MATHEMATICS MAJOR, B.A.

Contact Information
Department of Mathematics
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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.A. program is more flexible than the B.S. program; it allows students to specialize in mathematics and at the same time either to follow a broad liberal arts program or to specialize in a second area (possibly even taking a second major).

Department Programs

Majors
- Mathematics Major, B.A. (p. 1)
- Mathematics Major, B.S. (http://catalog.unc.edu/undergraduate/programs-study/mathematics-major-bs)

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

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

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

Requirements
In addition to the program requirements, students must
- attain a final cumulative GPA of at least 2.0
- complete a minimum of 45 academic credit hours earned from UNC–Chapel Hill courses
- take at least half of their major course requirements (courses and credit hours) at UNC–Chapel Hill
- earn a minimum of 18 hours of C or better in the major core requirements (some majors require 21 hours).

For more information, please consult the degree requirements section of the catalog (http://catalog.unc.edu/undergraduate/general-education-curriculum-degree-requirements/#degreerequirementstext).

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 381</td>
<td>Discrete Mathematics (^1,\text{H})</td>
<td>3</td>
</tr>
<tr>
<td>MATH 383</td>
<td>First Course in Differential Equations (^H)</td>
<td>3</td>
</tr>
<tr>
<td>MATH 521</td>
<td>Advanced Calculus I (^H)</td>
<td>3</td>
</tr>
<tr>
<td>MATH 547</td>
<td>Linear Algebra for Applications (preferably before the senior year)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>or MATH 577 Linear Algebra</td>
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</tbody>
</table>

At least three more MATH courses numbered above 500, including sequence MATH 383L + MATH 528L + MATH 529L

Eighteen hours of C or better (not C-) in MATH 233, MATH 381, MATH 383, or MATH courses numbered above 500

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>MATH 231</td>
<td>Calculus of Functions of One Variable (^H)</td>
<td>3-4</td>
</tr>
<tr>
<td></td>
<td>or MATH 241 BioCalculus I</td>
<td></td>
</tr>
<tr>
<td>MATH 232</td>
<td>Calculus of Functions of One Variable II (^H)</td>
<td>3-4</td>
</tr>
<tr>
<td></td>
<td>or MATH 283 BioCalculus II</td>
<td></td>
</tr>
<tr>
<td>MATH 233</td>
<td>Calculus of Functions of Several Variables (^H)</td>
<td>4</td>
</tr>
</tbody>
</table>

Total Hours 31-33

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

\(^1\) A current or former major in statistics and analytics (mathematical decision sciences) may substitute STOR 215 for MATH 381.

All Foundations, Approaches, Connections, and Supplemental General Education requirements apply (see the General Education Requirements (http://catalog.unc.edu/undergraduate/general-education-curriculum-degree-requirements) in this catalog).

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>
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</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>
</tbody>
</table>
MATH 577 Linear Algebra 3
MATH 578 Algebraic Structures 3

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 Economics**

Suitable for students planning to go on to graduate school in economics or a related area, or pursue a career in economics, business, or finance.

Note: With three more ECON courses numbered above 400, the requirements for the B.A. in economics could also be satisfied.

### Code and Title

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>ECON 101</td>
<td>Introduction to Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECON 410</td>
<td>Intermediate Theory: Price and Distribution</td>
<td>3</td>
</tr>
<tr>
<td>ECON 420</td>
<td>Intermediate Theory: Money, Income, and Employment</td>
<td>3</td>
</tr>
</tbody>
</table>

At least two of:

- ECON 510 Advanced Microeconomic Theory
- ECON 511 Advanced Game Theory in Economics
- ECON 520 Advanced Macroeconomic Theory
- ECON 570 Applied Econometric Analysis

At least three of:

- MATH 521 Advanced Calculus I

At least three of:

- MATH 522 Advanced Calculus II
- MATH 524 Elementary Differential Equations
- MATH 535 Introduction to Probability
- MATH 550 Topology
- MATH 555 Introduction to Dynamics
- MATH 564 Mathematical Modeling in the Life Sciences
- MATH 565 Computer-Assisted Mathematical Problem Solving

Either:

- MATH 535/STOR 435 Introduction to Probability
- STOR 555 Mathematical Statistics

Or:

- ECON 400 Introduction to Statistics and Econometrics
- ECON 570 Applied Econometric Analysis

- MATH 547 Linear Algebra for Applications
- or MATH 577 Linear Algebra

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

### Special Opportunities in Mathematics

Special activities for qualified students include an undergraduate Mathematics Club, problem-solving seminars, the Putnam Mathematical Competition, and the Virginia Tech Mathematics Contest. Students interested in these activities should consult the departmental honors advisor.

Qualified undergraduate students may work as research assistants in the Fluid Laboratory or as tutors in the Math Help Center. 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 experiential education credit. MATH 296, MATH 396, and MATH 410 satisfy 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 233H, MATH 383H).

Promising students are encouraged to work toward a bachelor's degree with honors in mathematics. This program consists of six or more courses approved by the departmental honors advisor and satisfactory completion of an honors project completed over the two semesters of the senior year. The honors project is conducted in association with a departmental faculty member on a topic approved by the departmental honors advisor, and 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. UNC–
BEST students meet all the degree requirements for their mathematics
major and complete a teaching methods class (MATH 410). Students
also fulfill teaching licensure coursework requirements (see list below) as
well as many General Education and elective requirements.

<table>
<thead>
<tr>
<th>Code</th>
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<tbody>
<tr>
<td>MATH 410</td>
<td>Teaching and Learning Mathematics</td>
<td>4</td>
</tr>
<tr>
<td>EDUC 689</td>
<td>Foundations of Special Education (may substitute EDUC 516)</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 532</td>
<td>Introduction to Development and Learning (may substitute EDUC 403)</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 615</td>
<td>Schools and Community Collaboration (may substitute EDUC 533)</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 593</td>
<td>Internship/Student Teaching</td>
<td>12</td>
</tr>
<tr>
<td>EDUC 601</td>
<td>Education Workshops</td>
<td>1</td>
</tr>
</tbody>
</table>

For more details on admission requirements and application processes,
visit the School of Education Web site (http://soe.unc.edu/academics/
uncbest).