

Proposal

The Department of Mathematics offers four tracks leading to the B.A. or B.S. degree. Students may major in mathematics by completing the requirements for one of the following tracks: Foundations of Mathematics; Applied Mathematics, Modeling, and Optimization; Mathematics of Data, Computation, and Finance; General Mathematics. The common requirements as well as the specific requirements for these tracks are outlined below.

Pre-Major requirements:

Total credits (Pre-major, Major Core and GCCR): 20 or 21

- **MA 113 Calculus 1 OR MA 137 Calculus 1 with Life Science Applications** (4 credits)
- **MA 114 Calculus 2 OR MA 138 Calculus 2 with Life Science Applications** (4 credits)
- **CS 115 (Intro to Computer Programming, 3 credits) OR EGR 102 (Fundamentals of Engineering Computing, 2 credits)**

Major Core requirements:

- **MA 213 Calculus 3** (4 credits)
- **MA 322 Matrix Algebra and Its Applications** (3 credits)

GCCR requirement:

- **MA 391 Mathematics: Composition and Communication** (3 credits)

TRACKS

In each track below the required courses are listed in bold. We indicate in parenthesis the current prerequisites for the course.

Foundations of Mathematics Track (additional 21 credits)

The Foundations of Mathematics track trains students in the practice of modern mathematics. Students in this track learn the core topics of analysis, algebra, and topology, and take elective mathematics courses according to their interests and career goals. Through their coursework, students will gain valuable experience in problem solving as well as the construction and communication of logical arguments – skills valued by industry, government, and academia. The goal of the Foundations of Mathematics track is to prepare students to be competitive for both careers in industries that prize creativity and for graduate programs in mathematics or related fields such as data science, statistics, or applied mathematics.

MA 261 Introduction to Number Theory

Pick four of the following

- MA 351 Elementary Topology 1** (MA 261 and MA 213 coreq)
- MA 352 Elementary Topology 2** (MA 261 and MA 213 coreq)
- MA 361 Elementary Modern Algebra 1** (MA 261, MA 322 coreq)
- MA 362 Elementary Modern Algebra 2** (MA 361)
- MA 433G Intro Complex Variables** (MA 213)
- MA 471G Advanced Calculus 1** (MA 213 and MA 322)
- MA 472G Advanced Calculus 2** (MA 471G)

Complete 6 additional credit hours of MA courses above MA 213, with the exclusion of MA 241 and MA 308, MA 322, and MA 391. Of these 6 credit hours, a maximum of 3 hours can be independent work in mathematics (MA 395).

Applied Mathematics, Modeling, and Optimization Track (additional 21 credits)

The Applied Mathematics, Modeling, and Optimization track provides a broad background in mathematics and its applications, with a focus on mathematical modeling and algorithms used in interdisciplinary settings such as in scheduling and routing problems, network analysis, secure communications, resource allocation, economics, biology, and biomedicine. Students will learn about fundamental results in probability, game theory, graph theory, mathematical modeling, linear programming, stability analysis, and uncertainty quantification, along with topics in elective mathematics courses that align with students' personal interests and career goals. Students will understand both how mathematical approaches are applied to solve problems and why the underlying mathematical theory is correct. The goal of the Applied Mathematics, Modeling, and Optimization track is to prepare students for a career in pharmaceutical companies or financial institutions, industrial or government research, public policy, security analysis, K-12 and higher education, technical or scientific writing, and more.

MA/STA 320 Introductory Probability (MA 213)

Pick four of the following

- MA/ECO 327 Strategic Decision Making: An Introduction to Game Theory** (needs B or better in MA 113 or MA 137)
- MA/BIO 337 Math Modeling Life Science** (needs B or better in MA 114 or MA 138)
- MA/CS 340 Applicable Algebra** (MA 213 or MA 322)
- MA/CS 415G Combinatorics and Graph Theory** (MA 213 or MA 322)
- MA/CS 416G Introduction to Optimization** (MA 213 and MA 322)
- MA 432G Methods Applied Math 1** (MA 213)

Complete 6 additional credit hours of MA courses above MA 213, with the exclusion of MA 241, MA 308, MA 322, and MA 391. Of these 6 credit hours, a maximum of 3 hours can be independent work in mathematics (MA 395).

Mathematics of Data, Computation, and Finance Track (additional 21 credits)

The Mathematics of Data, Computation, and Finance track provides a broad background in computational mathematics, with a focus on developing both mathematical concepts and algorithms that arise in data science and machine learning as well as tools needed to model and analyze a wide range of phenomena in fields where uncertainty plays a role such as finance, physics, engineering, and biology. Students will learn about fundamental results in computational mathematics, probability, statistics, financial mathematics, and machine learning algorithms along with topics in elective mathematics courses that align with students' personal interests and career goals. Students will understand both how mathematical approaches are applied to solve problems and why the underlying mathematical theory is correct. The goal of the Mathematics of Data, Computation, and Finance track is to prepare students for career that focus on data science, computational science, engineering, and finance, whether they are interested in applying mathematics to solve real-world problems or building a mathematical foundation for advanced studies in a related discipline.

MA/STA 320 Introductory Probability (MA 213)

Pick four of the following

MA/CS 321 Introduction to Numerical Methods (MA 114)

MA 323 Mathematical Introduction to Data Science (MA 213 and MA 322)

MA/STA 417G Decision Making Under Uncertainty (MA/STA 320)

MA 420G Introduction to Stochastic Processes (MA/STA 320 or STA 524)

MA 421G Mathematical Introduction to Deep Learning
(MA/STA 320 or STA 524, MA/CS 321, MA 322)

MA 427G Financial Mathematics (MA/STA 320 or STA 524)

Complete 6 additional credit hours of MA courses above MA 213, with the exclusion of MA 241, MA 308, MA 322, and MA 391. Of these 6 credit hours, a maximum of 3 hours can be independent work in mathematics (MA 395).

General Mathematics Track (additional 21 credits)

This is the default option for students who do not declare another track.

Complete 21 credit hours of additional MA courses above MA 213, with the exclusion of MA 241, MA 308, MA 322, and MA 391. Of these 21 credit hours, a maximum of 3 hours can be independent work in mathematics (MA 395). Students pursuing this track must plan their coursework in such a way to be compliant with the prerequisites of MA 391.