Bachelor of Science in Mathematics

Why study mathematics?

Because mathematics is a framework upon which humanity builds an understanding of the world.

The degree of Bachelor of Science in Mathematics offers more extensive training in mathematics and its applications than is possible in the B.A. curriculum. The requirements for the B.S. in Mathematics allow a great deal of flexibility in choice of courses and concentrations. Students should plan their programs carefully to meet individual interests and goals, and carefully check the prerequisites for all courses in their programs.

Many students have strong interests in particular areas of mathematics. The Department has created three informal tracks within the B.S. program: a statistics track, an applied mathematics track, and a track in pure mathematics. These tracks are advisory only. Students without strong interests in one of these areas are encouraged to put together a broad program within the B.S. Degree.

Undergraduate Admission

Admission to KU

All students applying for admission must send high school and college transcripts to the Office of Admissions. Unless they are college transfer students with at least 24 hours of credit, prospective students must send ACT or SAT scores to the Office of Admissions. Prospective first-year students should be aware that KU has qualified admission requirements that all new first-year students must meet to be admitted. Consult the Office of Admissions (http://admissions.ku.edu) for application deadlines and specific admission requirements.

Visit the Office of International Student and Scholar Services (http://www.iss.ku.edu) for information about international admissions.

Students considering transferring to KU may see how their college-level course work will transfer on the Office of Admissions (http://credittransfer.ku.edu) website.

Admission to the College of Liberal Arts and Sciences

Admission to the College is a different process from admission to a major field. Some CLAS departments have admission requirements. See individual department/program sections for departmental admission requirements.

Mathematics Programs

Separate programs lead to the B.A. in mathematics and the B.S. in mathematics. The B.A. has fewer mathematics course requirements and more general education requirements. The B.S. requires more mathematics courses, an applied mathematics concentration, and fewer general education courses. Students wishing to attend graduate school in mathematics or to pursue a career that makes substantial use of mathematics (as an actuary, for example) should get a B.S. in mathematics. Many students majoring in mathematics are interested in a liberal arts degree; such students may want to consider the B.A. in mathematics. Students who wish to teach mathematics in high school should pursue a B.A. or B.S. in mathematics while participating in the UKanTeach program (http://ukanteach.ku.edu).

Requirements for the B.S. Degree

First- and Second-Year Preparation (17)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 125</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 145</td>
<td>Calculus I, Honors</td>
<td>4</td>
</tr>
<tr>
<td>MATH 126</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 146</td>
<td>Calculus II, Honors</td>
<td>4</td>
</tr>
<tr>
<td>MATH 127</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 147</td>
<td>Calculus III, Honors</td>
<td>4</td>
</tr>
<tr>
<td>MATH 290</td>
<td>Elementary Linear Algebra</td>
<td>2</td>
</tr>
<tr>
<td>or MATH 291</td>
<td>Elementary Linear Algebra, Honors</td>
<td>2</td>
</tr>
</tbody>
</table>

Select one of the following: 3

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 320</td>
<td>Elementary Differential Equations</td>
</tr>
<tr>
<td>MATH 220</td>
<td>Applied Differential Equations</td>
</tr>
<tr>
<td>MATH 221</td>
<td>Applied Differential Equations, Honors</td>
</tr>
</tbody>
</table>

Core Requirements (12)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 590</td>
<td>Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 790</td>
<td>Linear Algebra II</td>
<td>3</td>
</tr>
<tr>
<td>MATH 500</td>
<td>Intermediate Analysis</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 765</td>
<td>Mathematical Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 558</td>
<td>Introductory Modern Algebra</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 791</td>
<td>Modern Algebra</td>
<td>3</td>
</tr>
</tbody>
</table>

Select one of the following: 3

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 526</td>
<td>Applied Mathematical Statistics I</td>
</tr>
<tr>
<td>MATH 628</td>
<td>Mathematical Theory of Statistics</td>
</tr>
<tr>
<td>MATH 728</td>
<td>Statistical Theory</td>
</tr>
</tbody>
</table>

Mathematics Concentration/Sequence Requirements (6-12)

Select one 2-course sequence from List A and a second 2-course sequence from either List A or List B 6-12

Electives (0-6)

Select up to 2 additional 3-credit-hour courses to complete a total of 0-6

24 credit hours of mathematics courses numbered MATH 450 and above.

Applied Concentration (8)

3 courses, totaling at least 8 credit hours, that make significant use of mathematics. At least 2 courses must be in the same area. Courses from List C have been approved for this requirement. Other upper-division courses making significant use of mathematics can be used for the applied concentration with the approval of a mathematics department advisor.

Note: Many of these courses have prerequisites that do not count toward the mathematics major.

Minimum Major Requirements

42 hours

Applied Concentration: 8 hours

General Education Requirements: 46-50 hours (Actual credit hours may be less because of overlap of Core Curriculum and degree-specific requirements.)
# Bachelor of Science in Mathematics

## Completion of the University Core Curriculum

### Writing (6)

- ENGL 101: Composition (or exemption) - 3 credits
- ENGL 102: Critical Reading and Writing (or exemption) - 3 credits
- ENGL 105: Honors Introduction to English (or exemption) - 3 credits

### Computer Science (3-4)

Select one of the following:
- EECS 138: Introduction to Computing: _____ - 3-4 credits
- EECS 168: Programming I - 3 credits
- EECS 169: Programming I: Honors - 3 credits

### Natural Science (7-10)

Select one course with laboratory:
- 4-5 credits

Select one additional course in a natural science other than mathematics:
- 3-5 credits

### List A Sequences

- MATH 627 & MATH 628: Probability and Mathematical Theory of Statistics - 6 credits
- MATH 660: Geometry I - 6 credits
- MATH 661: and Geometry II - 6 credits
- MATH 727: Probability Theory - 6 credits
- MATH 728: and Statistical Theory - 6 credits
- MATH 765: Mathematical Analysis I - 6 credits
- MATH 766: and Mathematical Analysis II - 6 credits
- MATH 781: Numerical Analysis I - 6 credits
- MATH 782: and Numerical Analysis II - 6 credits
- MATH 790: Linear Algebra II - 6 credits
- MATH 791: and Modern Algebra - 6 credits

### List B Sequences

- MATH 500: Intermediate Analysis - 6 credits
- MATH 540: and Complex Variable and Applications - 6 credits
- MATH 526: Applied Mathematical Statistics I - 6 credits
- MATH 526: and Applied Regression Analysis - 6 credits
- MATH 526: and Time Series Analysis - 6 credits
- MATH 540: Elementary Number Theory - 6 credits
- MATH 558: and Introductory Modern Algebra - 6 credits
- MATH 558: and Algebraic Coding Theory - 6 credits
- MATH 558: and Intermediate Modern Algebra - 6 credits
- MATH 590: Linear Algebra - 6 credits
- MATH 590: and Linear Algebra II - 6 credits
- MATH 601: Algebraic Coding Theory - 6 credits
- MATH 601: and Modern Algebra - 6 credits
- MATH 605: Applied Regression Analysis - 6 credits
- MATH 605: and Time Series Analysis - 6 credits
- MATH 646: Complex Variable and Applications - 6 credits
- MATH 646: and Applied Partial Differential Equations - 6 credits
- MATH 646: Complex Variable and Applications - 6 credits
- MATH 724 & MATH 725: Combinatorial Mathematics and Graph Theory - 6 credits

### List C Applied Concentration Courses

#### Statistics (15)

- MATH 605: Applied Regression Analysis - 3 credits
- MATH 611: Time Series Analysis - 3 credits
- MATH 624: Discrete Regression Analysis - 3 credits
- ECON 817: Econometrics I - 3 credits
- ECON 818: Econometrics II - 3 credits

#### Economics and Finance (45)

- ECON 526: Introduction to Econometrics - 3 credits
- ECON 590: Game Theory - 3 credits
- ECON 620: Elements of Mathematical Economics - 3 credits
- ECON 700: Survey of Microeconomics - 3 credits
- ECON 701: Survey of Macroeconomics - 3 credits
- ECON 715: Elementary Econometrics - 3 credits
- ECON 716: Econometric Forecasting - 3 credits
- FIN 310: Finance - 3 credits
- FIN 311: Finance, Honors - 3 credits
- FIN 410: Investment Theory and Applications - 3 credits
- FIN 415: Corporate Finance - 3 credits
- FIN 420: International Finance - 3 credits
- FIN 425: Futures and Options - 3 credits
- MATH 630: Actuarial Mathematics - 3 credits
- SCM 310: Management Science and Operations Management - 3 credits

#### Biology (21)

- BIOL 350: Principles of Genetics - 4 credits
- BIOL 412: Evolutionary Biology - 4 credits
- BINF 701: Computational Biology I - 5 credits
- BINF 702: Computational Biology II - 5 credits
- BIOL 743: Population Genetics - 3 credits

#### Physics and Astronomy (39)

- PHSX 313: General Physics III - 3 credits
- PHSX 511: Introductory Quantum Mechanics - 3 credits
- PHSX 518: Mathematical Physics - 3 credits
- PHSX 521: Mechanics I - 3 credits
- PHSX 531: Electricity and Magnetism - 3 credits
- ASTR 591: Stellar Astronomy - 3 credits
- ASTR 592: Galactic and Extragalactic Astronomy - 3 credits
- PHSX 621: Mechanics II - 3 credits
- PHSX 631: Electromagnetic Theory - 3 credits
- PHSX 671: Thermal Physics - 3 credits
- PHSX 691: Astrophysics I - 3 credits
- PHSX 711: Quantum Mechanics I - 3 credits
- PHSX 741: Nuclear Physics I - 3 credits
### Chemistry (10)
- CHEM 400 Analytical Chemistry 3
- CHEM 530 Physical Chemistry I 4
- CHEM 535 Physical Chemistry II 3

### Atmospheric Science (18)
- ATMO 630 Synoptic Meteorology 3
- ATMO 640 Dynamic Meteorology 3
- ATMO 642 Remote Sensing 3
- ATMO 650 Advanced Synoptic Meteorology 3
- ATMO 660 Advanced Dynamic Meteorology 3
- ATMO 680 Physical Meteorology 3

### Aerospace Engineering (25)
- AE 345 Fluid Mechanics 3
- AE 445 Aircraft Aerodynamics and Performance 3
- AE 507 Aerospace Structures I 3
- AE 545 Fundamentals of Aerodynamics 4
- AE 550 Dynamics of Flight I 4
- AE 551 Dynamics of Flight II 4
- AE 552 Honors Dynamics of Flight II 4

### Chemical and Petroleum Engineering (17)
- C&PE 211 Material and Energy Balances 4
- C&PE 511 Momentum Transfer 3
- C&PE 521 Heat Transfer 3
- C&PE 523 Mass Transfer 4
- C&PE 778 Applied Optimization Methods 3

### Civil Engineering (27)
- CE 201 Statics 2
- CE 300 Dynamics 3
- CE 301 Statics and Dynamics 5
- CE 330 Fluid Mechanics 3
- CE 461 Structural Analysis 4
- CE 704 Dynamics and Vibrations 3
- CE 461 Structural Analysis 4
- CE 704 Dynamics and Vibrations 3

### Electrical and Computer Science (60)
- EECS 211 Circuits I 3
- EECS 212 Circuits II 4
- EECS 220 Electromagnetics I 4
- EECS 360 Signal and System Analysis 4
- EECS 420 Electromagnetics II 4
- EECS 444 Control Systems 3
- EECS 510 Introduction to the Theory of Computing 3
- EECS 560 Data Structures 4
- EECS 562 Introduction to Communication Systems 4
- EECS 638 Fundamentals of Expert Systems 3
- EECS 644 Introduction to Digital Signal Processing 3
- EECS 649 Introduction to Artificial Intelligence 3
- EECS 660 Fundamentals of Computer Algorithms 3
- EECS 662 Programming Languages 3
- EECS 672 Introduction to Computer Graphics 3
- EECS 718 Graph Algorithms 3
- EECS 730 Introduction to Bioinformatics 3
- EECS 744 Communications and Radar Digital Signal Processing 3

### Mechanical Engineering (18)
- ME 311 Mechanics of Materials 3
- ME 312 Basic Engineering Thermodynamics 3
- ME 508 Numerical Analysis of Mechanical Engineering Problems 3
- ME 510 Fluid Mechanics 3
- ME 612 Heat Transfer 3
- ME 682 System Dynamics and Control Systems 3

### Curriculum & Instruction (9)
- C&T 360 Knowing and Learning in Mathematics and Science 3
- C&T 366 Classroom Interactions in Mathematics and Science 3
- C&T 460 Project Based Instruction in Mathematics and Science 3

**Notes:** A student using at least 2 statistics courses for the applied concentration must complete MATH 627 and MATH 628 (or MATH 727 and MATH 728) as a List A sequence. (MATH 627, MATH 628, MATH 727, and MATH 728 do not count for the applied concentration.) Courses used to satisfy the core requirements can also be used to complete List A and List B sequences. However, no course can be used for 2 List A or B sequences, and courses used for the Applied Concentration requirement cannot also be counted toward the 24 credit hours of advanced mathematics courses for the B.S. degree. Some courses satisfying the sequence requirements are taught infrequently. More advanced courses can be substituted for lower level courses in many cases. Consult the mathematics department for expected course offerings and substitutions.

Below is a sample 4-year plan for students pursuing the BS in Mathematics. To view the list of courses approved to fulfill KU Core Goals, please visit the KU Core website (http://kucore.ku.edu/courses).

This degree plan assumes students will have the equivalent of MATH 104 prior to the freshman year, fall semester.

### Freshman

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal 1.1 Critical Thinking</td>
<td>3 ENGL 102 (Goal 2.1 Written Communication, 2 Crs Required, BS Writing 2)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Goal 3 Natural Science</td>
<td>3 Goal 2.2 Oral Communication</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Lab Science (to complement Goal 3N) (BS Requirement)</td>
<td>1-2 EECS 138, 168, or 169 (BS Requirement)</td>
<td>3-4</td>
<td></td>
</tr>
<tr>
<td>ENGL 101 (Goal 2.1 Written Communication, 2 Crs Required, BS Writing 1)</td>
<td>3 MATH 126 (Major Requirement)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>MATH 125 (Goal 1.2 Quantitative Literacy, Major Requirement)</td>
<td>4 Elective (Total Hours)</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- 3-4 hours of advanced mathematics courses for the B.S. degree.
- Courses used to satisfy the core requirements can also be used to complete List A and List B sequences. However, no course can be used for 2 List A or B sequences, and courses used for the Applied Concentration requirement cannot also be counted toward the 24 credit hours of advanced mathematics courses for the B.S. degree.
- Some courses satisfying the sequence requirements are taught infrequently. More advanced courses can be substituted for lower level courses in many cases. Consult the mathematics department for expected course offerings and substitutions.

The University of Kansas

14-15 16-17
Sophomore

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
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<tbody>
<tr>
<td>Goal 3 Humanities</td>
<td>3</td>
<td>Goal 3 Social Science</td>
<td>3</td>
</tr>
<tr>
<td>Additional Natural Science (BS Requirement)</td>
<td>3</td>
<td>MATH 320, 220, or 221 (Major Requirement)</td>
<td>3</td>
</tr>
<tr>
<td>MATH 127 (Major Requirement)</td>
<td>4</td>
<td>Goal 4.1 US Diversity</td>
<td>3</td>
</tr>
<tr>
<td>MATH 290 (Major Requirement)</td>
<td>2</td>
<td>MATH 590 (Major Requirement)</td>
<td>3</td>
</tr>
<tr>
<td>Pre-requisite for Applied Concentration or Elective (Pre-requisite for Major Requirement, Total Hours)</td>
<td>3</td>
<td>Pre-requisite for Applied Concentration or Elective (Pre-requisite for Major Requirement, Total Hours)</td>
<td>3</td>
</tr>
</tbody>
</table>

| Total | 15 | 15 |

Junior

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal 4.2 Global Awareness</td>
<td>3</td>
<td>Goal 5 Social Responsibility &amp; Ethics</td>
<td>3</td>
</tr>
<tr>
<td>MATH 558 (Major Requirement)</td>
<td>3</td>
<td>MATH 500 (Major Requirement)</td>
<td>3</td>
</tr>
<tr>
<td>MATH Sequence Course 500+ (Major Requirement)</td>
<td>3</td>
<td>MATH Sequence Course 500+ (Major Requirement)</td>
<td>3</td>
</tr>
<tr>
<td>Applied Concentration Course (Major Requirement)</td>
<td>3</td>
<td>Applied Concentration Course (Major Requirement)</td>
<td>3</td>
</tr>
<tr>
<td>Elective (Total Hours)</td>
<td>3</td>
<td>Elective (Total Hours)</td>
<td>3</td>
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</tbody>
</table>

| Total | 15 | 15 |

Senior

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH Sequence Course 500+ (Major Requirement)</td>
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<td>MATH Sequence Course 500+ (Major Requirement)</td>
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<tr>
<td>Applied Concentration Course (Major Requirement)</td>
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<td>Elective (Total Hours)</td>
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</tr>
<tr>
<td>MATH Elective 450+ (Major Requirement)</td>
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</tr>
<tr>
<td>Elective (Total Hours)</td>
<td>3</td>
<td>Elective (Total Hours)</td>
<td>3</td>
</tr>
</tbody>
</table>

| Total | 15 | 15 |

Total Hours: 120-122

1. Students are required to select one 2-course sequence from List A and a second 2-course sequence from either List A or List B. Refer to the Degree Requirements tab for a list of courses that can fulfill this major requirement.

2. Students are required to complete a total of 24 credit hours of mathematics courses numbered MATH 450 and above.

3. The Applied Concentration consists of 3 courses, totaling at least 8 credit hours, that make significant use of mathematics. At least 2 courses must be in the same area. Courses from List C have been approved for this requirement. Refer to the Degree Requirements tab for a list of courses that can fulfill this major requirement.

4. Most courses that count for the Applied Concentration have one or more pre-requisites that may or may not apply to other degree requirements.

5. Students using MATH 627-MATH 628 as their List A sequence need not take MATH 526; MATH 526 is required for those not taking MATH 628 or MATH 728.

Please note:

All students in the College of Liberal Arts and Sciences are required to complete 120 total hours of which 45 hours must be at the Jr/Sr (300+) level.

The same course cannot be used to fulfill more than one KU Core Goal. However, overlap of a KU Core course with a major or degree-specific requirement is allowed. Overlapping is recommended to allow more opportunities to explore other majors and/or minors.

Departmental Honors

For undergraduate departmental honors, the student must satisfy the College requirements for honors, attain a grade-point average of 3.5 in all mathematics courses numbered 500 and above. The student must also complete two out of the following four sequences: MATH 727 and MATH 728; MATH 765 and MATH 766; MATH 781 and MATH 782; and MATH 790 and MATH 791, with a grade no lower than B- in each of these courses. The student must make a satisfactory oral presentation to the department, preferably on a topic related to his or her mathematics course work. Preparation should include enrollment in MATH 699 Directed Reading (for 1 or more credit hours) with a faculty mentor.