# MATHEMATICS (MATH)

**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**
This course covers mathematical induction, introduction to logical reasoning and set theory, including relations and functions; enumeration techniques, generating functions, recurrence relations; graphs and trees; and applications to computer and decision sciences. This course satisfies the Discrete-focused requirement for math majors. Offered annually. Offered in the College for Women.
**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 2510 Mathematics For Middle School Teachers — 4 credits**
This course covers number sense; space, shape and measurement; data investigations; randomness and uncertainty; patterns, relations and functions; and discrete mathematics with applications to middle school mathematics. It is for students seeking a mathematics middle level endorsement. Does not fulfill the liberal arts core requirement in mathematics/statistics. Also offered in Evening/Weekend/Online program as a hybrid course.
**Prerequisite:** MATH 2500.

**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 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 3250 Geometry — 4 credits**
This course covers axioms for geometries, geometrical transformations, and their invariants and non-Euclidean geometries. This course satisfies both the discrete-focused and proof-focused requirements for math majors. Offered in the College for Women.
**Prerequisite:** MATH 2050.

**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 4952 Independent Study — 2 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 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.