

# MATHEMATICS

St. Catherine University's mathematical sciences department offers majors in mathematics as well as minors in mathematics, statistics, and computer science.

Mathematics majors are provided with a broad background in theoretical and applied mathematics and computer science. Students will gain the knowledge they need for graduate work or to pursue a variety of careers in such areas as business, industry, service, or education. When combined with other disciplines, the mathematics major prepares students for entry into many graduate school programs, including mathematics, MBA, econometrics, law, computer science, operations research, biostatistics, medical school, etc.

Students may pursue a computer science major through an agreement with the Associated Colleges of the Twin Cities (<http://catalog.stkate.edu/undergraduate/special-academic-programs/associated-colleges-twin-cities/>), details to be found in the Special Academic Programs section of this catalog.

## Major

- Mathematics - BA (<http://catalog.stkate.edu/undergraduate/humanities-arts-sciences/mathematics/mathematics-ba/>)
- Mathematics - BS (<http://catalog.stkate.edu/undergraduate/humanities-arts-sciences/mathematics/mathematics-bs/>)

## Minors

- Computer Science - Minor (<http://catalog.stkate.edu/undergraduate/humanities-arts-sciences/mathematics/computer-science-minor/>)
- Mathematics - Minor (<http://catalog.stkate.edu/undergraduate/humanities-arts-sciences/mathematics/mathematics-minor/>)
- Statistics - Minor (<http://catalog.stkate.edu/undergraduate/humanities-arts-sciences/mathematics/statistics-minor/>)

### CSCI 1110 Algorithms and Computer Programming I with Lab – 4 credits

This course is an introduction to the perspectives and methods of computer science. Students learn to develop algorithms, which are step-by-step procedures for accomplishing a task. Students translate these algorithms into a programming language (Python), utilizing common programming structures such as variables, functions, loops, control flow, basic data structures, classes, and a brief introduction to object-oriented programming. Offered in the College for Women.

**Prerequisite:** The mathematical level is Algebra II and some Trigonometry or an appropriate math placement score.

### CSCI 1120 Algorithms and Computer Programming II with Lab – 4 credits

This course is a continuation of Algorithms and Computer Programming I. Special emphasis will be placed on current software practices, such as object-oriented programming, as well as on the building blocks of software design: abstraction, decomposition, and encapsulation. Programming projects will include graphics, games, simulations, and mobile applications.

**Prerequisite:** A grade of C or better in CSCI 1110. NOTE: If you transferred CSCI 1110 to St. Catherine University and the course did not include Java or object-oriented programming techniques, you must learn them before enrolling in CSCI 1120.

### CSCI 4954 Independent Study – 4 credits

Independent study offers students the opportunity for specialized research not covered in a course offering, by the action project or thesis. Students work with a faculty advisor to develop a learning contract, which specifies the content and objectives of the study as well as the requirements and procedures for evaluation. The amount of credit earned for the study also is included in the learning contract.

**Prerequisites:** Permission of the faculty and department chair or program director.

### MATH 1010 Mathematical Skills for Quantitative Reasoning with Lab – 2 credits

This preparatory course is designed to help students refresh and strengthen mathematical concepts and problem-solving skills for use within the context of other courses, such as chemistry, physics, economics and statistics. Successful completion of MATH 1010 ensures placement into MATH 1050, MATH 2500, ECON 1080, ECON 1090, PSYC 1090, STAT 1090, CHEM 1010, and CHEM 1110. Offered every semester. Offered in the College for Women and the College for Adults.

### MATH 1050 Mathematical Ideas in Contemporary Society – 4 credits

This course offers an examination of mathematical ideas and insights that permeate society and influence modern thinking. The course topics derive from areas including decision making, geometry and measurement, statistics and data analysis, and management science. Other topics may be included depending on current interests of instructor and students. Offered every semester. Offered in the College for Women. MATH 1050 does not serve as a preparation for any other mathematics course.

### MATH 1089 Precalculus with Corequisite – 4 credits

Analytical treatment of the elementary functions emphasizing the exponential, logarithmic, and trigonometric functions and their graphs. This course is intended as preparation for calculus with supplemental review of intermediate algebra material included. Offered every fall semester. **Prerequisites:** High school higher algebra and appropriate level on mathematics/statistics placement assessment.

### MATH 1090 Precalculus – 4 credits

Analytical treatment of the elementary functions emphasizing the exponential, logarithmic and trigonometric functions and their graphs. This course is intended as preparation for calculus. Offered every semester. Offered in the College for Women.

**Prerequisites:** High school higher algebra and appropriate level on mathematics/statistics placement assessment.

### MATH 1130 Calculus I – 4 credits

This course covers limits, derivatives and integrals of functions of one real variable and applications. Offered every semester. Offered in the College for Women.

**Prerequisite:** appropriate level on calculus and trigonometry placement assessments; or appropriate level on ACT math score, SAT math score, or a grade of at least C in MATH 1090.

### MATH 1140 Calculus II – 4 credits

This course involves techniques of integration; applications of integration; infinite series; L'Hopital's rule and improper integrals. Offered every semester. Offered in the College for Women.

**Prerequisite:** A grade of C or better in MATH 1130.

**MATH 1800 Discrete Mathematics – 4 credits**

Discrete mathematics studies finite collections of distinct, separate objects and is complementary to calculus (which studies continuous phenomena). Topics include logic and sets, properties of the integers (divisibility, congruence), mathematical induction, the binomial theorem, discrete probability, and combinatorics. Applications will include topics in computer science, statistics, and the theory of games.

**Prerequisite:** Appropriate level on mathematics/statistics placement assessment or ACT math score, or minimum grade of C in MATH 1090.

**MATH 2050 Linear Algebra – 4 credits**

The course covers vectors and vector spaces; matrices, determinants, systems of linear equations; linear transformations; characteristic vectors; and linear programming. Offered annually. Offered in the College for Women.

**Prerequisite:** MATH 1130 or permission of instructor.

**MATH 2060 Calculus III – 4 credits**

This course covers vectors and analytic geometry of three dimensions; functions of several real variables; partial derivatives; and multiple integrals. Offered annually. Offered in the College for Women.

**Prerequisite:** MATH 1140.

**MATH 2500 Mathematical Structures – 4 credits**

This course covers the real number system and its operations; patterns and relations, number sense, and number theory; and space and shape, data collection, randomness and uncertainty, with a special emphasis on problem solving and communication. This course is designed to fulfill the Minnesota Board of Teaching's requirements for grades K-6 teachers of mathematics for elementary education majors. Does not fulfill liberal arts core requirement in mathematics/statistics. Offered every spring semester. Offered in the College for Women and the College for Adults.

**Prerequisites:** High school higher algebra and appropriate level on mathematics/statistics placement assessment or ACT math score.

**MATH 2600 Differential Equations – 4 credits**

This course involves methods for solving first order and linear equations; solution of linear systems and power series solutions; introduction to the Laplace transform; and approximation methods and application of differential equations. This course satisfies the Continuous-focused requirement for math majors. Offered alternate years. Offered in the College for Women.

**Prerequisite:** MATH 1140.

**Prerequisite with concurrency:** MATH 2050.

**MATH 2682 Directed Study – 2 credits**

Directed study is provided for students whose unusual circumstances prohibit taking a regularly scheduled course but who need the material of that course to satisfy a requirement. Availability of this faculty-directed learning experience depends on faculty time and may be limited in any given term and restricted to certain courses.

**Prerequisites:** Faculty, department chair and dean approval.

**MATH 2684 Directed Study – 4 credits**

Directed study is provided for students whose unusual circumstances prohibit taking a regularly scheduled course but who need the material of that course to satisfy a requirement. Availability of this faculty-directed learning experience depends on faculty time and may be limited in any given term and restricted to certain courses. For declared mathematics majors only.

**Prerequisites:** Faculty, department chair and dean approval.

**MATH 2850 Sophomore Seminar for Mathematics Majors – 2 credits**

This course will introduce students to the study of mathematical papers and writings in seminar format, involving student-led discussions. There is an emphasis on learning how to read and write mathematics in a cooperative environment. It requires the production and presentation of papers on seminar topics and emphasizes writing as a process.

The emphasis is on the introduction and practice of skills that will be demonstrated in Senior Seminar. Together with MATH 4850W, this fulfills the WI requirement in the major. Offered fall semester. Offered in the College for Women.

**Prerequisite:** MATH 1130.

**MATH 2994 Topics – 4 credits**

The subject matter of the course is announced in the annual schedule of classes. Content varies from year to year but does not duplicate existing courses. Offered in the College for Women.

**MATH 3010 Abstract Algebra – 4 credits**

This course covers the properties of sets, relations, and mappings and an introduction to groups, rings, and fields. This course satisfies both the discrete-focused and proof-focused requirements for math majors. Offered in alternate years. Offered in the College for Women.

**Prerequisites:** MATH 1800, MATH 2050.

**MATH 3130 Probability – 4 credits**

This course involves probability theory in discrete and continuous sample spaces; random variables and distribution functions and moments; the moment-generating function, functions of random variables, the law of large numbers, and the central limit theorem. This course satisfies both the Continuous-focused and discrete-focused requirements for math majors. Offered in alternate years. Offered in the College for Women.

**Prerequisites:** MATH 1800, MATH 2060.

**MATH 3140 Mathematical Statistics – 4 credits**

This course involves random sampling and sampling distributions. It also covers the theory of statistical estimation, criteria, and methods of point and interval estimation; theory of testing statistical hypotheses; regression, and analysis of variance. This course satisfies the Continuous-focused requirement for math majors. Offered alternate years. Offered in the College for Women.

**Prerequisite:** MATH 3130.

**MATH 4682 Directed Study – 2 credits**

Directed study is provided for students whose unusual circumstances prohibit taking a regularly scheduled course but who need the material of that course to satisfy a requirement. Availability of this faculty-directed learning experience depends on faculty time and may be limited in any given term and restricted to certain courses. For declared mathematics majors only.

**Prerequisites:** Faculty, department chair and dean approval.

**MATH 4684 Directed Study – 4 credits**

Directed study is provided for students whose unusual circumstances prohibit taking a regularly scheduled course but who need the material of that course to satisfy a requirement. Availability of this faculty-directed learning experience depends on faculty time and may be limited in any given term and restricted to certain courses. For declared mathematics majors only.

**Prerequisites:** Faculty, department chair and dean approval.

**MATH 4850W Senior Seminar – 2 credits**

Study of mathematical papers and writings in seminar format, involving student-led discussions. Emphasis on reading and writing mathematics in a cooperative environment. Production and presentation of paper on seminar topic. Offered yearly as needed.

**Prerequisites:** MATH 2850, Senior status or permission of department chair.

**MATH 4954 Independent Study – 4 credits**

Independent study offers students the opportunity for specialized research not covered in a course offering, by the action project or thesis. Students work with a faculty advisor to develop a learning contract, which specifies the content and objectives of the study as well as the requirements and procedures for evaluation. The amount of credit earned for the study also is included in the learning contract.

**Prerequisites:** Permission of the faculty and department chair or program director.

**MATH 4994 Topics – 4 credits**

The subject matter of the course is announced in the annual schedule of classes. Content varies from year to year but does not duplicate existing courses. Possible topics include Real Analysis, Number Theory, Mathematical Logic, History of Mathematics, Topology, Complex Variables. Students are invited to suggest topics.

**STAT 1089 Statistical Analysis with Corequisite – 5 credits**

This course is a co-requisite course. This means that in addition to learning statistical concepts four days a week, a fifth day of course contact is designed to help students refresh and strengthen mathematical concepts and problem-solving skills for use within the context of statistics. With regard to statistical content, the course includes the following: introduction to fundamental uses and misuses of statistics; exploratory data analysis, regression and correlation, uncertainty and randomness, intuitive probability, one- and two-sample inference, one-way analysis of variance, interpretation and communication of results. Use of computers integrated throughout course. Offered every semester. Credit is given for only one of the following courses: ECON 1080, ECON 1090, HLTH 1090, STAT 1089, STAT 1090, or PSYC 1090.

**STAT 1090 Statistical Analysis – 4 credits**

This course is an introduction to fundamental uses and misuses of statistics. Exploratory data analysis, regression and correlation, uncertainty and randomness, intuitive probability, one- and two-sample inference, one-way analysis of variance, interpretation and communication of results are all involved. Use of computers is integrated throughout course. Offered every semester. Offered in the College for Women. Credit is given for only one of the following courses: ECON 1080, ECON 1090, HLTH 1090, STAT 1089, STAT 1090, or PSYC 1090.

**STAT 2090 Statistical Modeling – 4 credits**

This course is focused on using technology to perform statistical analyses. The techniques covered in this course will include linear and logistic regression, classification analysis, bootstrapping and resampling methods, multivariate model selection, clustering, and unsupervised machine learning. The course will also have an emphasis in data processing and visualization in the statistical programming language R.

**Prerequisite:** STAT 1090 or equivalent. Offered in the College for Women.

**STAT 2684 Directed Study – 4 credits**

Directed study is provided for students whose unusual circumstances prohibit taking a regularly scheduled course but who need the material of that course to satisfy a requirement. Availability of this faculty-directed learning experience depends on faculty time and may be limited in any given term and restricted to certain courses.

**Prerequisites:** Faculty, department chair and dean approval.

**STAT 2994 Topics – 4 credits**

The subject matter of the course is announced in the annual schedule of classes. Content varies from year to year but does not duplicate existing courses. Offered in the College for Women.

**STAT 3090 Predictive Analysis – 4 credits**

This course is focused on using technology to perform statistical analyses. The techniques covered in this course will include linear and logistic regression, classification analysis, bootstrapping and resampling methods, multivariate model selection, clustering, and unsupervised machine learning. The course will also have an emphasis in data processing and visualization in the statistical programming language R.

**Prerequisite:** STAT 1090 or equivalent. Offered in the College for Women.

**STAT 4602 Internship – 2 credits**

Structured out-of-class learning experience that takes place on or off campus and includes a substantial work component. An internship involves students in a particular profession in an exploratory way to test career interests and potential. To initiate an internship experience, meet with the internship coordinator in the Career Development Office.

**Prerequisites:** Faculty sponsorship and approval by department chair.

**STAT 4684 Directed Study – 4 credits**

Directed study is provided for students whose unusual circumstances prohibit taking a regularly scheduled course but who need the material of that course to satisfy a requirement. Availability of this faculty-directed learning experience depends on faculty time and may be limited in any given term and restricted to certain courses.

**Prerequisites:** Faculty, department chair and dean approval.

**STAT 4994 Topics – 4 credits**

The subject matter of the course is announced in the annual schedule of classes. Content varies from year to year but does not duplicate existing courses. Offered in the College for Women.