Summer workshop (TATTO 600)

Before graduate students are allowed to teach at Emory, in any capacity, they must first take the LGS summer workshop TATTO 600. This is a 2-day course taken in August before the beginning of the student's first year.

2.4.2 Pedagogy and professional development (Math 590)

In the first year, Math students will take 2 semesters of Math 590, a one-credit hour seminar on teaching and professional ethics issues, in both fall and spring. The seminar will meet weekly and be attended by all first year Mathematics PhD students, all PhD students in later years whose first teaching responsibility has been delayed beyond the normal schedule, and any advanced students who have been asked to participate or have a wish to attend. The 590 seminars include the following elements:

- (a) **Instruction in teaching methods.** This includes advice on how to run a course (development of fair and explicit grading practices, adherence to a fixed and workable syllabus, timely evaluation of students' progress, how to encourage and conduct office meetings, setting exams), how to run a classroom (encouraging and handling questions, coping with disruption), as well as ways to lecture well (importance of preparation, understanding of how much an hour lecture can hold, use of examples and pictures).
- (b) **Lecture observations.** Students sit in on the lectures of faculty members or experienced graduate students 3-4 times per semester to observe a variety of styles and methods.
- (c) **Student mini-lectures.** Students in the seminar present short lectures (10-15 minutes) to seminar participants on topics from an elementary course syllabus. Normally each student gives two or three such lectures. The other seminar participants, DUS, and possibly other participating faculty, will critique these presentations and offer positive suggestions for improvement.
- (d) **Grading and help sessions.** First-year students participate in grading and weekly help sessions for undergraduate classes to gain experience in developing and applying grading schemes, answering questions, and dealing with students.
- (e) **Mathematics-specific instruction on ethics.** This coverage of the ethics of teaching, publication, mentoring and public scholarship in mathematics is part of the Jones Program in Ethics (JPE) required for all PhD students. (See Section 2.1.5 for more details.)

2.4.3 ESL training

PhD students who are non-native English speakers take a screening exam administered by the English as a Second Language Program (ESLP) at the beginning of their first year. Based on this exam, some students may be required to take ESLP training courses as part of the PhD program. These should be completed before the student takes TATTO 605 or 610. Normally the ESLP courses would be taken in the first year, alongside Math 590.

2.4.4 Teaching assistantship (TATTO 605)

After completing Math 590 in their first year, students will spend 2 semesters as a Teaching Assistant, which is credited as TATTO 605. Possible teaching assistant duties include coverage of lab and problem sections, staffing calculus review sessions, and grading. The expected time commitment for a TA is 10-12 hours per week. (Students who have demonstrated ability and commitment in Math 590 may request to waive one or both semesters of TATTO 605 in exchange for extra semesters of TATTO 610, as described in Section 2.4.6 below.) Teaching assistant assignments are determined by the DUS, and will be provided to students at least one month prior to the start of the semester.

2.4.5 Teaching associate (TATTO 610)

The final phase consists of spending 2 semesters as instructor of record for an elementary class such as Math 111 or 112. This experience is credited as TATTO 610. Teaching assignments are determined by the DUS, and will be provided to graduate students in

October for the spring semester and by the end of May for the fall semester. Graduate student instructors will be responsible for preparing lectures, designing assignments and exams, grading, and holding regular office hours. Instructors are provided with supervision and support as follows:

- A faculty member is assigned as a section leader to a cohort of student instructors teaching 100-level courses. The section leader tracks the progress of the course throughout the semester and makes sure all the sections are taught at the same level and pace. Weekly meetings are held to discuss upcoming topics and course-specific teaching matters. Section leaders supervise content issues, including the syllabus, tests, quizzes and final exam, as well as concerns or complaints from students.
- A faculty teaching mentor is assigned to each graduate student each semester, as an additional resource and source of support. Mentors discuss teaching issues and give advice on how to manage students, schedules, and classrooms. Teaching mentors sit in on their instructor's class twice each term and complete an observation report that details strengths and areas in need of improvement.
- During the term, the instructor will distribute midterm evaluation forms to their class. The instructor and teaching mentor review the evaluations and discuss adjustments to teaching methods suggested by the evaluations. The Emory College course evaluation form is used at the end of the semester to help gauge the overall success of the course and instructor.

2.4.6 Additional teaching experience

For students who are pursuing careers in academia, additional classroom experience beyond the 4 required semesters is strongly recommended. And for students who seek jobs primarily based on teaching, this extra experience is absolutely essential. There are two avenues available for extra teaching experience:

- In extraordinary circumstances, students who have demonstrated ability and commitment in Math 590 and who have demonstrated success in previous intensive teaching experiences may request to start teaching as instructor of record during their second year, effectively replacing TATTO 605 credits with TATTO 610. (Note that the waiver of the TATTO 605 requirement does not affect the requirement for at least 4 total semesters of teaching.) Such arrangements are subject to approval from the DUS.
- Advanced students may request additional teaching assignments in more advanced courses beyond the 100 level, after completing the required 4 semesters. These opportunities are reserved for the most committed and effective teachers, and subject to approval from the DUS. Compensation for teaching at this level will be offered in the form of a stipend supplement.

3 MS Degree Requirements

To complete an MS in the Emory Mathematics Program, a total of 30 credit hours are required. The optional paths for these requirements are described below.

3.1 MS in Mathematics

Pure mathematics track:

1. Core courses (12 credit hours):
 - Math 511-512: Analysis I & II
 - Math 521-522: Algebra I & II
2. Four additional courses chosen from the following (12 credit hours):
 - Math courses at the 500 level or above (except directed study, seminar or research courses)
 - At most one approved undergraduate level math course (such as 411 or 421)
3. One of the following (6 credit hours):
 - Thesis option: An acceptable thesis and oral defense.
 - Course-only option: Two additional approved elective courses. One of them can be a directed study course.

Computational mathematics track:

1. Three required courses (9 credit hours):
 - Either Math 511 (Analysis I) or Math 512 (Analysis II)
 - Math 515: Numerical Analysis I
 - Math 516: Numerical Analysis II
2. Three elective courses in computational mathematics (9 credit hours):
 - Math 517: Iterative Methods
 - Math 561: Matrix Analysis
 - Math 571: Numerical Optimization
 - Math 572: Numerical Partial Differential Equations
 - Math 789R: (any topics in applied or computational mathematics)

Newly created graduate-level courses in computational mathematics are also allowed (except directed study, seminar, or research courses), provided they have been approved by the LGS.

3. Two additional elective courses, chosen from the following list (6 credit hours):
 - Any of the computational math courses listed above
 - Math 511: Complex Analysis
 - Math 512: Real Analysis
 - Math 531: Graph Theory I
 - Math 532: Graph Theory II
 - Math 535: Combinatorics I
 - Math 536: Combinatorics II
 - Math 557: Partial Differential Equations I
 - Math 558: Partial Differential Equations II

- CS 555: Parallel Processing
- CS 561: Software Systems

Students may request to include other elective courses at the 500 level or above, possibly from another department (except directed study, seminar, or research courses). All such requests must be approved by the Math DGS.

4. One of the following options (6 credit hours):
 - Thesis option: An acceptable thesis and oral defense.
 - Course-Only option: Either two additional elective courses, as listed under (2) and (3) above, or one additional elective plus a directed study course.

3.2 MS by Candidacy

Mathematics PhD students traditionally earn a masters degree as part of their progress towards the dissertation. Students may elect one of the following options:

3.2.1 MS in Mathematics by candidacy

Mathematics PhD students qualify for a Masters degree in Mathematics after completing the following requirements:

1. Completing the coursework required for the PhD degree
2. Passing the written qualifying examinations for the PhD degree
3. Being admitted to candidacy

3.2.2 MS in CS with Computational Science Concentration

Mathematics PhD students have the option of earning a Masters in CS. To qualify, students must fulfill the candidacy requirements listed for the MS in Mathematics, and also the CS coursework and thesis/project requirements for the Masters with Computational Science concentration, as listed in the CS program handbook. Note: Students choosing this option may not also receive the MS in Mathematics by candidacy.

3.3 MS in Computer Science

See Section 3.2.2 for MS in CS by candidacy, which is only available with the Computational Science concentration. Mathematics PhD students desiring an MS in CS in any other concentration other than Computational Science must apply separately to the CS Masters program, be admitted, and complete the program requirements as listed in the CS program handbook. Students who elect this option will be liable for tuition and fees for the CS Masters program. Pursuit of such an MS degree should occur during a leave of absence from the Mathematics PhD program.

4. Mathematics 4+1 MS Program

The mathematics program supports a 4+1 Mathematics MS program for Emory undergraduates, which allows students to earn an MS degree by spending an additional fifth year at Emory.

4.1 Admissions

Applicants for the Mathematics 4+1 program may matriculate in any major of Emory College. The course requirements for admission to the program consist of the following undergraduate courses, which need to be completed by the end of the junior year:

Mathematics

- Math 318 (Complex Variables)
- Math 321 (Abstract Vector Spaces)
- Math 411-412 (Real Analysis I & II)
- Math 421-422 (Abstract Algebra I & II)

Applied Mathematics

- Math 315 (Numerical Analysis)
- Math 351 (Partial Differential Equations)
- At least 3 courses from: 318 (Complex Variables), 344 (Differential Geometry), 346 (Intro to Optimization), 347 (Non-Linear Optimization), 352 (PDEs in Action), 361-362 (Mathematical Statistics I & II), 411-412 (Real Analysis I & II)
- CS 171 (Intro to Computer Science II)

Applicants to the 4+1 Mathematics MS program are required to have a grade point average of 3.25 or higher at the time of admission. In addition, they must have obtained a grade of B or better in each of the prerequisite courses listed above. The minimum grade point average must be maintained through completion of their undergraduate degree.

Emory students who have transferred from Oxford College are eligible for the Mathematics 4+1 program, provided they have met the course requirements listed above. (Since the only required courses currently offered at Oxford are Math 315 and CS 171, students transferring from Oxford might only be able to meet the requirements for the applied mathematics option.)

Qualified students will be able to apply to the program during the spring of their junior year. The application materials will consist of a CV, personal statement, Emory transcript, and 3 recommendation letters from faculty. Applications will need to be completed by early March. The 4+1 program committee will then have the responsibility of reviewing the applications, and will then make recommendations for admission to ECAS/LGS. Final decisions will be made and students notified before the enrollment deadlines for the subsequent Fall semester.

4.2 Curriculum

Students in the 4+1 Mathematics MS program will complete the requirements for one of the two tracks in the existing master's program. In order to satisfy these requirements during the +1

year, students in the program must take at least two math courses at the 500 level or above by the end of their senior year. The program will recommend that students take two additional 500-level courses in either the junior or senior year, for a total of four graduate courses as an undergraduate. However, as noted above, only two such courses could count towards both BS and MS degrees. Under this plan, the +1 year would consist of a standard graduate load of 6 courses, or 4 courses plus a master's thesis.

A student who completes only two graduate courses as an undergraduate could still complete the program, but this would increase the course load during the +1 year. It might also limit course selection, because many graduate courses have full-year course sequences as prerequisites.

Mathematics track

1. Four core courses:
 - Math 511-512: Analysis I & II
 - Math 521-522: Algebra I & II
2. Four additional Math courses at the 500 level or above (except directed study, seminar or research courses).
3. One of the following:
 - Thesis option: An acceptable written thesis (with thesis research credited as 6 hours of Math 599R) and oral defense.
 - Course-only option: Two additional approved elective courses at the 500 level or above. One of them can be a directed study course.

Students in the pure mathematics track should plan to complete at least one of the core graduate sequences, 511-512 (Analysis) or 521-522 (Algebra), during the senior year.

Computational mathematics track

1. Three required courses:
 - Either Math 511 (Analysis I) or Math 512 (Analysis II)
 - Math 515: Numerical Analysis I
 - Math 516: Numerical Analysis II
2. Three elective courses in computational mathematics:
 - Math 517: Iterative Methods
 - Math 561: Matrix Analysis
 - Math 571: Numerical Optimization
 - Math 572: Numerical Partial Differential Equations
 - Math 789R: (any topics in applied or computational mathematics)
3. Two additional elective courses, chosen from the following list:
 - Any of the computational math courses listed above
 - Math 511: Complex Analysis
 - Math 512: Real Analysis
 - Math 531: Graph Theory I
 - Math 532: Graph Theory II
 - Math 535: Combinatorics I
 - Math 536: Combinatorics II
 - Math 557: Partial Differential Equations I

- Math 558: Partial Differential Equations II
 - CS 555: Parallel Processing
 - CS 561: Software Systems
4. One of the following options:
- Thesis option: An acceptable written thesis (with thesis research credited as 6 hours of Math 599R) and oral defense.
 - Course-Only option: Either two additional elective courses, as listed under (2) and (3) above, or one additional elective plus a directed study course.

Students in the computational track should plan to complete the graduate sequence 515-516 (Numerical analysis) during the senior year.

4.3 Advising and supervision

Each student in the 4+1 program will be assigned a faculty advisor from the Mathematics program. For students undertaking a master's thesis this will be the thesis advisor. This advisor will be assigned during the Spring semester of the senior year, after a student has successfully applied for admission to the program. Students admitted to the program will be advised on the financial aid requirements for the +1 year. In consultation with the advisor, students in the program will prepare a plan for the +1 year and submit this to the 4+1 program committee.

5. Annual Evaluation

Every student in the program, both PhD and Masters, is required to submit a yearly progress report to the DGS. The report must be reviewed and signed by the student's advisor (or by the DGS if the student does not yet have an advisor). Reports are due by the end of May, and cover the period from June 1 of the previous year to May 31 of the current year.

The LGS and the Mathematics program have standards for academic performance that all students must meet, including making satisfactory progress through the program. Students will be reviewed at the end of each semester, and will receive a written evaluation at the end of each year. The evaluation will be based on an assessment of the student's overall performance including coursework, exams, research and work duties (e.g., teaching). The result of a negative evaluation may be: (1) probation with a reduction, suspension or termination of financial support, or (2) termination from the program.

6. Financial Information

6.1 Fellowships and Assistantships

With the exception of students supported by external fellowships (e.g., DOD, DOE, and NSF), all full time students admitted to the PhD program receive either a Graduate School Fellowship (GSF) or a research assistantship (RA) funded by a faculty grant. GSF is not available to students in the MS degree program, but an RA may be available to MS students in some cases. The maximum length of support is five years for a PhD student, and two years for a Masters student.

6.2 Conditions, Evaluation, and Renewal

A student receiving an RA or a GSF must be registered as a full-time student. Students receiving support from Emory sources, including faculty grants, may not accept any remuneration for other work, either in or outside the university.

The performance of each student will be reviewed annually as described in Section 4. Continued support from either GSF or RA is contingent on satisfactory progress towards degree.

6.3 Payment

Students who are receiving a stipend will receive their first full payment at the end of September. Stipends are paid at the end of each month on the last working day. The first check for new students may be sent by regular mail if a direct deposit is not set up.

- **Students should immediately update their official Emory address to the local address.** Failure to do so may result in the first paycheck being sent to the home address. This is particularly important for international students. Note that the local address should be updated in two different places: Human Resources and OPUS.
- **Students receiving stipends must be on direct deposit.** Students completing the online orientation have the option of submitting their bank information at that time. If they are unable to do so, students should log in to the Emory Payroll system, <https://psofthr.cc.emory.edu/> and navigate through the portal to locate and enter their direct deposit information. Adding or changing direct deposit information can be found at <https://www.finance.emory.edu/home/payroll/Employees/Direct%20Deposit.html>.

Students who have not yet found a local bank may want to consider the Emory Federal Credit Union. They usually offer free banking services to students and are usually a much better deal for students than the bigger commercial banks. The main branch is located at 1237 Clairmont Road.

7. Grievance Policy

Students who have a grievance related to aspects of their program in the Department of Mathematics and Computer Science should describe the grievance and relevant details in a letter addressed to the DGS. The DGS will try to resolve the grievance in conversations with the student and relevant parties. If this is unsuccessful, the DGS will appoint a committee of three program faculty members or use an existing standing committee, who will review the grievance and propose an appropriate response. If it is not possible to resolve the grievance within this committee or the framework of the program's administrative structure, the DGS will forward the grievance to the Office of the Senior Associate Dean of the LGS. At that time, the grievance will be handled according to the grievance procedure described in the LGS Handbook. If the grievance is with the DGS, the student submits the grievance directly to the Senior Associate Dean of the LGS.

8. Frequently Asked Questions

How do I apply for Personal Development Support (PDS) funds?

Begin by reviewing the information from the LGS website, http://gs.emory.edu/professional_development/pds_funds/index.html. There are links on both the left and right side of this page for instructions on how to apply. Before submitting any documentation, please bring the information you plan to upload to Terry Ingram for review.

How do I get reimbursed for travel?

Remember to keep all original receipts. These will need to be **taped** neatly to sheets of paper in order to be scanned, and receipts should be turned in promptly. You will review the information with Terry Ingram before submitting them for reimbursement. If you received PDS funding from the LGS, you will need to follow their instructions on reporting the outcome of the trip. Please refer to section 1.7 on page 3 of this handbook for details.

Where do I book flights? Can I use other resources?

If you are traveling on Emory University business, you **must** use the Emory preferred travel agency. The information can be found on this, https://www.finance.emory.edu/home/travel/air_travel/index.html, website. If you book yourself, please remember that you will need a credit card. If a faculty member is covering your flight, you will need to get the speedtype from him or her. Please see the CONCUR Quick Start User Guide for more information.

How do I check my account balance?

Log in to OPUS and go to the Student Center link. This should be the display you see. The account balance is listed under the *Account Summary (*1)*.

The screenshot displays the Student Center interface. At the top, there is a header for "Student Center". Below this, there are three main sections: "Academics", "Finances", and "Personal Information".

- Academics:** Contains links for "My Class Schedule", "Shopping Cart", and "My Degree Planner". A message box states "You are not enrolled in classes." There is also a search bar for classes with a "SEARCH FOR CLASSES" button.
- Finances:** Contains a "My Account" section with links for "Account Inquiry", "View Monthly Bills", and "View Registration Bills". A "Account Summary" box is highlighted with a red arrow labeled "*1". The summary shows a "Total Account Balance" of \$1,515.00 and a due date of Monday, August 17, 2015. A red arrow labeled "*2" points to the "View Account Detail" link.
- Personal Information:** Contains a "Contact Information" section with links for "View Demographic Data", "View Emergency Contact Names", and "Names".

Where do I view my anticipated aid?

While still in the above screen, click on **Account Inquiry** (*2). The following should be the next screen you see:

View Account Detail



Total Student Account Balance:

Reverse Order

[View Policies and Procedures](#)

[View Contact List for Questions](#)

[View Anticipated Aid](#)



Click on *View Anticipated Aid*. The image below should be what you see. If the link is not available to you, it means that there is no aid posted to your account. Please contact Terry Ingram immediately. You will also notice when aid will post to your account and what amount of aid you will receive.

View Anticipated Aid



| View Anticipated Aid | | | | | |
|----------------------|-------------|-------------------------------|-----------------------------|--------------------------|-----------|
| Aid Year | Term | Award Description | Scheduled Disbursement Date | Disbursement Expire Date | Net Award |
| 2016 | Fall 2015 | Tuition Schol-Math | 08/17/2015 | 11/15/2015 | |
| 2016 | Spring 2016 | Tuition Schol-Math | 01/04/2016 | 04/03/2016 | |
| 2016 | Fall 2015 | Enrollment Scholarship | 08/17/2015 | 11/15/2015 | |
| 2016 | Spring 2016 | Enrollment Scholarship | 01/04/2016 | 04/03/2016 | |
| 2016 | Fall 2015 | Grad Health Insurance SCH | 08/17/2015 | 11/15/2015 | |
| 2016 | Spring 2016 | Grad Health Insurance SCH | 01/04/2016 | 04/03/2016 | |
| | | Total for Fall 2015: | | | |
| | | Total for Spring 2016: | | | |

What do my office keys open?

Graduate students who have been assigned an office, can use their key to open any classroom that the department has on the 2nd and 3rd floor of the MSC building.

What is the number of hours I need to register for?

Students must be registered for 9 hours or more to be considered full-time.

Can I register for fewer hours?

Students receiving a stipend cannot register for less than 9 hours. All students must maintain a full-time status. That is, unless you are an international student in the Masters program. Please see a follow up question below.

I am an international student in the MS program, and plan to graduate this semester. Can I register for fewer hours if I am graduating at the end of the current term?

Yes, it is possible to be enrolled less than full-time in your final semester and maintain your non-immigrant status. The Laney Graduate School should receive a letter from the DGS making this request. Once we have received their permission, you must complete a request for a reduced course load

(http://www.emory.edu/iss/students/maintaining_f1_status/reduced_courseload_authorization.html) through the ISSS website as soon as possible and before the end of add/drop.

I plan to graduate this semester, but I also want to get an MS degree as well as a PhD degree. Is it possible to do it in the same semester?

It is possible to obtain an MS and PhD in the same semester as long as they are not in the same program. Please note the following ways you can obtain an MS degree in another area:

- 1) Math PhD students may only receive the MS in CS with Computational Science concentration by candidacy, as described in Section 3.2. Students availing of an MS-CS by candidacy are not eligible to also receive an MS-Math by candidacy.
- 2) For other Masters degrees, including CS Masters in another concentration area, students must apply for and be admitted to the MS-CS, and complete the requirements usually during a leave of absence from their home programs. Students may also be liable for tuition and fees.