

Mathematics - B.S.

College of
Arts and Sciences

The department offers four tracks leading to the B.A. or B.S. degree. Students may major in mathematics by completing the requirements for one of these four tracks:

- Foundations of Mathematics Track
- Applied Mathematics, Modeling, and Optimization Track
- Mathematics of Data, Computation, and Finance Track
- General Mathematics Track

The requirements for these programs are outlined below.

120 hours (minimum)

Any student earning a Bachelor of Arts (BA) degree must complete a minimum of 39 hours at the 300+ level. These hours are generally completed by the major requirements. However, keep this hour requirement in mind as you choose your course work for the requirements in the major. See the complete description of College requirements for a Bachelor of Arts degree in the *Arts and Sciences* section of the 2024-2025 Undergraduate Catalog.

UK Core Requirements

See the *UK Core* section of the 2024-2025 Undergraduate Catalog for the complete UK Core requirements. The courses listed below are (a) recommended by the college, or (b) required courses that also fulfill UK Core areas. Students should work closely with their advisor to complete the UK Core requirements.

I. Intellectual Inquiry in Arts and Creativity

Choose one course from approved list..... 3

II. Intellectual Inquiry in the Humanities

Choose one course from approved list..... 3

III. Intellectual Inquiry in the Social Sciences

Choose one course from approved list..... 3

IV. Intellectual Inquiry in the Natural, Physical, and Mathematical Sciences

Choose one course from approved list..... 3

V. Composition and Communication I

CIS/WRD 110 Composition and Communication I 3

VI. Composition and Communication II

CIS/WRD 111 Composition and Communication II 3

VII. Quantitative Foundations

MA 113 Calculus I

or

MA 137 Calculus I with Life Science Applications..... 4

VIII. Statistical Inferential Reasoning

STA 296 Statistical Methods and Motivations 3

IX. Community, Culture and Citizenship in the USA

Choose one course from approved list..... 3

X. Global Dynamics

Choose one course from approved list..... 3

UK Core hours 31

Graduation Composition and Communication Requirement (GCCR)

MA 391 Mathematics: Composition and Communication 3

Graduation Composition and Communication Requirement hours (GCCR)..... 3

College Requirements

I. Foreign Language (*placement exam recommended*) 0-14

II. Disciplinary Requirements

a. Natural Science..... 6

b. Social Science..... 6

c. Humanities..... 6

III. Laboratory or Field Work..... 1

IV. Race and Ethnicity Requirement..... 0-3

V. Electives..... 6

College Requirement hours: **25-42**

Premajor Requirements

MA 113 Calculus I

or

MA 137 Calculus I with Life Science Applications..... 4

MA 114 Calculus II

or

MA 138 Calculus II with Life Science Applications 4

CS 115 Introduction to Computer Programming 3

or

EGR 102 Fundamentals of Engineering Computing 2

Premajor hours: **10-11**

Major Requirements

Major Core Requirements

MA 214 Calculus IV 4

MA 322 Matrix Algebra and its Applications 3

Major Core hours: **7**

TRACKS

Track 1 – Foundations of Mathematics

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 course work, 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.

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The University of Kentucky is accredited by the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC) to award associate, baccalaureate, masters, educational specialist, and doctorate degrees. The University of Kentucky also may offer credentials such as certificates and diplomas at approved degree levels. Questions about the accreditation of the University of Kentucky may be directed in writing to the Southern Association of Colleges and Schools Commission on Colleges at 1866 Southern Lane, Decatur, GA 30033-4097, by calling (404) 679-4500, or by using information available on SACSCOC's website (www.sacscoc.org).

Mathematics (B.S.) • 2

Track Requirements:

MA 261 Introduction to Number Theory3

Select **four** of the following courses:

MA 351 Elementary Topology I3
MA 352 Elementary Topology II3
MA 361 Elementary Modern Algebra I3
MA 362 Elementary Modern Algebra II3
MA 433G Introduction to Complex Variables3
MA 471G Advanced Calculus I3
MA 472G Advanced Calculus II3

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).

Track 2: Applied Mathematics, Modeling, and Optimization

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.

Track Requirements:

MA/STA 320 Introductory Probability3

Select **four** of the following courses:

MA/ECO 327 Strategic Decision Making: An Introduction to Game Theory3
MA/BIO 337 Mathematical Modeling in the Life Sciences3
MA/CS 340 Applicable Algebra3
MA/CS 415G Combinatorics and Graph Theory3
MA/CS 416G Introduction to Optimization3
MA 432G Methods of Applied Mathematics I3

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).

Track 3: Mathematics of Data, Computation, and Finance

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.

Track Requirements:

MA 320/STA 320 Introductory Probability3

Select **four** of the following courses:

MA/CS 321 Introduction to Numerical Methods3
MA 323 Mathematical Introduction to Data Science3
MA/STA 417G Decision Making Under Uncertainty3
MA 420G Introduction to Stochastic Processes3
MA 421G Mathematical Introduction to Deep Learning3
MA 427G Financial Mathematics3

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).

Track 4: General Mathematics

Track Requirements:

This is the default track 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 course work in such a way to be compliant with the prerequisites of the GCCR course, MA 391.

Total Track Hours 21

Electives

Choose electives to lead to the minimum total of 120 hours required for graduation.

Total Minimum Hours

Required for Degree 120

**Course used towards completion of a UK Core Requirement.*