Mathematics Major, B.S.

Mathematics has always been a fundamental component of human thought and culture, and the growth of technology in recent times has further increased its importance.

Students majoring in mathematics may enter either the B.A. or the B.S. program. The B.S. program is more comprehensive; it provides solid preparation for work or for further study in mathematics and related fields. Within the B.S. program there is an applied option, which is designed for students who are primarily interested in using mathematics for the study of other sciences. MATH 521 is a key class in the curriculum and MATH 381 is a key to prepare for it. The degree plan should be built with these classes as the backbone, and they should be taken in the second and third year by most students. Please see the sample plan for additional information and suggestions.

Student Learning Outcomes

Upon completion of the mathematics program (B.A., B.S.), students should be able to:

- Demonstrate mastery of the core of mathematics recognized as essential by national professional mathematics organizations
- Demonstrate mathematical reasoning and problem-solving skills
- Demonstrate the ability to construct logical arguments and mathematical proofs
- Demonstrate the ability to apply mathematical knowledge and skills in context and interpret results

In addition to the program requirements, students must

- earn a minimum final cumulative GPA of 2.000
- complete a minimum of 45 academic credit hours earned from UNC-Chapel Hill courses
- take at least half of their major core requirements (courses and credit hours) at UNC-Chapel Hill
- earn a minimum cumulative GPA of 2.000 in the major core requirements

For more information, please consult the degree requirements section of the catalog (https://catalog.unc.edu/undergraduate/degree-requirements/).

Mathematics Major, B.S.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Core Requirements</td>
<td></td>
</tr>
<tr>
<td></td>
<td>One of the following:</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>COMP 110 Introduction to Programming and Data Science</td>
<td></td>
</tr>
<tr>
<td></td>
<td>COMP 116 Introduction to Scientific Programming</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MATH 347 Linear Algebra for Applications (preferably before the junior year; previously offered as MATH 547)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>or MATH 577 Linear Algebra</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MATH 381 Discrete Mathematics H</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MATH 383 First Course in Differential Equations H</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MATH 521 Advanced Calculus I H</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>One of the following:</td>
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</table>

Mathematics Major, B.S. – Applied Option

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Core Requirements</td>
<td></td>
</tr>
<tr>
<td></td>
<td>COMP 110 Introduction to Programming and Data Science</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>COMP 116 Introduction to Scientific Programming</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MATH 381 Discrete Mathematics H</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MATH 383 First Course in Differential Equations H</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MATH 521 Advanced Calculus I H</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Five courses chosen from the following list:</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>COMP 116 Introduction to Scientific Programming</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MATH 381 Discrete Mathematics H</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MATH 383 First Course in Differential Equations H</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MATH 521 Advanced Calculus I H</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MATH 522 Advanced Calculus II H</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MATH 523 Functions of a Complex Variable with Applications</td>
<td></td>
</tr>
</tbody>
</table>

Additional Requirements

- MATH 231 Calculus of Functions of One Variable I H,F | 4     |
- MATH 232 Calculus of Functions of One Variable II H,F | 4     |
- MATH 233 Calculus of Functions of Several Variables H,F | 4     |
- or MATH 235 Mathematics for Data Science |       |
- PHYS 118 Introductory Calculus-based Mechanics and Relativity (recommended) H,F | 4     |

Physics course chosen from the following options:

- PHYS 114 General Physics I: For Students of the Life Sciences F | 12    |

Remaining General Education requirements and enough free electives to accumulate 122 academic hours | 64    |

Total Hours: 122

H Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.

F FY-Launch class sections may be available. A FY-Launch section fulfills the same requirements as a standard section of that course, but also fulfills the FY-SEMINAR/FY-LAUNCH First-Year Foundations requirement. Students can search for FY-Launch sections in ConnectCarolina using the FY-LAUNCH attribute.

1 A current or former major in statistics and analytics may substitute STOR 215 for MATH 381.

ConnectCarolina using the FY-LAUNCH attribute.
Mathematics Major, B.S.

MATH 524 Elementary Differential Equations
MATH 528 Mathematical Methods for the Physical Sciences I 2
MATH 529 Mathematical Methods for the Physical Sciences II 2
MATH 535 Introduction to Probability
MATH 548 Combinatorial Mathematics
MATH 560 Optimization with Applications in Machine Learning 2
MATH 563 Introduction to Fluid Mechanics 2
MATH 564 Mathematical Modeling in the Life Sciences 2
MATH 566 Introduction to Numerical Analysis 2
MATH 661 Scientific Computation I 2
MATH 668 Methods of Applied Mathematics I 2
Sequence MATH 383L, MATH 528L, and MATH 529L 2
MATH 347 Linear Algebra for Applications
or MATH 577 Linear Algebra

Additional Requirements
MATH 231 Calculus of Functions of One Variable I H, F 4
MATH 232 Calculus of Functions of One Variable II H, F 4
MATH 233 Calculus of Functions of Several Variables H, F 4
or MATH 235 Mathematics for Data Science

Physics course chosen from the following options: 4
PHYS 118 Introductory Calculus-based Mechanics and Relativity (recommended) H, F
PHYS 114 General Physics I: For Students of the Life Sciences F

Strongly recommended:
MATH 535/ STOR 435 Introduction to Probability
STOR 555 Mathematical Statistics

At least four courses in the Division of Natural Sciences and Mathematics (beyond the General Education requirements), but not in mathematics. STOR 555 can be counted for this requirement.

Remaining General Education requirements and enough free electives to accumulate 122 academic hours

Total Hours 122

H Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.

F FY-Launch class sections may be available. A FY-Launch section fulfills the same requirements as a standard section of that course, but also fulfills the FY-SEMINAR/FY-LAUNCH First-Year Foundations requirement. Students can search for FY-Launch sections in ConnectCarolina using the FY-LAUNCH attribute.

1 A current or former major in statistics and analytics may substitute STOR 215 for MATH 381.
2 with at least three from MATH 528, MATH 529, MATH 560, MATH 563, MATH 564, MATH 566, MATH 661, MATH 668, sequence MATH 383L + MATH 528L + MATH 529L.

Students must complete either the B.S. or B.S.-Applied Option for a B.S. degree with a major in mathematics. All requirements of the General Education curriculum (except for Supplemental General Education) apply to students in both options.

Following are suggested course selections (within the degree requirements) for students who have an interest in a particular direction.

Course Suggestions for Pure Mathematics
These courses provide a solid theoretical understanding of central mathematics and excellent preparation for graduate study in mathematics or the mathematical sciences.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 521</td>
<td>Advanced Calculus I H</td>
<td>3</td>
</tr>
<tr>
<td>MATH 522</td>
<td>Advanced Calculus II H</td>
<td>3</td>
</tr>
<tr>
<td>MATH 577</td>
<td>Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH 578</td>
<td>Algebraic Structures</td>
<td>3</td>
</tr>
</tbody>
</table>

Enough upper-level mathematics courses to satisfy the degree requirements

H Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.

Those planning graduate study in mathematics or the mathematical sciences may consider taking some of MATH 653, MATH 676, MATH 680, or subsequent courses.

Course Suggestions for Mathematical Biology
For students interested in careers or further study in mathematical life sciences.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 101</td>
<td>Principles of Biology H, F</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 101</td>
<td>General Descriptive Chemistry I H, F</td>
<td>3</td>
</tr>
<tr>
<td>or CHEM 102</td>
<td>General Descriptive Chemistry II</td>
<td>3</td>
</tr>
</tbody>
</table>

At least one of:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 201</td>
<td>Ecology and Evolution H</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 202</td>
<td>Molecular Biology and Genetics H, F</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 205</td>
<td>Cellular and Developmental Biology H</td>
<td>4</td>
</tr>
</tbody>
</table>

At least two of:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 454</td>
<td>Evolutionary Genetics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 526</td>
<td>Computational Genetics H</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 551</td>
<td>Comparative Biomechanics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 553</td>
<td>Mathematical and Computational Models in Biology</td>
<td>3</td>
</tr>
</tbody>
</table>

MATH 521 Advanced Calculus I H
One of:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 522</td>
<td>Advanced Calculus II H</td>
<td>3</td>
</tr>
<tr>
<td>MATH 523</td>
<td>Functions of a Complex Variable with Applications</td>
<td>3</td>
</tr>
<tr>
<td>MATH 528</td>
<td>Mathematical Methods for the Physical Sciences I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 566</td>
<td>Introduction to Numerical Analysis</td>
<td>3</td>
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</tbody>
</table>

One of:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 534</td>
<td>Elements of Modern Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH 548</td>
<td>Combinatorial Mathematics</td>
<td>3</td>
</tr>
</tbody>
</table>
Mathematics Major, B.S.

First Year

First-Year Foundation Courses

IDST 101  College Thriving 1
ENGL 105 or ENGL 105I  English Composition and Rhetoric 3
First-Year Seminar or First-Year Launch (https://catalog.unc.edu/undergraduate/ideas-in-action/first-year-seminars-launches/) F 3
Triple-I and Data Literacy (https://catalog.unc.edu/undergraduate/ideas-in-action/triple-i/) 4
Global Language through level 3 (https://catalog.unc.edu/undergraduate/ideas-in-action/global-language/) varies

Major Courses

COMP 110 or COMP 116  Introduction to Programming and Data Science or Introduction to Scientific Programming 3

Physics course chosen from the following options: 4

PHYS 118  Introductory Calculus-based Mechanics and Relativity (recommended) H,F
PHYS 114  General Physics I: For Students of the Life Sciences F

MATH 231  Calculus of Functions of One Variable I H,F 4

Second Year

Junior Year

MATH 521  Advanced Calculus I H 3
MATH 522  Advanced Calculus II H or Functions of a Complex Variable with Applications or Mathematical Methods for the Physical Sciences or Introduction to Numerical Analysis 3

MATH 533  Elementary Theory of Numbers or Elements of Modern Algebra or Algebraic Structures or Combinatorial Mathematics 3
MATH 534 or MATH 578 or MATH 548

One of 4 courses in Division of Natural Sciences and Mathematics, but not in mathematics 3

Hours 12

Senior Year

At least 3 additional MATH courses numbered above 520, excluding MATH 528L and MATH 529L 9
One of 4 courses in Division of Natural Sciences and Mathematics, but not in mathematics 3

Hours 12

Total Hours 69

Sample Plan of Study

Sample plans can be used as a guide to identify the courses required to complete the major and other requirements needed for degree completion within the expected eight semesters. The actual degree plan may differ depending on the course of study selected (second major, minor, etc.). Students should meet with their academic advisor to create a degree plan that is specific and unique to their interests. The sample plans represented in this catalog are intended for first-year students entering UNC–Chapel Hill in the fall term. Some courses may not be offered every term.

In the first two years, students are required to complete the standard calculus sequence, discrete mathematics, linear algebra, and first course in differential equations as well as introductory courses in computer science and physics. At the beginning of their third year, students take advanced courses in mathematics.

Mathematics Major, B.S.

First Year

First-Year Foundation Courses

IDST 101  College Thriving 1
ENGL 105 or ENGL 105I  English Composition and Rhetoric 3
First-Year Seminar or First-Year Launch (https://catalog.unc.edu/undergraduate/ideas-in-action/first-year-seminars-launches/) F 3
Triple-I and Data Literacy (https://catalog.unc.edu/undergraduate/ideas-in-action/triple-i/) 4
Global Language through level 3 (https://catalog.unc.edu/undergraduate/ideas-in-action/global-language/) varies

Major Courses

COMP 110 or COMP 116  Introduction to Programming and Data Science or Introduction to Scientific Programming 3

Physics course chosen from the following options: 4

PHYS 118  Introductory Calculus-based Mechanics and Relativity (recommended) H,F
PHYS 114  General Physics I: For Students of the Life Sciences F

MATH 231  Calculus of Functions of One Variable I H,F 4

Second Year

Junior Year

MATH 521  Advanced Calculus I H 3
MATH 522  Advanced Calculus II H or Functions of a Complex Variable with Applications or Mathematical Methods for the Physical Sciences or Introduction to Numerical Analysis 3

MATH 533  Elementary Theory of Numbers or Elements of Modern Algebra or Algebraic Structures or Combinatorial Mathematics 3
MATH 534 or MATH 578 or MATH 548

One of 4 courses in Division of Natural Sciences and Mathematics, but not in mathematics 3

Hours 12

Senior Year

At least 3 additional MATH courses numbered above 520, excluding MATH 528L and MATH 529L 9
One of 4 courses in Division of Natural Sciences and Mathematics, but not in mathematics 3

Hours 12

Total Hours 69

H Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.

F FY-Launch class sections may be available. A FY-Launch section fulfills the same requirements as a standard section of that course, but also fulfills the FY-SEMINAR/FY-LAUNCH First-Year Foundations requirement. Students can search for FY-Launch sections in ConnectCarolina using the FY-LAUNCH attribute.

1 A current or former major in statistics and analytics may substitute STOR 215 (https://catalog.unc.edu/search/?P=STOR%20215) for MATH 381 (https://catalog.unc.edu/search/?P=MATH%20381).
Mathematics Major, B.S.–Applied Option

First Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDST 101</td>
<td>College Thriving</td>
<td>1</td>
</tr>
<tr>
<td>ENGL 105 or ENGL 105i</td>
<td>English Composition and Rhetoric</td>
<td>3</td>
</tr>
<tr>
<td>MATH 233 or MATH 235</td>
<td>Calculus of Functions of Several Variables</td>
<td>3</td>
</tr>
</tbody>
</table>

Second Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 231 or MATH 232</td>
<td>Calculus of Functions of One Variable</td>
<td>3</td>
</tr>
<tr>
<td>One of 4 courses in Division of Natural Sciences and Mathematics, but not in mathematics</td>
<td>3</td>
<td></td>
</tr>
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Junior Year

<table>
<thead>
<tr>
<th>Course</th>
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<th>Hours</th>
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<tr>
<td>MATH 521</td>
<td>Advanced Calculus</td>
<td>3</td>
</tr>
<tr>
<td>Two of the five MATH elective courses (see list)</td>
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Senior Year

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<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>Three of the five MATH elective courses (see list)</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

Special Opportunities in Mathematics

Special activities for qualified students include an undergraduate Mathematics Club, problem-solving seminars, and the Putnam Mathematical Competition. Qualified students may pursue opportunities as undergraduate learning assistants or tutors in the Math Help Center. Students interested in these activities should consult the undergraduate student services manager for additional information.

Qualified students can conduct original research with the guidance of a faculty member, usually in conjunction with the preparation of an honors project. Study Abroad opportunities include semester or yearlong programs in a variety of countries. The Archibald Henderson Medal and the Alfred Brauer Prize recognize outstanding performance and promise in mathematics.

Undergraduate honors research projects as well as some internships or study abroad programs might qualify for research and discovery or experiential education credit in the General Education curriculum. MATH 296 satisfies this requirement.

Honors in Mathematics

Special honors (H) sections are given in some mathematics courses when student demand is sufficient (for example, MATH 62H, MATH 231H, MATH 232H, MATH 233H, MATH 381H, MATH 383H).
spans two semesters of independent research, during which time the honors candidate must be enrolled in MATH 691H and MATH 692H. The final report on the project includes both a written description and an oral presentation before a committee of three faculty (including the project advisor) approved by the departmental honors advisor. The committee will then report to the departmental honors advisor, who, in conjunction with a subcommittee of the undergraduate committee, will make the final recommendation on awarding a degree with honors or highest honors. The candidate must have a 3.5 grade point average in mathematics courses to begin an honors project and must maintain the 3.5 average through the completion of the senior year.

**UNC–BEST**
The UNC Baccalaureate Education in Science and Teaching (UNC–BEST) Program is a collaboration between the School of Education and the College of Arts and Sciences and is designed to allow undergraduate mathematics (and science) majors interested in teaching high school mathematics the opportunity to earn their degree and obtain licensure as a North Carolina high school mathematics teacher in four years. For more details, see the School of Education (https://catalog.unc.edu/undergraduate/programs-study/best-minor/) section of the Catalog.

**Department Programs**

**Majors**

- Mathematics Major, B.S. (p. 1)

**Minor**

- Mathematics Minor (https://catalog.unc.edu/undergraduate/programs-study/mathematics-minor/)

**Graduate Programs**

- M.A. in Mathematics (https://catalog.unc.edu/graduate/schools-departments/mathematics/)
- M.S. in Mathematics (https://catalog.unc.edu/graduate/schools-departments/mathematics/)
- Ph.D. in Mathematics (https://catalog.unc.edu/graduate/schools-departments/mathematics/)

**Contact Information**

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