

MATHEMATICS

Overview

The Mathematics Area of Concentration (AOC) at New College is both challenging and exciting. Students are exposed to a broad range of mathematical disciplines from linear and abstract algebra to analysis and differential equations. They develop strong critical thinking and problem-solving skills, the ability to produce rigorous mathematical proofs, and a deep understanding of powerful mathematical theories having many applications as well as their own internal beauty.

A variety of courses and tutorials on advanced topics are available, giving mathematics majors the opportunity to work on advanced material often found in graduate school offerings. Students are able to take courses and tutorials in topology, discrete mathematics, graph theory, probability, geometry, and number theory, as well as in computer science and other sciences. Students concentrating in mathematics often have the opportunity to participate in summer research programs. To attain a broad education, students are encouraged to foray into other liberal arts courses in the humanities and social sciences as well.

An essential element of the Mathematics program is participation in the Mathematics Seminar, a longstanding New College tradition. Offered every semester, this seminar provides a forum for math majors as well as non-majors to listen to talks on mathematically related topics alongside fellow students and the Mathematics faculty.

(See also Applied Mathematics (<https://catalog.ncf.edu/undergraduate/natural-sciences/applied-mathematics/>))

Faculty in Mathematics

Christopher Kottke (<https://www.ncf.edu/directory/christopher-kottke/>), Associate Professor of Mathematics

Patrick McDonald (<https://www.ncf.edu/directory/patrick-t-mcdonald/>), Professor of Mathematics

Eirini Poimenidou (<https://www.ncf.edu/directory/eirini-poimenidou/>), Professor of Mathematics (On Leave)

Vlad Serban (<https://www.ncf.edu/directory/vlad-serban/>), Visiting Assistant Professor of Mathematics

Necmettin Yildirim (<https://www.ncf.edu/directory/necmettin-yildirim/>), Professor of Mathematics/Soo Bong Chae Chair of Applied Mathematics

Requirements for the AOC in Mathematics

A minimum of twelve and one-half (12.5) academic units.

Code	Title
Core Requirements	
MATH 2311 or MATH 3472	Calculus I*
MATH 2312 or MATH 3473	Calculus with Theory I*
MATH 2313	Calculus II*
MATH 3105 or MATH 4015	Calculus with Theory II
MATH 3105 or MATH 4015	Calculus III
MATH 3105 or MATH 4015	Linear Algebra
MATH 3105 or MATH 4015	Advanced Linear Algebra
MATH 3330	Ordinary Differential Equations*
MATH 2500 & MATH 3510	Probability I and Probability II* ¹
Programming Course	

Select **one** from the following examples:

CSCI 2200	Introduction to Programming in Python*
CSCI 2400	Object-Oriented Programming
CSCI 2100	Functional Programming in Haskell*

Additional Math Requirements

MATH 4226	Real Analysis I*
MATH 4301	Abstract Algebra I
MATH 3710	Mathematics Seminar (Three Semesters) ²

Electives

Select **two** upper-level courses from the following examples:

MATH 4227	Real Analysis II
MATH 4302	Abstract Algebra II
MATH 4402	Complex Analysis
MATH 3210	Introduction to Number Theory with Applications to Cryptography*
MATH 3220	Graph Theory*
MATH 4230	Point-Set Topology
MATH 4015	Advanced Linear Algebra (If not also used for Linear Algebra requirement)
MATH 4341	Partial Differential Equations
MATH 3800	Basic Set Theory*
MATH 4410	Introduction to Numerical Methods
MATH 3410	Mathematical Modeling
MATH 4920	Advanced Topics: Analysis
MATH 4930	Advanced Topics: Algebra
MATH 4950	Advanced Topics: Probability
MATH 4960	Advanced Topics: Geometry/Topology
MATH 4940	Advanced Topics: Applied Math

Additional Requirement

Senior Thesis in Mathematics and Baccalaureate Exam

¹ These are each one-mod courses; together they count as one academic unit.

² To receive mod course credit (.5 unit) for the Mathematics Seminar, students must prepare and present a talk at one of the seminar sessions. One of the most important roles of the Mathematics Seminar, in addition to honing students' communication skills, has been to build a sense of community in the program.

Requirements for a Secondary Field in Mathematics

A minimum of six and one-half (6.5) academic units.

Code	Title
Core Requirements	
MATH 2311 or MATH 3472	Calculus I*
MATH 2312 or MATH 3473	Calculus with Theory I*
MATH 2313	Calculus II*
MATH 2313	Calculus with Theory II
MATH 2313	Calculus III

or MATH 3330	Ordinary Differential Equations*
MATH 3105	Linear Algebra

Additional Math Requirements

MATH 4226	Real Analysis I*
or MATH 4301	Abstract Algebra I
MATH 3710	Mathematics Seminar (One Semester) ¹

Elective

Select **one** upper-level course from the following examples:

MATH 4227	Real Analysis II
MATH 4302	Abstract Algebra II
MATH 4402	Complex Analysis
MATH 3210	Introduction to Number Theory with Applications to Cryptography*
MATH 3220	Graph Theory*
MATH 4230	Point-Set Topology

Optional

A programming course is highly recommended.

¹ To receive mod course credit (.5 unit) for the Mathematics Seminar, students must prepare and present a talk at one of the seminar sessions. One of the most important roles of the Mathematics Seminar, in addition to honing students' communication skills, has been to build a sense of community in the program.

- Methods in Tiling with subsets of \mathbb{Z}^n
- Group Ring Cryptography

Mathematics Facilities

The Mathematics program at New College has built a strong sense of community, resting in part on the existence of a place for faculty and students to gather and do mathematics—the Math Reading Room (Heiser Natural Sciences 106). This large seminar/study room is used for an active schedule of seminars, presentations, workshops, problem sessions, tutorials, and discussions. This stimulating interaction is highly valued by students and contributes greatly to their growth and development in mathematics.

Representative Senior Theses in Mathematics

- The Heat Content of Triangles
- Normal Power Graphs of Finite Groups
- Torsional Rigidity and Infinite Sums
- Lorentz Violation in the Collective Excitations of Condensates
- Faith and Confidence in New Age Markets: Cryptocurrencies and Stock Bubbles
- Knot Theory and the Alexander Polynomial
- Discretization of Regular Surfaces Preserving Curvature
- Topological K-Theory and Bott Periodicity
- More Rings More Problems: A Discussion of Number Fields for Homomorphic Cryptography
- Solutions to the Oberwolfach Problem and Odd Coverings of Graphs
- Mathematical Linguistics: The Pumping Lemma and Classification of Natural Languages
- The Stability of Theories from Categoricity to their Spectrum
- Abstract Synecdoche in Finite Semigroups: A General Theory of Pointlike Sets and Related Phenomena