The mathematics named option programs allow students to develop a deep understanding of how the subject relates to other areas of human inquiry. The requirements for these programs feature mathematics courses with topics inspired by and commonly applied to problems in these associated fields. Though often paired with a second major in a related area, these programs function well alone and are suited to any mathematics student with a variety of interests. Students interested in a named option program are recommended to meet with an advisor to navigate the various plans and courses available to them. Advising information can be found on the BA or BS pages.

The named options do not support honors in the major.

## Requirements

The Mathematics for Programming and Computing program requires 10 distinct courses for at least 30 credits as described below. While a single course may be used to fulfill more than one requirement, it will only contribute once to the total course count. Finally, only one course from each of the following groupings may be used to fulfill course and credit requirements: Intro Linear Algebra (MATH 320, MATH 340, MATH 341, MATH 375), Intro Differential Equations (MATH 319, MATH 320 or MATH 376), and Intro Probability (MATH/STAT 309 or MATH/STAT 431).

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>MATH 320</td>
<td>Linear Algebra and Differential Equations</td>
<td>3-5</td>
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<tr>
<td>or MATH 341</td>
<td>Linear Algebra</td>
<td></td>
</tr>
<tr>
<td>or MATH 375</td>
<td>Topics in Multi-Variable Calculus and Linear Algebra</td>
<td></td>
</tr>
<tr>
<td>or MATH 340</td>
<td>Elementary Matrix and Linear Algebra</td>
<td></td>
</tr>
</tbody>
</table>

**Intermediate Mathematics Requirement (complete at least one)**

- MATH 321 & MATH 322: Applied Mathematical Analysis and Applied Mathematical Analysis
- MATH 341: Linear Algebra
- MATH 375: Topics in Multi-Variable Calculus and Linear Algebra
- MATH 421: The Theory of Single Variable Calculus
- MATH 467: Introduction to Number Theory

**Advanced Mathematics Requirement (complete one)**

- MATH/COMP SCI 514: Numerical Analysis

**Core Math Requirement (minimum of six distinct MATH courses for at least 18 credits)**

<table>
<thead>
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<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 320</td>
<td>Linear Algebra and Differential Equations</td>
<td>3-5</td>
</tr>
<tr>
<td>or MATH 341</td>
<td>Linear Algebra</td>
<td></td>
</tr>
<tr>
<td>or MATH 375</td>
<td>Topics in Multi-Variable Calculus and Linear Algebra</td>
<td></td>
</tr>
<tr>
<td>or MATH 340</td>
<td>Elementary Matrix and Linear Algebra</td>
<td></td>
</tr>
</tbody>
</table>

**Select one or more from:**

- MATH/COMP SCI 513: Numerical Linear Algebra
- MATH/COMP SCI 514: Numerical Analysis
- MATH 521: Analysis I
- MATH 522: Analysis II
- MATH/COMP SCI/I SY E/STAT 525: Linear Optimization
- MATH 531: Probability Theory
- MATH 535: Mathematical Methods in Data Science
- MATH 540: Linear Algebra II
- MATH 541: Modern Algebra
- MATH 542: Modern Algebra
- MATH 567: Modern Number Theory
- MATH 570: Fundamentals of Set Theory
- MATH/PHILOS 571: Mathematical Logic
- MATH 605: Stochastic Methods for Biology
- MATH 619: Analysis of Partial Differential Equations
- MATH 627: Introduction to Fourier Analysis
- MATH 629: Introduction to Measure and Integration
- MATH/I SY E/OTM/STAT 632: Introduction to Stochastic Processes
- MATH 635: An Introduction to Brownian Motion and Stochastic Calculus

**Select remaining courses from:**

- MATH/STAT 310: Introduction to Probability and Mathematical Statistics II
- MATH 319: Techniques in Ordinary Differential Equations
- or MATH 320: Linear Algebra and Differential Equations
- or MATH 376: Topics in Multi-Variable Calculus and Differential Equations
- MATH 321: Applied Mathematical Analysis
- MATH 322: Applied Mathematical Analysis
- MATH 415: Applied Dynamical Systems, Chaos and Modeling
- MATH 421: The Theory of Single Variable Calculus
- MATH/COMP SCI/I SY E 425: Introduction to Combinatorial Optimization

**MATH Elective to reach required six courses and 18 credits**

- MATH 521: Analysis I
- MATH 531: Probability Theory
- MATH 540: Linear Algebra II
- MATH 541: Modern Algebra
- MATH 542: Modern Algebra
- MATH 567: Modern Number Theory
- MATH 570: Fundamentals of Set Theory
- MATH/PHILOS 571: Mathematical Logic
- MATH 605: Stochastic Methods for Biology
- MATH 619: Analysis of Partial Differential Equations
- MATH 627: Introduction to Fourier Analysis
- MATH 629: Introduction to Measure and Integration
- MATH/I SY E/OTM/STAT 632: Introduction to Stochastic Processes
- MATH 635: An Introduction to Brownian Motion and Stochastic Calculus

**Select remaining courses from:**

- MATH/STAT 310: Introduction to Probability and Mathematical Statistics II
- MATH 319: Techniques in Ordinary Differential Equations
- or MATH 320: Linear Algebra and Differential Equations
- or MATH 376: Topics in Multi-Variable Calculus and Differential Equations
- MATH 321: Applied Mathematical Analysis
- MATH 322: Applied Mathematical Analysis
- MATH 415: Applied Dynamical Systems, Chaos and Modeling
- MATH 421: The Theory of Single Variable Calculus
- MATH/COMP SCI/I SY E 425: Introduction to Combinatorial Optimization

**Select one or more from:**

- MATH/COMP SCI 513: Numerical Linear Algebra
- MATH/COMP SCI 514: Numerical Analysis
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- MATH 635: An Introduction to Brownian Motion and Stochastic Calculus

**Select remaining courses from:**

- MATH/STAT 310: Introduction to Probability and Mathematical Statistics II
- MATH 319: Techniques in Ordinary Differential Equations
- or MATH 320: Linear Algebra and Differential Equations
- or MATH 376: Topics in Multi-Variable Calculus and Differential Equations
- MATH 321: Applied Mathematical Analysis
- MATH 322: Applied Mathematical Analysis
- MATH 415: Applied Dynamical Systems, Chaos and Modeling
- MATH 421: The Theory of Single Variable Calculus
- MATH/COMP SCI/I SY E 425: Introduction to Combinatorial Optimization
MATH/STAT 431 Introduction to the Theory of Probability
or MATH/STAT 309 Introduction to Probability and Mathematical Statistics I

MATH/COMP SCI/EE 435 Introduction to Cryptography
MATH 443 Applied Linear Algebra
MATH 467 Introduction to Number Theory
MATH/COMP SCI/EE 475 Introduction to Combinatorics

Programming and Computations Requirement (Four Courses distinct from the above for at least 12 credits)

COMP SCI 300 Programming II 3
COMP SCI 400 Programming III 3
Elective 3 6-8

COMP SCI 412 Introduction to Numerical Methods
COMP SCI/ISYE 425 Introduction to Combinatorial Optimization
COMP SCI/EE 435 Introduction to Cryptography
COMP SCI/STAT 471 Introduction to Computational Statistics
COMP SCI/MATH/STAT 475 Introduction to Combinatorics
COMP SCI/MATH 513 Numerical Linear Algebra
COMP SCI/MATH 514 Numerical Analysis
COMP SCI 520 Introduction to Theory of Computing
COMP SCI/ISYE 524 Introduction to Optimization
COMP SCI/ISYE 525 Linear Optimization
COMP SCI/ISYE 526 Advanced Linear Programming
COMP SCI/EE 532 Matrix Methods in Machine Learning
COMP SCI/EE 533 Image Processing
COMP SCI 534 Computational Photography
COMP SCI 538 Introduction to the Theory and Design of Programming Languages
COMP SCI/EE 539 Introduction to Artificial Neural Networks
COMP SCI 540 Introduction to Artificial Intelligence
COMP SCI 545 Natural Language and Computing
COMP SCI/ISYE 558 Introduction to Computational Geometry
COMP SCI 559 Computer Graphics
COMP SCI/BMI 567 Medical Image Analysis
COMP SCI/BMI 576 Introduction to Bioinformatics
COMP SCI 577 Introduction to Algorithms

COMP SCI/ISYE 635 Tools and Environments for Optimization
COMP SCI 642 Introduction to Information Security

Total Credits 30

RESIDENCE AND QUALITY OF WORK

- 2.000 GPA on all MATH courses and courses eligible for the major.4
- 2.000 GPA on at least 15 credits of upper level credit in the major.5
- 15 credits in MATH in the major taken on the UW-Madison campus.6

FOOTNOTES

1. This course must be distinct from the advanced mathematics requirement.
2. Courses below may have prerequisites outside of the requirements for this named option.
3. Any MATH course from the elective list above may be used in lieu of any of the following courses.
4. This includes any course with a MATH prefix (including those cross-listed with MATH) regardless of major program as well as only those non-MATH course explicitly listed in the tables above.
5. This includes any course with a MATH prefix (including those cross-listed with MATH) numbered 307 and above as well as only those non-MATH courses which appear in the tables above and carry the advanced LAS designation.
6. This includes only those courses with a MATH prefix (or crosslisted with MATH).

FOUR-YEAR PLAN

SAMPLE FOUR-YEAR PLAN

This Sample Four-Year Plan is a tool to assist students and their advisor(s). Students should use it—along with their DARS report, the Degree Planner, and Course Search & Enroll tools—to make their own four-year plan based on their placement scores, credit for transferred courses and approved examinations, and individual interests. As students become involved in athletics, honors, research, student organizations, study abroad, volunteer experiences, and/or work, they might adjust the order of their courses to accommodate these experiences. Students will likely revise their own four-year plan several times during college.

In general, your four-year plan in mathematics should be organized along the following sequence: 1) Calculus, 2) Linear Algebra, 3) Required Intermediate level course, 4) Additional intermediate level courses as needed, 5) Required advanced level course, 6) Additional advanced level courses.

Freshman

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MATH 221</td>
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<td>MATH 222</td>
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<tr>
<td>Literature Breadth</td>
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<td>Literature Breadth</td>
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<tr>
<td>Communication A</td>
<td>3</td>
<td>Ethnic Studies</td>
<td>3</td>
</tr>
<tr>
<td>Foreign Language (if</td>
<td>4</td>
<td>Foreign Language (if</td>
<td>4</td>
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<td>required)</td>
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<td>required)</td>
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15 14
### Sophomore

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MATH 234(^1)</td>
<td>4</td>
<td>MATH Required Linear Algebra</td>
<td>3</td>
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<tr>
<td>Humanities Breadth</td>
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<td>Required Intermediate MATH</td>
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<tr>
<td>Communication B</td>
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<td>Humanities Breadth</td>
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<tr>
<td>Physical Science Breadth</td>
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<td>Physical Science Breadth</td>
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<tr>
<td><strong>Total</strong></td>
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<td><strong>Total</strong></td>
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</table>

### Junior

<table>
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<tr>
<th>Fall</th>
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<th>Spring</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Intermediate MATH</td>
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<td>Intermediate MATH</td>
<td>3</td>
</tr>
<tr>
<td>COMP SCI 300</td>
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<td>COMP SCI 400</td>
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<tr>
<td>Social Sciences Breadth</td>
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<td>L&amp;S Breadth - Social Science</td>
<td>3</td>
</tr>
<tr>
<td>Biological Sciences Breadth</td>
<td>3</td>
<td>Biological Sciences Breadth</td>
<td>3</td>
</tr>
<tr>
<td>Elective</td>
<td>3</td>
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<td><strong>Total</strong></td>
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### Senior

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required Advanced MATH</td>
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<td>Advanced MATH</td>
<td>3</td>
</tr>
<tr>
<td>Elective Programming/ Computations Course</td>
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<td>Elective Programming/ Computations Course</td>
<td>3</td>
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<tr>
<td>Social Science Breadth</td>
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<td>Social Science Breadth</td>
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<td><strong>Total</strong></td>
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<td><strong>Total</strong></td>
<td><strong>15</strong></td>
</tr>
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</table>

Total Credits 120

\(^1\) Students should declare the major upon the successful completion of this course