M.A. and M.S. Program Handbook
2020-2021 Mathematics Department
Brandeis University

The Brandeis Mathematics Graduate Program offers a Master of Arts degree in Mathematics and a Master of Science degree in Mathematics for students with a strong undergraduate background in mathematics. Students leverage the M.A. or M.S. degree either to apply for a Ph.D. program in mathematics or to prepare for a career outside academia (e.g. in data science, finance, or software engineering). Full-time Master’s students will register for at least 12 credits of courses every fall and spring semester.

A minimum passing grade for a course to meet your program requirements is a B-.

The purpose of this handbook is to provide more program details than are included in the Math Bulletin. It is meant to complement various other sources which apply more broadly to all students at Brandeis University (e.g., the Brandeis University Bulletin, the Rights & Responsibilities Handbook, and information on Student Accessibility Support) or to students in the Graduate School of Arts and Sciences (e.g. the GSAS Student Handbook). Please make sure you read the Bulletin carefully:

- GSAS: https://www.brandeis.edu/registrar/bulletin/provisional/gsas.html
- Math: https://www.brandeis.edu/registrar/bulletin/provisional/courses/subjects/4700.html

This handbook will answer many, but probably not all, of your questions. Further questions about the graduate curriculum and requirements should be directed to the Graduate Advising Head (GAH), Olivier Bernardi. Concerning non-academic matters such as office assignments and hourly work positions in the Department, see the Mathematics Department administrator, Catherine Broderick. For academic paperwork and information about different on campus resources, see the Grad Affairs Office Academic Administrator, Emily Palmer.

**Important Note Regarding COVID-19:** Due to the uncertain direction of COVID-19, please note that the contents in this handbook may be subject to change. If there are any changes, we will notify you as soon as possible by email. Please make sure you check your Brandeis email regularly, at least once a day. In addition, all talks and seminars will be held virtually via Zoom until further notice. This handbook contains both general program guidelines that generally stay the same from year to year and COVID-19 specific guidelines for 2020-2021. For GSAS COVID-19 updates, please consult their website.

1. The M.A. Program

The M.A. program usually takes three semesters, but students with strong backgrounds may complete it in two. Full-time Master’s students will register for at least 12 credits of courses every fall and spring semester. The program includes seven required courses and one higher level, graduate math course, which may also be a reading course. If you would like to count a course outside the Brandeis math department towards your requirements, this requires written approval of the Graduate Advising Head.
1.1 Required Courses. This curriculum is devoted to building a strong mathematical foundation.

All students are required to master the material of the following four core courses: Math 131a (Algebra I), Math 141a,b (Real and Complex Analysis), and Math 151a (Topology I). In addition, students are required to take at least three of the following seven courses: Math 131b (Algebra II), Math 140a (Geometric Analysis), Math 151b (Topology II), Math 161a (Advanced Bifurcation Analysis), Math 162a (Numerical Methods), Math 165a (Probability), and Math 164a (Partial Differential Equations).

Each student is responsible for mastering the material in these courses. This requirement can be fulfilled in one of two ways:

1. Take the course and earn a satisfactory grade (officially B- to A+, but grades in the B range are often signs of trouble).

2. Place out of the course by demonstrating a thorough understanding of the “core topics” in the syllabus. This must be done during the first two weeks of the semester in which you want to place out of the course. The placement exam (which may be written or oral) is usually given by the faculty member who most recently taught the course. This year’s examiners are listed in Appendix A. The Graduate Advising Head may also grant exemption from the course on the basis of evidence of having excelled in a similar course at another university. Students who place out of required courses are expected to take more advanced courses.

In order to ensure some consistency in the teaching of the required classes 131ab 141ab 151ab, a checklist is provided to both the instructors and students of these classes. At the end of the semester, you will be asked to review a required course checklist of the topics on the syllabi and to provide your feedback about the course and the topics covered. It is then the responsibility of the instructor to provide resources for any required topics that have not been covered.

If you are considering applying to transition into the Math MS program at the end of the fall semester, we strongly encourage you to register for a Math 299 or Math298 Seminar course this year because taking one of these seminars is a requirement of the MS program (see section 2.1).

If you are considering taking more than three 4-credit courses, please consult with the Graduate Advising Head. The course-load for our 4-credit graduate courses is quite intense, and we want to make sure that you are not overburdened with coursework.

It is department policy that to continue in good standing you must pass at least two out of the required courses each semester during your first year. If you do not, or if your performance in these courses is judged inadequate, you will be asked to withdraw from the program or warned that failure to improve your performance will result in your withdrawal.

Students who have completed all 8 courses for the M.A. degree need to file an Application to Graduate by the specified deadline: https://www.brandeis.edu/registrar/forms/graddegree.html. Important Note: if you are transitioning into the M.S. program (with the approval of the
faculty), please do NOT file for an M.A. degree; students can ONLY receive one master’s degree (either M.A. or M.S.) from the Brandeis Math program.

1.2 Residency requirement. The minimum residence requirement is one year. Students still completing requirements after this may complete the program as Extended Master’s students upon approval by the Department. Most M.A. students end up completing their course requirements in three semesters, finishing their last semester as an Extended Master’s student. This is because the course-load is quite demanding; students typically take three 4-credit courses per semester (and possibly the 2-credit Math 299/298 Seminar). Please note that extended master’s students will have a reduced tuition rate for the semester: https://www.brandeis.edu/gsas/financing/cost.html.

1.3 Transitioning from M.A. to M.S. Program. Some students in the M.A. program might be interested in transitioning into the M.S. program. If you are interested in the M.S. program, please let the Graduate Advising Head know by the end of the fall semester. Your admittance into the M.S. program will be based on a review of your fall course grades and progress, and the faculty will inform you of their decision by the end of January. If you are admitted into the M.S. program, you would continue to follow the same course plan during the spring term. Then, during your second fall term, you will need to determine by December 1st whether you will be taking two more elective courses or completing a thesis during the spring (see section 2.1).

2. The M.S. Program (Note: program requirements in handbook are still subject to revision)

The Master of Science in Mathematics program is typically completed in four semesters (although it may be completed in three semesters). The M.S. is designed for strong students who are interested in pursuing a longer program than our M.A. program. There are two options for the M.S. degree: one option culminates in writing a thesis during the last semester and the second option culminates in taking at least two additional advanced graduate math courses. The M.S. is particularly attractive for students who are applying to Ph.D. programs for the fall and would like to demonstrate more research experience in their application.

2.1 Required Courses. This curriculum is devoted to building a strong mathematical foundation. ALL M.S. students take the 7 core courses described in the M.A. program (see section 1.1) and the 2-credit Math 299 or 298 Seminar course.

Students completing a thesis (option 1) will take two additional higher-level, graduate math courses; register for a thesis class with their advisor (typically in their 4th semester); and complete a written thesis and oral presentation.

Students completing additional courses instead of a thesis (option 2) will take four additional higher-level, graduate math courses.

Elective Courses. These are higher-level, graduate math courses and may include reading courses. If you would like to count a course outside the Brandeis math department towards your elective course requirements, this requires written approval of the Graduate Advising Head.

Math Seminar Course (Math 299 or Math 298). When you register for the course Math 299, you will be required to regularly attend a combination of approved seminars for the term. Math
298 Seminar is in the process of being developed for spring 2021. This seminar will be similar, but instead of attending multiple types of seminars, you would select one type of seminar to attend regularly. Please see section 3.1 for more information about seminars. For more detailed seminar course requirements, you can consult the syllabi.

**Thesis (required for Option 1 ONLY).** Students interested in pursuing a thesis will need to find a thesis advisor by December 1\textsuperscript{st} of their second year (the advisor will be mathematics faculty, or faculty in another Brandeis department upon approval). Once you have received email approval from a thesis advisor for registering for the M.S. Thesis course, please forward this approval to Emily in the Graduate Affairs Office (scigradoffice@brandeis.edu). During spring semester course registration, you should then enroll in a Master’s Thesis course with your thesis advisor.

The M.S. thesis consists of reading some advanced mathematics material in the form of topics books or a series of research articles, writing a thesis on a topic, and presenting the results of your reading and research during an oral presentation at the end of the semester. The discovery of new mathematical result is encouraged, but is not a necessary condition to pass the class. The oral presentation should be given in front of the Graduate Advising Head and the professor supervising the MS Thesis, and are open to the other members of the department.

Please review GSAS’s deadlines for the Master’s Thesis and schedule a thesis presentation date with the GAH, your advisor and Emily in the Grad Affairs Office well in advance of these deadlines. The day before you submit your final thesis through ProQuest, you will need to submit the Certification of Thesis Acceptance form to the Registrar’s Office.

**2.2 Residency requirement.** The minimum residence requirement is 3 semesters. The typical time to degree is 2 years (4 semesters). The fourth semester will be completed as an Extended Master’s student. Please note that extended master’s students have a reduced tuition rate for the semester: [https://www.brandeis.edu/gsas/financing/cost.html](https://www.brandeis.edu/gsas/financing/cost.html).

**3. Seminars**

There are seminars and numerous other activities that graduate students benefit from, academically and otherwise. You are encouraged to take advantage of the opportunities available to you as a student in the department, at the university, and as part of the Boston area mathematical community.

The department has a variety of (usually) weekly seminars. Some are intended to be accessible to all graduate students, while others require more background. *The Everytopic Seminar* is intended to expose graduate students and undergraduates to research topics in mathematics and occasionally related areas, such as physics and computer science. The Graduate Student Seminar, organized by the graduate students, is one in which the students lecture to each other on topics of interest and eat pizza.

*The Joint Brandeis-Harvard-MIT-Northeastern Colloquium* is a weekly event that rotates among the four universities and meets at Brandeis 2 or 3 times a semester. The speakers are leading mathematicians from around the world, and the talks are often accessible to graduate students. The department takes the speaker to dinner afterwards and subsidizes dinners for graduate students.
The New Directions Lecture Series, also known as the NOSY (for Not Only Second Year) Seminar, is a series of lectures or mini-courses offered in the fall semester of each year. They are given by faculty members and are designed to introduce students to a current area of research in more depth than is possible in a single seminar lecture.

The Topology Seminar tends to choose a theme for the semester and works as a learning seminar with participants taking turns giving talks. Outside speakers sometimes give talks as well.

The Combinatorics Seminar is an introductory seminar for combinatorics. The talk should be accessible to graduate students.

There are a number of informal learning seminars on topics of interest to students in a particular area. In the past academic year this included working seminars on dynamics and number theory, modular and automorphic forms, and other topics.

The Undergraduate Math Club sometimes organizes interesting and accessible interdisciplinary lectures.

There are many other seminars in the Boston area that are regularly attended by Brandeis faculty and students—MIT’s Combinatorics Seminar, Harvard’s Number Theory Seminar, the Harvard-MIT Algebraic Geometry seminar, Harvard’s Gauge Theory and Topology Seminar, the Boston College Geometry and Topology Seminar, and the Boston University Algebra Seminar, to name a few.

4. Professional Development

4.1 Planning for Program Completion. Most of our students either apply for jobs that require strong mathematical and analytical skills (e.g. data science, finance and software engineering) or apply to math Ph.D. programs. If you are going to apply to Ph.D. programs, we recommend that you meet with the Graduate Advising Head early on in the semester to seek advice on your personal statement and letters of recommendation. In preparation for a job search, we highly recommend creating a Brandeis Handshake account (Brandeis’s equivalent of LinkedIn: https://brandeis.joinhandshake.com/login) and making an appointment with the Brandeis GSAS Center for Career and Professional Development. The Center (https://www.brandeis.edu/gsas/career/index.html) provides one-on-one coaching on interviewing, networking, resumes and CVs. During the semester, you can read postings on Handshake and emails about career-related networking events, such as data science or computer science job fairs.
4.2 Course Assistants and Graders (non-union positions). Course assistant (CA) and grader positions are generally reserved for Ph.D. students but may be available depending on demand. Students apply to the Dean’s office for these paid positions, with the approval of the Graduate Advising Head (GAH).

Grader positions are on average 7 hours of work per week with a rate of $2500 per semester (2020-2021 rates). Graduate students graders are expected to grade homework for a class and may be asked to grade midterm exams as well. In large classes, they may also help the instructor in grading the final exam or proctoring the midterms or final; however, the primary proctor (a TA or instructor) should be responsible for answering content questions during the exam. The grader should also allocate one hour per week during which students can come to the grader’s office and ask about their grades.

CA positions are on average 10 hours of work per week with a rate of $3,200 per semester (rates for 2020-2021). CA responsibilities vary based on the needs of the instructor and the course, but can include things like: attending class; holding office hours and/or recitations and/or review sessions outside of class; helping grade quizzes and exams; helping to proctor quizzes and exams; answering questions online; helping to write quizzes, exams, worksheets, review material (e.g., contributing problems).

4.3 Internships. Over the summer, students may be interested in pursuing an outside internship to help them further their career goals. Completing an internship is especially helpful for students considering careers outside of academia. We encourage students making progress in their program and research to apply for these kinds of opportunities even though it isn’t a requirement for the master’s program. Important note: international students who would like to pursue a summer internship MUST consult both ISSO and receive approval of the GAH to register for an internship course (Math 393G - Math Internship, a 1.00 course credit). International students will need to make an appointment with their ISSO advisor to discuss the steps for applying for CPT.

5. Other Program Information

5.1 The ELP program. The university’s English Language Program (or ELP) program provides English language support. All students from other countries (with the exception of students from or who have completed a degree in Australia, Canada, Ireland, New Zealand, South Africa, the US and the UK) will be required to take an English language exam during orientation. Based on these exam results from Brandeis’s English Language Program, students may or may not be required to take ESL courses. If you are asked to take an ELP class, then attendance and participation are required in order to maintain good academic standing, and a passing grade is a university requirement for graduation.

5.2 Boston Area Graduate Consortium. It is possible for Brandeis graduate students to cross-register for mathematics courses at Boston University, Boston College, and Tufts. Graduate students should check with the Graduate Advising Head before cross-registering for courses. For information on cross-registering, see https://www.brandeis.edu/registrar/registration/graduates.html. Graduate students sometimes sit in on courses at Harvard or MIT, but it is not possible to formally cross-register for these courses.

5.3 Social events. The department’s friendly and informal atmosphere fosters interaction among faculty and students and enhances the environment for learning and research. A variety of social events contribute to this atmosphere. There is an afternoon tea in the department
lounge two days each week when classes are in session. Two or three Thursdays each semester, the Joint Colloquium is held at Brandeis; it is preceded by a tea in the department and followed by dinner at a local restaurant. In addition, there are several annual events, usually including a fall barbecue and a holiday party.

6. Administration

The Graduate Advising Head is responsible for overseeing the instruction and advising of graduate students in the mathematics department. This responsibility includes making recommendations to the university concerning admission, readmission, and the granting of graduate degrees. Another resource is the Academic Administrator in the Graduate Affairs Office, who assists the Graduate Advising Head with academic matters and tracking student progress. If the Graduate Advising Head is unavailable, or unable to address a particular concern, then the matter should be taken care of by the Department Chair. Academic grievance and petition procedures are described in the GSAS Website: https://www.brandeis.edu/gsas/current/academic-status-and-regulations.html.

6.1 GSAS, GSA and ISSO. The mathematics graduate program is one of many that comprise Brandeis University’s Graduate School of Arts and Sciences. GSAS is responsible for overseeing these programs. GSAS provides a variety of support services for graduate students. These include an orientation program and workshops throughout the year. The GSAS Bulletin and newsletters provide information on a variety of topics such as academic policy and events.

The Graduate Student Association is a student organization devoted to enhancing graduate student life and representing graduate student concerns at Brandeis. There are also many other student groups, including but not limited to: Brandeis Queer Grad Student Union, Brandeis Graduate Science Social Committee, Diverse Brandeis Scholars, Career Development for the Sciences and Women in Science Initiative.

International students will also certainly avail themselves of the services of the International Students and Scholars Office, which assists with visa and immigration issues and helps international students adjust to life at Brandeis.

6.2 Program Advising. All students should meet with the Graduate Advising Head at the beginning of each semester to discuss courses and plans for the semester and progress towards the degree. The Graduate Advising Head serves as the primary advisor for all master’s students. For students completing a thesis, their thesis advisor will become their primary advisor.

6.3 Program Evaluation. The mathematics faculty meets at the end of each semester to evaluate the graduate students and a progress letter is sent to students in May (if the student is continuing into a second year in the program). Each faculty member who has taught the student reports on the student’s performance. Minor problems are handled informally by the Graduate Advising Head. Major problems result in a letter to the student and a meeting with the Graduate Advising Head. These letters are usually quite serious and warn of the student’s possible required withdrawal from the program if performance does not improve.

6.4 Tuition Scholarships. Master’s students may be eligible for merit-based or need-based financial aid from Brandeis in the form of reduced tuition. Students should contact GSAS regarding this and other financial aid opportunities, such as student loans. More information can be found here: https://www.brandeis.edu/gsas/financing/masters/index.html
6.5 Rights and Responsibilities. The university’s Rights and Responsibilities Handbook sets forth policies governing rules of conduct that apply to all Brandeis students. The Rights and Responsibilities Handbook also explains university policies. For information about how to report incidents of sexual harassment and discrimination, please consult the Office of Equal Opportunity. If you have concerns about your mental health or your peers’, please file a CARE Report and consult our Brandeis Counseling Center. Brandeis is also committed to providing accommodations to community members with disabilities. For more information, students should contact the GSAS Student Accessibility Support office: https://www.brandeis.edu/accessibility/.

Within Brandeis, the Mathematics Department forms a strong community that values research and learning and cultivates an atmosphere of respect and support for fellow students, faculty and staff. As a graduate student in the department, you are responsible for helping maintain that environment.

On a less lofty note, we have to remember to take care of the physical environment as well as the intellectual one, and keep the shared offices, lounge, and kitchen reasonably clean.

At the end of each academic year, the graduate students elect three or four Graduate Student Representatives for the following year. These representatives have the additional responsibility of looking after graduate student interests within the department. This includes expressing the opinion of graduate students on matters such as hiring and course offerings. There is also the opportunity for students to voice their opinions and concerns during an annual Town Hall.
Appendix A: Contact Information

- Department Chair: Joel Bellaiche (jbellaic@brandeis.edu)
- Graduate Advising Head: Olivier Bernardi (bernardi@)
- Graduate Committee: Mark Adler (adler@), Olivier Bernardi and Thomas Fai (tfai@)
- Elementary Mathematics Coordinator: Rebecca Torrey (rtorrey@)
- Math Department Administrator: Catherine Broderick (ebroderi@)
- Academic Administrator: Emily Palmer (emilydpalmer@) / (scigradoffice@)
- Grad Student Representatives: Shujian Chen (shujianchen@), Rebecca Rohrlich (rebeccarohrlich@brandeis.edu), Alex Semendinger (alexsemendinger@brandeis.edu)

Language Examiners:
- French: Bellaiche or Daniel Ruberman (Ruberman@)
- German: Omer Offen (offen@)
- Russian: Kleinbock

Placement Examiners:
- Algebra I (131a): Bernardi
- Algebra II (131b): An Huang (anhuang@)
- Geometric Analysis (140a): Bong Lian (lian@)
- Real Analysis (141a): Mark Adler (adler@)
- Complex Analysis (141b): Bellaiche
- Topology I (151a): Ruberman
- Topology II (151b): Ruth Charney (charney@)
- Advanced Bifurcation Analysis (161a): Jonathan Touboul (jtouboul@)
- Numerical Methods (162a): Thomas Fai (tfai@)

Important Offices:
- Math Department: Goldsmith 218, 781-736-3050
- Graduate Affairs Office: Ros-Kos Connector Room 3-RK02, 781-736-2369 (Emily)/781-736-2352 (main line), scigradoffice@brandeis.edu, available for appointments by Zoom
- Graduate School: Kutz Hall (2nd floor), 781-736-3410, GSAS@brandeis.edu
- Registrar: Kutz 121, 781-736-2010, registrar@brandeis.edu
- ISSO: Kutz 215, 781-736-3480, isso@brandeis.edu

**Special COVID-19 guidelines for 2020-2021: most offices are operating remotely, so you may find that email will be the fastest way to reach someone (although we are also checking voicemail).**