General Information
Students who have special placement problems, or are unclear about their level, should make an appointment with a faculty member or the Chair.

Two help rooms, one in 404 Mathematics (on Columbia’s campus) and one in 502 Milstein Center (on Barnard’s campus), are available. Hours will be posted in the rooms and on https://math.barnard.edu/math-tutoring-schedules for students seeking individual help and counseling from Barnard tutors and Columbia teaching assistants. No appointments are necessary. Both Barnard and Columbia students are welcome. NOTE: Changes to tutoring schedules and remote tutoring can occur in response to COVID-19.

Courses for First-Year Students
The systematic study of Mathematics begins with one of the following alternative sequences:

<table>
<thead>
<tr>
<th>Calculus I, II, III, IV</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH UN1101</td>
<td>CALCULUS I</td>
</tr>
<tr>
<td>MATH UN1102</td>
<td>CALCULUS II</td>
</tr>
<tr>
<td>MATH UN1201</td>
<td>CALCULUS III</td>
</tr>
<tr>
<td>MATH UN1202</td>
<td>CALCULUS IV</td>
</tr>
<tr>
<td>Honors Math A-B</td>
<td></td>
</tr>
<tr>
<td>MATH UN1207</td>
<td>HONORS MATHEMATICS A</td>
</tr>
<tr>
<td>MATH UN1208</td>
<td>HONORS MATHEMATICS B</td>
</tr>
</tbody>
</table>

Credit is allowed for only one of the calculus sequences. The calculus sequence is a standard course in differential and integral calculus. Honors Mathematics A-B is for exceptionally well-qualified students who have strong advanced placement scores. It covers second-year Calculus (MATH UN1201 CALCULUS III – MATH UN1202 CALCULUS IV) and MATH UN2010 LINEAR ALGEBRA, with an emphasis on theory.

Calculus II is NOT a prerequisite for Calculus III, so students who plan to take only one year of calculus may choose between I and II or I and III. The latter requires a B or better in Calculus I and is a recommended option for some majors.

MATH UN2000 INTRO TO HIGHER MATHEMATICS is a course that can be taken in their first or second year by students with an aptitude for mathematics who would like to practice writing and understanding mathematical proofs.

Placement in the Calculus Sequence
**College Algebra and Analytical Geometry** is a refresher course for students who intend to take Calculus but do not have adequate background for it.

**Advanced Placement:** Students who have passed the advanced placement test for Calculus AB with a grade of 4 or 5 or BC with a grade of 4 receive 3 points of credit. Those who passed Calculus BC with a grade of 5 will receive 4 points of credit or 6 points on placing into Calculus III or Honors Math A and completing with a grade of C or better.

**Calculus I, II, III:** Students who have not previously studied calculus should begin with Calculus I. Students with 4 or higher on the Calculus AB or BC advanced placement test may start with Calculus II. Students with 5 on the Calculus BC test should start with Calculus III.

**Honors Mathematics A:** Students who have passed the Calculus BC advanced placement test with a grade of 5, and who have strong mathematical talent and motivation, should start with Honors Mathematics A. This is the most attractive course available to well-prepared, mathematically talented first-year students, whether or not they intend to be mathematics majors. Students who contemplate taking this course should consult with the instructor. If this is not possible ahead of time, they should register and attend the first class.

**Chair:** Daniela De Silva (Olin Professor of Mathematics)

**Professors:** Dave Bayer, Daniela De Silva (Olin Professor of Mathematics), Dusa McDuff (Joan Lyttle Birman ’48 Chair of Mathematics)

**Assistant Professor:** Alisa Knizel

**Term Associate Professor:** Lindsay Piechnik

**Professors Emeriti:** Joan Birman, Walter Neumann

Links to other faculty of Columbia University offering courses in Mathematics:

Faculty by Rank: [http://www.math.columbia.edu/people/faculty-by-rank/](http://www.math.columbia.edu/people/faculty-by-rank/)


**Requirements for the Major**
The major programs in both Mathematics and Applied Mathematics are appropriate for students who plan to continue their training in graduate school. The major in Mathematical Sciences combines the elements of Mathematics, Computer Science and Statistics. It is designed to prepare students for employment in business, administration, and finance, and also give excellent background for someone planning graduate study in a social science field. Students who plan to obtain a teaching qualification in mathematics should plan their course of study carefully with an advisor, since courses that are too far from mathematics do not count towards certification.

**For a major in Mathematics: 14 courses (a minimum of 35 credits) as follows:**
- Four courses in calculus or Honors Mathematics A-B, including Advanced Placement Credit. A student who places out of Calc I/II with AP credits, will need to take a replacement course.
- Six courses in mathematics numbered at or above 2000.
- Four courses in any combination of mathematics and cognate courses.

The courses in mathematics must include:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH UN2010</td>
<td>LINEAR ALGEBRA (also satisfied by Honors Math A-B)</td>
</tr>
<tr>
<td>MATH GU4041</td>
<td>INTRO MODERN ALGEBRA I (I)</td>
</tr>
<tr>
<td>MATH GU4042</td>
<td>INTRO MODERN ALGEBRA II (II)</td>
</tr>
<tr>
<td>MATH GU4061</td>
<td>INTRO MODERN ANALYSIS I (I)</td>
</tr>
<tr>
<td>MATH GU4062</td>
<td>INTRO MODERN ANALYSIS II (II)</td>
</tr>
</tbody>
</table>
MATH UN3951 UNDERGRADUATE SEMINARS I (at least one term)
or MATH UN3952 UNDERGRADUATE SEMINARS II

* Note: It is strongly recommended that the sequences MATH GU4041 INTRO MODERN ALGEBRA I - MATH GU4062 INTRO MODERN ANALYSIS II and MATH GU4061 INTRO MODERN ANALYSIS I - MATH GU4062 INTRO MODERN ANALYSIS II be taken in separate years.

However, students who are not contemplating graduate study in mathematics may replace one or both of the two terms of MATH GU4061 INTRO MODERN ANALYSIS I - MATH GU4062 INTRO MODERN ANALYSIS II with one or two of the following courses:

- MATH UN2500 ANALYSIS AND OPTIMIZATION,
- MATH UN3007 COMPLEX VARIABLES,
- or MATH GU4032 FOURIER ANALYSIS

and may replace MATH GU4042 INTRO MODERN ALGEBRA II with

- MATH UN3020 NUMBER THEORY AND CRYPTOGRAPHY
- or MATH UN3025 MAKING, BREAKING CODES

In exceptional cases, the chair will approve the substitution of certain more advanced courses for those mentioned above.

For a major in Applied Mathematics: 14 courses (a minimum of 35 credits)

Four courses in calculus or Honors Mathematics A-B, including Advanced Placement Credit. A student that places out of Calc I/II with AP credits, will need to take a replacement course.

MATH UN2010 LINEAR ALGEBRA (also satisfied by Honors Math A-B)
MATH GU4061 INTRO MODERN ANALYSIS I
APMA E4901 SEM-PROBLEMS IN APPLIED MATH
APMA E4903 SEM-PROBLEMS IN APPLIED MATH
APMA E3900 UNDERGRAD RES IN APPLIED MATH (APMA E3900 may be replaced, with approval, by another technical elective for seniors that involves an undergraduate thesis or creative research report)

Additional electives, to be approved by the Applied Math Committee, e.g.:

MATH UN2500 ANALYSIS AND OPTIMIZATION
MATH UN3007 COMPLEX VARIABLES
or MATH GU4065 COMPLEX VARIABLES
or APMA E4204 FUNCTNS OF A COMPLEX VARIABLE
MATH UN3027 Ordinary Differential Equations
or MATH UN2030 ORDINARY DIFFERENTIAL EQUATIONS
MATH UN2038 PARTIAL Differential Equations
or APMA E4200 PARTIAL DIFFERENTIAL EQUATIONS
MATH GU4062 FOURIER ANALYSIS
APMA E4300 COMPUT MATH:INTRO-NUMERCL METH
APMA E4101 APPL MATH III:DYNAMICAL SYSTMS
APMA E4150 APPLIED FUNCTIONAL ANALYSIS

For a major in Mathematical Sciences: 14 courses (a minimum of 38 credits):

6 from Mathematics, 5 from a combination of Statistics and Computer Science and 3 electives from a combination of Mathematics, Statistics, Computer Science.

Mathematics

Six required courses:

MATH UN1101 CALCULUS I
MATH UN1102 CALCULUS II
MATH UN1201 CALCULUS III
MATH UN2010 LINEAR ALGEBRA (also satisfied by Honors Math A-B)
MATH UN2000 INTRO TO HIGHER MATHEMATICS
MATH UN2030 ORDINARY DIFFERENTIAL EQUATIONS
or MATH UN3027 Ordinary Differential Equations

Possible further courses selected from the following:

MATH UN1202 CALCULUS IV
MATH UN2500 ANALYSIS AND OPTIMIZATION
MATH UN3020 NUMBER THEORY AND CRYPTOGRAPHY
MATH UN3025 MAKING, BREAKING CODES

Any 3 credit MATH course numbered 2000 or above

Statistics

Select at least one of the following:

STAT UN1101 INTRODUCTION TO STATISTICS
STAT UN1201 CALC-BASED INTRO TO STATISTICS
or equivalent

Other courses from the Statistics list (eg, STAT UN2102, STAT UN2103, STAT UN2104, STAT UN3105, STAT UN3106)

Computer Science

Select at least one of the following programming courses:

COMS W1002 COMPUTING IN CONTEXT
COMS W1004 Introduction to Computer Science and Programming in Java (preferred)
COMS W1005 Introduction to Computer Science and Programming in MATLAB
COMS W1007

Possible further courses selected from the following:

Other classes from the Computer Science Core
COMS W3203 DISCRETE MATHEMATICS
COMS W3210 Scientific Computation
ENGI E1006 INTRO TO COMP FOR ENG/APP SCI

More generally, electives may be any course with a prerequisite of at least one semester of Calculus, Statistics or Computer Science with the prior approval of the Mathematics Chair.

The Capstone Experience can be fulfilled by a significant thesis written under the supervision of faculty of any one of the three departments or by the Undergraduate Seminar in Mathematics.

NOTE: A student that places out of Calc I/II with AP credits, will need to take a replacement course.

For a major in Mathematics-Statistics: 14 courses (a minimum of 38 credits):

Mathematics

Select one of the following sequences:
Mathematics

MATH UN1101 - MATH UN1102 - MATH UN1201 - MATH UN2010 - MATH UN2500
and ANALYSIS AND OPTIMIZATION

MATH UN1207 - MATH UN1208 - MATH UN2500
HONORS MATHEMATICS A and HONORS MATHEMATICS B
and ANALYSIS AND OPTIMIZATION

Statistics

Statistics required courses
STAT UN1201 - MATH UN2010
CALC-BASED INTRO TO STATISTICS

And select one of the following courses:
STAT GU4203 - MATH GU4041
PROBABILITY THEORY

STAT GU4204 - MATH GU4061
STATISTICAL INFERENCE

STAT GU4205 - MATH GU4051
LINEAR REGRESSION MODELS

STOCHASTIC METHODS IN FINANCE

Computer Science

COMS W1004 - ENGI E1006
Introduction to Computer Science and Programming in Java
INTRO TO COMP FOR ENG/APP SCI

COMS W1005 - CSEE W3827
Introduction to Computer Science and Programming in MATLAB
FUNDAMENTALS OF COMPUTER SYSTS

COMS W3134 - CSOR W4231
Data Structures in Java
ANALYSIS OF ALGORITHMS I

COMS W3157 - COMS W4241
ADVANCED PROGRAMMING
Numerical Algorithms and Complexity

COMS W3203 - MATH UN3020
DISCRETE MATHEMATICS
NUMBER THEORY AND CRYPTOGRAPHY

COMS W3261 - MATH BC2006
COMPUTER SCIENCE THEORY
COMBINATORICS

CSEE W3827 - MATH UN3007
FUNDAMENTALS OF COMPUTER SYSTS
COMPLEX VARIABLES

MATH GU4051 - MATH UN3386
TOPOLOGY
DIFFERENTIAL GEOMETRY

Students seeking to pursue a Ph.D. program in either discipline are urged
to take additional courses, in consultation with their advisers.

For a major in Economics and Mathematics, see the catalogue.

Requirement for the Minor in Mathematics

For a minor in Mathematics or Applied Mathematics: Six courses from any of the courses offered by the department except MATH UN1003 COLLEGE ALGEBRA-ANLYTIC GEOMETRY, MATH UN1101 CALCULUS I / MATH UN1102 CALCULUS II. Some cognate courses are also acceptable with prior approval from the department chair.

Requirements for the Minor in Mathematical Sciences

The minor in Mathematical Sciences comprises 6 courses, at least two from Mathematics and one from each of Statistics and Computer Science. There should be a minimum of three courses in Statistics and Computer Science. Eligible courses are any listed in the Mathematical Sciences Major with the exception of Calculus I and II.

For a major in Mathematics-Computer Science 15 courses (a minimum of 38 credits):

Mathematics

Four courses in calculus or Honors Mathematics A-B, including Advanced Placement Credit. A student that places out of Calc I/II with AP credits, will need to take a replacement course; and the 3 following courses:

MATH UN2010 - MATH GU4041 - MATH UN3951
LINEAR ALGEBRA (also satisfied by Honors Math A-B)
INTRO MODERN ALGEBRA I
UNDERGRADUATE SEMINARS I (at least one term)

MATH UN3952
UNDERGRADUATE SEMINARS II

Computer Science

COMS W1004
Introduction to Computer Science and Programming in Java

COMS W3134 - Data Structures in Java
COMS W3157 - ADVANCED PROGRAMMING
COMS W3203 - DISCRETE MATHEMATICS
COMS W3261 - COMPUTER SCIENCE THEORY
CSEE W3827 - FUNDAMENTALS OF COMPUTER SYSTS

Note A: AP Computer Science with a grade of 4 or 5 or similar experience is a prerequisite for COMS W1007.

Electives: Two additional electives from computer science or math should be included. At least one should be level 3000 or higher; the second should be level 2000 or higher. With adviser approval, appropriate electives from other departments can be considered, such as Statistics or Applied Math.

CSOR W4231 - ANALYSIS OF ALGORITHMS I
COMS W4241 - Numerical Algorithms and Complexity
MATH UN3020 - NUMBER THEORY AND CRYPTOGRAPHY
MATH BC2006 - COMBINATORICS
MATH GU4061 - INTRO MODERN ANALYSIS I
MATH UN2500 - ANALYSIS AND OPTIMIZATION
MATH UN3007 - COMPLEX VARIABLES
MATH UN3386 - DIFFERENTIAL GEOMETRY
MATH GU4051 - TOPOLOGY

Students seeking to pursue a Ph.D. program in either discipline are urged
to take additional courses, in consultation with their advisers.

For a major in Economics and Mathematics, see the catalogue.

Requirement for the Minor in Mathematics

For a minor in Mathematics or Applied Mathematics: Six courses from any of the courses offered by the department except MATH UN1003 COLLEGE ALGEBRA-ANLYTIC GEOMETRY, MATH UN1101 CALCULUS I / MATH UN1102 CALCULUS II. Some cognate courses are also acceptable with prior approval from the department chair.
MATH UN1003 COLLEGE ALGEBRA-ANLYTC GEOMETRY. 3.00 points.
Prerequisites: score of 550 on the mathematics portion of the SAT completed within the last year, or the appropriate grade on the General Studies Mathematics Placement Examination. For students who wish to study calculus but do not know analytic geometry. Algebra review, graphs and functions, polynomial functions, rational functions, conic sections, systems of equations in two variables, exponential and logarithmic functions, trigonometric functions and trigonometric identities, applications of trigonometry, sequences, series, and limits

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1003</td>
<td>001/12296</td>
<td>M W 11:40am - 12:55pm</td>
<td>Taeseok Lee</td>
<td>3.00</td>
<td>19/30</td>
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<tr>
<td>MATH 1003</td>
<td>002/12298</td>
<td>T Th 6:10pm - 7:25pm</td>
<td>Baiqing Zhu</td>
<td>3.00</td>
<td>16/30</td>
</tr>
</tbody>
</table>

Spring 2024: MATH UN1003

MATH UN1101 CALCULUS I. 3.00 points.
Prerequisites: (see Courses for First-Year Students). Functions, limits, derivatives, introduction to integrals, or an understanding of pre-calculus will be assumed. (SC)

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
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<td>Mrudul Thatte</td>
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<td>42/100</td>
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<td>003/12301</td>
<td>T Th 2:40pm - 3:55pm</td>
<td>Alex Xu</td>
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<td>25/30</td>
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<td>004/12302</td>
<td>T Th 6:10pm - 7:25pm</td>
<td>Amal Mattoo</td>
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<td>006/12304</td>
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<td>Jorge Pineiro</td>
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<td>44/100</td>
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<td>MATH 1101</td>
<td>007/11830</td>
<td>M W 6:10pm - 7:25pm</td>
<td>304 Barnard Hall</td>
<td>Lindsay Piechnik</td>
<td>3.00</td>
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<tr>
<td>MATH 1101</td>
<td>008/11831</td>
<td>M W 11:40am - 12:55pm</td>
<td>407 Mathematics Building</td>
<td>Taeseok Lee</td>
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<td>MATH 1101</td>
<td>009/11832</td>
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<td>Room TBA</td>
<td>Marco Castronovo</td>
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<td>MATH 1101</td>
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<td>M W 10:10am - 11:25am</td>
<td>Room TBA</td>
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<td>MATH 1101</td>
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<td>M W 10:10am - 11:25am</td>
<td>Room TBA</td>
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<tr>
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<td>MATH 1101</td>
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<tr>
<td>MATH 1101</td>
<td>022/11845</td>
<td>M W 10:10am - 11:25am</td>
<td>Room TBA</td>
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<td>3.00</td>
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</table>
Prerequisites: MATH UN1101 or the equivalent. Methods of integration, applications of the integral, Taylor’s theorem, infinite series. (SC)

Spring 2024: MATH UN1102

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
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<tr>
<td>MATH 1102</td>
<td>001/00227</td>
<td>T Th 2:40pm - 3:55pm</td>
<td>Lindsay Plchok</td>
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<td>MATH 1102</td>
<td>002/12305</td>
<td>T Th 10:10am - 11:25am</td>
<td>Lucy Yang</td>
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<tr>
<td>MATH 1102</td>
<td>003/12306</td>
<td>T Th 1:10pm - 2:25pm</td>
<td>Tomasz Owsiak</td>
<td>3.00</td>
<td>61/64</td>
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<tr>
<td>MATH 1102</td>
<td>004/12307</td>
<td>T Th 6:10pm - 7:25pm</td>
<td>Fan Zhou</td>
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<td>11/30</td>
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<td>Davis Lazowski</td>
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Fall 2024: MATH UN1102

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<td>Andres Ibanez Nunez</td>
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<td>003/11849</td>
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<td>004/11850</td>
<td>T Th 8:40am - 9:55am</td>
<td>Lucy Yang</td>
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<td>T Th 6:10pm - 7:25pm</td>
<td>Elliott Stein</td>
<td>3.00</td>
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Prerequisites: MATH UN1101 or the equivalent. Vectors in dimensions 2 and 3, complex numbers and the complex exponential function with applications to differential equations, Cramer’s rule, vector-valued functions of one variable, scalar-valued functions of several variables, partial derivatives, gradients, surfaces, optimization, the method of Lagrange multipliers. (SC)

Spring 2024: MATH UN1201

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
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<tbody>
<tr>
<td>MATH 1201</td>
<td>001/00228</td>
<td>M W 10:10am - 11:25am</td>
<td>Cristian Iovanov</td>
<td>3.00</td>
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<tr>
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<td>MATH 1201</td>
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<td>Shaoyun Bai</td>
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<tr>
<td>MATH 1201</td>
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Fall 2024: MATH UN1201

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<th>Course Number</th>
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<td>MATH 1201</td>
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<td>Yoonjoo Kim</td>
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<td>Yoonjoo Kim</td>
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Prerequisites: MATH UN1102 and MATH UN1201 or the equivalent. Multiple integrals, Taylor’s formula in several variables, line and surface integrals, calculus of vector fields, Fourier series. (SC)

Spring 2024: MATH UN1202

<table>
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<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
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<td>M W 4:10pm - 5:25pm</td>
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Fall 2024: MATH UN1202

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<th>Section/Call Number</th>
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<th>Instructor</th>
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<th>Enrollment</th>
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<tr>
<td>MATH 1202</td>
<td>001/00012</td>
<td>M W 10:10am - 11:25am</td>
<td>Daniela De Silva</td>
<td>3.00</td>
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<tr>
<td>MATH 1202</td>
<td>002/11863</td>
<td>M W 6:10pm - 7:25pm</td>
<td>Mikhail Smirnov</td>
<td>3.00</td>
<td>45/100</td>
</tr>
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</table>
MATH UN2000 INTRO TO HIGHER MATHEMATICS. 3.00 points.
Introduction to understanding and writing mathematical proofs. Emphasis on precise thinking and the presentation of mathematical results, both in oral and in written form. Intended for students who are considering majoring in mathematics but wish additional training. CC/GS: Partial Fulfillment of Science Requirement. BC: Fulfillment of General Education Requirement: Quantitative and Deductive Reasoning (QUA)

MATH UN2000 Course

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
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<tbody>
<tr>
<td>MATH 2000</td>
<td>001/12330</td>
<td>T Th 10:10am - 11:25am</td>
<td>Giulia Sacca</td>
<td>3.00</td>
<td>21/44</td>
</tr>
<tr>
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MATH UN2030 ORDINARY DIFFERENTIAL EQUATIONS. 3.00 points.
Prerequisites: MATH UN1102 and MATH UN1201 or the equivalent. Special differential equations of order one. Linear differential equations with constant and variable coefficients. Systems of such equations. Transform and series solution techniques. Emphasis on applications

MATH UN2030 Course

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
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<td>001/12341</td>
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<td>Ovidiu Savin</td>
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MATH BC2006 COMBINATORICS. 3.00 points.
Spring 2024: MATH BC2006

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<tr>
<td>MATH 2006</td>
<td>001/00254</td>
<td>T Th 10:10am - 11:25am</td>
<td>Alisa Knizel</td>
<td>3.00</td>
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MATH BC2011 PERSPECTIVES IN MATHEMATICS. 1.00 point.
Prerequisites: some calculus or the instructor's permission. Intended as an enrichment to the mathematics curriculum of the first years, this course introduces a variety of mathematical topics (such as three dimensional geometry, number theory) that are often not discussed until later, and explains some current applications of mathematics in the sciences, technology and economics

MATH BC2011 Course

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
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<td>MATH 2011</td>
<td>001/00231</td>
<td>W 1:10pm - 2:00pm</td>
<td>Dusa McDuff</td>
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<td>17/28</td>
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MATH BC2001 PERSPECTIVES IN MATHEMATICS A. 4.00 points.
Prerequisites: (see Courses for First-Year Students). The second term of this course may not be taken without the first. Multivariable calculus and linear algebra from a rigorous point of view. Recommended for mathematics majors. Fulfills the linear algebra requirement for the major.

MATH BC2001 Course

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
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MATH BC2005 INTRO TO HIGHER MATHEMATICS B. 4.00 points.
Prerequisites: (see Courses for First-Year Students). Prerequisites: (see Courses for First-Year Students). The second term of this course may not be taken without the first. Multivariable calculus and linear algebra from a rigorous point of view. Recommended for mathematics majors. Fulfills the linear algebra requirement for the major.

MATH BC2005 Course

<table>
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<tr>
<th>Course Number</th>
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<th>Times/Location</th>
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<tr>
<td>MATH 2005</td>
<td>001/12329</td>
<td>T Th 1:10pm - 2:25pm</td>
<td>George Dragomir</td>
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MATH UN2010 LINEAR ALGEBRA. 3.00 points.
Matrices, vector spaces, linear transformations, eigenvalues and eigenvectors, canonical forms, applications. (SC)

MATH UN2010 Course

<table>
<thead>
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<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
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<th>Enrollment</th>
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<td>MATH 2010</td>
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<td>Amadou Bah</td>
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MATH UN2010 Honors Linear Algebra. 3 points.
Not offered during 2023-2024 academic year.

Prerequisites: MATH UN1201. A more extensive treatment of the material in MATH UN2010, with increased emphasis on proof. Not to be taken in addition to MATH UN2010 or MATH UN1207-MATH UN1208.

MATH UN2020 ORDINARY DIFFERENTIAL EQUATIONS. 3.00 points.
Prerequisites: MATH UN1102 and MATH UN1201 or the equivalent. Prerequisites: MATH UN1102 and MATH UN1201 or the equivalent. Special differential equations of order one. Linear differential equations with constant and variable coefficients. Systems of such equations. Transform and series solution techniques. Emphasis on applications

MATH UN2020 Course

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
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<tr>
<td>MATH 2020</td>
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<td>Panagiota Daskalopoulos</td>
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MATH UN2020 Honors Linear Algebra. 3 points.
Not offered during 2023-2024 academic year.

Prerequisites: MATH UN1201. A more extensive treatment of the material in MATH UN2010, with increased emphasis on proof. Not to be taken in addition to MATH UN2010 or MATH UN1207-MATH UN1208.

MATH UN2030 ORDINARY DIFFERENTIAL EQUATIONS. 3.00 points.
Prerequisites: MATH UN1102 and MATH UN1201 or the equivalent. Prerequisites: MATH UN1102 and MATH UN1201 or the equivalent. Special differential equations of order one. Linear differential equations with constant and variable coefficients. Systems of such equations. Transform and series solution techniques. Emphasis on applications

MATH UN2030 Course

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
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<td>Jeanne Bourier</td>
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MATH UN2030 Honors Ordinary Differential Equations. 3 points.
Not offered during 2023-2024 academic year.

Prerequisites: MATH UN1201. A more extensive treatment of the material in MATH UN2010, with increased emphasis on proof. Not to be taken in addition to MATH UN2010 or MATH UN1207-MATH UN1208.
MATH UN2500 ANALYSIS AND OPTIMIZATION. 3.00 points.
Prerequisites: MATH UN1102 and MATH UN1201 or the equivalent and MATH UN2010.
Prerequisites: MATH UN1102 and MATH UN1201 or the equivalent and MATH UN2010. Mathematical methods for economics. Quadratic forms, Hessian, implicit functions. Convex sets, convex functions. Optimization, constrained optimization, Kuhn-Tucker conditions. Elements of the calculus of variations and optimal control. (SC)

Spring 2024: MATH UN2500
<table>
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<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
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<tr>
<td>MATH 2500</td>
<td>001/12347</td>
<td>T Th 11:40am - 12:55pm 207 Mathematics Building</td>
<td>Wenjian Liu</td>
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Fall 2024: MATH UN2500
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<th>Instructor</th>
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<th>Enrollment</th>
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<td>Qiao He</td>
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<td>MATH 2500</td>
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<td>Roger Van Peski</td>
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MATH UN3007 COMPLEX VARIABLES. 3.00 points.
Prerequisites: MATH UN1202 An elementary course in functions of a complex variable.
Prerequisites: MATH UN1202 An elementary course in functions of a complex variable. Fundamental properties of the complex numbers, differentiability, Cauchy-Riemann equations. Cauchy integral theorem. Taylor and Laurent series, poles, and essential singularities. Residue theorem and conformal mapping. (SC)

Fall 2024: MATH UN3007
<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
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MATH UN3020 NUMBER THEORY AND CRYPTOGRAPHY. 3.00 points.
Prerequisites: one year of calculus.
Prerequisites: one year of calculus. Prerequisite: One year of Calculus. Congruences. Primitive roots. Quadratic residues. Contemporary applications

Spring 2024: MATH UN3020
<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
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<th>Enrollment</th>
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<tr>
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<td>Yoonjoo Kim</td>
<td>3.00</td>
<td>71/100</td>
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MATH UN3025 MAKING, BREAKING CODES. 3.00 points.
Prerequisites: (MATH UN1101 and MATH UN1102 and MATH UN1201) and and MATH UN2010.
Prerequisites: (MATH UN1101 and MATH UN1102 and MATH UN1201) and and MATH UN2010. A concrete introduction to abstract algebra. Topics in abstract algebra used in cryptography and coding theory

Fall 2024: MATH UN3025
<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
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<th>Enrollment</th>
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<td>Dorian Goldfeld</td>
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MATH UN3027 Ordinary Differential Equations. 3 points.
Prerequisites: MATH UN1102 and MATH UN1201 or the equivalent.
Corequisites: MATH UN2010

MATH UN3028 PARTIAL DIFFERENTIAL EQUATIONS. 3.00 points.
Prerequisites: MATH UN3027 and MATH UN2010 or the equivalent
Prerequisites: (MATH UN2010 and MATH UN2030) or the equivalent introduction to partial differential equations. First-order equations. Linear second-order equations; separation of variables, solution by series expansions. Boundary value problems

Spring 2024: MATH UN3028
<table>
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<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
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<tr>
<td>MATH 3028</td>
<td>001/12359</td>
<td>T Th 1:10pm - 2:25pm 312 Mathematics Building</td>
<td>Simon Brendle</td>
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MATH UN3050 DISCRETE TIME MODELS IN FINANC. 3.00 points.
Prerequisites: (MATH UN1102 and MATH UN1201) or (MATH UN1101 and MATH UN1102 and MATH UN1201) and MATH UN2010 Recommended: MATH UN3027 (or MATH UN2030 and SIEO W3600).
Prerequisites: (MATH UN1102 and MATH UN1201) or (MATH UN1101 and MATH UN1102 and MATH UN1201) and MATH UN2010 Recommended: MATH UN3027 (or MATH UN2030 and SIEO W3600).
Elementary discrete time methods for pricing financial instruments, such as options. Notions of arbitrage, risk-neutral valuation, hedging, term-structure of interest rates

Spring 2024: MATH UN3050
<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
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<th>Enrollment</th>
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<tr>
<td>MATH 3050</td>
<td>001/12360</td>
<td>M W 6:10pm - 7:25pm 312 Mathematics Building</td>
<td>Mikhail Smirnov</td>
<td>3.00</td>
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MATH UN3386 DIFFERENTIAL GEOMETRY. 3.00 points.
Prerequisites: MATH UN1202 or the equivalent.
Local and global differential geometry of submanifolds of Euclidean 3-space. Frenet formulas for curves. Various types of curvatures for curves and surfaces and their relations. The Gauss-Bonnet theorem.

MATH UN3901 SUPERVISED READINGS I. 1.00-3.00 points.
Prerequisites: The written permission of the faculty member who agrees to act as sponsor (sponsorship limited to full-time instructors on the staff list), as well as the permission of the Director of Undergraduate Studies. The written permission must be deposited with the Director of Undergraduate Studies before registration is completed. Guided reading and study in mathematics. A student who wishes to undertake individual study under this program must present a specific project to a member of the staff and secure his or her willingness to act as sponsor. Written reports and periodic conferences with the instructor. Supervising Readings do NOT count towards major requirements, with the exception of an advanced written approval by the DUS

Fall 2024: MATH UN3901
<table>
<thead>
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<th>Course Number</th>
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<td>Dusa McDuff</td>
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<td>MATH 3901</td>
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</table>
MATH UN3902 SUPERVISED READINGS II. 1.00-3.00 points.
Prerequisites: The written permission of the faculty member who agrees to act as sponsor (sponsorship limited to full-time instructors on the staff list), as well as the permission of the Director of Undergraduate Studies. The written permission must be deposited with the Director of Undergraduate Studies before registration is completed. Guided reading and study in mathematics. A student who wishes to undertake individual study under this program must present a specific project to a member of the staff and secure his or her willingness to act as sponsor. Written reports and periodic conferences with the instructor. Supervising Readings do NOT count towards major requirements, with the exception of an advanced written approval by the DUS

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 3902</td>
<td>001/18557</td>
<td>Julien Dubedat</td>
<td>1.00-3.00</td>
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<tr>
<td>MATH 3902</td>
<td>002/20706</td>
<td>Amadou Bah</td>
<td>1.00-3.00</td>
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<td>MATH 3902</td>
<td>003/20734</td>
<td>Andrew Blumberg</td>
<td>1.00-3.00</td>
<td>2/2</td>
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<td>MATH 3902</td>
<td>004/20960</td>
<td>Simon Brendle</td>
<td>1.00-3.00</td>
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<tr>
<td>MATH 3902</td>
<td>005/20967</td>
<td>Francesco Lin</td>
<td>1.00-3.00</td>
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<td>MATH 3902</td>
<td>006/20991</td>
<td>Mu-Tao Wang</td>
<td>1.00-3.00</td>
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</table>

MATH UN3951 UNDERGRADUATE SEMINARS I. 3.00 points.
Prerequisites: Two years of calculus, at least one year of additional mathematics courses, and the director of undergraduate studies’ permission.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
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<tbody>
<tr>
<td>MATH 3951</td>
<td>001/00078</td>
<td>Cristian Iovanov</td>
<td>3.00</td>
<td>47/64</td>
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MATH UN3952 UNDERGRADUATE SEMINARS II. 3.00 points.
Prerequisites: Two years of calculus, at least one year of additional mathematics courses, and the director of undergraduate studies’ permission.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 3952</td>
<td>001/00233</td>
<td>Alisa Knizel</td>
<td>3.00</td>
<td>61/80</td>
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</table>

MATH UN3997 SUPERVISED INDIVIDUAL RESEARCH. 1.00-4.00 points.
Prerequisites: The written permission of the faculty member who agrees to act as a supervisor, and the director of undergraduate studies permission. For specially selected mathematics majors, the opportunity to write a senior thesis on a problem in contemporary mathematics under the supervision of a faculty member

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
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<tr>
<td>MATH 3997</td>
<td>001/00910</td>
<td></td>
<td>Daniela De Silva</td>
<td>1.00-4.00</td>
<td>1/5</td>
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</table>

MATH UN3998 SUPERVISED INDIVIDUAL RESEARCH. 3.00 points.
Prerequisites: The written permission of the faculty member who agrees to act as a supervisor, and the permission of the Director of Undergraduate Studies. For specially selected mathematics majors, the opportunity to write a senior thesis on a problem in contemporary mathematics under the supervision of a faculty member.

MATH GU4007 ANALYTIC NUMBER THEORY. 3.00 points.
Prerequisites: MATH UN3007

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<tr>
<th>Course Number</th>
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<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
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<tr>
<td>MATH 4007</td>
<td>001/12361</td>
<td>T Th 2:40pm - 3:55pm</td>
<td>Dorian Goldfield</td>
<td>3.00</td>
<td>8/19</td>
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</table>

MATH GU4032 FOURIER ANALYSIS. 3.00 points.
Prerequisites: three terms of calculus and linear algebra or four terms of calculus.

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<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
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<tr>
<td>MATH 4032</td>
<td>001/11879</td>
<td></td>
<td>Simon Brendle</td>
<td>3.00</td>
<td>43/49</td>
</tr>
</tbody>
</table>
MATH GU4041 INTRO MODERN ALGEBRA I. 3.00 points.
Prerequisites: MATH UN1102 and MATH UN1202 and MATH UN2010 or the equivalent.
Prerequisites: MATH UN1102 and MATH UN1202 and MATH UN2010 or the equivalent.
The second term of this course may not be taken without the first. Groups, homomorphisms, normal subgroups, the isomorphism theorems, symmetric groups, group actions, the Sylow theorems, finitely generated abelian groups.

Spring 2024: MATH GU4041
Course Number: 001/12362
Times/Location: M W 10:10am - 11:25am
Instructor: Yujie Xu
Points: 3.00
Enrollment: 55/64

Fall 2024: MATH GU4041
Course Number: 001/11904
Times/Location: M W 1:10pm - 2:25pm
Instructor: Robert Friedman
Points: 3.00
Enrollment: 88/100

MATH GU4042 INTRO MODERN ALGEBRA II. 3.00 points.
Prerequisites: MATH UN1102 and MATH UN1202 and MATH UN2010 or the equivalent.
Prerequisites: MATH UN1102 and MATH UN1202 and MATH UN2010 or the equivalent.
The second term of this course may not be taken without the first. Rings, homomorphisms, ideals, integral and Euclidean domains, the division algorithm, principal ideal and unique factorization domains, fields, algebraic and transcendental extensions, splitting fields, finite fields, Galois theory.

Spring 2024: MATH GU4042
Course Number: 001/12363
Times/Location: M W 2:40pm - 3:55pm
Instructor: Konstantin Alekshkin
Points: 3.00
Enrollment: 43/64

Fall 2024: MATH GU4042
Course Number: 001/11846
Times/Location: M W 10:10am - 11:25am
Instructor: Michael Thaddeus
Points: 3.00
Enrollment: 30/49

MATH GU4043 ALGEBRAIC NUMBER THEORY. 3.00 points.
Prerequisites: MATH GU4041 and MATH GU4042 or the equivalent.
Prerequisites: MATH GU4041 and MATH GU4042 or the equivalent.
Algebraic number fields, unique factorization of ideals in the ring of algebraic integers in the field into prime ideals. Dirichlet unit theorem, finiteness of the class number, ramification. If time permits, p-adic numbers and Dedekind zeta function.

Spring 2024: MATH GU4043
Course Number: 001/12364
Times/Location: T Th 4:10pm - 5:25pm
Instructor: Gyuhe Oh
Points: 3.00
Enrollment: 8/20

MATH GU4044 REPRESENTATNS OF FINITE GROUPS. 3.00 points.
Prerequisites: MATH UN2010 and MATH GU4041 or the equivalent.
Prerequisites: MATH UN2010 and MATH GU4041 or the equivalent.
Finite groups acting on finite sets and finite dimensional vector spaces. Group characters. Relations with subgroups and factor groups. Arithmetic properties of character values. Applications to the theory of finite groups: Frobenius groups, Hall subgroups and solvable groups. Characters of the symmetric groups. Spherical functions on finite groups.

Fall 2024: MATH GU4044
Course Number: 001/11880
Times/Location: T Th 1:10pm - 2:25pm
Instructor: Andrei Okounkov
Points: 3.00
Enrollment: 26/30

MATH GU4045 ALGEBRAIC CURVES. 3.00 points.
Prerequisites: (MATH GU4041 and MATH GU4042) and MATH UN3007
Prerequisites: (MATH GU4041 and MATH GU4042) and MATH UN3007
Plane curves, affine and projective varieties, singularities, normalization, Riemann surfaces, divisors, linear systems, Riemann-Roch theorem.

Spring 2024: MATH GU4045
Course Number: 001/12366
Times/Location: M W 2:40pm - 3:55pm
Instructor: Nathan Chen
Points: 3.00
Enrollment: 5/20

MATH W4046 Introduction to Category Theory. 3 points.
CC/JS: Partial Fulfillment of Science Requirement
Not offered during 2023-2024 academic year.

Prerequisites: MATH W4041.
Categories, functors, natural transformations, adjoint functors, limits and colimits, introduction to higher categories and diagrammatic methods in algebra.

MATH GU4051 TOPOLOGY. 3.00 points.
Prerequisites: (MATH UN1202 and MATH UN2010) and rudiments of group theory (e.g., MATH GU4041). MATH UN1208 or MATH GU4061 is recommended, but not required.
Prerequisites: (MATH UN1202 and MATH UN2010) and rudiments of group theory (e.g., MATH GU4041). MATH UN1208 or MATH GU4061 is recommended, but not required.

Fall 2024: MATH GU4051
Course Number: 001/11881
Times/Location: T Th 6:10pm - 7:25pm
Instructor: Rostislav Akhmechet
Points: 3.00
Enrollment: 35/49
MATH GU4052 INTRODUCTION TO KNOT THEORY. 3.00 points.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: MATH GU4051 Topology and/or MATH GU4061 Introduction To Modern Analysis I (or equivalents). Recommended (can be taken concurrently): MATH UN2010 linear algebra, or equivalent. The study of algebraic and geometric properties of knots in R^3, including but not limited to knot projections and Reidemeister moves, Seifert surfaces, braids, tangles, knot polynomials, fundamental group of knot complements. Depending on time and student interest, we will discuss more advanced topics like knot concordance, relationship to 3-manifold topology, other algebraic knot invariants.

Fall 2024: MATH GU4052
Course Number  Section/Call Number  Times/Location  Instructor  Points  Enrollment
MATH 4052  001/11782  M W 11:40am - 12:55pm Room TBA  Siddhi Krishna  3.00  9/20

MATH GU4053 INTRO TO ALGEBRAIC TOPOLOGY. 3.00 points.
Prerequisites: MATH UN2010 and MATH GU4041 and MATH GU4051
Prerequisites: MATH UN2010 and MATH GU4041 and MATH GU4051
The study of topological spaces from algebraic properties, including the essentials of homology and the fundamental group. The Brouwer fixed point theorem. The homology of surfaces. Covering spaces.

Spring 2024: MATH GU4053
Course Number  Section/Call Number  Times/Location  Instructor  Points  Enrollment
MATH 4053  001/12368  T Th 11:40am - 12:55pm 407 Mathematics Building  Lucy Yang  3.00  15/30

MATH GU4061 INTRO MODERN ANALYSIS I. 3.00 points.
Prerequisites: MATH UN1202 or the equivalent, and MATH UN2010. The second term of this course may not be taken without the first. Real numbers, metric spaces, elements of general topology, sequences and series, continuity, differentiation, integration, uniform convergence, Ascoli-Arzela theorem, Stone-Weierstrass theorem.

Spring 2024: MATH GU4061
Course Number  Section/Call Number  Times/Location  Instructor  Points  Enrollment
MATH 4061  001/12541  M W 11:10am - 2:25pm 203 Mathematics Building  Ivan Corwin  3.00  55/110

Fall 2024: MATH GU4061
Course Number  Section/Call Number  Times/Location  Instructor  Points  Enrollment
MATH 4061  001/11858  T Th 11:10am - 2:25pm Room TBA  Sven Hirsch  3.00  49/64
MATH 4061  002/11859  T Th 2:40pm - 3:55pm Room TBA  Sven Hirsch  3.00  52/64

MATH GU4062 INTRO MODERN ANALYSIS II. 3.00 points.
Prerequisites: MATH UN1202 or the equivalent, and MATH UN2010. The second term of this course may not be taken without the first. The second term of this course may not be taken without the first. Power series, analytic functions, Implicit function theorem, Fundamental theorem, change of variables formula, Lebesgue measure and integration, function spaces.

Spring 2024: MATH GU4062
Course Number  Section/Call Number  Times/Location  Instructor  Points  Enrollment
MATH 4062  001/12540  T Th 4:10pm - 5:25pm 417 Mathematics Building  Nikolaos Apostolakis  3.00  14/50

Fall 2024: MATH GU4062
Course Number  Section/Call Number  Times/Location  Instructor  Points  Enrollment
MATH 4062  001/11883  M W 11:40am - 12:55pm Room TBA  Milind Hegde  3.00  24/49

MATH GU4065 HONORS COMPLEX VARIABLES. 3.00 points.
Prerequisites: (MATH UN1207 and MATH UN1208) or MATH GU4061
Prerequisites: (MATH UN1207 and MATH UN1208) or MATH GU4061
A theoretical introduction to analytic functions. Holomorphic functions, harmonic functions, power series, Cauchy-Riemann equations, Cauchy's integral formula, poles, Laurent series, residue theorem. Other topics as time permits: elliptic functions, the gamma and zeta function, the Riemann mapping theorem, Riemann surfaces, Nevanlinna theory.

Fall 2024: MATH GU4065
Course Number  Section/Call Number  Times/Location  Instructor  Points  Enrollment
MATH 4065  001/11884  T Th 11:40am - 12:55pm Room TBA  Francesco Lin  3.00  37/45

MATH GU4071 Introduction to the Mathematics of Finance. 3 points.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: MATH UN1202 and MATH UN3027 and STAT W4150 and SEIO W4150, or their equivalents.
The mathematics of finance, principally the problem of pricing of derivative securities, developed using only calculus and basic probability. Topics include mathematical models for financial instruments, Brownian motion, normal and lognormal distributions, the Black-Scholes formula, and binomial models.

MATH GU4081 INTRO-DIFFERENTIABLE MANIFOLDS. 3.00 points.
Prerequisites: (MATH GU4051 or MATH GU4061) and MATH UN2010
Prerequisites: (MATH GU4051 or MATH GU4061) and MATH UN2010

Spring 2024: MATH GU4081
Course Number  Section/Call Number  Times/Location  Instructor  Points  Enrollment
MATH 4081  001/00234  M W 10:10am - 11:25am L103 Diana Center  Dusa McDuff  3.00  17/40
MATH GU4155 PROBABILITY THEORY. 3.00 points.
Prerequisites: MATH GU4061 or MATH UN3007
Prerequisites: MATH GU4061 or MATH UN3007 A rigorous introduction to the concepts and methods of mathematical probability starting with basic notions and making use of combinatorial and analytic techniques. Generating functions. Convergence in probability and in distribution. Discrete probability spaces, recurrence and transience of random walks. Infinite models, proof of the law of large numbers and the central limit theorem. Markov chains.

Spring 2024: MATH GU4155
Course Number Section/Call Number Times/Location Instructor Points Enrollment
MATH 4155 001/12373 T Th 2:40pm - 3:55pm 520 Mathematics Building Ioannis Karatzas 3.00 27/49

Fall 2024: MATH GU4155
Course Number Section/Call Number Times/Location Instructor Points Enrollment
MATH 4155 001/11860 T Th 2:40pm - 3:55pm Room TBA Ivan Corwin 3.00 34/49

MATH GU4392 INTRO TO QUANTUM MECHANICS II. 3.00 points.
Continuation of GU4391. This course will focus on quantum mechanics, paying attention to both the underlying mathematical structures as well as their physical motivations and consequences. It is meant to be accessible to students with no previous formal training in quantum theory. The role of symmetry, groups and representations will be stressed.

SIEO W3600 INTRO PROBABILITY/STATISTICS. 4.00 points.
SIEO W4150 INTRO-PROBABILITY # STATISTICS. 3.00 points.

Cross-Listed Courses

Computer Science
COMS S3251 Computational Linear Algebra. 3 points.
Not offered during 2023-2024 academic year.

Prerequisites: two terms of calculus.
Computational linear algebra, solution of linear systems, least squares, eigenvalue problems, and numerical solution of other multivariate problems as time permits.

COMS W4203 Graph Theory. 3 points.
Lect: 3.

Prerequisites: (COMS W3203)
General introduction to graph theory. Isomorphism testing, algebraic specification, symmetries, spanning trees, traversability, planarity, drawings on higher-order surfaces, colorings, extremal graphs, random graphs, graphical measurement, directed graphs, Burnside-Polya counting, voltage graph theory.

Spring 2024: COMS W4203
Course Number Section/Call Number Times/Location Instructor Points Enrollment
COMS 4203 001/20497 W 7:00pm - 9:30pm 451 Computer Science Bldg Yihao Zhang 3 24/60

Industrial Engineering and Operations Research
CSOR E4010 GRAPH THEORY: COMBINATL VIEW. 3.00 points.
Lect: 3. Not offered during 2023-2024 academic year.

Prerequisites: Linear Algebra, or instructor’s permission.
An introductory course in graph theory with emphasis on its combinatorial aspects. Basic definitions, and some fundamental topics in graph theory and its applications. Topics include trees and forests graph coloring, connectivity, matching theory and others.