NYU Mathematics
UNDERGRADUATE PROGRAM

ACADEMIC YEAR 2015 – 2016
(Revised September 2015)

New York University
Mathematics Department
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This guide is meant to provide majors with a comprehensive picture of the offerings of the Mathematics Department. It contains information on courses, degree requirements, special programs, activities, prizes and awards. It supplements and repeats the information contained in the New York University Bulletin for the College of Arts and Sciences.

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I. Welcome To The Mathematics Department

The undergraduate division of the Department of Mathematics offers a wide variety of courses in pure and applied mathematics. The faculty are members of the University's Courant Institute of Mathematical Sciences, noted for its advanced training and research programs, which emphasize the applications of mathematics to technology and other branches of science.

Joint programs are available in mathematics and (1) computer science, (2) economics, and (3) engineering. They lead to the B.A. in four years, with the exception of the engineering option, which leads to a joint B.S./B.S. degree from NYU and NYU Tandon School of Engineering. Additionally, an accelerated B.A. and M.S. degree in Mathematics, as well as an M.A. in Math Education with Steinhardt, from New York University in five years is offered. The department also provides an honors program in (1) mathematics and (2) mathematics and computer science for outstanding students. Additionally, independent study courses are available for students with special interests.

Required courses for all mathematics majors include MATH-UA 121 Calculus I, MATH-UA 122 Calculus II, MATH-UA 123 Calculus III, MATH-UA 140 Linear Algebra, MATH-UA 325 Analysis, and MATH-UA 343 Algebra (except the joint mathematics and economics major).

Mathematics majors are encouraged to spend a semester studying abroad at one of the many centers run by NYU Global Programs. Currently, mathematics can be studied at NYU Abu Dhabi, NYU Berlin, NYU Florence, NYU London, and NYU Shanghai.

II. Advising

Students intending to major in mathematics are urged to declare their major as early as possible and no later than the beginning of their junior year. Students can declare their major by completing a major declaration form which is found on the undergraduate mathematics website: http://www.math.nyu.edu/degree/undergrad/declaring.html.

The Undergraduate Advisement office for the Department is located in room 625 of Warren Weaver Hall. All matters concerning mathematics courses, mathematics majors and minors can be addressed here. When necessary, the Program Administrator will arrange appointments with the Director of Undergraduate Studies or Vice Chair of Undergraduate Affairs for advisement or academic counseling. Each mathematics major is assigned to a faculty advisor in the mathematics department. All declared mathematics majors must have their proposed course schedules approved each term by his/her faculty advisor. The approved schedule must be signed by their faculty advisor and delivered to the mathematics department administrative staff in room 625 or 627 for final clearance.

Students who believe that they are prepared to start their work in mathematics at an advanced level, or who feel qualified to enter a course without the formal prerequisites, should submit a documentation of prior college level coursework along with syllabuses to the Vice Chair of Undergraduate Affairs. Calculus placement exams are offered each semester.

III. Degree Programs

Requirements for all degree programs have changed effective Fall 2014. For each student, program requirements that must be adhered to are determined by the term in which the student enters NYU.

A. Major in Mathematics

1. Requirements for students entering NYU Fall 2014 or later

The requirements for the mathematics major are thirteen courses numbered MATH-UA 120 or higher. The only exceptions are MATH-UA 211, 212, and 213 Math for Economics I, II and III which are not open to anyone who has taken Calculus and are for Economics Majors and MATH-UA 270 which is only for Math Education students. The courses must include:

a. Calculus Requirement

- MATH-UA 121 Calculus I

and either the following three courses:

- MATH-UA 122 Calculus II
- MATH-UA 123 Calculus III
- MATH-UA 140 Linear Algebra

or the two intensive courses:

- MATH-UA 221 Honors Calculus I
- MATH-UA 222 Honors Calculus II

b. Analysis and Algebra Requirement

- MATH-UA 325 Analysis
- MATH-UA 343 Algebra

Either of these courses can be substituted by its more intensive counterpart:

- MATH-UA 328 Honors Analysis I
- MATH-UA 348 Honors Algebra I

c. Advanced Electives Requirement

The rest of the 13 required courses must include at least three of the following:

- MATH-UA 233 Theory of Probability
- MATH-UA 234 Mathematical Statistics
- MATH-UA 252 Numerical Analysis
- MATH-UA 263 Partial Differential Equations
- MATH-UA 282 Functions of a Complex Variable
- MATH-UA 329 Honors Analysis II
- MATH-UA 349 Honors Algebra II
- MATH-UA 377 Differential Geometry
- MATH-UA 393 Honors I
- MATH-UA 394 Honors II
- MATH-UA 397 Honors III
- MATH-UA 398 Honors IV

It is strongly suggested for students to take MATH-UA 325 Analysis before enrolling in MATH-UA 343 Algebra.

In addition, the student must maintain a 2.0 mathematics GPA.

* Any two computer science courses (numbered CSCI-UA 101 or higher, except CSCI-UA 380) or graduate data science DS-GA courses may be credited toward the 13 course requirement. The prerequisites for DS-GA courses are Calculus III, Linear Algebra, and programming experience in Python (preferred) or MATLAB. Probability is useful, but not a required course prerequisite.
Students enrolled in and who complete the Premedical or Predental Program and who wish to major in mathematics may substitute at most two math classes by any two of the following; PHYS-UA 11 and 12 General Physics I and II or PHYS-UA 91 and 93

Physics I and II toward their 12 course requirement. However, if these physics courses are used towards the mathematics major, the computer science or data science courses will not apply towards the major. Students may double-count no more than two courses towards both the Mathematics Major and the requirements of another major or minor. Courses taken under the pass/fail option are not counted toward the major. A grade of C or better is required in all courses used to fulfill the major requirement.

2. Requirements for students who entered NYU Fall 2012 – Summer 2014

   a. Calculus Requirement

      - MATH-UA 121 Calculus I

      and either the following three courses:

      - MATH-UA 122 Calculus II
      - MATH-UA 123 Calculus III
      - MATH-UA 140 Linear Algebra

      or the two intensive courses:

      - MATH-UA 221 Honors Calculus I
      - MATH-UA 222 Honors Calculus II

   b. Analysis and Algebra Requirement

      - MATH-UA 325 Analysis
      - MATH-UA 343 Algebra

      Either of these courses can be substituted by its more intensive counterpart:

      - MATH-UA 328 Honors Analysis I
      - MATH-UA 348 Honors Algebra I

   c. Advanced Electives Requirement
      The rest of the 12 required courses must include at least two of the following:

      - MATH-UA 326 Analysis II or MATH-UA 329 Honors Analysis II

- MATH-UA 344 Algebra II or MATH-UA 349 Honors Algebra II
- MATH-UA 224 Vector Analysis
- MATH-UA 233 Theory of Probability
- MATH-UA 252 Numerical Analysis
- MATH-UA 263 Partial Differential Equations
- MATH-UA 282 Functions of a Complex Variable

AND

- Four Electives to a total of 12 courses

It is strongly suggested for students to take MATH-UA 325 Analysis before enrolling in MATH-UA 343 Algebra.

In addition, the student must maintain a 2.0 mathematics GPA.

* Any two computer science courses numbered CSCI-UA 101 or higher, except CSCI-UA 380, may be credited toward the 12 course requirement. Students enrolled in and who complete the Premedical or Predental Program and who wish to major in mathematics may substitute at most two math classes by any two of the following; PHYS-UA 11 and 12 General Physics I and II or PHYS-UA 91 and 93 Physics I and II toward their 12 course requirement. However, if these physics courses are used towards the mathematics major, the computer science courses will not apply towards the major. Students may double-count no more than two courses towards both the Mathematics Major and the requirements of another major or minor. Courses taken under the pass/fail option are not counted toward the major. A grade of C or better is required in all courses used to fulfill the major requirement.

3. Requirements for students who entered NYU before Fall 2012

   a. <u>Calculus Requirement</u>

      - MATH-UA 121 Calculus I

      and either the following three courses:

      - MATH-UA 122 Calculus II
      - MATH-UA 123 Calculus III

- MATH-UA 140 Linear Algebra

or the two intensive courses:

- MATH-UA 221 Honors Calculus I
- MATH-UA 222 Honors Calculus II

b. Analysis and Algebra Requirement
   - MATH-UA 325 Analysis I
   - MATH-UA 343 Algebra
   -

c. Advanced Electives Requirement
   The rest of the 12 required courses must include at least one of the following:
   - MATH-UA 326 Analysis II
   - MATH-UA 344 Algebra II
   - MATH-UA 224 Vector Analysis

In addition, the student must maintain a 2.0 mathematics GPA.

* Any two computer science courses numbered CSCI-UA 101 or higher, except CSCI-UA 380, may be credited toward the 12 course requirement. Students who complete the Pre-medical or Pre-dental Program and who wish to major in mathematics may count any two of the following courses toward their 12 course mathematics requirement: PHYS-UA 11 and 12 General Physics I and II or PHYS-UA 91 and 93 Physics I and II. However, if these physics courses are used towards the mathematics major, the computer science courses will not apply towards the major. Students may double-count no more than two courses towards both the Mathematics Major and the requirements of another major or minor. Courses taken under the pass/fail option cannot be counted toward the major. A grade of C or better is required in all courses used to fulfill the major requirement.

B. Joint Major in Mathematics and Computer Science
An interdisciplinary major offered jointly by the Department of Mathematics and Computer Science, provides the opportunity to study both computer science and relevant mathematics courses such as analysis, algebra, probability, and statistics. Students must complete one CSCI-UA course with a recorded grade of C or better before they can declare this joint major (this policy applies to all NYU students, not

just to those matriculated in CAS).

1. Requirements for students entering NYU Fall 2014 or later

    a. Mathematics Requirements
    The requirements are ten courses numbered MATH-UA 120 or higher, except MATH-UA 211, 212, 213 or 270 from the Mathematics Department, which must include:

    - MATH-UA 120 Discrete Math
    - MATH-UA 121 Calculus I
    - MATH-UA 122 Calculus II
    - MATH-UA 123 Calculus III
    - MATH-UA 140 Linear Algebra
    - MATH-UA 325 Analysis or MATH-UA 328 Honors Analysis I
    - MATH-UA 343 Algebra or MATH-UA 348 Honors Algebra I

    The rest of the 10 required courses must include two of the following:

    - MATH-UA 233 Theory of Probability
    - MATH-UA 234 Mathematical Statistics
    - MATH-UA 251 Mathematical Modeling
    - MATH-UA 252 Numerical Analysis
    - MATH-UA 263 Partial Differential Equations
    - MATH-UA 282 Functions of a Complex Variable
    - MATH-UA 329 Honors Analysis II
    - MATH-UA 349 Honors Algebra II
    - MATH-UA 377 Differential Geometry

    b. Computer Science Requirements
    Eight computer science courses as required for the major in that department. Please refer to the undergraduate computer science website for information on computer science courses:

http://www.cs.nyu.edu/webapps/content/academic/undergrad/majors

* Students may double-count no more than two courses towards both the Joint Major in Mathematics and Computer Science and the requirements of another major or minor. Courses taken under the pass/fail option cannot be counted toward the major. A grade of C or better is required in all courses used to fulfill the major requirement.

2. Requirements for students who entered NYU Fall 2012 – Summer 2014

    a. Mathematics Requirements

    The requirements are ten courses numbered MATH-UA 120 or higher from the Mathematics Department, which must include:

    - MATH-UA 120 Discrete Math
    - MATH-UA 121 Calculus I
    - MATH-UA 122 Calculus II
    - MATH-UA 123 Calculus III
    - MATH-UA 140 Linear Algebra
    - MATH-UA 325 Analysis or MATH-UA 328 Honors Analysis I
    - MATH-UA 343 Algebra or MATH-UA 348 Honors Algebra I

    The rest of the 10 required courses must include two of the following:

    - MATH-UA 326 Analysis II or MATH-UA 329 Honors Analysis II
    - MATH-UA 344 Algebra II or MATH-UA 349 Honors Algebra II
    - MATH-UA 224 Vector Analysis
    - MATH-UA 233 Theory of Probability
    - MATH-UA 252 Numerical Analysis
    - MATH-UA 263 Partial Differential Equations
    - MATH-UA 282 Functions of a Complex Variable

b. Computer Science Requirements
Eight computer science courses as required for the major in that department. Please refer to the undergraduate computer science website for information on computer science courses:

http://www.cs.nyu.edu/webapps/content/academic/undergrad/majors

* Students may double-count no more than two courses towards both the Joint Major in Mathematics and Computer Science and the requirements of another major or minor. Courses taken under the pass/fail option cannot be counted toward the major. A grade of C or better is required in all courses used to fulfill the major requirement.

3. Requirements for students who entered NYU before Fall 2012

a. Mathematics Requirements
The mathematics requirements are ten courses numbered MATH-UA 120 or higher from the Mathematics Department, which must include MATH-UA 325 Analysis I and MATH-UA 343 Algebra I; MATH-UA 246 Intro to Abstract Algebra cannot be counted if MATH-UA 343 Algebra I is applied toward the major. The remaining mathematics courses must include one of the following: MATH-UA 326 Analysis II, MATH-UA 344 Algebra II, or MATH-UA 224 Vector Analysis.

b. Computer Science Requirements
Eight computer science courses are required for the major. Please refer to the undergraduate computer science website for more information about the computer science courses:

http://www.cs.nyu.edu/webapps/content/academic/undergrad/majors

* Students may double-count no more than two courses towards both the Joint Major in Mathematics and Computer Science and the requirements of another major or minor. Courses taken under the pass/fail option cannot be counted toward the major. A grade of C or better is required in all courses used to fulfill the major requirement.

C. Joint Major in Mathematics and Economics
An interdisciplinary major offered jointly by the Departments of Mathematics and Economics, providing the opportunity to study

economics, and in mathematics, analysis, statistics, and operations research. Please note: Students in the joint mathematics/economics major may only take the theory sequence.

1. Requirements for students entering NYU Fall 2014 or later

    a. Mathematics Requirements
    The requirements are nine courses numbered MATH-UA 120 or higher from the Mathematics Department, which must include:

        - MATH-UA 211 Math for Economics I or MATH-UA 121 Calculus I
        - MATH-UA 212 Math for Economics II or MATH-UA 122 Calculus II
        - MATH-UA 213 Math for Economics III or MATH-UA 123 Calculus III
        - MATH-UA 140 Linear Algebra
        - MATH-UA 325 Analysis or MATH-UA 328 Honors Analysis I

        *The Math for Economics sequence is the preferred sequence for this major, although we will accept either Math for Economics or Calculus. Students must complete one of the sequences and courses from the other sequence may not be applied to the same degree program. Students may not register simultaneously for separate courses within the two sequences.

        Plus four chosen from:

        - MATH-UA 233 Theory of Probability
        - MATH-UA 234 Mathematical Statistics
        - MATH-UA 235 Probability & Statistics
        - MATH-UA 240 Combinatorics
        - MATH-UA 248 Theory of Numbers
        - MATH-UA 250 Mathematics of Finance
        - MATH-UA 251 Mathematical Modeling
        - MATH-UA 252 Numerical Analysis
        - MATH-UA 262 Ordinary Differential Equations

- MATH-UA 263 Partial Differential Equations
- MATH-UA 264 Chaos & Dynamical Systems
- MATH-UA 282 Functions of a Complex Variable
- MATH-UA 329 Honors Analysis II
- MATH-UA 343 Algebra or MATH-UA 348 Honors Algebra I

b. Economics Requirements
The economics requirements are ECON-UA 1, 2, 11, 13, 20, 266, plus any three economics elective courses, two of which must be theory electives numbered ECON-UA 3XX. Please refer to the undergraduate economics website for information on economics courses:

http://econ.as.nyu.edu/object/economics.1214.ug.req#major

* Students may double-count no more than two courses towards both the Joint Major in Mathematics and Economics and the requirements of another major or minor. Courses taken under the pass/fail option cannot be counted toward the major. A grade of C or better is required in all courses used to fulfill the major requirement.

2. Requirements for students who entered NYU Fall 2013 – Summer 2014

a. Mathematics Requirements
The requirements are a total of nine courses, which must include:

- MATH-UA 211 Math for Economics I or MATH-UA 121 Calculus I
- MATH-UA 212 Math for Economics II or MATH-UA 122 Calculus II
- MATH-UA 213 Math for Economics III or MATH-UA 123 Calculus III
- MATH-UA 140 Linear Algebra
- MATH-UA 325 Analysis or MATH-UA 328 Honors Analysis I

*The Math for Economics sequence is the preferred

sequence for this major, although we will accept either Math for Economics or Calculus. Students must complete one of the sequences and courses from the other sequence may not be applied to the same degree program. Students may not register simultaneously for separate courses within the two sequences.

Plus four chosen courses from:

- MATH-UA 141 Honors Linear Algebra
- MATH-UA 224 Vector Analysis
- MATH-UA 233 Theory of Probability
- MATH-UA 234 Mathematical Statistics
- MATH-UA 235 Probability & Statistics
- MATH-UA 262 Ordinary Differential Equations
- MATH-UA 240 Combinatorics
- MATH-UA 263 Partial Differential Equations
- MATH-UA 264 Chaos & Dynamical Systems
- MATH-UA 248 Theory of Numbers
- MATH-UA 250 Mathematics of Finance
- MATH-UA 252 Numerical Analysis
- MATH-UA 270 Transformations & Geometries
- MATH-UA 282 Functions of a Complex Variable
- MATH-UA 326 Analysis II or MATH-UA 329 Honors Analysis II
- MATH-UA 343 Algebra or MATH-UA 348 Honors Algebra I
- MATH-UA 344 Algebra II or MATH-UA 349 Honors Algebra II

b. Economics Requirements

The economics requirements are ECON-UA 1, 2, 11, 13, 20, 266, plus any two economics elective courses, which must be theory electives numbered ECON-UA 3XX and one which must be numbered ECON-UA 2XX. Please refer to the undergraduate economics website for information on economics courses:

http://econ.as.nyu.edu/object/economics.1214.ug.req#major

* Students may double-count no more than two courses towards both the Joint Major in Mathematics and Economics and the requirements of another major or minor. Courses taken under the pass/fail option cannot be counted toward the major. A grade of C or better is required in all courses used to fulfill the major requirement.

3. Requirements for students who entered NYU before Fall 2013

   a. Mathematics Requirements

      The mathematics requirements are nine courses consisting of MATH-UA 121 – 123 Calculus I, II, III, MATH-UA 140 Linear Algebra, MATH-UA 325 Analysis I, plus four courses chosen below:

MATH-UA 224 Vector Analysis
MATH-UA 235 Probability & Statistics
MATH-UA 240 Combinatorics
MATH-UA 141 Honors Linear Algebra
MATH-UA 343, 344 Algebra I, II
MATH-UA 234 Mathematical Statistics
MATH-UA 252 Numerical Analysis
MATH-UA 282 Functions of a Complex Variable
MATH-UA 262 Ordinary Differential Equations
MATH-UA 363 Partial Differential Equations
MATH-UA 264 Chaos & Dynamical Systems
MATH-UA 248 Theory of Numbers
MATH-UA 233 Theory of Probability
MATH-UA 250 Mathematics of Finance
MATH-UA 270 Transformations & Geometries
MATH-UA 326 Analysis II

   b. Economics Requirements

      The economics requirements are 9 courses in Economics including:

      ECON-UA 5, ECON-UA 6, ECON-UA 11, ECON-UA 13, ECON-UA 20, ECON-UA 266, plus any three economics elective courses, at least two of which must be theory electives numbered ECON-UA 300 to ECON-UA 399.

      Please refer to the undergraduate economics website for more information about the economics courses:

      http://econ.as.nyu.edu/object/economics.1214.ug.req#major.

* Students may double-count no more than two courses towards both the Joint Major in Mathematics and Economics and the requirements of another major or minor. Courses taken under the pass/fail option cannot be counted toward the major. A grade of C or better is required in all courses used to fulfill the major requirement.

D. Mathematics Minor

The requirements for a mathematics minor are four courses in the department numbered MATH-UA 120 or higher. Courses from the sequences MATH-UA 121-123 Calculus I-III and MATH-UA 211-213 Math for Economics I-III may not both be applied to the mathematics minor. Although courses transferred from other colleges may count towards the minor, at least two courses for the minor must be taken at NYU. Students pursuing majors that require mathematics courses may follow this minor, as long as two of the four courses do not apply simultaneously to the requirements for their major. Courses taken under the pass/fail option are not counted toward the minor. A grade of C or better is required in all courses to count toward the minor.

E. Joint Mathematics and Computer Science Minor

The requirements are the four courses MATH-UA 121, MATH-UA 122, CSCI-UA 101 and CSCI-UA 102. Students must complete one CSCI-UA course with a recorded grade of C or better before they can declare this joint minor (this policy applies to all NYU students, not just to those matriculated in CAS). At most one mathematics course in the joint minor may be transferred from other colleges. Students who wish to double-count courses for the math portion of the minor and another requirement may count at most two such courses toward the minor. Courses taken under the pass/fail option are not counted toward the minor. A grade of C or better is required in all courses to count toward the minor.

F. Advanced Mathematical Methods Minor

The Advanced Mathematical Methods Minor (for Stern undergraduates only) provides students with mathematical tools to handle complex business problems. The requirements are MATH-UA 140, STAT-UB 14, MATH-UA 252 or MATH-GA 2010, and one of these advanced courses: MATH-UA 262, MATH-UA 263, STAT-UB 15, STAT-UB 21, or MATH-UA 325. Note: All students must take at least one Stern course in order to meet minor requirements. If a student has completed the CAS version of Probability, STAT-UB 14 should not be taken. Instead, please select one of the following: STAT-UB 15 or STAT-UB 21. Students who have the equivalent of MATH-UA 140 should substitute a more advanced course from the list above.

G. Mathematics Education Minor for Mathematics Majors

The Mathematics Education Minor (for Mathematics Majors) enables you to complete coursework as an undergraduate in CAS that will reduce the number of credits required of a Steinhardt School of Education M.A. degree in Teachers of Mathematics, Grades 7-12 that will fulfill the requirements for Initial teacher certification. The master's degree will require 30 credits including student teaching internships beyond the bachelor's degree.

It is recommended that you declare the minor and begin taking these courses during your first semester of junior year. Most of these courses require a fieldwork component consisting of classroom observation and participation. For course descriptions, please see the current Steinhardt School of Education's Undergraduate website at: http://steinhardt.nyu.edu/teachlearn/minors/general

H. B.S. /B.S. Program in Engineering

The College of Arts and Science, in cooperation with the NYU Tandon School of Engineering, offers a joint B.S./B.S. program in engineering. Students in the program receive the B.S. degree in mathematics and the B.S. degree in either civil, computer, electrical or mechanical engineering. The joint mathematics/engineering students must complete the 13-course mathematics requirement. Students are allowed to substitute CSCI-UA 101, 102 Computer Science I, II, or PHYS-UA 91, 93 Physics I, II for a maximum of two mathematics classes. Further information is available from Mr. Tyrell Davis, advisor for the B.S./B.S. program, in the College Advising Center, Silver Center, 100 Washington Square East, Room 905; 212-998-8133.

I. B.A./M.S. Program in Mathematics

New York University has introduced a program that allows students to obtain a Mathematics Bachelor's and Master's degree in five years. The program is suited to students who have decided not to enter a Ph.D. program at this time but who would like to increase their skills before entering the job market. Qualifying students are accepted into a program toward the end of the sophomore year or during their junior year before they reach 96 credits. Students must earn a minimum of a 3.50 GPA in order to qualify for acceptance into the joint B.A. /M.S. During the last few undergraduate semesters, students should accelerate by taking one quarter of their graduate courses during regular terms and/or during the summer. In the graduate portion of the program, they can qualify for a scholarship covering up to 50 percent of the tuition for the master's degree. For more information, please contact Associate Director, Juniors and Inter-School Programs, Scott Statland at scott.statland@nyu.edu or (212) 998-8521.

J. B.A./M.A. Program in Mathematics/Teacher Education

Students in Mathematics can complete both their Bachelor's degree and a Master's degree in Teaching (grades 7 - 12) in just 5 years. In addition to saving money by completing the MA at an accelerated pace, students in this dual degree program receive a generous scholarship toward the MA degree. The scholarship typically covers 30% of graduation tuition and may cover more depending on the program of study and availability of external funds. For more information, please contact Associate Director, Juniors and Inter-School Programs, Scott Statland at scott.statland@nyu.edu or (212) 998-8521.

IV. Honors Program

A. Mathematics Honors Major

The Honors Program is designed for students with a strong commitment to mathematics. It is recommended for students who intend to pursue graduate study in mathematics.

1. Requirements for students entering NYU Fall 2014 or later

Beyond the major core requirements, which are MATH-UA 121, 122, 123, Calculus I, II, and III, and MATH-UA 140, Linear Algebra, an honors major must take four of the following courses: MATH-UA 328, 329 Honors Analysis I, II; MATH-UA 348, 349 Honors Algebra I, II; or MATH-UA 393, 394, 397, 398 Honors, I-IV. Under special circumstances, with the permission of the department, certain graduate courses may be substituted for Honors I-IV. Potential honors students are strongly encouraged to register for MATH-UA 221 and 222 Honors Calculus I and II (to replace MATH-UA 122, 123 and 140), if they have the necessary prerequisites. However, Honors Calculus I and II are not mandatory for participation in the honors program.

Students must also complete a senior research project and present it at the DURF presentations in the spring. Students should register for two semesters of MATH-UA 997, 998 independent study under faculty supervision. Students should seek approval of their research project from the Faculty Honors Advisor, Director of Undergraduate Studies or Vice Chair of Undergraduate Affairs. The research project can also be completed through the mathematics summer research program (S.U.R.E.). Students who participate in this program are required to present their research at the undergraduate research forum in the fall semester of their senior year.

Students seeking admission into the honors program must: 1) maintain a grade point average of 3.65 or higher in the major sequence (including Honors requirements), 2) obtain approval of the director of the honors program. Interested students can consult with the mathematics Honors Advisor, Professor Elie Hameiri at hameiri@cims.nyu.edu.

2. Requirements for students who entered NYU before Fall 2014

Beyond the major core requirements, which are MATH-UA 121, 122, 123, Calculus I, II, and III, and MATH-UA 140, Linear Algebra, an honors major must take: MATH-UA 325, 326 Analysis, Analysis II (or MATH-UA 328, 329 Honors Analysis I, II) and MATH-UA 343,

344 Algebra, Algebra II (or MATH-UA 348, 349 Honors Algebra I, II), both usually taken during the junior year; two of the following: MATH-UA 393, 394, 397, 398 Honors, I-IV, are usually taken in the senior year; and three electives, numbered MATH-UA 120 or higher. Under special circumstances, with the permission of the department, certain graduate courses may be substituted for Honors I-IV. Potential honors students are strongly encouraged to register for Honors Calculus I and II, if they have the necessary prerequisites. However, Honors Calculus I and II are not mandatory for participation in the honors program.

Students must also complete a senior research project. Students should register for two semesters of MATH-UA 997, 998 independent study under faculty supervision. Students should seek approval of their research project from the Director of Undergraduate Studies or Vice Chair of Undergraduate Affairs. The research project can also be completed through the mathematics summer research program (S.U.R.E.). Students who participate in this program are required to present their research at the undergraduate research forum in the fall semester of their senior year.

Students seeking admission into the honors program must: 1) maintain a grade point average of 3.65 or higher in the major sequence (including Honors requirements), 2) obtain approval of the director of the honors program. Interested students can consult with the mathematics Honors Advisor, Professor Elie Hameiri at hameiri@cims.nyu.edu.

B. Joint Honors in Mathematics and Computer Science

This is an interdisciplinary major offered by the Department of Mathematics and the Department of Computer Science.

1. Mathematics Requirements

- MATH-UA 121, 122, 123 Calculus I, II, III
- MATH-UA 140 Linear Algebra
- MATH-UA 325 or 328 Analysis or Honors Analysis I
- MATH-UA 329 Honors Analysis II
- MATH-UA 343 or 348 Algebra or Honors Algebra I
- MATH-UA 349 Honors Algebra II
- Two of MATH-UA 393, 394, 397 or 398 Honors I, II, III, IV (MATH-UA 393 - 398 may be substituted for two graduate classes with mathematics faculty approval).

2. Computer Science Requirements

   The computer science requirements include: CSCI-UA 101, CSCI-UA 102, CSCI-UA 201, CSCI-UA 202, CSCI-UA 310, CSCI-UA 421, CSCI-UA 453, and three computer science courses listed at the CSCI-UA 400 level.

   Students should complete a guided research, sponsored by either department and presented at the Dean's Undergraduate Research Forum which takes places in late April. Students are expected to dedicate 10-20 hours per week toward their research.

V. Transfer Students

Transfer students who have taken mathematics courses at other colleges should consult the Vice Chair for Undergraduate Affairs as soon as possible to determine proper placement. They should bring copies of their transcripts along with syllabi including course description, schedule of topics, assessment plan, and textbook title and author for all mathematics courses taken elsewhere. Transfer courses that are to be counted toward major or optional minor requirements must be judged equivalent to courses currently taught by the mathematics department. Credit cannot be transferred for courses in which a majority of the assessment is conducted in a distance-learning environment. Official transcripts must also be sent to the University registrar's office.

To graduate with a major in mathematics, transfer students must complete at least 12 eligible mathematics courses, each with grade of C or better. At least half the courses comprising the major must be taken in the College of Arts and Science at New York University during two or more semesters. For the minor in mathematics, at least two of the four required mathematics courses must be taken in residence at the College of Arts and Science at New York University, and cannot be applied towards major or minor requirements in other departments.

VI. Courses Offered in Academic Year 2015 – 2016

FALL		SPRING	
Algebra and Calculus	MATH-UA 9	Algebra and Calculus	MATH-UA 9
Discrete Mathematics	MATH-UA 120	Discrete Mathematics	MATH-UA 120
Calculus I	MATH-UA 121	Calculus I	MATH-UA 121
Calculus II	MATH-UA 122	Calculus II	MATH-UA 122
Calculus III	MATH-UA 123	Calculus III	MATH-UA 123
Set Theory	MATH-UA 130	Linear Algebra	MATH-UA 140
Linear Algebra	MATH-UA 140	Intro. to Computer Simulation	MATH-UA 144
Math for Economics I	MATH-UA 211	Math for Economics I	MATH-UA 211
Math for Economics II	MATH-UA 212	Math for Economics II	MATH-UA 212
Math for Economics III	MATH-UA 213	Math for Economics III	MATH-UA 213
Honors Calculus I	MATH-UA 221	Honors Calculus II	MATH-UA 222
Theory of Probability	MATH-UA 233	Vector Analysis	MATH-UA 224
Theory of Numbers	MATH-UA 248	Earth's Atmosphere and Fluid Dynamics	MATH-UA 228
Mathematics of Finance	MATH-UA 250	Introduction to Fluid Dynamics	MATH-UA 230
Intro to Math Modeling	MATH-UA 251	Theory of Probability	MATH-UA 233
Mathematics in Medicine and Biology	MATH-UA 255	Mathematical Statistics	MATH-UA 234
Ordinary Differential Equations	MATH-UA 262	Probability and Statistics	MATH-UA 235
Partial Differential Equations	MATH-UA 263	Combinatorics	MATH-UA 240
Transformations and Geometry	MATH-UA 270	Mathematics of Finance	MATH-UA 250
Analysis	MATH-UA 325	Intro to Math Modeling	MATH-UA 251
Honors Analysis I	MATH-UA 328	Numerical Analysis	MATH-UA 252
Algebra	MATH-UA 343	Computers in Medicine and Biology	MATH-UA 256
Honors Algebra I	MATH-UA 348	Ordinary Differential Equations	MATH-UA 262
Honors III	MATH-UA 397	Partial Differential Equations	MATH-UA 263
Independent Study	MATH-UA 997	Chaos and Dynamical Systems	MATH-UA 264
		Functions of Complex Variable	MATH-UA 282
		Analysis	MATH-UA 325
		Honors Analysis II	MATH-UA 329
		Algebra	MATH-UA 343
		Honors Algebra II	MATH-UA 349
		Topology	MATH-UA 375
		Differential Geometry	MATH-UA 377
		Honors IV	MATH-UA 398
		Independent Study	MATH-UA 998

• MATH-UA 397-98 Honors topics are announced and posted in advance.
• MATH-UA 211, 212, 213 and 270 do not count towards the Math Major degree.
• MATH-UA 211, 212, and 213 are for Economics Majors (if they are double majoring in Math they may use these instead of Calculus I – III)

VII. Suggested Course Programs

The programs shown below are suggestions only. Many students will take more mathematics electives than are listed in these programs.

A. Possible program for mathematics majors:

YEAR	FALL	SPRING
First Year	MATH-UA 121 Calculus I	MATH-UA 122 Calculus II
Second Year	MATH-UA 123 Calculus III	MATH-UA 140 Linear Algebra
		Mathematics Elective
Third Year	MATH-UA 325 Analysis	Advanced Elective or MATH-UA 343 Algebra
	Mathematics Elective	Mathematics Elective
Fourth Year	MATH-UA 343 Algebra	Mathematics Elective
	Advanced Elective	Advanced Elective

By the end of the seventh semester students should complete Analysis, Algebra, and one or more proofs courses.

B. Possible program for mathematics majors who intend to go into secondary school education:

YEAR	FALL	SPRING
First Year	MATH-UA 121 Calculus I	MATH-UA 122 Calculus II
Second Year	MATH-UA 123 Calculus III	MATH-UA 140 Linear Algebra
		Mathematics Elective
Third Year	MATH-UA 233 Probability	Advanced Elective
	Mathematics Elective	Mathematics Elective
Fourth Year	Mathematics Elective	Advanced Elective
	MATH-UA 325 Analysis	MATH-UA 343 Algebra

Recommended electives are MATH-UA 120 Discrete Mathematics, MATH-UA 255 Mathematics in Medicine and Biology, MATH-UA 248 Theory of Numbers, MATH-UA 264 Chaos & Dynamical Systems, MATH-UA 262 Ordinary Differential Equations, and MATH-UA 282 Function of Complex Variables.

C. Possible Honors Program. (Especially recommended for students who intend to go to graduate school for advanced work in mathematics).

YEAR	FALL	SPRING
First Year	MATH-UA 221 Honor Cal. I	MATH-UA 222 Honor Cal. II
Second Year	MATH-UA 328 Honors Analysis I	MATH-UA 329 Honors Analysis II
		MATH-UA 262 Ordinary Diff. Equ.
Third Year	MATH-UA 348 Honors Algebra I	MATH-UA 349 Honors Algebra II
	Mathematics Elective	Mathematics Elective
Fourth Year	MATH-UA 393 Honors I or III	MATH-UA 394 Honors II or IV
	Mathematics Elective	

Students with advanced standing should begin their freshman year at the appropriate level. Highly qualified students are encouraged to take graduate mathematics courses provided they satisfy the prerequisites and obtain permission from both undergraduate and graduate departmental advisors.

VIII. Activities

A. Mathematics Society

There is an active mathematics society open to all students interested in the study of mathematics. An organizational meeting is held shortly after classes begin in the fall to plan for the coming academic year. Activities include talks by faculty and guest speakers on a variety of topics including mathematics and career opportunities as well as attending conferences. The club is under the supervision of Professor Elizabeth Stepp.

B. Association for Women in Mathematics

The mission and purpose of AWM – NYU Chapter is to increase interest in the mathematical sciences and their applications in various industries. More specifically, it focuses on mentoring, encouraging and bringing together women undergraduates in mathematics to increase visibility of women and their contributions in the discipline.

C. William Lowell Putnam Competition

The mathematics department participates in the annual William Lowell Putnam Competition, a mathematics competition open to all undergraduate mathematics students in the U.S.A. and Canada. Interested students should contact the department as early as possible in the school year since the contest takes place in early December. A series of preparation sessions is held under the supervision of mathematics faculty.

D. Mathematical Contest in Modeling

MCM is a contest where teams of undergraduates use mathematical modeling to present their solutions to real world problems. Interested students should contact the department as early as possible in the school year.

E. Interdisciplinary Contest in Modeling

The Interdisciplinary Contest in Modeling (ICM) is an international contest for high school students and college undergraduates. ICM is an extension of the Mathematical Contest in Modeling (MCM). It is designed to develop and advance interdisciplinary problem-solving skills as well as competence in written communication. Registration for ICM is via MCM.

F. Peer Mentor Program

The mathematics department has an active peer mentor program for mathematics majors. The program is designed to assist new mathematics majors in making the transition to the mathematics major and life at NYU. If you're interested in becoming a mentor or mentee please send an email to entin@cims.nyu.edu.

G. Study Abroad

NYU undergraduates can spend a semester studying abroad at one of the many centers run by NYU Global Programs. Currently, mathematics can be studied at NYU Berlin, NYU London, NYU Abu Dhabi, and NYU Shanghai. If you are interested in participating in any of these programs, please contact the study abroad office.

H. S.U.R.E. Program

Since the spring 2000 semester the Mathematics Department has sponsored a number of summer research experiences (S.U.R.E.) for a selected number of undergraduate math majors. The Summer Undergraduate Research Experience is aimed at advanced undergraduate math students in their junior year. The project ends with a written report and an oral presentation in the beginning of the fall semester.

Funds to support this activity are limited and student participants are chosen by a faculty committee based on grades, coursework, and fit between their research interests and those of the supervising faculty. Applications are considered more highly if students have found a faculty mentor and research topic.

I. Courant International Students Program (CISP)

CISP is a program open to all undergraduate Courant students from both the Computer Science and Mathematics departments. CISP's goal is to provide a place for international students to learn about all of the resources available to them at NYU and to create a community among Courant international students. The group meets two to three times per semester.

IX. Awards

A. Prizes

Every spring the mathematics department presents awards to exceptional students in the department.

- The Mathematics Award is presented to a graduating senior for excellence in mathematics and service to the department and fellow students; and to members of the junior class for meritorious service, or for excellence in mathematics
- The Hollis Cooley Memorial Prize is awarded for excellence and exceptional promise in mathematics.
- The Perley Lenwood Thorne Medal, endowed by the faculty to honor Professor Thorne at the time of his retirement in 1949, is awarded for outstanding scholarship in mathematics.
- Mathematics Awards for Academic Achievement are presented to graduating seniors for academic excellence in mathematics.

B. Scholarships and Grants

New York University sponsors and administers a wide variety of financial aid programs, including its own scholarship and grant funds and some New York State and Federal funds. For additional information, refer to the College of Arts and Science Bulletin.

X. Work Opportunities in the Mathematics Department

A. Tutoring

The department offers paid undergraduate tutoring positions for advanced mathematics majors. Tutors provide free tutoring for undergraduate students taking lower level mathematics courses. Preferred applicants have completed and received at least an A in Calculus I, II, III, Linear Algebra, and Analysis.

B. Grading

Paid grader positions are available for advanced mathematics majors. Students grade homework problems for undergraduate mathematics courses. Preferred applicants have completed and received at least an A in Calculus I, II, III, and Linear Algebra.

Applications are available online at
http://math.nyu.edu/degree/undergrad/opportunities.html

XI. Course Descriptions

Listed below are descriptions of all mathematics courses that satisfy the major and minor requirements. Some of the courses are given only in the fall, others only in the spring, a few are given once every other year, and some only on request. However, any course may be scheduled if there is sufficient demand.

MATH-UA 9 Algebra and Calculus (offered each term) – 4 points

Prerequisites:
High school mathematics or permission of the department.

An intensive course in intermediate algebra and trigonometry. Topics include algebraic, exponential, logarithmic, and trigonometric functions and their graphs.

MATH-UA 120 Discrete Mathematics (offered each term) – 4 points

Prerequisite:
A grade of C or higher in MATH-UA 121 Calculus I or MATH-UA 212 Math for Economics II (for Economics Majors), or permission of the department.

A first course in discrete mathematics. Sets, algorithms, induction. Combinatorics. Graphs and trees. Combinatorial circuits. Logic and Boolean algebra.

Calculus Tracks:

Two tracks are currently available: The standard track of MATH-UA 121-123 Calculus I, II, and III and MATH-UA 221 – 222 Honors I, II track. The honors track assumes that the student knows the material from Calculus I, as the track covers Calculus II and III along with Linear Algebra. The courses MATH-UA 221 – 222 are worth 5 credits each and count as the equivalent of three mathematics courses, as it will satisfy a student's Calculus II, III and Linear Algebra requirements. The student, however, must still meet the indicated number of courses requirement associated with his or her major.
For more information about Honors Calculus please visit the Honors Calculus website: http://math.nyu.edu/degree/undergrad/honors_calculus.html.
While it is possible in some circumstance to switch tracks, it is neither advised nor encouraged. Thus, a student who intends to take the full calculus sequence should be prepared to continue on the same track to complete the sequence.

MATH-UA 121 Calculus I (offered each term) – 4 points

Prerequisite:

a. a score of 650 or higher on the mathematics portion of the SAT
b. a score of 650 or higher on the SAT Subject Test in Mathematics 1
c. a score of 650 or higher on the SAT Subject Test in Mathematics 2
d. an ACT mathematics score of 30 or higher
e. a score of 3 or higher on the AP Calculus AB exam
f. a score of 3 or higher on the AP Calculus BC exam
g. A level Maths score of C or higher (anyone who took Further Maths should contact the math department as it varies depending on the exam board)
h. AS level Maths score of B or higher
i. IB HL score of 5 or higher
j. IB SL score of 6 or higher
k. a grade of C or higher in MATH-UA 9 Algebra and Calculus

OR

A passing score on a departmental placement exam

Derivatives, antiderivatives, and integrals of functions of one real variable. Trigonometric, inverse trigonometric, logarithmic and exponential functions. Applications, including graphing, maximizing and minimizing functions. Areas and volumes.

MATH-UA 122 Calculus II (offered each term) – 4 points

Prerequisite:

a. a score of 4 or higher on the AP Calculus AB exam, or

b. a score of 4 or higher on the AP Calculus BC exam, or
c. A level Maths score of B or higher (anyone who took Further Maths should contact the math department as it varies depending on the exam board)
d. IB HL of 6 or higher
e. a grade of C or higher in MATH-UA 121 Calculus I

OR

A passing score on a departmental placement exam

Techniques of integration. Further applications. Plane analytic geometry. Polar coordinates and parametric equations. Infinite series, including power series.

MATH-UA 123 Calculus III (offered each term) – 4 points
Prerequisite:
a. a score of 5 on the AP Calculus BC exam
b. a grade of C or higher in MATH-UA 122 Calculus II

OR

A passing score on a departmental placement exam

Functions of several optimization and variables. Vectors in the plane and space. Partial derivatives with applications, especially Lagrange multipliers. Double and triple integrals. Spherical and cylindrical coordinates. Surface and line integrals. Divergence, gradient and curl. Theorem of Gauss and Stokes.

MATH-UA 130 Set Theory - 4 points (*Identical to PHIL-UA 73)*

The axioms of set theory; Boolean operations on sets; set-theoretic representation of relations, functions, and orderings; the natural numbers; theory of transfinite cardinal and ordinal numbers; the axiom of choice and its equivalents; and the foundations of analysis. May also cover such advanced topics as large cardinals or independence results.

MATH-UA 140 Linear Algebra (offered each term) – 4 points
Prerequisite:
A grade of C or higher in MATH-UA 121 Calculus I or MATH-UA 211 Math for Economics I (for Economics majors) or equivalent.

Systems of linear equations, Gaussian elimination, matrices, determinants, Cramer's rule. Vectors, vector spaces, basis and dimension, linear transformations. Eigenvalues, eigenvectors, and quadratic forms.

MATH-UA 144 Introduction to Computer Simulation (offered spring term) – 4 points *(Identical to CSCI-UA 330)*
Prerequisite:
A grade of C or higher in MATH-UA 121 Calculus I or MATH-UA 212 Math for Economics II (for Economics majors) and PHYS-UA 11 General Physics.

In this course, students will learn how to do computer simulations of such phenomena as orbits (Kepler problem and N-body problem), epidemic and endemic disease (including evolution in response to the selective pressure of a malaria), musical stringed instruments (piano, guitar, and violin), and traffic flow in a city (with lights, breakdowns, and gridlock at corners). The simulations are based on mathematical models, numerical methods, and Matlab programming techniques that will be taught in class. The use of animations (and sound where appropriate) to present the results of simulations will be emphasized.

MATH-UA 211, 212 Mathematics for Economics I and II (offered each term) – 4 points
Prerequisite for MATH-UA 211
The same as for MATH-UA 121 Calculus I.
Prerequisite for MATH-UA 212
A grade of C or higher in MATH-UA 211.

NOTE: Cannot apply both Calculus courses and Math for Economics courses to your major. Economics majors pursuing a double major in mathematics may substitute MATH-UA 211, 212 for the regular calculus sequence and must complete MATH-UA 213 as well.

Elements of calculus and linear algebra with examples and motivation drawn from important topics in economics. Topics include derivatives of functions of one and several variables; interpretations of the derivatives; convexity; constrained and unconstrained optimization; series, including geometric and Taylor series; ordinary differential equations; matrix algebra; eigenvalues; and (if time permits) dynamic optimization and multivariable integration.

MATH-UA 213 Mathematics for Economics III (offered each term) – 4 points
Prerequisite:
A grade of C or higher in MATH-UA 212 Math for Economics II.

Further topics in vector calculus. Vector spaces, matrix analysis. Linear and nonlinear programming with applications to game theory. This course will provide economics students who have taken MATH-UA 211 Mathematics for Economics I and MATH-UA 212 Mathematics for Economics II with the tools to take higher-level mathematics courses.

MATH-UA 221 Honors Calculus I: Accelerated Calculus with Linear Algebra (offered fall term) – 5 points
Prerequisite:
a. A score of 4 or higher on the Advanced Placement Calculus BC or AB exam,
b. A level Maths of B or higher, or IB HL of 6 or higher, or
c. A grade of B+ or higher in MATH-UA 121 Calculus I

This is the first semester of a yearlong course that covers the essential content of

Calculus II and III as well as Linear Algebra. The first 1/3 semester discusses sequences and series, Taylor's theorem and power series. The next 1/3 semester introduces concepts from linear algebra including: linear systems of equations; matrices and LU decomposition; determinants; vector spaces; eigenvalues and eigenvectors. The last 1/3 semester introduces topics from vector calculus including: functions of several variables; vector-valued functions; partial derivatives; various applications including maxima and minima.

MATH-UA 222 Honors Calculus I: Accelerated Calculus with Linear Algebra (offered spring term) – 5 points

Prerequisite:
A grade of B or higher in MATH-UA 221 Honors Calculus I.

Second semester of a yearlong sequence that covers the content of Calculus II and III as well as Linear Algebra. Topics covered in the spring are multidimensional differentiation (e.g. differentials, gradients, Taylor expansions, applications), multidimensional integration (e.g. double and triple integrals, Green's theorem, divergence theorem, applications), differential equations (e.g. first-order linear equations, second-order linear equations, applications), and additional topics in linear algebra (e.g. inner products, orthogonality, applications).

MATH-UA 224 Vector Analysis (offered spring term) – 4 points

Prerequisite:
A grade of C or higher in MATH-UA 325 Analysis.

Brief review of multivariate calculus: partial derivatives, chain rule, Riemann integral, change of variables, line integrals. Lagrange multipliers. Inverse and implicit function theorems and their applications. Introduction to calculus on manifolds: definition and examples of manifolds, tangent vectors and vector fields, differential forms, exterior derivative, line integrals and integration of forms. Gauss' and Stokes' theorems on manifolds.

MATH-UA 228 Earth's Atmosphere and Ocean: Fluid Dynamics and Climate – 4 points *(Identical to ENVST-UA 360)*

Prerequisite:
A grade of B- or higher in MATH-UA 121 Calculus I or MATH-UA 212 Math for Economics II (for Economics majors) or equivalent and familiarity with introductory physics (at least at the advanced high school level).

Recommended and Preferred: MATH-UA 123 Calculus III

Introduction to dynamical processes that drive the circulation of the atmosphere and ocean, and their interaction. Goal of the lectures is to develop an understanding of the unifying principles of planetary fluid dynamics. Topics include the global energy balance, convection and radiation (the greenhouse effect), effects of planetary rotation (the Coriolis force), structure of the atmospheric circulation (the Hadley cell and wind patterns),

structure of the oceanic circulation (wind-driven currents and the thermohaline circulation), and climate and climate variability (including El Niño and anthropogenic warming).

MATH-UA 230 Introduction to Fluid Dynamics (offered spring term) – 4 points *(Identical to PHYS-UA 180)*
Prerequisite:
A grade of C or higher in MATH-UA 123 Calculus III or MATH-UA 213 Math for Economics III (for Economics majors)
Suggested:
PHYS-UA 106 Mathematical Physics

Fluid dynamics is the branch of physics that describes motions of fluids as varied as the flow of blood in the human body, the flight of an insect or the motions of weather systems on Earth. The course introduces the key concepts of fluid dynamics: the formalism of continuum mechanics, the conservation of mass, energy and momentum in a fluid, the Euler and Navier-Stokes equations, viscosity and vorticity. These concepts are applied to study classic problems in fluid dynamics, such as potential flow around a cylinder, the Stokes flow, the propagation of sound and gravity waves and the onset of instability in shear flow.

MATH-UA 233 Theory of Probability (offered in the fall and spring terms) – 4 points
Prerequisite:
A grade of C or higher in MATH-UA 123 Calculus III or MATH-UA 213 Math for Economics III (for Economics majors) or equivalent.

NOTE: Not open to students who have taken MATH-UA 235 Probability and Statistics.

An introduction to the mathematical treatment of random phenomena occurring in the natural, physical, and social sciences. Axioms of mathematical probability, combinatorial analysis, binomial distribution, Poisson and normal approximation, random variables and probability distributions, generating functions, Markov chains, applications.

MATH-UA 234 Mathematical Statistics (offered spring term) – 4 points
Prerequisite:
A grade of C or higher in MATH-UA 233 Theory of Probability or equivalent.

NOTE: Not open to students who have taken MATH-UA 235.

An introduction to the mathematical foundations and techniques of modern statistical analysis for the interpretation of data in the quantitative sciences. Mathematical theory of sampling; normal populations and distributions; chi-square, t, and F distributions; hypothesis testing; estimation; confidence intervals; sequential analysis; correlation, regression; analysis of variance.

Applications to the sciences.

MATH-UA 235 Probability and Statistics (offered spring term) – 4 points
Prerequisite:
A grade of C or higher in MATH-UA 122 Calculus II or MATH-UA 212 Math for Economics II (for Economics majors) or equivalent.

NOTE: Not open to students who have taken MATH-UA 233

A combination of MATH-UA 233 and MATH-UA 234 at a more elementary level, so as to afford the student some acquaintance with both probability and statistics in a single term. In probability: mathematical treatment of chance; combinatorics; binomial, Poisson, and Gaussian distributions; law of large numbers and the normal approximation; application to coin-tossing, radioactive decay, etc. In statistics: sampling; normal and other useful distributions; testing of hypotheses; confidence intervals; correlation and regression; applications to scientific, industrial, and financial data.

MATH-UA 240 Combinatorics (offered spring term) – 4 points
Prerequisite:
A grade of C or higher in MATH-UA 122 Calculus II or MATH-UA 212 Math for Economics II (for Economics majors) or equivalent.

Techniques for counting and enumeration including generating functions, the principle of inclusion and exclusion, and Polyacounting. Graph theory. Modern algorithms and data structures for graph-theoretic problems.

MATH-UA 248 Theory of Numbers (offered fall term) – 4 points
Prerequisite:
A grade of C or higher in MATH-UA 122 Calculus II or MATH-UA 212 Math for Economics II (for Economics majors) or equivalent.

Divisibility theory and prime numbers. Linear and quadratic congruences. The classical number-theoretic functions. Continued fractions. Diophantine equations.

MATH-UA 250 Mathematics of Finance (offered fall term) – 4 points
Prerequisite:
A grade of C or higher in MATH-UA 123 Calculus III and one of the following: MATH-UA 233 Theory of Probability, MATH-UA 235 Probability and Statistics, ECON-UA 18 Statistics, or ECON-UA 20 Analytical Statistics and/or permission of the instructor.

Introduction to the mathematics of finance. Topics include: Linear programming with application to pricing. Interest rates and present value. Basic probability, random walks, central limit theorem, Brownian motion, log-normal model of stock prices. Black-Scholes theory of options. Dynamic programming with application to portfolio optimization.

MATH-UA 251 Introduction to Mathematical Modeling (offered spring term) – 4 points
Prerequisite:
A grade of C or higher in MATH-UA 123 Calculus III or MATH-UA 213 Math for Economics III (for Economics majors) or permission of the instructor.

Formulation and analysis of mathematical models. Mathematical tools include dimensional analysis, optimization, simulation, probability, and elementary differential equations. Applications to biology, economics, and other areas of science. The necessary mathematical and scientific background is developed as needed. Students participate in formulating models as well as in analyzing them.

MATH-UA 252 Numerical Analysis (offered spring term) – 4 points
Prerequisite:
A grade of C or higher in both MATH-UA 123 Calculus III or MATH-UA 213 Math for Economics III (for Economics majors) and MATH-UA 140 Linear Algebra or equivalent.

In numerical analysis, one explores how mathematical problems can be analyzed and solved with a computer. As such, numerical analysis has very broad applications in mathematics, physics, engineering, finance, and the life sciences. This course introduces the subject for mathematics majors. Theory and practical examples using Matlab are combined to explore topics ranging from simple root-finding procedures to differential equations and the finite element method.

MATH-UA 255 Mathematics in Medicine and Biology (offered fall term) – 4 points *(Identical to BIOL-GA 1501)*
Prerequisite:
MATH-UA 121 Calculus I or MATH-UA 212 Math for Economics II (for Economics majors) and BIOL-UA 11 Principles of Biology I or permission of the instructor.

Intended primarily for premedical students with interest and ability in mathematics. Topics of medical importance using mathematics as a tool, including control of the heart, optimal principles in the lung, cell membranes, electrophysiology, countercurrent exchange in the kidney, acid-base balance, muscle, cardiac catheterization, computer diagnosis. Material from the physical sciences and mathematics is introduced as needed and developed within the course.

MATH-UA 256 Computers in Medicine and Biology (offered spring term) - 4 points *(Identical to BIOL-GA 1502)*
Prerequisite:
A grade of C or higher in MATH-UA 255 Mathematics in Medicine and Biology or permission of the instructor.
Recommendation:

Familiarity with a programming language. The language used in the course will be MATLAB, but prior experience with MATLAB is not required.

Introduces students to the use of computer simulation as a tool for investigating biological phenomena. The course requirement is to construct three computer models during the semester, to report on results to the class, and to hand in a writeup describing each project. These projects can be done individually, or as part of a team. Topics discussed in class are the circulation of the blood, gas exchange in the lung, electrophysiology of neurons and neural networks, the renal countercurrent mechanism, cross-bridge dynamics in muscle, and the dynamics of epidemic and endemic diseases. Projects are normally chosen from this list, but may be chosen otherwise by students with other interests.

MATH-UA 262 Ordinary Differential Equations (offered in fall and spring terms) – 4 points

Prerequisite:
A grade of C or higher in both MATH-UA 123 Calculus III or MATH-UA 213 Math for Economics III (for Economics majors) and MATH-UA 140 Linear Algebra or equivalent.

A first course in ordinary differential equations, including analytical solution methods, elementary numerical methods, and modeling. Topics to be covered include: first-order equations including integrating factors; second-order equations including variation of parameters; series solutions; elementary numerical methods including Euler's methods, Runge-Kutta methods, and error analysis; Laplace transforms; systems of linear equations; boundary-value problems. Some optional topics to be chosen at the instructor's discretion include: nonlinear dynamics including phase-plane description; elementary partial differential equations and Fourier series.

MATH-UA 263 Partial Differential Equations (offered spring term) – 4 points

Prerequisite:
A grade of C or higher in MATH-UA 262 Ordinary Differential Equations or equivalent.

Many laws of physics are formulated as partial differential equations. This course discusses the simplest examples, such as waves, diffusion, gravity, and static electricity. Non-linear conservation laws and the theory of shock waves are discussed. Further applications to physics, chemistry, biology, and population dynamics.

MATH-UA 264 Chaos and Dynamical Systems (offered spring term) – 4 points

Prerequisite:
A grade of C or higher in both MATH-UA 122 Calculus II or MATH-UA 212 Math for Economics II (for Economics majors) and MATH-UA 140 Linear Algebra or equivalent.

Topics include dynamics of maps and of first-order and second-order differential equations: stability, bifurcations, limit cycles, and dissection of systems with fast and slow timescales. Geometric viewpoint, including phase planes, is stressed. Chaotic behavior is introduced in the context of one-variable maps (the logistic), fractal sets, etc. Applications are drawn from physics and biology. Homework and projects are assigned, as well as a few computer lab sessions. (Programming experience is not a prerequisite.)

MATH-UA 270 Transformations and Geometries (offered fall term) – 4 points

Prerequisite:
A grade of C or higher in MATH-UA 122 Calculus II or MATH-UA 212 Math for Economics II (for Economics majors) or equivalent.
Strongly recommended:
A grade of C or higher in MATH-UA 140 Linear Algebra

NOTE: Not open to Math Majors, this course is for Math Education Majors only.

This is a thorough course in planar Euclidean geometry. Emphasis is placed on development of students' proof-writing and problem-solving skills. It begins with a study of the basic structures (e.g., angles, lines, arcs) and concepts (e.g.,construction, congruence, similarity) known to Euclid and builds toward modern results. The second half of the course will focus on isometries of the plane, their classification, and applications of complex numbers and conformal maps to geometry. Time permitting, contrasts will be made with some non-Euclidean geometries.

MATH-UA 282 Functions of a Complex Variable (offered spring term) – 4 points

Prerequisite:
A grade of C or higher in both MATH-UA 123 Calculus III or MATH-UA 213 Math for Economics III (for Economics majors) and MATH-UA 140 Linear Algebra or equivalent.

Complex numbers and complex functions. Differentiation and the Cauchy-Riemann equations. Cauchy's theorem and the Cauchy integral formula. Singularities, residues, Taylor and Laurent series. Fractional Linear transformations and conformal mapping. Analytic continuation. Applications to fluid flow etc.

MATH-UA 325 Analysis (offered in fall and spring terms) – 4 points

Prerequisite:
A grade of C or higher in MATH-UA 123 Calculus III or MATH-UA 213 Math for Economics III (for Economics majors) and MATH-UA 140 Linear Algebra or equivalent.

This course is an introduction to rigorous analysis on the real line. Topics

include: the real number system, sequences and series of numbers, functions of a real variable (continuity and differentiability), the Riemann integral, basic topological notions in a metric space, sequences and series of functions including Taylor and Fourier series.

MATH-UA 328 Honors Analysis I (offered fall term) – 4 points

Prerequisite:
A grade of C or higher in MATH-UA 123 Calculus III or MATH-UA 213 Math for Economics III (for Economics majors) and MATH-UA 140 Linear Algebra or equivalent.
Recommended:
Intensive calculus versions MATH-UA 221 Honors Calculus I and MATH-UA 222 Honors Calculus II.

This is an introduction to the rigorous treatment of the foundations of real analysis in one variable. It is based entirely on proofs. Students are expected to know what a mathematical proof is and are also expected to be able to read a proof before taking this class. Topics include: properties of the real number system, sequences, continuous functions, topology of the real line, compactness, derivatives, the Riemann integral, sequences of functions, uniform convergence, infinite series and Fourier series. Additional topics may include: Lebesgue measure and integral on the real line, metric spaces, and analysis on metric spaces.

MATH-UA 329 Honors Analysis II (offered spring term) – 4 points

Prerequisite:
A grade of C or higher in MATH-UA 328 Honors Analysis I, or grade of A in MATH-UA 325 Analysis in conjunction with permission by instructor.

This is a continuation of MATH-UA 328 Honors Analysis I. Topics include: metric spaces, differentiation of functions of several real variables, the implicit and inverse function theorems, Riemann integral on R^n, Lebesgue measure on R^n, the Lebesgue integral.

MATH-UA 343 Algebra (offered fall and spring terms) – 4 points

Prerequisite:
A grade of C or higher in both MATH-UA 123 Calculus III or MATH-UA 213 Math for Economics III (for Economics majors) and MATH-UA 140 Linear Algebra or equivalent.
Strongly recommended:
MATH-UA 325 Analysis

Introduction to abstract algebraic structures, including groups, rings, and fields. Sets and relations. Congruences and unique factorization of integers. Groups, permutation groups, homomorphisms and quotient groups. Rings and quotient rings, Euclidean rings, polynomial rings. Fields, finite extensions.

MATH-UA 348 Honors Algebra I (offered fall term) – 4 points
Prerequisite:
A grade of C or higher in both MATH-UA 123 Calculus III or MATH-UA 213 Math for Economics III (for Economics majors) and MATH-UA 140 Linear Algebra or equivalent.
Strongly recommended:
Intensive calculus versions MATH-UA 221 Honors Calculus I and MATH-UA 222 Honors Calculus II and MATH-UA 325 Analysis or MATH-UA 328 Honors Analysis I.

Introduction to abstract algebraic structures, including groups, rings, and fields. Sets and relations. Congruences and unique factorization of integers. Groups, permutation groups, group actions, homomorphisms and quotient groups, direct products, classification of finitely generated abelian groups, Sylow theorems. Rings, ideals and quotient rings, Euclidean rings, polynomial rings, unique factorization.

MATH-UA 349 Honors Algebra II (offered spring term) – 4 points
Prerequisite:
A grade of C or higher in MATH-UA 348 Honors Algebra I, or grade of A in MATH-UA 343 Algebra in conjunction with permission by instructor.

Principle ideal domains, polynomial rings in several variables, unique factorization domains. Fields, finite extensions, constructions with ruler and compass, Galois theory, solvability by radicals.

MATH-UA 375 Topology (offered spring term) – 4 points
Prerequisite:
A grade of C or higher in MATH-UA 325 Analysis or permission of the department.

Set-theoretic preliminaries. Metric spaces, topological spaces, compactness, connectedness, covering spaces, and homotopy groups.

MATH-UA 377 Differential Geometry (offered spring term) – 4 points
Prerequisite:
A grade of C or higher in MATH-UA 329 Honors Analysis II or permission of the department.

The differential properties of curves and surfaces. Introduction to differential manifolds and Riemannian geometry.

MATH-UA 393 Honors I (offered fall term of even years) – 4 points
Prerequisite:
Honors standing or approval of the director of the honors program.

A lecture/seminar course on advanced topics. Topics vary yearly and are updated from time to time. Detailed course descriptions are available during

preregistration.

MATH-UA 394 Honors II (offered spring term of odd year) – 4 points
Prerequisite:
Honors standing or approval of the director of the honors program.

A lecture/seminar course on advanced topics. Topics vary yearly and are updated from time to time. Detailed course descriptions are available during preregistration.

MATH-UA 397 Honors III (offered fall term of odd years) – 4 points
Prerequisite:
Honors standing or approval of the director of the honors program.

A lecture/seminar course on advanced topics. Topics vary yearly and are updated from time to time. Detailed course descriptions are available during preregistration.

MATH-UA 394 Honors IV (offered spring term of even year) – 4 points
Prerequisite:
Honors standing or approval of the director of the honors program.

A lecture/seminar course on advanced topics. Topics vary yearly and are updated from time to time. Detailed course descriptions are available during preregistration.

MATH-UA 997, 998 Independent Study – 2 or 4 points per term
Prerequisite:
Permission of the department.

To register for this course, a student must seek out a faculty sponsor and draft a brief research proposal to be approved by the director of undergraduate studies.

XII. Graduate Courses Open to Undergraduates

Qualified students may take courses from the math department in the Graduate School of Arts and Science provided they first obtain permission from the Director of Undergraduate Studies or Vice Chair for Undergraduate Affairs. A few such courses are listed below. If these courses are used toward fulfillment of the requirements for the baccalaureate degree, no advanced credit is allowed for them in the graduate school.

MATH-GA 2010, 2020	Numerical Methods
MATH-GA 2043	Scientific Computing
MATH-GA 2111	Linear Algebra
MATH-GA 2130, 2140	Algebra

MATH-GA 2210	Number Theory
MATH-GA 2320	Topology
MATH-GA 2430	Real Variables
MATH-GA 2470	Ordinary Differential Equations
MATH-GA 2701	Methods of Applied Mathematics
MATH-GA 2702	Fluids Dynamics
MATH-GA 2851	Advanced Topics in Math Biology (Mathematical Models of Primitive Organisms)
MATH-GA 2911, 2912	Probability: Limit Theorems I, II
MATH-GA 2350, 2360	Differential Geometry I, II

XIII. Departmental Faculty

Tim Austin. Assistant Professor. PhD. 2010, University of California, Los Angeles. Research interests: analysis, probability and ergodic theory.

Marco M. Avellaneda. Professor. Licenciado en Ciencias 1981, Buenos Aires; Ph.D. 1985, Minnesota. Research interests: applied mathematics, mathematical modeling in finance, probability.

Yuri Baktin Associate Professor. B.A. 1998, M.A. 1999, Ph.D. 2001, Moscow State University. Research interests: Random dynamics, probabilistic models of mathematical physics.

Vindya Bhat. Clinical Assistant Professor. B.A. 2000, Rutgers University; M.A. 2007, Columbia University; Ph.D. 2014, Emory University. Research interests: Ramsey theory and combinatorics.

Gerard Ben Arous. Professor. Ph.D. 1981, University of Paris. Research interests: probability theory, stochastic processes, partial differential equations.

Fedor A. Bogomolov. Professor. Diploma 1970, Moscow University; Ph.D. 1974, Steklov Institute of Mathematics. Research interests: algebraic geometry and related problems in algebra, topology, number theory.

Paul Bourgade. Associate Professor. B.S. 2006, Ecole Polytechnique; M.S. 2007, Ph.D. 2009, Université Paris 6. Research interests: Probability, random matrices, statistical physics and stochastic processes.

Oliver Bühler. Professor. Ph.D. 1996, Cambridge University. Research interests: geophysical fluid dynamics, interactions between waves and vortices, acoustics, statistical mechanics.

David Cai. Professor. B.S. 1984, Peking University; M.S. 1989, Ph.D. 1994, Northwestern. Research interests: nonlinear stochastic behavior in physical and biological systems.

Sylvain E. Cappell. Professor. B.A. 1966, Columbia; Ph.D. 1969, Princeton. Research interests: algebraic and geometric topology, symplectic and algebraic geometry.

Antoine Cerfon. Assistant Professor of Mathematics. Magnetohydrodynamics in fusion and astrophysical plasmas, nonneutral plasmas, kinetic theory in plasmas and rarefied gases.

Jeff Cheeger. Professor. B.A. 1964, Harvard College; M.S. 1966, Ph.D. 1967, Princeton. Research interests: differential geometry and its connections to analysis and topology.

Yu Chen. Associate Professor. B.S. 1982, Tsinghua University; M.S. 1988, Ph.D. 1991, Yale. Research interests: numerical scattering theory, ill-posed problems, scientific computing.

Percy A. Deift. Professor. B.S. 1967, M.S. 1970, Natal, Durban; M.S. 1971, Rhodes South Africa; Ph.D. 1976, Princeton. Research interests: spectral theory and inverse spectral theory, integrable

systems, Riemann-Hilbert problems.

Aleksandar Donev. Assistant Professor of Mathematics. Multi-scale (hybrid) methods; fluctuating hydrodynamics; coarse-grained particle methods; jamming and packing

Carlos Fernandez-Granda . Assistant Professor of Mathematics. B.S. 2008, École des Mines de Paris / ETSIT, Universidad Politécnica de Madrid; M.S., École Normale Supérieure de Cachan, Paris; Ph.D. 2015, Stanford.

Edwin Gerber. Assistant Professor of Mathematics and Atmosphere/Ocean Science. Ph.D. 2005, Princeton; B.S. 2000, The University of the South. Research interests: Atmospheric dynamics, climate variability, stochastic modeling.

Pierre Germain Assistant Professor, MS 2001, PhD 2006 Ecole polytechniqe. Research interests: nonlinear partial differentail, harmonic analysis.

Dimitris Giannakis. Assistant Professor, Ph.D. 2009, University of Chicago. Research interests: Atmosphere ocean science, geometric data analysis, uncertainty quantification.

Jonathan B. Goodman. Professor. B.S. 1977, Massachusetts Institute of Technology; Ph.D. 1982, Stanford. Research interests: fluid dynamics, computational physics, computational finance.

Leslie Greengard. Professor. B.A. 1979, Wesleyan; M.D. 1987, Ph.D. 1987, Yale. Research interests: applied and computational math, partial differential equations, computational chemistry, mathematical biology.

Frederick P. Greenleaf. Professor. B.S. 1955 Pennsylvania State; M.A. 1961, Ph.D. 1964, Yale. Research interests: noncommutative harmonic analysis, Lie groups and group representations, invariant partial differential operators.

Mikhael Gromov. Professor. Maitrise 1965, Doctorat 3e Cycle 1969, D.Sc. 1973, University of Leningrad. Research interests: Riemannian manifolds, symplectic manifolds, infinite groups, math models of biomolecular systems.

Sinan Gunturk. Associate Professor. B.S. 1996, Bogazici University; Ph.D. 2000, Princeton. Research interests: harmonic analysis, information theory, signal processing.

Eliezer Hameiri. Professor. B.A. 1970, M.A. 1972, Tel Aviv; Ph.D. 1976, New York. Research interests: applied mathematics, magnetohydrodynamics, plasma physics.

Fengbo Hang. Associate Professor. B.S. 1993, Tsinghua University; M. S. 1996, Peking University; Ph.D. 2001, New York University. Research interests: Geometric analysis and nonlinear partial differential equations.

David Holland. Professor. B.S. 1984, B.A. 1993, M.S. 1986, Memorial University (Newfoundland); Ph.D. 1993, McGill. Research interests: ocean-ice studies, climate theory and modeling.

Miranda Holmes-Cerfon . Assistant Professor of Mathematics. Applied math, mesoscale physics, ocean dynamics, stochastic methods.

Chris Jankowski. Clinical Assistant Professor. Ph.D. 2009, University of Pennsylvania. Research interests: Operator Algebras.

Selin Kalaycioglu. Clinical Assistant Professor, Ph.D. 2009 University of Arizona. Research interests: Computational group theory, representation theory of finite groups and algebras, math education.

Richard Kleeman. Professor. B.S. 1980, Australian National University, Ph.D. 1986, Adelaide University. Research interests: climate dynamics, El Nino, predictability of weather and climate dynamical systems.

Bruce Kleiner. Professor. Research interests: Geometric analysis, geometric group theory and geometric evolution equations.

Robert V. Kohn. Professor. A.B. 1974, Harvard; M.S. 1975, Warwick (England); Ph.D. 1979, Princeton. Research interests: nonlinear partial differential equations, materials science, mathematical finance.

Matthew Leingang. Vice Chair for Undergraduate Studies, Clinical Associate Professor. Ph.D. 2000, Harvard; Research interests: Mathematics Education, Web Pedagogies, differential geometry

Fang-Hua Lin. Professor. B.S. 1981, Zhejing; Ph.D. 1985, Minnesota. Research interests: partial differential equations, geometric measure theory.

Eyal Lubetsky. Associate Professor. B.S. 2002, Ph.D. 2007, Tel-Aviv University. Research interests: Probability theory and combinatorics.

Andrew Majda. Professor. B.S. 1970, M.S. 1971, Ph.D. 1973, Stanford. Research interests: modern applied mathematics, atmosphere/ocean science, partial differential equations.

Trushant Majmudar. Clinical Assistant Professor. Ph.D. 2006, Duke University. Research interests: Bio-fluid Dynamics, bio-locomotion, soft condensed matter.

Nader Masmoudi. Professor. Ph.D. 1999, University of Paris Dauphine. Research interests: nonlinear parallel differential equations.

Henry P. McKean. Professor. B.A. 1952, Dartmouth; Ph.D. 1955, Princeton. Research interests: probability, partial differential equations, complex function theory.

David W. McLaughlin. Professor. B.S. 1966, Creighton. M. S. 1969, Ph.D. 1971, Indiana University. Research interests: applied mathematics, nonlinear wave equations, visual neural science.

Bhubaneswar Mishra. Professor. B.Tech 1980, Indian Institute of Technology; M.S. 1982, Ph.D. 1985, Carnegie Mellon. Research interests: robotics, genomics, finance, mathematical and theoretical computer science.

Alex Mogilner. Professor (Mathematics and Biology). M.Eng. 1985, Ural Polytechnic Institute; Ph.D. 1990, USSR Academy of Sciences; Ph.D. 1995, University of British Columbia. Research interests: Computational Biology, Cell Biophysics and Mathematical Biology.

Michael Munn. Clinical Assistant Professor. B.S. 2001, University of Notre Dame; M.Phil. 2006, Ph.D. 2008, CUNY. Research interests: geometric analysis and metric geometry.

Charles M. Newman. Professor. B.S. 1966, Massachusetts Institute of Technology; M.A. 1968, Ph.D. 1971, Princeton. Research interests: probability theory, statistical physics, stochastic models.

Michael O'Neil. Assistant Professor (NYU Polytechnic School of Engineering and NYU Courant). A.B. 2003, Cornell University; M.Phil 2005, Ph.D. 2007, Yale University. Research interests: Electromagnetics, acoustics, fluid dynamics, fast algorithms, integral equations and computational statistics.

Michael Overton. Professor. B.S. 1974, British Columbia; M.S. 1977, Ph.D. 1979, Stanford. Research interests: numerical linear algebra, optimization, linear and semi-definite programming.

Olivier Pauluis. Associate Professor. B.S./M.S. 1995, Université Catholique de Louvain; Ph.D. 2000, Princeton. Research interests: climate and the general circulation of the atmosphere, moist convection, tropical meteorology, numerical modeling.

Jerome K. Percus. Professor. B.S. 1947, M.A. 1948, Ph.D. 1954, Columbia. Research interests: chemical physics, mathematical biology.

Charles S. Peskin. Professor. B.A. 1968, Harvard; Ph.D. 1972, Yeshiva. Research interests:

applications of mathematics and computing to problems in medicine and biology, cardiac fluid dynamics, molecular machinery within biological cells, mathematical/computational neuroscience.

Alena Pirutka. Assistant Professor. Ph.D. 2011, Université Paris-Sud XI, Orsay. Research interests: arithmetic and algebraic geometry, number theory.

Aaditya Rangan. Assistant Professor. B.A. 1999, Dartmouth; Ph.D. 2003 California (Berkley). Research interests: Large-scale scientific modeling of physical biological, and neurobiological phenomena.

John Rinzel. Professor. B.S. 1967, University of Florida; M.S. 1968, Ph.D. 1973, New York. Research interests: computational neuroscience, nonlinear dynamics of neurons and neural circuits, sensory processing.

Leif Ristroph. Assistant Professor of Mathematics. Research Interests: Fluid dynamics, non-linear dynamics, experimental physics, biophysics, and geophysics.

Sylvia Serfaty. Global Distinguished Professor. M.S. 1995, Ecole Normale Superieure; Ph.D. 1999, University of Paris-Orsay. Research interests: partial differential equations, nonlinear analysis applied to physics.

Jalal M. I. Shatah. Professor. B.S. 1979, Texas (Austin); Ph.D. 1983, Brown. Research interests: partial differential equations, analysis.

Michael J. Shelley. Professor. B.A. 1981, Colorado; M.S. 1984, Ph.D. 1985, Arizona. Research interests: applied math and modeling, visual neuroscience, fluid dynamics, computational physics and neuroscience.

K. Shafer Smith. Associate Professor. B.S. 1992, Indiana; Ph.D. 1999, UC Santa Cruz. Research interests: geophysical fluid dynamics, physical oceanography and climate.

Mutiara Sondjaja. Clinical Assistant Professor. B.A. 2008, Harvey Mudd College; Ph.D. 2014, Cornell University. Research interests: Optimization; interior-point methods; operations research.

Joel H. Spencer. Professor. B.S. 1965, Massachusetts Institute of Technology; Ph.D. 1970, Harvard. Research interests: discrete mathematics, theoretical computer science.

K.R. Sreenivasan. Professor of Physics and Mathematics; Senior Vice Provost, NYU; Research interest: turbulence, complex fluids, cryogenic helium and nonlinear dynamics.

Georg Stadler. Associate Professor. Mag.rer.nat. 2001, Dr.rer.nat. 2004, University of Graz. Research interests: Numerical solution of PDEs, high-performance computing, variational inequalities, and computational earth sciences.

Daniel Stein. Professor. Sc.B. 1975, Brown University; M.A. 1977, Ph.D. 1979, Princeton University. Research interests: theoretical condensed matter physics, statistical mechanics, and mathematical physics.

Elizabeth Stepp. Clinical Assistant Professor; B.S. 1992 Vanderbilt, M.S. 1996 Middle Tennessee State University; Ph.D. University of Kentucky.

Esteban G. Tabak. Professor. Bach. 1988, University of Buenos Aires; Ph.D. 1992, Massachusetts Institute of Technology. Research interests: dynamics of the atmosphere and ocean, energy transfer in systems with many degrees of freedom.

Daniel A. Tranchina. Professor. B.A. 1975, SUNY (Binghamton); Ph.D. 1981, Rockefeller. Research interests: mathematical modeling in neuroscience.

Nick Trefethen. Global Distinguished Professor of Mathematics and Computer Science. A.B. 1997 Harvard. M.S. 1980 Stanford University. Ph.D. 1982 Stanford University.

Yuri Tschinkel. Professor. M.A. 1990, Moscow State University; Ph.D. 1992, Massachusetts Institute of Technology. Research interests: algebraic geometry, number theory, automorphic forms.

Eric Vanden-Eijnden. Professor. B. S., M. S., 1992, Ph.D. 1997, Universite Libre de Bruxelles. Research interests: stochastic partial differential equations, statistical mechanics, turbulence theory.

S. R. Srinivasa Varadhan. Professor. B.S. 1959, M.A. 1960, Madras; Ph.D. 1963, Indian Statistical Institute. Research interests: probability theory, stochastic processes, partial differential equations.

Olof B. Widlund. Professor. M.S. 1960, Ph.D. 1964, Royal Institute of Technology (Stockholm); D. Phil. 1966, Upsala. Research interests: numerical analysis, partial differential equations, parallel computing.

Margaret H. Wright. Silver Professor of Computer Science and Mathematics Optimization; scientific computing; linear algebra.

Lai-Sang Young. Professor. B.A. 1973, Wisconsin; M.A. 1976, Ph.D. 1978, California (Berkeley). Research interests:
dynamical systems and ergodic theory.

Robert Young. Associate Professor. B.A. 2002, Simon's Rock College of Bard; M.S. 2004, Ph.D. 2007, University of Chicago. Research interests: Geometric group theory, metric geometry, and quantitative geometry.

Drew Youngren. Clinical Assistant Professor. Ph.D. 2006, Northwestern University. Research interests: microlocal analysis.

Ofer Zeitouni Global Distinguished Professor of Mathematics

Jun Zhang. Professor. B.S. 1985, Wuhan University (China); Ph.D. 1994, University of Copenhagen. Research interests: fluid dynamics, biophysics, complex systems.

Denis Zorin. Professor of Computer Science and Mathematics Computer graphics; geometric modeling; subdivision surfaces; multiresolution surface representations; fluid and solid simulation; perceptually based methods for computer graphics.