MATHEMATICS

332G Milbank Hall
212-854-3577
Department Assistant: Marsha Peruo

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 and one in 502 Milstein Center, are available. Hours will be posted on the door 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>
</tr>
</thead>
<tbody>
<tr>
<td>MATH UN1101</td>
</tr>
<tr>
<td>MATH UN1102</td>
</tr>
<tr>
<td>MATH UN1201</td>
</tr>
<tr>
<td>MATH UN1202</td>
</tr>
<tr>
<td>Honors Math A-B</td>
</tr>
<tr>
<td>MATH UN1207</td>
</tr>
<tr>
<td>MATH UN1208</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 (Professor)
Professors: Dave Bayer, Daniela De Silva, Dusa McDuff (Helen Lyttle Kimmel Chair)
Term Assistant 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/

Alphabetical Faculty Listing: http://www.math.columbia.edu/people/alphabetical-faculty-listing/

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. Six courses in mathematics numbered at or above 2000, and four courses in any combination of mathematics and cognate courses. The courses in mathematics must include:

<table>
<thead>
<tr>
<th>MATH UN2010</th>
<th>LINEAR ALGEBRA (also satisfied by Honors Math A-B)</th>
</tr>
</thead>
<tbody>
<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>
<tr>
<td>MATH UN3951</td>
<td>Undergraduate Seminars in Mathematics I (at least one term)</td>
</tr>
<tr>
<td>or MATH UN3952</td>
<td>Undergraduate Seminars in Mathematics II</td>
</tr>
</tbody>
</table>
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.

- 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

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

- MATH UN2500 ANALYSIS AND OPTIMIZATION
- MATH UN3007 Complex Variables
- or MATH GU4065 or APMA E4204 FUNCNTS OF A COMPLEX VARIABLE
- MATH UN3027 Ordinary Differential Equations
- or MATH UN2030 ORDINARY DIFFERENTIAL EQUATION
- MATH UN3028 PARTIAL DIFFERENTIAL EQUATIONS
- or APMA E4200 PARTIAL DIFFERENTIAL EQUATIONS
- MATH GU4032 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

Statistics

Statistics required courses

- STAT UN1201 Calculus-Based Introduction to Statistics
- STAT GU4203 PROBABILITY THEORY
- STAT GU4204 Statistical Inference
- STAT GU4205 Linear Regression Models
And select one of the following courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT GU4207</td>
<td>Elementary Stochastic Processes</td>
</tr>
<tr>
<td>STAT GU4262</td>
<td>Stochastic Processes for Finance</td>
</tr>
<tr>
<td>STAT GU4264</td>
<td>STOCHASTIC PROCESSES-APPLIC</td>
</tr>
<tr>
<td>STAT GU4265</td>
<td>Stochastic Methods in Finance</td>
</tr>
</tbody>
</table>

**Computer Science**

Select one of the following courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMS W1004</td>
<td>Introduction to Computer Science and Programming in Java</td>
</tr>
<tr>
<td>COMS W1005</td>
<td>Introduction to Computer Science and Programming in MATLAB</td>
</tr>
<tr>
<td>COMS W1007</td>
<td>Honors Introduction to Computer Science</td>
</tr>
<tr>
<td>ENGI E1006</td>
<td>Introduction to Computing for Engineers and Applied Scientists</td>
</tr>
</tbody>
</table>

or an advanced Computer Science offering in programming

**Electives**

An approved selection of three advanced courses in mathematics, statistics, applied mathematics, industrial engineering and operations research, computer science, or approved mathematical methods courses in a quantitative discipline. At least one elective must be a Mathematics Department course numbered 3000 or above.

Students should plan to include a senior thesis or the Undergraduate Seminar in Mathematics in their program, in consultation with their advisors.

**Note:** Students must obtain approval from an adviser in each of the two departments before selecting electives. Students should take MATH UN2010 LINEAR ALGEBRA in the second semester of the second year.

**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, and the 3 following courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</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</td>
</tr>
<tr>
<td>MATH UN3951</td>
<td>Undergraduate Seminars in Mathematics I (at least one term)</td>
</tr>
<tr>
<td>or MATH UN3952</td>
<td>Undergraduate Seminars in Mathematics II</td>
</tr>
</tbody>
</table>

**Computer Science**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMS W1004</td>
<td>Introduction to Computer Science and Programming in Java</td>
</tr>
<tr>
<td>COMS W3134</td>
<td>Data Structures in Java</td>
</tr>
<tr>
<td>COMS W3157</td>
<td>Advanced Programming</td>
</tr>
<tr>
<td>COMS W3203</td>
<td>DISCRETE MATHEMATICS</td>
</tr>
<tr>
<td>COMS W3261</td>
<td>Computer Science Theory</td>
</tr>
<tr>
<td>CSEE W3827</td>
<td>Fundamentals of Computer Systems</td>
</tr>
</tbody>
</table>

**Note:** AP Computer Science with a grade of 4 or 5 or similar experience (e.g., COMS W1004) is a prerequisite for COMS W1007

**Electives:** 2 of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSOR W4231</td>
<td>Analysis of Algorithms I</td>
</tr>
<tr>
<td>COMS W4241</td>
<td>Numerical Algorithms and Complexity</td>
</tr>
<tr>
<td>MATH UN3020</td>
<td>Number Theory and Cryptography</td>
</tr>
<tr>
<td>MATH BC2006</td>
<td>Combinatorics</td>
</tr>
<tr>
<td>MATH GU4061</td>
<td>INTRO MODERN ANALYSIS I</td>
</tr>
</tbody>
</table>

**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.

**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.

**MATH UN1003 COLLEGE ALGEBRA-ANLYTIC 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.
**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)

**Fall 2021: MATH UN1101**

<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 1101</td>
<td>001/10622</td>
<td>M W 10:10am - 11:25am 203 Mathematics Building</td>
<td>Daniele Alessandrini</td>
<td>3.00</td>
<td>57/100</td>
</tr>
<tr>
<td></td>
<td>002/10623</td>
<td>M W 1:10pm - 2:25pm 417 Mathematics Building</td>
<td>Amadou Bah</td>
<td>3.00</td>
<td>41/64</td>
</tr>
<tr>
<td></td>
<td>003/10624</td>
<td>M W 2:40pm - 3:55pm 203 Mathematics Building</td>
<td>Akash Sengupta</td>
<td>3.00</td>
<td>109/110</td>
</tr>
<tr>
<td></td>
<td>004/10625</td>
<td>M W 4:10pm - 5:25pm 203 Mathematics Building</td>
<td>Akash Sengupta</td>
<td>3.00</td>
<td>105/110</td>
</tr>
<tr>
<td></td>
<td>005/10626</td>
<td>T Th 10:10am - 11:25am 312 Mathematics Building</td>
<td>George Dragomir</td>
<td>3.00</td>
<td>95/116</td>
</tr>
<tr>
<td></td>
<td>006/10628</td>
<td>T Th 11:40am - 12:55pm 203 Mathematics Building</td>
<td>George Dragomir</td>
<td>3.00</td>
<td>79/110</td>
</tr>
<tr>
<td></td>
<td>007/00170</td>
<td>M W 6:10pm - 7:25pm 405 Milbank Hall</td>
<td>Lindsay Piechnik</td>
<td>3.00</td>
<td>98/100</td>
</tr>
<tr>
<td></td>
<td>008/10629</td>
<td>T Th 1:10pm - 2:25pm 417 Mathematics Building</td>
<td>Xi Shen</td>
<td>3.00</td>
<td>47/64</td>
</tr>
<tr>
<td></td>
<td>009/10630</td>
<td>T Th 4:10pm - 5:25pm 407 Mathematics Building</td>
<td>Xi Shen</td>
<td>3.00</td>
<td>31/35</td>
</tr>
<tr>
<td></td>
<td>010/00171</td>
<td>T Th 2:40pm - 3:55pm 302 Barnard Hall</td>
<td>Muadil Thatte</td>
<td>3.00</td>
<td>0/100</td>
</tr>
<tr>
<td></td>
<td>012/20205</td>
<td>T Th 2:40pm - 3:55pm 517 Hamilton Hall</td>
<td>Panagiota Daskalopoulos</td>
<td>3.00</td>
<td>0/49</td>
</tr>
</tbody>
</table>

**Spring 2022: MATH UN1101**

<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 1101</td>
<td>001/00005</td>
<td>M W 6:10pm - 7:25pm Room TBA</td>
<td>Lindsay Piechnik</td>
<td>3.00</td>
<td>0/100</td>
</tr>
<tr>
<td></td>
<td>002/00006</td>
<td>T Th 2:40pm - 3:55pm Room TBA</td>
<td>Lindsay Piechnik</td>
<td>3.00</td>
<td>0/100</td>
</tr>
<tr>
<td></td>
<td>003/11815</td>
<td>T Th 11:40am - 12:55pm Room TBA</td>
<td>Xi Shen</td>
<td>3.00</td>
<td>0/100</td>
</tr>
<tr>
<td></td>
<td>004/11818</td>
<td>M W 10:10am - 11:25am Room TBA</td>
<td>Panagiota Daskalopoulos</td>
<td>3.00</td>
<td>0/30</td>
</tr>
<tr>
<td></td>
<td>005/11822</td>
<td>T Th 4:10pm - 5:25pm Room TBA</td>
<td>Panagiota Daskalopoulos</td>
<td>3.00</td>
<td>0/30</td>
</tr>
</tbody>
</table>

**MATH UN102 CALCULUS II. 3.00 points.**
Prerequisites: MATH UN1101 or the equivalent. Methods of integration, applications of the integral, Taylor's theorem, infinite series. (SC)

**Fall 2021: 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>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1102</td>
<td>001/10631</td>
<td>M W 1:10pm - 2:25pm 407 Mathematics Building</td>
<td>Gerhardt Hirade</td>
<td>3.00</td>
<td>20/35</td>
</tr>
<tr>
<td></td>
<td>002/10632</td>
<td>M W 2:40pm - 3:55pm 407 Mathematics Building</td>
<td>Yash Uday Deshmukh</td>
<td>3.00</td>
<td>19/35</td>
</tr>
<tr>
<td></td>
<td>003/10634</td>
<td>M W 4:10pm - 5:25pm 312 Mathematics Building</td>
<td>Francesco Lin</td>
<td>3.00</td>
<td>97/116</td>
</tr>
<tr>
<td></td>
<td>004/10635</td>
<td>T Th 10:10am - 11:25am 203 Mathematics Building</td>
<td>Dobrein Marchev</td>
<td>3.00</td>
<td>58/100</td>
</tr>
<tr>
<td></td>
<td>005/10636</td>
<td>T Th 11:40am - 12:55pm 614 Schermerhorn Hall</td>
<td>Yu-sheng Lee</td>
<td>3.00</td>
<td>31/35</td>
</tr>
<tr>
<td></td>
<td>006/10638</td>
<td>T Th 6:10pm - 7:25pm 520 Mathematics Building</td>
<td>Elliott Stein</td>
<td>3.00</td>
<td>41/49</td>
</tr>
</tbody>
</table>

**Spring 2022: 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>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1102</td>
<td>001/11826</td>
<td>M W 1:10pm - 2:25pm Room TBA</td>
<td>Panagiota Daskalopoulos</td>
<td>3.00</td>
<td>0/49</td>
</tr>
<tr>
<td></td>
<td>002/11827</td>
<td>M W 2:40pm - 3:55pm Room TBA</td>
<td>Tudor Paduraru</td>
<td>3.00</td>
<td>0/110</td>
</tr>
<tr>
<td></td>
<td>003/11829</td>
<td>M W 6:10pm - 7:25pm Room TBA</td>
<td>Panagiota Daskalopoulos</td>
<td>3.00</td>
<td>0/30</td>
</tr>
<tr>
<td></td>
<td>004/11831</td>
<td>T Th 10:10am - 11:25am Room TBA</td>
<td>Panagiota Daskalopoulos</td>
<td>3.00</td>
<td>0/30</td>
</tr>
<tr>
<td></td>
<td>005/11833</td>
<td>T Th 11:40am - 12:55pm Room TBA</td>
<td>George Dragomir</td>
<td>3.00</td>
<td>0/116</td>
</tr>
<tr>
<td></td>
<td>006/11834</td>
<td>T Th 2:40pm - 3:55pm Room TBA</td>
<td>Evan Warner</td>
<td>3.00</td>
<td>0/116</td>
</tr>
</tbody>
</table>
MATH UN1201 Calculus III. 3 points.
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)

Prerequisites: MATH UN1102 and MATH UN1201 or the equivalent

MATH UN1202 CALCULUS IV. 3.00 points.
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)

Fall 2021: 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>
</tr>
</thead>
</table>
| MATH 1201     | 001/10640           | M W 10:10am - 11:25am  
312 Mathematics Building | Konstantin Aleshkin | 3       | 26/100     |
| MATH 1201     | 002/10641           | M W 11:40am - 12:55pm  
203 Mathematics Building | Konstantin Aleshkin | 3       | 25/100     |
| MATH 1201     | 003/10642           | M W 11:00pm - 2:25pm  
207 Mathematics Building | Tudor Padararu | 3       | 30/100     |
| MATH 1201     | 004/10645           | M W 2:40pm - 3:55pm  
312 Mathematics Building | Tudor Padararu | 3       | 26/100     |
| MATH 1201     | 005/10646           | T Th 11:40am - 12:55pm  
207 Mathematics Building | Chen-Chih Lai | 3       | 37/100     |
| MATH 1201     | 006/10647           | T Th 1:10pm - 2:25pm  
203 Mathematics Building | Stephen Miller | 3       | 77/100     |
| MATH 1201     | 007/10648           | T Th 2:40pm - 3:55pm  
207 Mathematics Building | Inbar Klang | 3       | 102/100    |
| MATH 1201     | 008/10649           | T Th 4:10pm - 5:25pm  
207 Mathematics Building | Inbar Klang | 3       | 102/100    |

Spring 2022: 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>
</tr>
</thead>
</table>
| MATH 1201     | 001/11836           | M W 10:10am - 11:25am  
Room TBA | Kyle Hayden | 3       | 6/110      |
| MATH 1201     | 002/11837           | M W 11:40am - 12:55pm  
Room TBA | Kyle Hayden | 3       | 6/110      |
| MATH 1201     | 003/11840           | M W 11:00pm - 2:25pm  
Room TBA | Konstantin Aleshkin | 3       | 6/110      |
| MATH 1201     | 004/11841           | T Th 1:10pm - 2:25pm  
Room TBA | Chen-Chih Lai | 3       | 6/110      |
| MATH 1201     | 005/12698           | T Th 2:40pm - 3:55pm  
Room TBA | Stephen Miller | 3       | 6/110      |

MATH UN1207 Honors Mathematics A. 4 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. (SC)

Fall 2021: MATH UN1207
<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>
</table>
| MATH 1207     | 001/10656           | T Th 1:10pm - 2:25pm  
207 Mathematics Building | Evan Warner | 4       | 47/100     |

MATH UN1208 HONORS 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. (SC)

Spring 2022: MATH UN1208
<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>
</table>
| MATH 1208     | 001/11854           | T Th 1:10pm - 2:25pm  
Room TBA | Evan Warner | 4       | 0/64       |

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)

Fall 2021: MATH UN2000
<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>
</table>
| MATH 2000     | 001/00172           | M W 10:10am - 11:25am  
302 Milbank Hall | Dusa McDuff | 3       | 31/55      |

Spring 2022: MATH UN2000
<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>
</table>
| MATH 2000     | 001/11855           | T Th 1:10pm - 2:25pm  
Room TBA | Giulia Sacca | 3       | 0/49       |

MATH BC2001 Perspectives in Mathematics. 1 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, probability, number theory) that are often not discussed until later, and explains some current applications of mathematics in the sciences, technology and economics.

MATH BC2006 Combinatorics. 3 points.
Corequisites: MATH V2010 is helpful as a corequisite, but not required. Honors-level introductory course in enumerative combinatorics. Pigeonhole principle, binomial coefficients, permutations and combinations. Polya enumeration, inclusion-exclusion principle, generating functions and recurrence relations.
MATH UN2010 LINEAR ALGEBRA. 3.00 points.
Prerequisites: MATH UN1201 or the equivalent. Prerequisites: MATH UN1201 or the equivalent. Matrices, vector spaces, linear transformations, eigenvalues and eigenvectors, canonical forms, applications. (SC)

Fall 2021: MATH UN2010

<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 2010</td>
<td>001/00173</td>
<td>T Th 8:40am - 9:55am</td>
<td>David Bayer</td>
<td>3.00</td>
<td>29/50</td>
</tr>
<tr>
<td>MATH 2010</td>
<td>002/00174</td>
<td>T Th 10:10am - 11:25am</td>
<td>David Bayer</td>
<td>3.00</td>
<td>40/50</td>
</tr>
<tr>
<td>MATH 2010</td>
<td>003/10679</td>
<td>M W 10:10am - 11:25am 328 Milbank Hall</td>
<td>Marco Castronovo</td>
<td>3.00</td>
<td>38/100</td>
</tr>
<tr>
<td>MATH 2010</td>
<td>004/10693</td>
<td>M W 11:40am - 12:55pm 520 Mathematics Building</td>
<td>Marco Castronovo</td>
<td>3.00</td>
<td>50/100</td>
</tr>
<tr>
<td>MATH 2010</td>
<td>005/10698</td>
<td>T Th 4:10pm - 5:25pm 312 Mathematics Building</td>
<td>Henry Pinkham</td>
<td>3.00</td>
<td>13/49</td>
</tr>
</tbody>
</table>

Spring 2022: MATH UN2010

<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 2010</td>
<td>001/11856</td>
<td>M W 10:10am - 11:25am Room TBA</td>
<td>Amadou Bah</td>
<td>3.00</td>
<td>0/110</td>
</tr>
<tr>
<td>MATH 2010</td>
<td>002/11857</td>
<td>M W 11:40am - 12:55pm Room TBA</td>
<td>Amadou Bah</td>
<td>3.00</td>
<td>0/110</td>
</tr>
<tr>
<td>MATH 2010</td>
<td>003/11858</td>
<td>T Th 1:10pm - 2:25pm Room TBA</td>
<td>0. FACULTY</td>
<td>3.00</td>
<td>0/116</td>
</tr>
<tr>
<td>MATH 2010</td>
<td>004/11859</td>
<td>T Th 4:10pm - 5:25pm Room TBA</td>
<td>Henry Pinkham</td>
<td>3.00</td>
<td>0/49</td>
</tr>
<tr>
<td>MATH 2010</td>
<td>005/11860</td>
<td>T Th 6:10pm - 7:25pm Room TBA</td>
<td>Elliott Stein</td>
<td>3.00</td>
<td>0/49</td>
</tr>
</tbody>
</table>

MATH UN2020 Honors Linear Algebra. 3 points.
Not offered during 2021-22 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 EQUATION. 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 (SC)

Fall 2021: MATH UN2030

<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 2030</td>
<td>001/10718</td>
<td>M W 1:10pm - 2:25pm 312 Mathematics Building</td>
<td>Florian Johne</td>
<td>3.00</td>
<td>36/100</td>
</tr>
<tr>
<td>MATH 2030</td>
<td>002/10719</td>
<td>T Th 2:40pm - 3:55pm 312 Mathematics Building</td>
<td>Evgeni Dimitrov</td>
<td>3.00</td>
<td>67/100</td>
</tr>
</tbody>
</table>

Spring 2022: MATH UN2030

<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 2030</td>
<td>001/11861</td>
<td>T Th 10:10am - 11:25am Room TBA</td>
<td>Evgeni Dimitrov</td>
<td>3.00</td>
<td>0/100</td>
</tr>
<tr>
<td>MATH 2030</td>
<td>002/11863</td>
<td>T Th 11:40am - 12:55pm Room TBA</td>
<td>Evgeni Dimitrov</td>
<td>3.00</td>
<td>0/64</td>
</tr>
</tbody>
</table>

MATH UN2500 ANALYSIS AND OPTIMIZATION. 3.00 points.
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)

Fall 2021: MATH UN2500

<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 2500</td>
<td>001/10720</td>
<td>T Th 10:10am - 11:25am 417 Mathematics Building</td>
<td>Kanstantsin Matetski</td>
<td>3.00</td>
<td>33/64</td>
</tr>
<tr>
<td>MATH 2500</td>
<td>002/10721</td>
<td>T Th 11:40am - 12:55pm 417 Mathematics Building</td>
<td>Kanstantsin Matetski</td>
<td>3.00</td>
<td>49/64</td>
</tr>
</tbody>
</table>

Spring 2022: MATH UN2500

<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 2500</td>
<td>001/11869</td>
<td>M W 1:10pm - 2:25pm Room TBA</td>
<td>Yash Jhaveri</td>
<td>3.00</td>
<td>0/100</td>
</tr>
<tr>
<td>MATH 2500</td>
<td>002/11875</td>
<td>M W 2:40pm - 3:55pm Room TBA</td>
<td>Yash Jhaveri</td>
<td>3.00</td>
<td>0/64</td>
</tr>
</tbody>
</table>

MATH UN3007 Complex Variables. 3 points.
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 2021: MATH UN3007

<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 3007</td>
<td>001/10722</td>
<td>M W 2:40pm - 3:55pm 417 Mathematics Building</td>
<td>Ovidiu Savin</td>
<td>3.00</td>
<td>40/64</td>
</tr>
</tbody>
</table>

MATH UN3020 Number Theory and Cryptography. 3 points.
Prerequisites: one year of calculus. Prerequisite: One year of Calculus. Congruences. Primitive roots. Quadratic residues. Contemporary applications.

Spring 2022: MATH UN3020

<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 3020</td>
<td>001/11887</td>
<td>M W 10:10am - 11:25am Room TBA</td>
<td>Daniele Alessandri</td>
<td>3.00</td>
<td>0/116</td>
</tr>
</tbody>
</table>

MATH UN3025 Making, Breaking Codes. 3 points.
Prerequisites: (MATH UN1101 and MATH UN1102 and MATH UN1201) and MATH UN2010. A concrete introduction to abstract algebra. Topics in abstract algebra used in cryptography and coding theory.

Fall 2021: MATH UN3025

<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 3025</td>
<td>001/10723</td>
<td>T Th 1:10pm - 2:25pm 312 Mathematics Building</td>
<td>Dorian Goldfield</td>
<td>3.00</td>
<td>82/100</td>
</tr>
</tbody>
</table>
MATH UN3027 Ordinary Differential Equations. 3 points.
Prerequisites: MATH UN1102 and MATH UN1201 or the equivalent.
Corequisites: MATH UN2010

Fall 2021: MATH UN3027
Course  | Section/Call Number  | Times/Location | Instructor  | Points | Enrollment |
--- | --- | --- | --- | --- | --- |
MATH 3027 | 001/10735 | T Th 11:40am - 12:55pm (312 Mathematics Building) | Elena Giorgi | 3 | 39/100 |

MATH UN3028 PARTIAL DIFFERENTIAL EQUATIONS. 3.00 points.
Prerequisites: MATH UN3027 and MATH UN2010 or the equivalent
Prerequisites: MATH UN3027 and MATH UN2010 or the equivalent

Spring 2022: MATH UN3028
Course  | Section/Call Number  | Times/Location | Instructor  | Points | Enrollment |
--- | --- | --- | --- | --- | --- |
MATH 3028 | 001/11891 | M W 1:10pm - 2:25pm (Room TBA) | Florian Johne | 3.00 | 0/64 |

MATH UN3050 Discrete Time Models in Finance. 3 points.
Prerequisites: (MATH UN1102 and MATH UN1201) or (MATH UN1101 and MATH UN1102 and MATH UN201) 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 2022: MATH UN3050
Course  | Section/Call Number  | Times/Location | Instructor  | Points | Enrollment |
--- | --- | --- | --- | --- | --- |
MATH 3050 | 001/11893 | M W 6:10pm - 7:25pm (Room TBA) | Mikhail Smirnov | 3 | 0/116 |

MATH UN3386 Differential Geometry. 3 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.

Fall 2021: MATH UN3386
Course  | Section/Call Number  | Times/Location | Instructor  | Points | Enrollment |
--- | --- | --- | --- | --- | --- |
MATH 3386 | 001/10751 | T Th 11:40am - 12:55pm (520 Mathematics Building) | Richard Hamilton | 3 | 9/49 |

MATH UN3901 Supervised Readings in Mathematics I. 2-3 points.
Prerequisites: The written permission of the staff 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.

Fall 2021: MATH UN3901
Course  | Section/Call Number  | Times/Location | Instructor  | Points | Enrollment |
--- | --- | --- | --- | --- | --- |
MATH 3901 | 001/00010 | T Th 11:40am - 12:55pm (520 Mathematics Building) | David Bayer | 3 | 0/64 |

MATH UN3902 Supervised Readings in Mathematics II. 2-3 points.
Prerequisites: The written permission of the staff 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.

Fall 2021: MATH UN3902
Course  | Section/Call Number  | Times/Location | Instructor  | Points | Enrollment |
--- | --- | --- | --- | --- | --- |
MATH 3902 | 001/13725 | | | 2-3 | 1/1 |
MATH 3902 | 002/18860 | | | 2-3 | 2/2 |
MATH 3902 | 003/20170 | | | 2-3 | 1/1 |
MATH 3902 | 004/20293 | | | 2-3 | 1/1 |
MATH 3902 | 005/20556 | | | 2-3 | 1/1 |
MATH 3902 | 006/20296 | | | 2-3 | 1/1 |
MATH 3902 | 007/20649 | | | 2-3 | 2/2 |

MATH UN3951 Undergraduate Seminars in Mathematics I. 3 points.
Prerequisites: Two years of calculus, at least one year of additional mathematics courses, and the director of undergraduate studies’ permission.
The subject matter is announced at the start of registration and is different in each section. Each student prepares talks to be given to the seminar, under the supervision of a faculty member or senior teaching fellow.

Fall 2021: MATH UN3951
Course  | Section/Call Number  | Times/Location | Instructor  | Points | Enrollment |
--- | --- | --- | --- | --- | --- |
MATH 3951 | 001/00015 | | | 3 | 61/64 |

MATH UN3952 Undergraduate Seminars in Mathematics II. 3 points.
Prerequisites: Two years of calculus, at least one year of additional mathematics courses, and the director of undergraduate studies’ permission.
The subject matter is announced at the start of registration and is different in each section. Each student prepares talks to be given to the seminar, under the supervision of a faculty member or senior teaching fellow. Prerequisite: two years of calculus, at least one year of additional mathematics courses, and the director of undergraduate studies’ permission.

Spring 2022: MATH UN3952
Course  | Section/Call Number  | Times/Location | Instructor  | Points | Enrollment |
--- | --- | --- | --- | --- | --- |
MATH 3952 | 001/00010 | | | 3 | 0/64 |

MATH UN3997 Supervised Individual Research. 3 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 UN3998 Supervised Individual Research. 3 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 points.
Prerequisites: MATH UN3007
A one semester course covering the theory of modular forms, zeta functions, L -functions, and the Riemann hypothesis. Particular topics covered include the Riemann zeta function, the prime number theorem, Dirichlet characters, Dirichlet L-functions, Siegel zeros, prime number theorem for arithmetic progressions, SL (2, Z) and subgroups, quotients of the upper half-plane and cusps, modular forms, Fourier expansions of modular forms, Hecke operators, L-functions of modular forms.

MATH GU4032 Fourier Analysis. 3 points.
Prerequisites: three terms of calculus and linear algebra or four terms of calculus.
Prerequisite: three terms of calculus and linear algebra or four terms of calculus.

MATH GU4041 INTRO MODERN ALGEBRA I. 3 points.
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.

MATH GU4042 INTRO MODERN ALGEBRA II. 3 points.
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.

MATH GU4043 Algebraic Number Theory. 3 points.
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.

MATH GU4044 Representations of Finite Groups. 3 points.
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.

MATH GU4045 Algebraic Curves. 3 points.
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.
MATH W4046 Introduction to Category Theory. 3 points.
CC/GS: Partial Fulfillment of Science Requirement
Not offered during 2021-22 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 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.

Fall 2021: MATH GU4051
Course Number   Section/Call Number  Times/Location          Instructor  Points  Enrollment
MATH 4051       001/10767          T Th 2:40pm - 3:55pm   Stephen Miller 3  26/49

MATH GU4052 Introduction to Knot Theory. 3 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’s theorem, 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 2021: MATH GU4052
Course Number   Section/Call Number  Times/Location          Instructor  Points  Enrollment
MATH 4052       001/10768          M W 1:10pm - 2:25pm    Kyle Hayden 3  11/19

MATH GU4053 Introduction to Algebraic Topology. 3 points.
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 2022: MATH GU4053
Course Number   Section/Call Number  Times/Location          Instructor  Points  Enrollment
MATH 4053       001/11901          T Th 2:40pm - 3:55pm    Inbar Klang 3  8/19

MATH GU4061 INTRO MODERN ANALYSIS I. 3 points.
Prerequisites: MATH UN1202 or the equivalent, and MATH UN2010. The second term of this course may not be taken without the first.
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.

Fall 2021: MATH GU4061
Course Number   Section/Call Number  Times/Location          Instructor  Points  Enrollment
MATH 4061       001/10769          T Th 2:40pm - 3:55pm    Abhijit 3  33/100
     203 Mathematics Building
MATH 4061       002/10770          T Th 4:10pm - 5:25pm    Jorge Pineiro 3  37/100
     203 Mathematics Building

Spring 2022: MATH GU4061
Course Number   Section/Call Number  Times/Location          Instructor  Points  Enrollment
MATH 4061       001/11902          M W 2:40pm - 3:55pm    Florian John 3  0/49
     Room TBA
MATH 4061       002/11903          M W 4:10pm - 5:25pm    0. FACULTY 3  0/49
     Room TBA

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

Fall 2021: MATH GU4062
Course Number   Section/Call Number  Times/Location          Instructor  Points  Enrollment
MATH 4062       001/10771          M W 4:10pm - 5:25pm    Yash Jhaveri 3.00 11/64
     417 Mathematics Building

Spring 2022: MATH GU4062
Course Number   Section/Call Number  Times/Location          Instructor  Points  Enrollment
MATH 4062       001/11904          T Th 4:10pm - 5:25pm    Abhijit 3.00 0/64
     Room TBA
     Champanerkar

MATH GU4065 Honors Complex Variables. 3 points.
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.

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 Introduction to Differentiable Manifolds. 3 points.
Prerequisites: (MATH GU4051 or MATH GU4061) and MATH UN2010
Concept of a differentiable manifold. Tangent spaces and vector fields.
The inverse function theorem. Transversality and Sard’s theorem.
forms and Stokes’ theorem.

Spring 2022: MATH GU4081
Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
MATH 4081	001/00011	M W 10:10am - 11:25am Room TBA	Dusa McDuff	3	0/40

MATH GU4155 Probability Theory. 3 points.
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 2022: MATH GU4155
Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
MATH 4155	001/11906	T Th 1:10pm - 2:25pm Room TBA	0. FACULTY	3	0/40

MATH GU4392 INTRO TO QUANTUM MECHANICS II. 3.00 points.
Not offered during 2021-22 academic year.
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

Cross-Listed Courses

Computer Science
COMS S3251 Computational Linear Algebra. 3 points.
Not offered during 2021-22 academic year.
Prerequisites: two terms of calculus.
Computational linear algebra, solution of linear systems, sparse 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.

COMS W3203 DISCRETE MATHEMATICS. 4.00 points.
Lect: 3.
Prerequisites: Any introductory course in computer programming.
Prerequisites: Any introductory course in computer programming. Logic
and formal proofs, sequences and summation, mathematical induction,
binomial coefficients, elements of finite probability, recurrence relations,
equivalence relations and partial orderings, and topics in graph theory
(including isomorphism, traversability, planarity, and colorings)

Industrial Engineering and Operations Research
CSOR E4010 GRAPH THEORY: COMBINATL VIEW. 3.00 points.
Lect: 3. Not offered during 2021-22 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