

MATHEMATICS

Greenquist 344 • 262-595-2326 • Keyword: *Mathematics*

Degree Offered:

Bachelor of Science.

Professors:

Beneish, Ph.D.; Lichtman, Ph.D. (Chair)

Senior Lecturers:

Kohneh, B.S., Widup, B.A.

Professional Accreditations or Memberships:

American Mathematical Society

Student Organizations/Clubs:

Math Club: Pi Mu Epsilon (Wisconsin Gamma Chapter)

Career Possibilities:

The future outlook for careers in mathematics remains promising, especially for those who combine their training with other specialties. A degree in mathematics with supporting work in computer science, business or economics will increase employment opportunities.

Department Overview

Mathematics is of central importance in the sciences. In fact, mathematics has been called the language of science. This applies not only to the physical and biological sciences but increasingly to the social, managerial and behavioral sciences as well. Much of mathematics has been developed to meet the needs of the areas of human knowledge that it serves. In addition to its service role in other areas, mathematics occupies a place of its own in our intellectual heritage. From ancient Greece to our own times, people have been drawn to the elegant structure and the fascinating problems of mathematics.

Requirements for the Mathematics Major (40-44 credits)

The major in mathematics includes options in pure and applied mathematics and teaching mathematics in middle childhood through early adolescence. Students should declare their mathematics major before their sophomore year. Upon declaring a major in mathematics, students must consult with a mathematics adviser to set up a program of study.

At least 15 credits of upper-level courses in the major must be completed at UW-Parkside. Students may satisfy a mathematics major by completing the mathematics core and one of the following options or, upon consultation with

a mathematics adviser, by developing programs to suit their special needs, subject to the written approval of the Mathematics Department. The following options are minimal, and students are encouraged to elect additional advanced mathematics courses.

Mathematics Core (24 credits)

These courses provide the background concepts and techniques required in upper-level mathematics offerings.

MATH 221	Calculus and Analytic Geometry I	5 cr
MATH 222	Calculus and Analytic Geometry II	5 cr
MATH 223	Calculus and Analytic Geometry III.....	5 cr
MATH 301	Linear Algebra	4 cr
PHYS 201	General Physics I.....	5 cr

General Mathematics Option (15-20 credits)

This sequence of courses leads to an undergraduate mathematics major covering the principal areas of modern mathematics. It is recommended for students planning to study mathematics in graduate school. Students in this program are required to take all of the courses in the Mathematics Core together with those listed below. They are also encouraged to broaden their mathematics background by electing additional advanced courses.

MATH 350	Advanced Calculus	4 cr
OR		
MATH 451	Topology	3 cr

Electives:

At least two additional courses from MATH 310, 317, 361, 367, and at least two additional courses from the 400 level.

Applied Mathematics Option (19 credits)

This sequence of courses is intended for those students who are interested in mathematics and the application of mathematics. Students in this program are required to take all of the courses in the mathematics core together with those listed below. They are also encouraged to broaden their mathematics background by electing additional advanced courses.

MATH 310	Advanced Probability Theory and Statistics	4 cr
MATH 317	Differential Equations and their Applications.....	4 cr
MATH 350	Advanced Calculus	4 cr
MATH 368	Mathematical Modeling	3 cr
Elective:		
MATH 423	Complex Analysis.....	4 cr
or		
MATH 441	Abstract Algebra	4 cr

Mathematics with a Second Major

Students are encouraged to consider combining a major in mathematics with a major in a related area, such as computer science, behavioral science, a physical science, business or economics. This has the advantage of enhancing the understanding of two allied areas, as well as improving the prospects for employment after graduation. Students with a second major may, with the consent of their mathematics adviser, make substitutions for the Physics 201 requirement in the mathematics core. For example, mathematics-business management double majors may request substitution consisting of at least 5 credits of quantitative business management courses which use a substantial amount of mathematics.

Mathematics/Computer Science Double Major

The mathematics/computer science double major has been specifically designed for students with interests in both areas. This double major emphasizes the companionship between computer science and mathematics and gives students a particularly strong theoretical background in addition to a wide variety of applications. A complete description of the double major requirements may be found in the computer science catalog section.

Requirements for the Mathematics Minor (25-27 credits)

To earn a mathematics minor students must complete a minimum of 25 credits in mathematics by completing the four required courses and at least two other upper level courses, one of which must be at the 400 level.

Required courses:

MATH 221	Calculus and Analytic Geometry I	5 cr
MATH 222	Calculus and Analytic Geometry II	5 cr
MATH 223	Calculus and Analytic Geometry III.....	5 cr
MATH 301	Linear Algebra	4 cr

High School Preparation

Students entering a degree program at UW-Parkside should have taken at least three years of high school mathematics including ninth-grade algebra, 10th-grade geometry and 11th-grade advanced algebra and trigonometry. Students intending to take college-level mathematics courses are encouraged to strengthen their preparation by taking 12th-grade pre-calculus. ACSK A010, A015 and MATH 111 are not replacements for high school mathematics courses.

Computational Skills Requirement

Students satisfy this requirement with the completion of either MATH 102 for 3 credits or MATH 111 for 4 credits (with a grade of C-minus or better).

Students are exempt from the requirement if their placement results (based on ACT scores or Wisconsin Placement Test) are above MATH 102 or MATH 111. Students must complete computational skills within their first 60 academic credits. Students seeking teacher licensure must complete the course that satisfies this requirement with a grade of C or better.

Mathematics Placement Examination

Mathematics Placement is by ACT mathematics scores. It is possible as well to take a placement test administered by the Learning Assistance Center. This examination serves as a guide for placement in mathematics courses. Placement in mathematics courses is usually made at the following levels:

- 1) ACSK A010 Essential Math Skills, or ACSK A015 Elementary Algebra or MATH 102 or MATH 111 – students with fewer than three years of high school math, or inadequate background, or who have been out of school for an extended period of time.
- 2) MATH 112, MATH 113 or MATH 114 – students with three years of high school mathematics.
- 3) MATH 221 – students with four years of high school mathematics.

Courses in Mathematics (MATH):

102 Survey of Mathematics..... 3 cr

Prereq: ACSK A015 with a grade of C or better or appropriate placement. Freq: Fall, Spring.

Intended for students who need no further mathematics courses beyond competency. Topics selected from sets and logic, number theory, numeration systems, geometry, probability and statistics.

111 College Algebra I..... 4 cr

Prereq: ACSK A015 with a grade of C or better or appropriate placement. Freq: Fall, Spring.

Linear equations and inequalities; lines in the plane, rational exponents and radicals, polynomials and rational expressions, quadratic polynomials, systems of equations, exponential equations and logarithms.

- 112 College Algebra II..... 4 cr**
Prereq: A grade of C- or better in MATH 111 or equivalent, or appropriate placement score. Freq: Fall, Spring.
 Functions and graphs, polynomial functions, exponential and logarithmic functions, sequences, series, induction and combinatorics.
- 113 Trigonometry..... 2 cr**
Prereq: MATH 112 or equivalent or concurrent registration. Freq: Fall, Spring.
 An introduction to trigonometry with applications. Angular and circular definitions of trigonometric functions, graphing, use of fundamental identities.
- 114 College Algebra II with Trigonometry..... 5 cr**
Prereq: A grade of C- or better in MATH 111 or equivalent or appropriate placement score. Freq: Fall, Spring.
 Functions and graphs, polynomials and rational functions, exponential and logarithmic functions, trigonometric functions, trigonometric identities and equations, applications, sequences, series. Not open to those with credit in MATH 112 or 113.
- 215 Mathematics for Middle Childhood Through Early Adolescence Teachers I..... 3 cr**
Prereq: A grade of C or better in MATH 111 or consent of instructor. Freq: Fall, Spring.
 Topics include the development of the algorithms of arithmetic, numeration systems, problem solving, number theory and set theory.
- 216 Mathematics for Middle Childhood Through Early Adolescence Teachers II..... 3 cr**
Prereq: MATH 215. Freq: Spring.
 Topics include introductory geometry, constructions, congruence, similarity, motion geometry, concepts of measurements, probability and statistics.
- 221 Calculus and Analytic Geometry I..... 5 cr**
Prereq: MATH 112 and 113 or equivalent or appropriate placement score. Freq: Fall, Spring.
 Rate of change and limits, differentiation, applications of the derivative, integration, applications of the integral and transcendental functions.
- 222 Calculus and Analytic Geometry II..... 5 cr**
Prereq: MATH 221 or equivalent. Freq: Fall, Spring.
 Methods of integration, analytic geometry, polar coordinates, hyperbolic functions, infinite series, power series, and introduction to ordinary differential equations.
- 223 Calculus and Analytic Geometry III..... 5 cr**
Prereq: MATH 222. Freq: Fall, Spring.
 Vectors and parametric equations, vector functions and their derivatives, partial and directional derivatives, multiple integrals, vector analysis, Green's Theorem and Stokes' Theorem.
- 290 Special Topics in Mathematics.....1-4 cr**
Prereq: None. Freq: Occasionally.
 Selected topics in mathematics will be examined.
- 301 Linear Algebra..... 4 cr**
Prereq: MATH 223 or MATH 222 and consent of instructor. Freq: Fall.
 Introduction to linear algebra including systems of equations, matrices, determinants, vector spaces and linear transformations, and diagonalization.
- 303 Set Theory and Logic..... 3 cr**
Prereq: MATH 222 or PHIL 201 and consent of instructor. Freq: Spring.
 Elementary propositional and predicate logic; language and axioms of set theory; operations on sets; well-orderings, ordinals, transfinite induction and recursion; cardinals; the axiom of choice; and some equivalents. Cross-listed with PHIL 303.
- 310 Advanced Probability Theory and Statistics..... 4 cr**
Prereq: MATH 223. Freq: Fall.
 The main mathematical methods and techniques of probability theory; random variables, expected values, variance, central limit theorem, parameter estimation, and hypothesis testing.
- 317 Differential Equations and Their Applications 4 cr**
Prereq: MATH 222. Freq: Yearly.
 First- and second-order differential equations and applications; higher-order linear differential equations; series solutions of second-order differential equations; Laplace transforms; matrix algebra, systems of equations, eigen values and eigenvectors; systems of differential equations; and partial differential equations. Not open to those with credit in MATH 321.
- 331 Logic and Combinatorics..... 3 cr**
Prereq: MATH 222 Calculus and Analytic Geometry II. Freq: Occasionally.
 Permutations and combinations, graphs, trees, mathematical induction, propositional calculus, Mathematica and its applications in combinatorics, number theory and linear programming. Intended for students working for teaching certification in mathematics.
- 350 Advanced Calculus 4 cr**
Prereq: MATH 223, 301. Freq: Yearly.
 This course covers the fundamental notions of limits, continuity, uniform continuity, derivative, and integral. Also examines infinite series with a study of convergence and uniform convergence.
- 361 Foundations of Geometry 3 cr**
Prereq: MATH 222. Freq: Alternate years.
 Introduction to axiomatic geometry including Euclidean, non-Euclidean, and projective geometries.
- 367 Elementary Number Theory..... 3 cr**
Prereq: MATH 222. Freq: Alternate years.
 Prime numbers, fundamental theorem of arithmetic, congruence, quadratic residues and quadratic reciprocity, number theoretic functions and diophantine equations.
- 368 Mathematical Modeling..... 3 cr**
Prereq: MATH 222; MATH 250 or CSCI 242. Freq: Alternate years.
 Survey of mathematical models, models involving differential equations, probabilistic models, Markovian models, simulation, and Monte Carlo methods. Cross-listed with CSCI 368.
- 373 History of Mathematics 3 cr**
Prereq: MATH 221 or consent of instructor. Freq: Alternate years.
 Main lines of mathematical development from the Babylonians, Egyptians and Greeks to the present day; the lives of great mathematicians: Euclid, Archimedes, Descartes, Newton, Gauss, Cantor.
- 421 Real Analysis..... 4 cr**
Prereq: MATH 350. Freq: Fall.
 Construction of the real number system; basic theory of metric spaces; fundamental notions of limit, continuity, uniform continuity and basic theorems concerning these; convergence and uniform convergence; differentiation and the Riemann integral.
- 422 Topics in Real Analysis..... 4 cr**
Prereq: MATH 421. Freq: Occasionally.
 Differentials and Jacobians; implicit and inverse function theorems; introduction to the Lebesgue integral; additional topics chosen in accordance with the interests and needs of the participants.
- 423 Complex Analysis..... 4 cr**
Prereq: MATH 223. Freq: Alternate years.
 Elementary functions of a complex variable; analytic functions; complex integrals and residue theory; conformal mapping; applications to electrostatics and hydrodynamics.

441 Abstract Algebra 4 cr*Prereq: MATH 301. Freq: Alternate years.*

A study of group theory which includes subgroups, normal subgroups, isomorphisms, quotient groups, Cayley's Theorem, and Lagrange's Theorem. Provides an introduction to ring theory which includes subrings, ideals and factor rings, and polynomial rings.

442 Topics in Abstract Algebra 4 cr*Prereq: MATH 441. Freq: Occasionally.*

Rings and ideals; fundamental theorems of Abelian groups; Sylow theorems; solvable groups; elements of Galois theory; solvability by radicals; characteristic roots, matrices and canonical forms. Additional topics chosen in accordance with the needs and interests of the participants, e.g. applications of group theory.

451 Topology 3 cr*Prereq: MATH 301. Freq: Alternate years.*

Introduction to the theory of topological spaces, metric spaces, continuous functions, two-dimensional manifolds, and the concept of the fundamental group.

461 Differential Geometry 3 cr*Prereq: MATH 301 and 350. Freq: Occasionally.*

Local theory of curves and surfaces, curvature tensors, and global theory of surfaces.

467 Computability and Automata 3 cr*Prereq: C or better in MATH/CSCI 331. Freq: Alternate years.*

Turing machines, recursive functions, Kleene's T Predicate, Ackermann's functions, finite automata, grammars and languages. Cross-listed as CSCI 467.

490 Special Topics in Mathematics 1-3 cr*Prereq: Consent of instructor. Freq: Occasionally.*

Intensive treatment of various specialized areas of mathematics.

499 Independent Study 1-3 cr*Prereq: Consent of instructor and department chair.**Freq: Occasionally.*