Math Undergraduate Program

Alberto Corso, DUS

https://math.as.uky.edu/undergrad

Department of Mathematics
University of Kentucky
## Officers of the Department of Mathematics

<table>
<thead>
<tr>
<th>Officer</th>
<th>Position</th>
<th>Office</th>
<th>Email</th>
</tr>
</thead>
<tbody>
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</table>
Math Degrees

Major Degrees

- BA Bachelor of Arts
- BS Bachelor of Sciences

Each has two options:

- Option A: Mathematics
- Option B Mathematical Sciences

- Complete a minimum of 120 credit hours and earn a 2.0 cumulative grade point average (GPA)
- Mathematics Departmental Honors Requirement: 3.5 cumulative GPA or above
- Dean’s List Requirement: 3.6 cumulative GPA or above

We also offer a Minor in Math
Degree Requirements for BA and BS

- UK Core — 31 credits
- GCCR (Composition and Communication) — 3 credits (Starting Fall 2014)
- College — 25-39 credits (BA); 16-30 credits (BS)
- Math Department — 53 (option A) or 55 (option B) credits
- Electives — 0-9 credits (BS)
Mathematics (B.A.) • 2

OPTION B - Mathematical Sciences

Premajor Requirements
*MA 113 Calculus I
*MA 114 Calculus II
MA 137 Calculus I with Life Science Applications
MA 138 Calculus II with Life Science Applications
CS 115 Introduction to Computer Programming
Alternatively, MA 138 Calculus II with Life Science Applications may be used.

Major Requirements

Core Requirements
MA 213 Calculus III
MA 214 Calculus IV
MA 261 Introduction to Number Theory
MA 322 Matrix Algebra and its Applications

Other Course Work Required for the Major

From the Major Department:
Choose one course acceptable MA courses at the 300+ level and above (MA 308 may not be used)

From Outside the Major Department:
Nine hour supporting program chosen from one area outside mathematics.
The Director of Undergraduate Studies must approve the supporting program. Courses in the supporting program must be at the 300+ level and above. Cross-listed courses may be used for the supporting program provided they are approved to satisfy another major requirement.

Total Minimum Hours: 15

—if a two-semester sequence chosen from the following:
MA/CS 415G Combinatorics and Graph Theory
MA/CS 416G Introduction to Optimization
Mathematics - B.S.

Graduation Composition and Communication Requirement (GCCR)

MA 110 Mathematical Composition and Communication ............................................ 1

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

College Requirements

I. Foreign Language (placement exam recommended) .................................................. 0-14
II. Disciplinary Requirements
   a. Natural Science .................................................................................................. 3
   b. Social Science .................................................................................................. 3
   c. Humanities ...................................................................................................... 3
III. Laboratory or Field Work ...................................................................................... 6
IV. Electives ............................................................................................................. 6

College Requirement hours: ...................................................................................... 16-30

OPTION A - Mathematics

Premajor Requirements

*MA 113 Calculus I .................................................................................................... 4
*MA 114 Calculus II .................................................................................................. 4
CS 115 Introduction to Computer Programming ..................................................... 3

Premaj or hours: ........................................................................................................ 11

Major Requirements

Major Core Requirements

MA 213 Calculus III ................................................................................................... 4
MA 214 Calculus IV ................................................................................................... 4
MA 261 Introduction to Number Theory .................................................................... 3
MA 322 Matrix Algebra and its Applications ......................................................... 3

Major Core hours: ................................................................................................... 10

Other Course Work Required for the Major

From the Major Department

Choose 18 hours of 300-400 level mathematics courses. One of the following sequences, or an equivalent approved by the Director of Undergraduate Studies, must be taken: MA 351, 352, MA 361, 362, MA 457, 458, MA 459G, 461G, MA 462G, MA 463G, MA 471G, MA 472G. Students may also choose an equivalent course or sequence of their own design. Cross-listed courses may not be used to satisfy this requirement.

Other Major hours: ................................................................................................ 32

Other Major hours: ................................................................................................ 32

Mathematics (B.S.) • 2

Other Course Work Required for the Major

From the Major Department

Choose six hours of acceptable MA courses at the 300 level and above (MA 306 may not be used) ................................................................. 6

From Outside the Major Department

Nine hours supporting program chosen from one area outside mathematics. The Director of Undergraduate Studies must approve the supporting program. Courses in the supporting program must be at the 300 level and above. Cross-listed courses may be used for the supporting program provided they are not used to satisfy another major requirement.

Other Major hours: ................................................................................................ 9

Electives

Choose electives to lead to the minimum total of 120 hours required for graduation (110)

Total Minimum Hours

Required for Degree .................................................................................................. 120

*Course mathematician completion of a UK Core Requirement.

Mathematics Cooperative Education

Qualified students who major in mathematics may participate in the Mathematical Sciences Cooperative Education Program which provides the opportunity for alternate summers of academic study and full-time employment in business or industry. Guidelines and application forms are available in the Engineering/Math Sciences Co-op Program Office, 230 Reaves Building.
Math Major Requirements: **Option A**

**Premajor Requirements (11 credits):**
- MA 113, Calculus I
- MA 114, Calculus II
- CS 115, Introduction to Computer Programming

**Major Core Requirements (10 credits):**
- MA 213, Calculus III
- One of
  - MA 214, Calculus IV
  - MA 261, Introduction to Number Theory
- MA 322, Matrix Algebra and its Applications
18 hours of 300+ level Mathematics courses (other than MA 322)

Must include one of the sequences:

- Topology: MA 351/352
- Algebra: MA 361/362
- Advanced Calculus: MA 471G/MA 472G
- Differential Equations: MA 481G/MA 483G
- Optimization: MA 416G/417G

Must include MA 391 (Composition and Communication) and

at least 2 of the following: MA 351, 352, 361, 362, 471G, 472G

14 hours of 300+ level courses outside of Mathematics

Courses used to satisfy College requirements can also be counted here

Electives

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

https://math.as.uky.edu/undergrad

Math Undergraduate Program
Math Major Requirements: **Option B**

**Premajor Requirements (11 credits):**
- MA 113 or MA 137, Calculus I with Life Science Applications
- MA 114 or MA 138, Calculus II with Life Science Applications
- CS 115, Introduction to Computer Programming

**Major Core Requirements (29 credits):**
- CS 215, Introduction to Program Design, Abstraction and Problem Solving
- MA 213, Calculus III
- MA 214, Calculus IV
- MA/STA 320, Introductory Probability
- MA/CS 321, Introduction to Numerical Analysis
- STA 321, Basic Statistical Theory I
- MA 322, Matrix Algebra and its Applications
**Plus** a two-semester sequence chosen from the following:

- **MA/CS 340** and **MA/CS 415G**
  Applicable Algebra and Combinatorics and Graph Theory

- **MA 432G** and **MA 433G**
  Methods of Applied Mathematics I and Introduction to Complex Variables

- **MA 481G** and **MA 483G**
  Differential Equations and Introduction to Partial Differential Equations

- **MA/CS 416G I** and **MA/STA 417G**
  Introduction to Optimization and Decision Making Under Uncertainty

**From the Math Department (6 credits)**
Choose six hours of MA courses at the 300+ level (MA 308 may not be used)

[Comment: The GCCR course MA 391 (Composition and Communication) can be one of these!]

**From Outside the Major Department (9 credits)**
Nine hour from a supporting program chosen from one area outside mathematics. The DUS must approve the supporting program. Courses in the supporting program must be at the 300+ level. Cross-listed courses may be used for the supporting program provided they are not used to satisfy another major requirement.

**Electives**
Choose electives to lead to the minimum total of 120 hours required for graduation.
General Advice

Students should select their upper-division coursework based on their goals and interests. Below are some suggestions:

**Preparation for graduate school:**
MA 351, MA 352, MA 361, MA 362, MA 471G, MA 472G

**Secondary education:**
MA 310, MA 320, MA 330, MA 341, MA 361, MA 362

**Mathematics and computer science:**
MA 320, MA 321, MA 340, MA 361, MA 362, MA 415G

**Mathematics and engineering or physical science:**
MA 320, MA 321, MA 361, MA 471G and select from MA 351, MA 362, MA 432G, MA 433G, MA 472G, MA 481G, MA 483G
Math Minor

21 hours of Math Courses:

- MA 113 or MA 137, Calculus I
- MA 114 or MA 138, Calculus II
- MA 213, Calculus III
- MA 322, Matrix Algebra

6 additional hours of courses numbered 214 or higher.
Possible choices: MA 214, MA 261, MA 320, MA 321, MA 330, MA 341, MA 351, MA 361, or any 400+ level course

To declare a minor, a student must visit the advising center of the college of their primary major.
Major Programs Related to Math

- Mathematical Economics
- Statistics
- Physics
- Engineering
- Computer Science
- Chemistry
- STEM Education

Many math majors are double (or even second degree) majors or have interesting minors.

Talk to your advisor about your interests!
Study Abroad

Various options exist for math majors to study abroad, e.g.

- Budapest Semester in Mathematics
- Budapest Semester in Mathematics Education
- UKY-City University of Hong Kong Program

Talk to your advisor about options, check out

http://www.uky.edu/international/students
University Scholars Program (USP): 4+1

- The USP offers students the opportunity of integrating their undergraduate and graduate courses of study in a single continuous program culminating in both a baccalaureate and a master’s. The total number of hours for the combined program may be as many as 12 less than the total required for the separate degrees.

- Application to the program should be submitted at the end of the student’s junior year. Applicants should have completed at least 90 credit hours of work toward the bachelor’s degree, or be eligible for senior standing in the semester they are admitted to the program.

- The master’s program should be in the field of the undergraduate major, and the undergraduate grade point average must be at least a 3.50 in the applicant’s major field and 3.20 overall.

- Students submit the University Scholars Program form, GRE scores and an online application to the Graduate School in their junior year.

- Undergraduate tuition rates will be applied to the 12 hours (or less) of graduate level coursework designated for dual credit.
### Integrated 4+1 Year BS/MS in Mathematics

**Based on BS Option A**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Year 1</th>
<th>Spring</th>
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<tbody>
<tr>
<td>UK Core CC1</td>
<td>3</td>
<td>UK Core CC2</td>
</tr>
<tr>
<td>Foreign Language 101</td>
<td>4</td>
<td>Foreign Language 102</td>
</tr>
<tr>
<td>UK Core QFO (MA 113/MA 193)</td>
<td>5</td>
<td>UK Core QFO (MA 114/MA 194)</td>
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<tr>
<td>UK Core HUM</td>
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<td>CS 115</td>
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<th>Year 2</th>
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<tr>
<td>Foreign Language 201</td>
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<td>Foreign Language 202</td>
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<tr>
<td>UK Core NPM (PHY 231)</td>
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<td>MA 261: Number Theory or MA 214: Calculus IV</td>
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<tr>
<td>UK Core NPM (PHY 241)</td>
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<td>MA 322: Matrix Algebra</td>
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<tr>
<td>MA 213: Calculus III</td>
<td>4</td>
<td>A&amp;S NS (PHY 232: General Physics)</td>
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<td>UK Core SIR (STA 210)</td>
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<td>A&amp;S Lab (PHY: 242: Physics Lab II)</td>
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<tr>
<td>Total Credits</td>
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<tr>
<th>Fall</th>
<th>Year 3</th>
<th>Spring</th>
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<tbody>
<tr>
<td>MA 361 Abstract Algebra I</td>
<td>3</td>
<td>MA 362 Abstract Algebra II</td>
</tr>
<tr>
<td>MA 471G Advanced Calculus I</td>
<td>3</td>
<td>MA 472G Advanced Calculus II</td>
</tr>
<tr>
<td>CS 215: Introduction to program design, abstraction, and problem solving</td>
<td>4</td>
<td>UK Core GDY</td>
</tr>
<tr>
<td>UK Core ACR</td>
<td>3</td>
<td>MA 391 - GCCR</td>
</tr>
<tr>
<td>UK Core CCC</td>
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<td>A&amp;S SS (ECO 201: Principles of Economics)</td>
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<td>Total Credits</td>
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<thead>
<tr>
<th>Fall</th>
<th>Year 4</th>
<th>Spring</th>
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<tbody>
<tr>
<td>MA 565 Linear Algebra I</td>
<td>3</td>
<td>MA 614 Enumerative Combinatorics</td>
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<tr>
<td>MA 575 Principles of Analysis</td>
<td>3</td>
<td>MA 676 Real Analysis I</td>
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<tr>
<td>UK Core CCC</td>
<td>3</td>
<td>UK Core GDY</td>
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<td>UK Core SSC</td>
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<th>Year 5</th>
<th>Spring</th>
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<tbody>
<tr>
<td>MA 561 Abstract Algebra I</td>
<td>3</td>
<td>MA 661 Abstract Algebra II</td>
</tr>
<tr>
<td>MA 514 Combinatorial Structures</td>
<td>3</td>
<td>MA 671 Complex Analysis I</td>
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<tr>
<td>MA 551 Topology I</td>
<td>3</td>
<td>MA 651 Topology II</td>
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<table>
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<tr>
<th><strong>Degree Requirement Analysis</strong></th>
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<tbody>
<tr>
<td>Total Undergraduate Hours</td>
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<tr>
<td>Total Undergraduate Hours Toward MA</td>
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<tr>
<td>Total Graduate Hours Toward MA</td>
</tr>
<tr>
<td>Total Hours at 600+ from Year 4</td>
</tr>
<tr>
<td>Total Hours at 600+ from Year 5</td>
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[www.as.uky.edu/university-scholars-program](http://www.as.uky.edu/university-scholars-program)

[https://math.as.uky.edu/undergrad](https://math.as.uky.edu/undergrad)

**Math Undergraduate Program**
Math Club

▶ The UK Math Club is open to all undergraduate students with an interest in mathematics and serves as a focus of activities for our majors and a way to draw students to the major.

▶ The group holds several meetings each semester on topics such as an interesting piece of mathematics, information about summer internship or travel opportunities for mathematics students as well as career information.

▶ A list of recent activities is available from the website http://www.math.uky.edu/~mathclub/
Each event will draw from 20 to 100 students.

▶ The Math Club enables undergraduate students to interact with faculty members and each other in an informal setting.
Math Competitions

- Several students at the University of Kentucky take part in regional and national mathematical competitions.

- This activity is challenging as well as satisfying, since it lets you test your intellectual power against problems whose solution needs original thought besides textbook routines.

- Typically, we participate in the Virginia Tech competition (October) and the Putnam competition (December).

- You may also find a collection of problems and other information on Professor Avinash Sathaye’s website: www.msc.uky.edu/sohum/putnam/index.htm

- If you would like to join, please send an email to: sathaye@uky.edu
The Geometry Lab at UK

▶ Since Spring 2018 Dr. Chris Manon is running the UK Math Lab (UKML) in order to provide a year-round venue for undergraduates to participate in mathematics research and outreach.

▶ On a typical semester there are a number of research projects dedicated to an unsolved mathematical problem and running under the direction of faculty members from the department.

▶ The Lab is also running visualization projects aimed at a broader non-mathematical audience.
Lab members have a weekly commitment to research and visualization projects in exchange for course credit (MA 398 or MA 399) or, in special circumstances, a stipend.

Each project nominally lasts the length of a summer or a semester, at the end of which project members give a seminar-style research talk on their work.

This experience is typically a good introduction to research outside UK through summer REUs (as described next). UKML is part of a larger consortium called Geometry Labs United.
REU = Research Experience for Undergraduates

- REUs are summer programs typically lasting 6-9 weeks
- They take place all over the USA
- Specific research topics vary
- Typical stipend is $2,000 to $4,000, plus extra funds for food, travel, and lodging

Application Information

- Application deadlines range January-March
- You will write an essay or two when you apply
- You will usually need three letters of recommendation from math or science professors who know you reasonably well
Typical Course Prerequisites for REUs

- MA 113 [MA 137], MA 114 [MA 138], MA 213: Calculus I-III
- MA 322: Matrix Algebra
  [VERY IMPORTANT, take it as early as possible]
- CS 115: Computer Programming
- Experience in upper-division math courses. For example:
  - MA 261 (Number Theory)
  - MA 361 (Modern Algebra)
  - MA 351 (Topology)
  - MA 321 (Numerical Methods)
  - MA 471G (Advanced Calculus)
  - MA 416G (Optimization)
How do I find REUs?

- American Mathematical Society REU page
  [http://www.ams.org/programs/students/undergrad/emp-reu](http://www.ams.org/programs/students/undergrad/emp-reu)

- MathPrograms.org
Scholarship/Awards Information

The **Sally E. Pence Award** was established in 1963 by Dr. James C. Eaves, the Mathematics chair at the time. The award honors Dr. Sallie Pence, a UK faculty member interested in encouraging prospective teachers of mathematics, and provides recognition to Sophomore or Junior mathematics or secondary math education majors who have expressed their intention of becoming a teacher. Applicants for the award must have an overall standing of 3.0 and a standing in mathematics of 3.3. Application is in the Fall of the Sophomore or Junior year and selected applicants are presented the award at the annual Spring awards ceremony held at the Math House. Students may use the award to join the NCTM.

The **Carolyn S. Bunyan Scholarship** was established in 1992 in memory of her brother C.G. Soward and in honor of her older brother, William C. Soward, her sister Mary A. Soward, and her two nieces, Ann Soward Vance and Erwinna Soward Wright. Mrs. Bunyan received a degree from the University of Wisconsin in 1925 and wanted to encourage outstanding mathematics majors to continue their studies. Application is in the Fall of the Sophomore or Junior year and the selected applicant is presented the award (≈ $1,500) at the annual Spring awards ceremony held at the Math House.

The **Robert B. Royster Memorial Award** is given to a graduating mathematics senior who is pursuing a career in teaching.

The **J.C. Eaves Endowed Scholarship in Mathematics** was established in 2004 by J.C. Eaves and Mary G. Eaves in memory of Professor J.C. Eaves, former Mathematics chair and Professor at UK until 1967. The scholarship (≈ $2,500) is intended for students who are graduates of any high school in the Commonwealth of Kentucky (with preference for qualified students from Muhlenberg, Taylor or Adair counties), who are Junior or Senior level Arts and Science students majoring in Mathematics and have at least a 3.0 GPA. Financial need may be a consideration in awarding this scholarship.

The **J.C. Eaves Undergraduate Summer Research Award** provides a stipend (≈ $3,000) for an undergraduate student to conduct research under a faculty supervisor. Summer research awards will be awarded on a competitive basis by the Undergraduate Committee. Students are asked to submit a research proposal and a supporting letter from their faculty mentor.

The **J.C. Eaves Undergraduate Travel Award** provides support for (1) students who have the opportunity to travel to a national conference to present the results of their undergraduate research projects (≈ $500) or (2) groups of students interested in attending conferences in Kentucky, such as the sectional meeting of the Math Association of America (≈ $100/$200). Travel awards will be granted on a competitive basis by the Undergraduate Committee.
The J.C. Eaves Undergrad. Excellence Fund in Math

The J.C. Eaves Excellence Fund in Mathematics provides the Department with flexible, non-endowed funds to conduct a range of activities to enhance our program for undergraduate mathematics majors:

- **Math Club Activities**
- **J.C. Eaves Undergraduate Summer Research Awards**
- **J.C. Eaves Undergraduate Travel Awards**
- **J.C. Eaves Undergraduate Teaching Assistantships**

provide our undergraduate students with a wider range of teaching opportunities in advanced Math courses. This will help to strengthen their understanding of the mathematics studied in these courses. By working closely with a faculty member, undergraduate assistants will strengthen their preparation as teachers which will be valuable for students heading to graduate school or to secondary school teaching. The typical undergraduate assistant will work 5 hours per week throughout a semester (≈ $1,000) and may help with grading, conducting study sessions, or other activities as determined by the supervising instructor.

- **J.C. Eaves Speakers Series**
UK Office of Nationally Competitive Awards

Math majors often are good candidates for national awards and scholarships such as:

- Astronaut
- Goldwater
- Marshall
- Fulbright
- NSF Graduate Fellowships

This office can also assist with REU applications.

http://www.uky.edu/academy/competitive-awards

If interested, contact Pat Whitlow, Director:  pat.whitlow@uky.edu
Astronaut Scholarship
2016-17 Corrine Elliott, Math & Chemistry
2015-16 Robert Cass, Math
2014-15 Matthew Fahrbach, CS & Math
2013-14 Josiah Hanna, CS & Math

Goldwater Scholarship
Award 2017 Benjamin Riley, Physics & Math
2016 Corrine Elliott, Math & Chemistry
2014 Matthew Fahrbach, CS & Math
2014 Samuel Saarinen, Math
2013 Josiah Hanna, CS & Math
Hon. Mention 2018 Angela Wei, ABT & Math
2015 Robert Cass, Math
2015 Corrine Elliott, Math
2012 Josiah Hanna, CS & Math

NSF Graduate Research Fellowship
Award 2016 Robert Cass, Math
2016 Matthew Fahrbach, CS & Math
2016 Charles Fieseler, Physics & Math
2015 Tamas Nagy, Chemistry & Math
2014 Josiah Hanna, CS & Math
Job Opportunities For Math Majors

- Tutor at Mathskeller
- Undergraduate Assistant for the Math Department
- Math Excel Classroom Assistant
- Tutor at the Study (not Math Department)
- For requirements and to apply, go to https://ukjobs.uky.edu/ and search for student jobs in the Math Department.
- You can also inquire with Dr. Robert Denomme, Director of the Mathskeller: robert.denomme@uky.edu