Brandeis University
Mathematics Department

Undergraduate Curriculum and Advising Event

Wednesday Nov. 15th, 2023

Introductions by Undergraduate Advising Head Prof. Dmitry Kleinbock (kleinboc@brandeis.edu)

with

Prof. Olivier Bernardi, Math Chair
Catherine Broderick, Math Admin
Prof. Kiyoshi Igusa
Prof. Keith Merrill
Prof. Tyler Maunu
Bhakti Parwani, UDR
Prof. Rebecca Torrey
Prof. Daniel Ruberman

Feel free to contact any of us with questions.

Fall Undergraduate Events

- "MathMerch": Math Department T-shirt Design contest, results to be announced by our UDRs soon!
- Guided Reading Program (GRP) Student Presentations, Monday December 11th in Goldsmith 300: 10am – 12pm; 2pm – 4pm. All are welcome—refreshments.
- During final exams, refreshments will be available in Goldsmith 200, the Math Department's "Community Room".
- From "Brandeis to Google" joint-UDR event with the English Department's alumni Scott Josephson '01 who is *a* Corporate Operations Engineer at Google, November 10th, 2023.
- "Graduate School Panel," hosted by STEM UDRs designed to help in navigating the path to higher education, September 2023.
- "Boba X Math Meet and Greet", Sept. 6th, 2023

Be sure to follow the Math Department on Instagram!

Brandeis Mathematics Mentoring Program

- The mission of the Brandeis Mathematics Mentoring Program is to help students successfully navigate the undergraduate program in Mathematics at Brandeis, and make it as inclusive as possible. https://www.brandeis.edu/mathematics/undergraduate/mentor-program.html

- The mentors are math or applied-math majors (typically a junior or senior). The mentees are students interested in the minor/major in math or applied math (typically a 1st or 2nd year student). The mentees meet weekly in small group discussions lead by the mentor.

- Application to become a Mentor or Mentee will open in December.

Drop-in Tutoring

The Brandeis Math Department offers free drop-in tutoring for undergraduate math classes. Talking about math is one of the best ways to learn and to deepen your understanding. It can also be the most fun way to learn! So we invite you to enjoy this resource.

Just show up to Goldsmith 200 during any of the scheduled times; you don't need to have questions or prepare anything ahead of time. You can also just use it as a place to do your homework or studying, so that there are other people around if you get stuck or have questions as you work.

See the tutoring schedule: For fall 2023: Monday-Thursday from 4pm-6pm and Fridays from 12pm – 2pm in Goldsmith 200.

Guided Reading Program

- Each semester, the Guided Reading Program (GRP) pairs undergraduate students with graduate student mentors to undertake independent study projects of various sizes and scopes over the course of the spring semester. The projects can take the form of reading and working through a mathematics text, reading research papers, or even doing research. https://www.brandeis.edu/mathematics/undergraduate/directed-reading-program.html

- Any sophomore, junior, or senior who has taken 15A (Linear Algebra) and 20A (Multi-Variable Calculus) is eligible to apply.

- No course credit given.

Putnam Exam and the Art of Problem Solving

- The Putnam Exam is a Mathematics Competition for all undergrad math students and students from other disciplines in the US and Canada. It is famous for the intricate mathematical puzzles it proposes, whose solutions require imagination and inventiveness. The competition takes place annually on each university campus on the first Saturday of December.

https://www.maa.org/math-competitions/putnam-competition

- We offer some relaxed, convivial, pizza-endowed, training sessions each fall. If you like mathematical challenges and beautiful problems, we encourage you to participate in these meetings. You are not required to enter the Putnam competition itself, and can just come to the training sessions to learn new math, discuss math problems, and challenge yourself with some tricky puzzles. The training will be conducted by Professor Kiyoshi Igusa, and PhD candidate Tudor Popescu. We hope that these training sessions will give many students an occasion to discover advanced mathematics in a different setting.

Textbooks

- The Math Department keeps the current semester's textbooks in Goldsmith 200 for you to view. Have a question about a book? See Catherine Broderick in Goldsmith 218 or email cbroderi@brandeis.edu.

- Textbooks are also placed on reserve in the library whenever possible.

Commitment to Diversity

- The Math Department is committed to fostering an inclusive community, bringing together individuals from diverse backgrounds to celebrate and expand the power of mathematical thinking. Regardless of our students' paths, they leave our Department with an enhanced ability to question, analyze and evaluate problems encountered throughout their lives.

- DEI Actions: https://www.brandeis.edu/mathematics/dei/index.html

- You may read our full statement at: https://www.brandeis.edu/mathematics/docs/diversity-statement.html

- New Outreach Opportunity: Online Tutoring Program starting in Spring 2024 https://tinyurl.com/AshlandBrandeisTutoring

Degree Programs in Math

- Bachelor of Arts in Mathematics
- Bachelor of Science in Mathematics
- Bachelor of Science in Applied Mathematics
- Minor in Mathematics
- Teacher Preparation Track
- Combined BA/MA: A student must make an appointment with the Undergraduate Advising Head in the Department of Mathematics in order to add the BA/MA to his/her program. This must be done no later than May 1 preceding his/her final year of study on campus.
- A student can declare a Major in Mathematics or a Major in Applied Mathematics but not both.
- A student may declare a minor in Mathematics but not in Applied Mathematics.

Requirements for All Math Degrees

As part of completing any Math Major, students must:

- Satisfy the Brandeis Core Requirements (see ”Notes” for listing of courses which fulfill these requirements).
- One of: Math 15a (Linear Algebra) or 22a (Honors Linear Algebra)
- One of: Math 20a (Multivariable Calculus) or 22b (Honors Multivariable Calculus)
- Math 23b (Introduction to Proofs)

Checklist of Courses

We have course checklists to help you prepare your schedules:

https://www.brandeis.edu/mathematics/docs/major-checklist.pdf

https://www.brandeis.edu/mathematics/docs/minor-checklist1.pdf

BA in Mathematics

As part of completing the BA in Math major, students must complete these courses with at least a grade of C- :

- Satisfy the Brandeis Core Requirements.
- One of MATH 15a or 22a; MATH 20a or 22b.
- MATH 23b or exemption
- MATH 35a, 110a, or 115a.
- MATH 28a, 28b, or 100a.
- Four additional semester courses, either MATH courses numbered 27 or higher or cross-listed courses in Mathematics.
- No course taken pass/fail may count toward the major, honors, or the teacher preparation track

BS in Mathematics

As part of completing the BS in Math, students must complete these courses with at least a grade of C-

- Satisfy the Brandeis Core Requirements
- MATH 15a or 22a; MATH 20a or 22b
- MATH 23b or exemption.
- MATH 35a, 110a, or 115a.
- MATH 28a, 28b, or 100a.
- Seven additional semester courses, either MATH courses numbered 27 or higher or cross-listed courses in Mathematics.
- No course taken pass/fail may count toward the major, honors, or the teacher preparation track

BS in Applied Mathematics

As part of completing the BS in Applied Math major, students must complete courses with at least a grade of C- :

- Satisfy the Brandeis Core Requirements.

At least twelve semester courses are required, including the following:

- Three foundational courses: Math 15a or Math 22a, Math 20a or Math 22b, and Math 36a.
- Math 23b or an exemption.
- Math 36b or Math 40a.
- Two of the following analysis courses: Math 35a, Math 37a, Math 110a or Math 115a.
- Two of the following: Math 121a, Math 122a, Math 123a, Math 124a, Math 125a or Math 126a.

(go to next slide for more requirements…)

BS in Applied Math (con't)

- One additional mathematics course number 27 or higher or a course cross-listed in Applied Mathematics.
- Two courses must be taken from another department from the following list: BCHM 102a, BCHM 104a, BCHM 145a, CHEM 141a, CHEM 142a, CHEM 146b, COSI 21a, COSI 112a, COSI 123a, COSI 130a, COSI 177a, COSI 180a, ECON 80a, ECON 161a, ECON 181b, ECON 182a, ECON 184b, NBIO 136b, NPHY 115a, any PHYS course numbered 20 or higher, and QBIO 110a.
- No grade below a C- will be given credit toward the Bachelor of Science degree.
- No course taken credit/no credit may count towards the Bachelor of Science degree.

How to Declare a Math Major

- Study all the requirements for the major in the University Bulletin: https://www.brandeis.edu/registrar/bulletin/provisional/courses/subjects/4700.html
- Fill out a Major/Minor Declaration Worksheet with a complete course plan for the major: https://www.brandeis.edu/registrar/forms/major-minor.html
- Schedule an appointment with the Undergraduate Advising Head (UAH), Prof. Dmitry Kleinbock (kleinboc@brandeis.edu) to declare the major. Bring the filled out worksheet to the appointment or send by email.

How to be Assigned a Math Faculty Advisor

- Go to the faculty list on the Math Department website, and pick a candidate professor that you would like to be your advisor. Note: faculty who are listed as “Instructors”, “Postdoctoral Associates/Fellows” or “Lecturers” do not generally act as advisors. https://www.brandeis.edu/mathematics/people/index.html

- Discuss and decide on the advisor in the appointment with the UAH. Get the signature from the advisor on your Major/Minor Declaration Worksheet, and submit the worksheet, with the signature, to the UAH.

Undergraduate Department Representatives (UDRs)

- Bhakti Parwani is a junior majoring in Math, Business and Economics.
- Dakota Lichauco is a junior currently pursuing a degree in Computer Science with a minor in math and music.

Bhakti Parwani (bhaktiparwani@brandeis.edu)

Dakota Lichaucho (olivialichauco@brandeis.edu)

Courses for Spring 2024

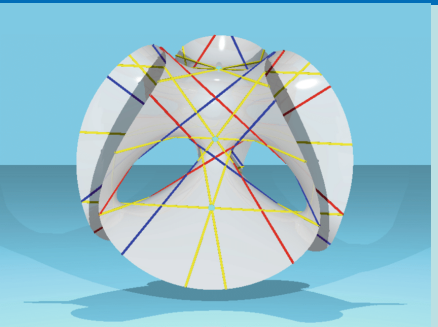
(see "Notes" for listing of Pre-requisites and Rotation of Courses)

- Math 3a Explorations in Math: A course for educators
- Math 5a Pre-Calculus
- Math 8a Intro. to Probability and Statistics
- Math 9b Math Puzzles and Games
- Math 10a Techniques of Calculus (a)
- Math 10b Techniques of Calculus (b)
- Math 15a Linear Algebra
- Math 16b Linear Algebra Practicum
- Math 20a Multi-variable Calculus
- Math 22b Honors Linear Algebra
- Math 23b Introduction to Proofs

Courses for Spring 2024

(see "Notes" for listing of Pre-requisites and Rotation of Courses)

- Math 28a Introduction to Groups
- Math 36b Mathematical Statistics
- Math 37a Differential Equations
- Math 47a Introduction to Mathematical Research
- Math 91g (1/4 credit), Math 98b (4 credits), Math 99b (4 credits)
- Math 100b Introduction to Algebra II
- Math 104a Introduction to Topology
- Math 110b Intro. to Real Analysis II
- Math 115a Introduction to Complex Analysis
- Math 121a Mathematics for Natural Sciences
- Math 123a Principles of Mathematical Modeling



Questions and Answers

thank you for coming!

Notes Section

1) Course Pre-Requisites
2) Senior Honors Research
3) Foundational Literacy Requirements
4) Rotation of Courses
5) Research: How to do Research Guide

Course Pre-requisites

Where do I find course pre-requisites and full course descriptions?

You will find course pre-requisites and descriptions in the University Bulletin.

Math 3A Explorations in Math: A course for educators
Does not satisfy the School of Science requirement. Permission of instructor required. No prerequisites.

Math 5a Pre-calculus
Does not satisfy the School of Science requirement. Students may not take MATH 5a if they have received a satisfactory grade in any math class numbered 10 or higher.

Math 8a Introduction to Probability and Statistics
Does not require calculus; only high school algebra and graphing of functions.

Math 9b Math Puzzles and Games
Pre-requisite: Math 5a

Math 10a Techniques in Calculus .
Prerequisite: Students may not take MATH 10a if they have received a satisfactory grade in MATH 10b or MATH 20a.

Math 10b Techniques in Calculus
Prerequisite: A satisfactory grade of C- or higher in MATH 10a or placement by examination.

Course Pre-requisites (con't)

Math 15a Linear Algebra
Prerequisites: MATH 5a and permission of the instructor, placement by examination, or any mathematics course numbered 10 or above. Students may take MATH 15a or 22a for credit, but not both.

MATH 16b Applied Linear Algebra Practicum . Yields ½ credit.
Prerequisite: MATH 15a or MATH 22a.

Math 20a Multi-variable Calculus

Prerequisites: MATH 10a and b and MATH 15a, or placement by examination.

Math 22a Honors Linear Algebra
Prerequisite: MATH 22 placement exam and permission of the instructor.

Math 22b Honors Multi-variable Calculus, Part II
Prerequisite: Math 22a or permission of instructor

Math 23b Introduction to Proofs
Prerequisites: MATH 15a, 20a, or 22a, or permission of the instructor.

Math 28a Introduction to Groups
Prerequisites: MATH 23b and either MATH 15a or 22a, or permission of the instructor. Students may take MATH 28a or 100a for credit, but not both

Course Pre-requisites (con't)

Math 28b Introduction to Rings and Fields
Prerequisites: MATH 23b and either MATH 15a, 22a, or permission of the instructor. Students may take MATH 28b or 100b for credit, but not both.
Math 31a Abstract Linear Algebra
Prerequisites: MATH 23b or equivalent.
MATH 35a Advanced Calculus and Fourier Analysis
Prerequisites: MATH 15a or 22a and MATH 20a or 22b
MATH 36a Probability
Prerequisite: MATH 20a or 22b
MATH 36b Mathematical Statistics
Prerequisite: MATH 36a or permission of the instructor.
MATH 37a Differential Equations
Prerequisites: MATH 15a or 22a and MATH 20a or 22b.
MATH 39a Introduction to Combinatorics
Prerequisite: COSI 29a or MATH 23b, or permission of the instructor.
MATH 40a Introduction to Applied Mathematics
Prerequisites: MATH 15a or MATH 22a and MATH 20a or MATH 22b.
MATH 47a Introduction to Mathematical Research
Prerequisites: MATH 23b or permission of the instructor

Course Pre-requisites (con't)

MATH 100a Introduction to Algebra, Part I
Prerequisite: MATH 23b and MATH 15a or 22a, or permission of the instructor. Students may take MATH 28a or 100a for credit, but not both.
MATH 100b Introduction to Algebra, Part II
Prerequisite: MATH 100a or permission of the instructor. Students may take MATH 28b or 100b for credit, but not both.
MATH 102a Introduction to Differential Geometry
Prerequisites: MATH 23b and either MATH 20a or 22b or permission of the instructor.
MATH 104a Introduction to Topology
Prerequisites: MATH 15a or 22a and MATH 20a or 22b, and MATH 23b, or permission of the instructor.
MATH 108b Introduction to Number Theory
Prerequisites: MATH 23b and MATH 15a or 22a, or permission of the instructor.
MATH 110a Introduction to Real Analysis, Part I
Prerequisites: MATH 15a or 22a and MATH 20a or 22b, and MATH 23b, or permission of the instructor.
MATH 110b Introduction to Real Analysis, Part II
Prerequisite: MATH 110a or permission of the instructor.

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Course Pre-requisites (con't)

MATH 115a Introduction to Complex Analysis
Prerequisites: MATH 15a or 22a and MATH 20a or 22b, and MATH 23b or permission of the instructor.
MATH 121a Mathematics for Natural Sciences
Prerequisites: MATH 15a or MATH 22a and MATH 20a or MATH 22b.
MATH/MUS 121b Mathematics and Music
Prerequisites: None. Does not satisfy the School of Science requirement.
MATH 122a Numerical Methods and Big Data
Prerequisites: MATH 15a or MATH 22a and MATH 20a or MATH 22b, and basic proficiency with a programming language such as Python or Matlab.
MATH 123a Principles of Mathematical Modeling
Prerequisites: MATH 15a or MATH 22a, MATH 20a or MATH 22b, and MATH 37a.
MATH 124a Optimization
Prerequisites: MATH 15a or MATH 22a, MATH 20a or MATH 22b, MATH 23b, and basic proficiency with a programming language such as Python or Matlab, or permission of the instructor.
Math 125a Mathematics for Machine
Prerequisites: Math 10b and (Math 15a or Math 22a).
Math 126a Introduction to Stochastic Processes and Models]
Prerequisites: Math 15a, 20a, and 36a

Senior Honors Research, Math 99a/b

For complete listing of rules for Senior Honors Research, go to the Math website: https://www.brandeis.edu/mathematics/undergraduate/senior-honors-thesis.html.

- The honors program is a two-semester sequence (Math 99a, "Senior Research" in fall, followed by Math 99b, "Senior Research" in spring) during which senior mathematics majors carry out independent research and the writing and oral presentation of a senior thesis.
- Only students who major in the BS in Mathematics or BS in Applied Math may choose the option of writing a thesis in order to be considered for Honors, High Honors or Highest Honors in mathematics.

Brandeis Core Requirements

Foundational Literacy Requirements for All Math Majors (Spring 2024)

Writing Intensive Requirement (wi): MATH 23b or MATH 47a (check the University Bulletin for the most up to date listings).

Oral Communication Requirement (oc): MATH 16b or MATH 40a (check the University Bulletin for the most up to date listings)

Digital Literacy Requirement (dl): MATH 16b, Math 40a, Math 122a, Math 124a, COSI 10a, COSI 12b, or COSI 21a (check the University Bulletin for the most up to date listings).

Quantitative Reasoning Requirement for the University

These Math courses currently fulfill the University's QR requirement--check the University Bulletin for the most up-to-date listings:
Math 8a "Introduction to Probability and Statistics"
Math 36a "Probability"
Math 36b "Mathematical Statistics"
Math 231a "Advanced Bifurcation Analysis in Dynamical Systems" (graduate course).

Guide to Research

- Ask a faculty member in the math department if they have any projects that you can help with. Not sure how to approach a faculty member or what to ask for? Sign up for Research 101 workshops: https://www.brandeis.edu/undergraduate-research/index.html
- Apply for the Math Department's Guided Reading Program, fall and spring semesters. You will work one-on-one with an advanced graduate student in the math department. Any sophomore, junior, or senior who has taken 15A (Linear Algebra) and 20A (Multi-variable Calculus) is eligible to apply. First-years who have seen this material are considered on a case-by-case basis.
- Create a Forager One Account: https://foragerone.com/auth/get-started. Find the faculty members who are doing research at Brandeis.
- In your senior year, consider pursuing Senior Honors Research (Math 99a/b).
- To receive academic credit for work with a faculty member, register for Math 91g "Intro to Research Practice" (1/4 credit) or Math 98a/b "Independent Research" (4 credits)," with the faculty member's approval.

Guide to Research (links)

Off-Campus, including Research Experiences for Undergraduates (REUs)

- Mathematical Sciences: https://www.nsf.gov/crssprgm/reu/list_result.jsp?unitid=5044
- REU's: https://www.maa.org/member-communities/students/undergraduate-research/research-experiences-for-undergraduates
- STEM: https://www.pathwaystoscience.org/undergrads.aspx

Undergraduate Research and Creative Collaborations (URCC) at Brandeis

- https://www.brandeis.edu/undergraduate-research/index.html

Division of Science

- https://www.brandeis.edu/science/undergraduate-research/surf.html

Rotation of Courses

Math 3a	Explorations in Math: A Course for Educators	Every Year, Spring
Math 5a	Precalculus Mathematics	Every semester, Fall and Spring
Math 8a	Introduction to Probability and Statistics (qr,sn)	Every semester, Fall and Spring
Math 9a	Science and Science Fiction (sn)	TBD
Math 9b	Math Puzzles and Games	Every Year, Spring
Math 10a	Techniques of Calculus (a) (sn)	Every semester, Fall and Spring
Math 10b	Techniques of Calculus (b) (sn)	Every semester, Fall and Spring
Math 15a	Linear Algebra (sn)	Every semester, Fall and Spring
Math 16b	Linear Algebra Practicum (dl,oc)	Every Year, Spring
Math 20a	Multi-variable Calculus (sn)	Every semester, Fall and Spring
Math 22a	Honors Linear Algebra (sn)	Every Year, Fall
Math 22b	Honors Multi-variable Calculus (sn)	Every Year, Spring
Math 23b	Introduction to Proofs (sn,wi)	Every semester, Fall and Spring
Math 28a	Introduction to Groups (sn)	Every other year, Spring Even Years
Math 28b	Introduction to Rings and Fields (sn)	Every other year, Spring Odd Years
Math 31a	Advanced Linear Algebra (sn)	Every Year, Fall
Math 35a	Advanced Calculus and Fourier Analysis (sn)	Every Year, Fall
Math 36a	Probability (qr, sn)	Every Year, Fall
Math 36b	Mathematical Statistics (qr,sn)	Every Year, Spring
Math 37a	Differential Equations (sn)	Every Year, Spring
Math 39a	Introduction to Combinatorics (sn)	Every other year, Fall Odd Years
Math 40a	Introduction to Applied Mathematics (oc dl,sn)	Every Year, Fall
Math 47a	Introduction to Mathematical Research (sn,wi)	Every Year, semester to be determined

Rotation of Courses (con't)

Math 100a	Introduction to Algebra, Part I (sn)	Every Year, Fall	
Math 100b	Introduction to Algebra, Part II (sn)	Every other year, Spring Even Years	
Math 102a	Introduction to Differential Geometry (sn)	Every other year, TBA	
Math 104a	Introduction to Topology (sn)	Every other year, Fall Odd Years	
Math 108b	Introduction to Number Theory (sn)	Every other year, Fall Even Years	
Math 110a	Introduction to Real Analysis, Part I (sn)	Every Year, Fall	
Math 110b	Introduction to Real Analysis, Part II (sn)	Every other year, Spring Even Years	
Math 115a	Introduction to Complex Analysis (sn)	Every Year, Spring	
Math 121a	Mathematics for Natural Sciences (sn)	Every Year, Spring	
MATH/MUS	Math and Music (ca)	TBD	
Math 122a	Numerical Methods and Big Data (dl, sn)	Every Year, Fall	
Math 123a	Principles of Mathematical Modeling	Every other year, Fall Odd Years	
Math 124a	Optimization (dl,sn)	Every other year, Spring Odd Years	
Math 125a	Mathematics for Machine Learning	Every other year, Spring Even Years	
Math 126a	Introduction to Stochastic Processes & Models	Every other year, Fall Even Years	
Math 201a	Algebra I (sn)	Every Year, Fall	
Math 201b	Algebra II (sn)	Every Year, Spring	
Math 211a	Real Analysis (sn)	Every Year, Fall	
Math 211b	Complex Analysis (sn)	Every Year, Spring	
Math 221a	Topology I (sn)	Every Year, Fall	
Math 221b	Topology II (sn)	Every Year, Spring	
Math 225a	Geometry of Manifolds (sn)	Every Year, Fall	