

MATHEMATICS, B.S.

Mathematics emphasizes careful reasoning, along with the analysis and solution of problems. Hence, a major or minor in mathematics will appeal to students who like to develop their skills in problem solving and analytical thinking. For this reason, mathematics is also an appropriate major for students planning careers in law or medicine.

Saint Louis University's mathematics program combines the features of both small and large schools to create a compelling educational experience. Students can expect a student-friendly environment, with the math courses for majors small in size and taught by regular faculty (calculus classes are capped at 30 students). Faculty get to know students and give individual advice. Students are recruited for participation in math contests and other opportunities.

Like a large school's program, math at SLU also has enough breadth to let students tailor their upper-division math courses to their interests and goals. Students interested in pure mathematics can choose theoretical courses that provide a solid preparation for graduate school. Since SLU has a graduate program in mathematics, exceptional undergraduate students have the opportunity to take graduate courses in mathematics. Students interested in applied mathematics (or science and engineering students interested in a second major in mathematics) can focus on a wide selection of applied courses. Students interested in statistics can select a variety of courses in statistics and probability theory. Students interested in secondary school teaching can select courses that fill the requirements of the major and of a teaching certificate at the same time.

Curriculum Overview

All students majoring in mathematics start with a basic core of five required mathematics courses, including calculus and linear algebra.

The B.S. degree in mathematics is designed to provide a strong grounding in mathematics for students considering graduate school in mathematics or a closely allied field. For the B.S. degree, the student builds on the basic core of required math courses with a selection of nine upper-division mathematics courses, chosen to include pure mathematics courses in real analysis and algebra, an upper-level statistics course, two completed upper-division sequences including one in pure mathematics, and electives to complete the required nine upper-division courses. Students must also take at least one course in computer programming and one course in another discipline that has a strong mathematical or computational component. The requirements for the B.S. in mathematics follow the recommendations of the Mathematics Association of America for degree programs in mathematics that prepare students for graduate work.

Fieldwork and Research Opportunities

The SLU Mathematics and Computer Science Club gives students interested in mathematics and computers a chance to explore relevant topics outside of the classroom. The club holds weekly meetings with activities such as game beta testing, dancing and coding.

Careers

Graduates in mathematics and statistics are versatile. They enter jobs in business, industry, medicine, government, and education. Mathematicians, statisticians, data scientists, actuaries, analysts and consultants are in high demand and this demand is growing, leading to rewarding and well compensated careers.

Many of our graduates pursue advanced degrees in mathematics, statistics, or other fields. Students with mathematics and statistics degrees are attractive to professional graduate schools in law, medicine, and business because these graduate programs value analytical skills and the ability to work in a problem solving environment.

Some of the industry and government employers where our graduates have found success include:

- Allstate
- Ameren
- Boeing
- Booz Allen Hamilton Consulting
- Boston Scientific
- Cofactor Genomics
- Georgia-Pacific
- Kemper Insurance
- MetLife
- National Geospatial-Intelligence Agency
- National Security Agency

Admission Requirements

Freshman

Begin your application for this program at www.slu.edu/apply. Saint Louis University also accepts the Common App.

All applications are thoroughly reviewed with the highest degree of individual care and consideration to all credentials that are submitted. Solid academic performance in college preparatory course work is a primary concern in reviewing a freshman applicant's file. College admission test scores (ACT or SAT) are used as an additional indicator of the student's ability to meet the academic rigors of Saint Louis University and are used as qualifiers for certain University scholarship programs. To be considered for admission to any Saint Louis University undergraduate program, the applicant must be graduating from an accredited high school or have an acceptable score on the General Education Development (GED) test.

Begin Your Application (<http://www.slu.edu/apply.php>)

Transfer

Begin your application for this program at www.slu.edu/apply.

Applicants must be a graduate of an accredited high school or have an acceptable score on the GED. An official high school transcript and official test scores are required only of those students who have attempted fewer than 24 transferable semester credits (or 30 quarter credits) of college credit. Those having completed 24 or more of college credit need only submit a transcript from previously attended college(s). In reviewing a transfer applicant's file, the office of admission holistically examines the student's academic performance in college-level coursework as an indicator of the student's ability to meet the academic rigors of Saint Louis University.

International Applicants

Begin your application for this program at www.slu.edu/apply.

All admission policies and requirements for domestic students apply to international students along with the following:

- Demonstrate English Language Proficiency (<http://catalog.slu.edu/academic-policies/office-admission/undergraduate/english-language-proficiency>)
- Proof of financial support must include:
 - A letter of financial support from the person(s) or sponsoring agency funding the time at Saint Louis University
 - A letter from the sponsor's bank verifying that the funds are available and will be so for the duration of study at the University
- Academic records, in English translation, of students who have undertaken postsecondary studies outside the United States must include the courses taken and/or lectures attended, practical laboratory work, the maximum and minimum grades attainable, the grades earned or the results of all end-of-term examinations, and any honors or degrees received. WES and ECE transcripts are accepted.

Scholarships and Financial Aid

There are two principal ways to help finance a Saint Louis University education:

- Scholarships: awarded based on academic achievement, service, leadership and financial need.
- Financial Aid: provided in the form of grants and loans, some of which require repayment.

For priority consideration for merit-based scholarships, applicants should apply for admission by Dec. 1 and complete a Free Application for Federal Student Aid (FAFSA) by March 1.

For information on other scholarships and financial aid, visit the student financial services office online at <https://finaid.slu.edu>.

Learning Outcomes

1. Graduates will be able to demonstrate the ability to solve a variety of mathematical problems.
2. Graduates will be able to demonstrate an ability to recall important mathematical definitions and results (for example, theorems).
3. Graduates will be able to demonstrate an ability to apply mathematical reasoning, including formulating definitions.
4. Graduates will be able to demonstrate an ability to apply the methods of direct and indirect proof.
5. Graduates will be able to demonstrate an ability to communicate mathematical ideas and concepts clearly in written problem solutions.
6. Graduates will be able to demonstrate an ability to perform statistical analyses.
7. Graduates will be able to demonstrate an ability to write computer programs to analyze data and perform calculations.

Requirements

Mathematics students must complete a minimum total of **51 credit hours** for the major.

| Code | Title | Credits |
|---|-------|---------|
| Core Requirements | | |
| College core requirements (p. 3) | | 54-63 |
| For additional information about core courses (http://catalog.slu.edu/colleges-schools/arts-sciences/#coretext) | | |
| Mathematics Required Courses | | |

| | | |
|-----------|--------------------------------|---|
| MATH 1510 | Calculus I | 4 |
| MATH 1520 | Calculus II | 4 |
| MATH 2530 | Calculus III ¹ | 4 |
| MATH 2660 | Principles of Mathematics | 3 |
| MATH 3120 | Introduction to Linear Algebra | 3 |

Computer Programming Requirement

| | | |
|-----------|--|-----|
| CSCI 1060 | Introduction to Computer Science: Scientific Programming | 3-4 |
| | or CSCI 1300 Introduction to Object-Oriented Programming | |

Upper Division Requirements

Students then take an additional nine upper division mathematics courses, and an allied elective meeting the distribution requirements below. A 2.00 or "C" GPA is required in upper division mathematics courses counting toward the major.

Pure Mathematics Requirements

| | | |
|-----------|----------------------------------|---|
| MATH 4110 | Introduction to Abstract Algebra | 3 |
| MATH 4120 | Linear Algebra | 3 |

Statistics Requirement

| | | |
|-----------|--------------------------|---|
| MATH 3850 | Foundation of Statistics | 3 |
|-----------|--------------------------|---|

Sequence Requirement

Students must complete two sequences, one of which must be either the Algebra sequence or the analysis sequence. 6

Differential Equations Sequence

| | | |
|-----------|------------------------|--|
| MATH 3550 | Differential Equations | |
|-----------|------------------------|--|

And one of the following:

| | | |
|-----------|--|--|
| MATH 4550 | Nonlinear Dynamics and Chaos | |
| | or MATH 457 Partial Differential Equations | |

Statistics Sequence

| | | |
|-----------|--------------------------|--|
| MATH 3850 | Foundation of Statistics | |
|-----------|--------------------------|--|

And one of the following:

| | | |
|-----------|--------------------------------|--|
| STAT 4800 | Probability Theory | |
| | or STAT 484 Time Series | |
| | or STAT 487 Applied Regression | |

Algebra Sequence

| | | |
|-----------|----------------------------------|--|
| MATH 4110 | Introduction to Abstract Algebra | |
|-----------|----------------------------------|--|

And one of the following:

| | | |
|-----------|---------------------------|--|
| MATH 4120 | Linear Algebra | |
| | or MATH 414 Number Theory | |

Analysis Sequence

| | | |
|-----------|--------------------------|--|
| MATH 4210 | Introduction to Analysis | |
|-----------|--------------------------|--|

And one of the following:

| | | |
|-----------|------------------------------------|--|
| MATH 4220 | Metric Spaces | |
| | or MATH 424 Multivariable Analysis | |

Complex Analysis Sequence

| | | |
|-----------|-----------------------------------|--|
| MATH 4310 | Introduction to Complex Variables | |
|-----------|-----------------------------------|--|

And one of the following:

| | | |
|-----------|--------------------------------|--|
| MATH 4320 | Complex Variables II | |
| | or MATH 434 Geometric Topology | |

Upper Division Mathematics Elective Courses

| | |
|---|----|
| 3000 or 4000-level mathematics electives ² | 12 |
|---|----|

Allied Elective

An additional course in another discipline that has a strong mathematical or computational component. This course cannot be used to satisfy any of the other requirements for a B.S. degree. A list of approved courses that satisfy this requirement is provided below:

| | | |
|--|--------------------------------------|-----|
| BIOL 4030 | Introduction to Genomics | 3-4 |
| CHEM 4300 | Mathematical Techniques in Chemistry | |
| Any 3 or 4-credit CSCI course other than the one used to satisfy the programming requirement for the B.S. in mathematics. | | |
| EAS 3330 | Physical Meteorology I | |
| or EAS 3500 Numerical Modeling Applications | | |
| Any 3000 or 4000 level ECON course (paying attention to prerequisites). ³ | | |
| PHIL 4080 | Advanced Symbolic Logic ⁴ | |
| Any 3 or 4-credit PHYS course numbered 1610 or higher, not already counting for the B.S. core requirement in laboratory sciences. ⁵ | | |
| Any 3 or 4-credit course in Engineering ^{6,7} | | |

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|--------------------------|--|------|
| General Electives | | 4-15 |
| Total Credits | | 120 |

- ¹ Calculus III Must be taken at Saint Louis University with minimum grade of "C-"
- ² Except for MATH 3270 Advanced Mathematics for Engineers and MATH 4050 History of Mathematics
- ³ Excluding ECON 3010 Introduction to Econometrics
- ⁴ Noting that PHIL 4040 Symbolic Logic is its prerequisite
- ⁵ PHYS 1610 Engineering Physics I should not be taken for credit if the student already has taken PHYS 1310 Physics I or its equivalent for credit.
- ⁶ That has at least MATH 1510 Calculus I or PHYS 1610 Engineering Physics I as a prerequisite (paying attention to other prerequisites)
- ⁷ AENG 2000 Intro to Aeronautics & Astron (or a higher numbered course with AENG 2000 Intro to Aeronautics & Astron in the prerequisite sequence), BME 3100 Signals, BME 3200 Mechanics, BME 3300 Transport Fundamentals, ECE 3140 Electromagnetic Fields, ECE 3150 Linear Systems, ECE 4120 Automatic Control Systems, ECE 4151 Digital Signal Processing, ECE 4153 Image Processing, ESCI 2150 Dynamics, ESCI 2300 Thermodynamics (or a higher numbered ESCI courses with at least one of ESCI 2100-2200 in the prerequisite sequence), and MENG 2000 Foundation to Engineering Design.

Continuation Standards

Students must have a minimum of a 2.00 cumulative GPA in their mathematics major or minor courses by the conclusion of their sophomore year, must maintain a minimum of 2.00 cumulative GPA in these courses at the conclusion of each semester thereafter, and must be registered in at least one mathematics course counting toward their major or minor in each academic year (until all requirements are completed).

Bachelor of Science Core Curriculum Requirements

| Code | Title | Credits |
|--|-------|---------|
| Core Components and Credits | | |
| Foundations of Discourse (http://catalog.slu.edu/colleges-schools/arts-sciences/bs-core/foundations-discourse) | | 3 |

| | |
|---|--------------|
| Diversity in the U.S. (http://catalog.slu.edu/colleges-schools/arts-sciences/bs-core/cultural-diversity) | 3 |
| Global Citizenship (http://catalog.slu.edu/colleges-schools/arts-sciences/bs-core/global-citizenship) | 3 |
| Foreign Language (http://catalog.slu.edu/colleges-schools/arts-sciences/bs-core/foreign-language) | 0-9 |
| Fine Arts (http://catalog.slu.edu/colleges-schools/arts-sciences/bs-core/fine-arts) | 3 |
| Literature (http://catalog.slu.edu/colleges-schools/arts-sciences/bs-core/literature) | 6 |
| Mathematics (http://catalog.slu.edu/colleges-schools/arts-sciences/bs-core/mathematics) | 4 |
| Science (http://catalog.slu.edu/colleges-schools/arts-sciences/bs-core/sciences) | 8 |
| Philosophy (http://catalog.slu.edu/colleges-schools/arts-sciences/bs-core/philosophy) | 6 |
| Social Science (http://catalog.slu.edu/colleges-schools/arts-sciences/bs-core/social-science) | 6 |
| Theology (http://catalog.slu.edu/colleges-schools/arts-sciences/bs-core/theology) | 6 |
| World History (http://catalog.slu.edu/colleges-schools/arts-sciences/bs-core/world-history) | 6 |
| Total Credits | 54-63 |

Graduation Requirements

- Complete a minimum of 120 credits (excluding pre-college level courses [numbered below 1000]).
- Complete either the College of Arts and Sciences Bachelor of Arts or Bachelor of Science Core Curriculum Requirements
- Complete Major Requirements: minimum 30 credits required.
- Complete remaining credits with a second major, minor, certificate, and/or elective credits to reach the minimum of 120 credits required for graduation.
- Achieve at least a 2.00 cumulative grade point average, a 2.00 grade point average in the major(s) and a 2.00 grade point average in the minor/certificate, or related elective credits.
- Complete Dept/Program specific academic and performance requirements.
- Complete at least 50% of the coursework for the major and 75% for the minor/certificate through Saint Louis University or an approved study abroad program.
- Complete 30 of the final 36 credits through Saint Louis University or an approved study abroad program.
- Complete an online degree application by the required University deadline.

Roadmap

Roadmaps are recommended semester-by-semester plans of study for programs and assume full-time enrollment unless otherwise noted.

Courses and milestones designated as critical (marked with !) must be completed in the semester listed to ensure a timely graduation. Transfer credit may change the roadmap.

This roadmap should not be used in the place of regular academic advising appointments. All students are encouraged to meet with their advisor/mentor each semester. Requirements, course availability and sequencing are subject to change.

| Course | Title | Credits |
|---|----------------------------------|---------|
| Year One | | |
| Fall | | |
| MATH 1510 | Calculus I | 4 |
| UNIV 1010 | Enhancing First-Year Success | 1 |
| A&S Core | | 3 |
| A&S Core | | 3 |
| A&S Core | | 3 |
| Credits | | 14 |
| Spring | | |
| MATH 1520 | Calculus II | 4 |
| Programming Course ¹ | | 3-4 |
| A&S Core | | 3 |
| A&S Core | | 3 |
| Elective (if needed) | | 3 |
| Credits | | 16-17 |
| Year Two | | |
| Fall | | |
| MATH 2530 | Calculus III | 4 |
| MATH 2660 | Principles of Mathematics | 3 |
| A&S Core | | 3 |
| A&S Core | | 3 |
| A&S Core | | 3 |
| Credits | | 16 |
| Spring | | |
| MATH 3120 | Introduction to Linear Algebra | 3 |
| MATH/STAT 3850 | Foundation of Statistics | 3 |
| A&S Core | | 3 |
| A&S Core | | 3 |
| Elective (if needed) | | 3 |
| Credits | | 15 |
| Year Three | | |
| Fall | | |
| MATH 4110 | Introduction to Abstract Algebra | 3 |
| Mathematics or Statistics Elective ² | | 3 |
| A&S Core | | 3 |
| A&S Core | | 3 |
| Elective (if needed) | | 3 |
| Credits | | 15 |
| Spring | | |
| Pure Mathematics Elective ³ | | 3 |
| Mathematics or Statistics Elective ² | | 3 |
| A&S Core | | 3 |
| A&S Core | | 3 |
| A&S Core | | 3 |
| Credits | | 15 |
| Year Four | | |
| Fall | | |
| Mathematics or Statistics Sequence ⁴ | | 3 |
| MATH 4210 | Introduction to Analysis | 3 |
| Allied Elective ⁵ | | 3 |

| | | |
|---|---|---------|
| A&S Core | 3 | |
| Elective (if needed) | 3 | |
| Credits | | 15 |
| Spring | | |
| Mathematics or Statistics Sequence ⁴ | 3 | |
| Mathematics or Statistics Elective ² | 3 | |
| A&S Core | 3 | |
| Elective (if needed) | 3 | |
| Elective (if needed) | 3 | |
| Credits | | 15 |
| Total Credits | | 121-122 |

¹ See note below about the Programming Requirement.

² See note below about Mathematics and Statistics Electives.

³ See note below about the Pure Mathematics Sequence Requirement.

⁴ See note below about Mathematics and Statistics Sequences.

⁵ See note below about Allied Electives.

Program Notes

Programming Requirement

CSCI 1060 Introduction to Computer Science: Scientific Programming (3 cr) or CSCI 1300 Introduction to Object-Oriented Programming (4 cr) (with attention paid to prerequisites)

Mathematics and Statistics Elective

Any 3000- or 4000-level MATH or STAT course numbered higher than MATH 3120 Introduction to Linear Algebra (3 cr).

Pure Mathematics Sequence

Students can satisfy the pure mathematics sequence requirement by completing either the Algebra Sequence or Real Analysis sequence, as defined below.

Mathematics and Statistics Sequences

Students must complete a second sequence in addition to the pure mathematics sequence, chosen from the following list.

- Algebra Sequence:** MATH 4110 Introduction to Abstract Algebra (3 cr) and either MATH 4120 Linear Algebra (3 cr) or MATH 4150 Number Theory (3 cr).
- Complex Analysis Sequence:** MATH 4310 Introduction to Complex Variables (3 cr) and either MATH 4320 Complex Variables II (3 cr) or MATH 4360 Geometric Topology (3 cr).
- Differential Equations Sequence:** MATH 3550 Differential Equations (3 cr) and either MATH 4550 Nonlinear Dynamics and Chaos (3 cr) or MATH 4570 Partial Differential Equations (3 cr).
- Real Analysis Sequence:** MATH 4210 Introduction to Analysis (3 cr) and one of either MATH 4220 Metric Spaces (3 cr) or MATH 4230 Multivariable Analysis (3 cr).
- Statistics Sequence:** MATH 3850 Foundation of Statistics (3 cr)/STAT 3850 Foundation of Statistics (3 cr) and one of: MATH 4800 Probability Theory (3 cr)/STAT 4800 Probability Theory (3 cr), MATH 4840 Time Series (3 cr)/STAT 4840 Time Series (3 cr), or MATH 4870 Applied Regression (3 cr)/STAT 4870 Applied Regression (3 cr).

Allied Elective

A course in another discipline that has a strong mathematical or computational component. Appropriate courses are available in

computer science, economics, physics and other science and engineering disciplines. This course cannot be used to satisfy any of the other requirements for a B.S. degree. See Course Catalog for a list and description of acceptable courses