

# Mathematics

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Disciplinary Major or Minor (<http://catalog.uwgb.edu/archive/2017-2018/undergraduate/planning/disciplinary-majors-minors>)  
(Bachelor of Science)

The Mathematics discipline has programs of study in two emphasis areas: mathematics and statistics. A student who elects a disciplinary major in Mathematics must choose an area of emphasis from one of these two programs of study.

Students choosing the emphasis in mathematics will focus their studies in a discipline which has been an important part of our intellectual heritage for centuries. Students select this area of emphasis if they are interested in mathematics for its own sake (pure mathematics) or as a tool for analyzing and solving real-world problems (applied mathematics). Graduates may use their skills in many careers, including fields such as secondary education and engineering. Other typical areas of employment traditional for mathematicians are those requiring physics. Today, mathematical techniques are required in social, industrial, and management realms as well.

The emphasis in statistics provides applied courses in experimental design, multivariate statistical analysis, and applied regression analysis. Students also gain an extensive background in statistical computing. Students who wish to enter actuarial professions may prepare for the first two actuarial examinations by completing the calculus sequence, linear algebra sequence, and statistical theory sequence. Students who concentrate studies in statistics may find employment in business, industry, and government, as well as pursue further professional training in graduate school.

## Program Entrance Requirements

The University of Wisconsin System placement examination in mathematics is used to advise entering freshmen about the level at which they should enter university courses. In rare cases, a student who has been accelerated and has mastery of calculus may, with advice of faculty, enter MATH 203 Calculus and Analytic Geometry II. Upon earning a "C" or better in MATH 203, an additional four credits are granted for MATH 202 Calculus and Analytic Geometry I.

Credits for calculus at UW-Green Bay may also be awarded for satisfactory performance on an AP exam. More details are available at <http://www.uwgb.edu/oira/cfpl/ap/>.

Retroactive credit for MATH 202 is not awarded to students who transfer to UW-Green Bay and have completed coursework deemed to be equivalent to MATH 203. If the student completes Math 209 or 305 at UW-Green Bay, they may submit an approved Retroactive Credit Form to the Registrar's Office to be awarded credit for MATH 202 only.

Mathematics majors must choose an interdisciplinary minor. Examples are Environmental Science or Business Administration.

Students seeking information on teacher certification should contact the Education Office.

## This disciplinary major also requires:

Completion of an interdisciplinary major or minor (<http://catalog.uwgb.edu/archive/2017-2018/undergraduate/planning/interdisciplinary-majors-minors>)

Completion of one of the following areas of emphasis:

- Mathematics Emphasis (<http://catalog.uwgb.edu/archive/2017-2018/undergraduate/programs/mathematics/mathematics-major/mathematics-emphasis>)
- Statistics Emphasis (<http://catalog.uwgb.edu/archive/2017-2018/undergraduate/programs/mathematics/mathematics-major/statistics-emphasis>)

## This disciplinary minor also requires:

Completion of an interdisciplinary major (<http://catalog.uwgb.edu/archive/2017-2018/undergraduate/planning/interdisciplinary-majors-minors>)

Completion of one of the following area of emphasis:

- Mathematics Emphasis (<http://catalog.uwgb.edu/archive/2017-2018/undergraduate/programs/mathematics/mathematics-minor/mathematics-emphasis>)
- Statistics Emphasis (<http://catalog.uwgb.edu/archive/2017-2018/undergraduate/programs/mathematics/mathematics-minor/statistics-emphasis>)

The following are only examples of four-year Mathematics degree programs and are subject to change without notice. Students should consult a Mathematics program advisor to ensure that they have the most accurate and up-to-date information available about a particular four-year degree option.

- Mathematics Emphasis (<http://catalog.uwgb.edu/archive/2017-2018/undergraduate/programs/mathematics/cg/math>)
- Statistics Emphasis (<http://catalog.uwgb.edu/archive/2017-2018/undergraduate/programs/mathematics/cg/statistics>)

**Woo Jeon**; Associate Professor; Ph.D., University of Wisconsin - Madison, chair

**Saeid Amiri**; Assistant Professor; Ph.D., Uppsala University

**Tetyana Malysheva**; Assistant Professor; Ph.D., University of Oklahoma

**Megan J Olson-Hunt**; Assistant Professor; Ph.D., University of Pittsburgh

**Theresa E Adsit**; Senior Lecturer; M.S., University of Wisconsin - Milwaukee

**Mary E Guy**; Senior Lecturer; M.S., University of Wisconsin - Oshkosh

**James M Meyer**; Senior Lecturer; Ph.D., University of North Carolina

## Courses

### **MATH 94. Elementary Algebra. 3 Credits.**

Intended as a preparation for Math 101. Topics include: properties of real numbers, exponents and polynomials, simplifying variable expressions, linear equations and inequalities, factoring, graphing, and basic quadratic equations. Offered on a pass/no credit, non-degree credit basis only. Fall and Spring.

### **MATH 99. Intermediate Algebra. 2 Credits.**

Intended as a preparation for Math 101. Topics include: functions, linear equations, quadratic equations, set operations, Venn diagrams, polynomials, rational functions, rational exponents, radicals. Offered on a pass/no credit, non-degree credit basis only.

P: Math 094 or WPT-MFND score greater than 415

Fall and Spring.

### **MATH 100. Math Appreciation. 3 Credits.**

An exploration of the exciting, rich, practical, historical, and creative nature of mathematics, while emphasizing reasoning skills and problem-solving abilities. Core material includes probability/statistics, rational and irrational numbers, infinity, and additional topics chosen from other areas of modern mathematics.

Fall and Spring.

### **MATH 101. Advanced Algebra. 2 Credits.**

Absolute values, linear inequalities, system of linear equations in three variables, matrices, complex numbers, quadratic functions, exponential functions, logarithmic functions, sequences, logic, basic probability.

P: Math 99 or WPT:MFND test score >465

Fall and Spring.

### **MATH 104. Precalculus. 4 Credits.**

Functions and their graphs, the algebra of functions, polynomial functions, rational functions, exponential and logarithmic functions, trigonometric functions, analytic trigonometry, conic sections

P: Math 101 with at least a C grade or WPT-MFND score >465 and WPT-AALG score >525

Fall and Spring.

### **MATH 201. Calculus for the Management and Social Sciences. 3 Credits.**

Basic concepts and techniques of differential and integral calculus; Applications in the fields of accounting, economics, finance and management.

P: Math 101 with at least a C grade or WPT-MFND score >465 and WPT-AALG score >525

Fall and Spring.

### **MATH 202. Calculus and Analytic Geometry I. 4 Credits.**

Differential and integral calculus of the elementary functions with associated analytic geometry; transcendental functions; techniques of integration; application.

P: Math 104 with at least a C grade or WPT-MFND score >465 and WPT-AALG score >525 and WPT-TAG score >525

Fall and Spring.

### **MATH 203. Calculus and Analytic Geometry II. 4 Credits.**

Differential and integral calculus of the elementary functions with associated analytic geometry; transcendental functions; techniques of integration; application; sequences and series.

P: Math 202 with at least a C grade.

Fall and Spring.

### **MATH 209. Multivariate Calculus. 4 Credits.**

Real-valued functions of several variables; tangent and normal lines; chain rule for partial derivatives; extrema; least squares method; higher-ordered derivatives; integration; polar and cylindrical coordinates; spherical coordinates; vector fields; line integrals; physical applications.

P: Math 203 with at least a C grade.

Fall and Spring.

**MATH 260. Introductory Statistics. 4 Credits.**

Descriptive and inferential statistics; frequency distributions; graphical techniques; measure of central tendency and of dispersion; probability regression correlation, analysis of count data, analysis of variance. Credit will not be granted for both Math 260 and Bus Adm 216.

P: Math 101 with at least a C grade or WPT-MFND score >465 and WPT-AALG score >525

Fall and Spring.

**MATH 281. Conceptual Foundations of Elementary Mathematics I. 3 Credits.**

Foundations of mathematics, particularly those concepts common to the mathematics curriculum of elementary schools. Explores the processes of abstraction, symbolic representation, notational manipulation and modeling in all arithmetic contexts; examines non-arithmetic topics such as geometry, probability, statistics, algebra, and programming concepts.

P: Full admission to Education, concurrent enrollment with MATH 282 and EDUC 324

Fall and Spring.

**MATH 282. Conceptual Foundations of Elementary Mathematics II. 3 Credits.**

Foundations of mathematics, particularly those concepts common to the mathematics curriculum of elementary schools. Explores the processes of abstraction, symbolic representation, notational manipulation and modeling in all arithmetic contexts; examines non-arithmetic topics such as geometry, probability, statistics, algebra, and programming concepts. May not be taken on a pass/no credit basis.

P: Full admission to the Education program, concurrent enrollment with MATH 281 and EDUC 324

Fall and Spring.

**MATH 299. Travel Course. 1-4 Credits.**

Travel courses are conducted to various parts of the world and are led by one or more faculty members. May be repeated to different locations.

P: cons of instr & prior trip arr & financial deposit.

**MATH 305. Ordinary Differential Equations. 3 Credits.**

Solutions and applications of first and higher order linear differential equations; the meanings of existence and uniqueness theorems; nonlinear differential equations; modeling physical and biological systems.

P: Math 203 with at least a C grade.

Spring.

**MATH 314. Proofs in Number Theory and Topology. 3 Credits.**

This course deals with the construction of detailed proofs of mathematical theorems within the context of the fertile fields of Number Theory and Topology.

P: Math 202 with at least a C grade; REC: Math 203.

Spring.

**MATH 320. Linear Algebra I. 3 Credits.**

Matrices and vector space concepts. Systems of linear equations, matrices, determinants, vectors in two-and three-space, vector spaces, linear transformations, eigenvalues, and eigenvectors; positive-definite matrices, normal forms, the principal axis theorem, applications.

P: Math 203 with at least a C grade.

Fall Only.

**MATH 321. Linear Algebra II. 3 Credits.**

Matrices and vector space concepts. Systems of linear equations, matrices, determinants, vectors in two-and three-space, vector spaces, linear transformations, eigenvalues, and eigenvectors; positive-definite matrices, normal forms, the principal axis theorem, applications.

P: Math 320 with at least a C grade.

Spring.

**MATH 323. Analysis I. 4 Credits.**

A course in the basic ideas of classical real analysis. Sets, functions, real numbers, limits, Euclidean space, topology of Euclidean space, continuity and uniform continuity, uniform convergence, and function spaces and their applications.

P: Math 209 with at least a C grade and 314 with at least a C grade.

Fall Only.

**MATH 324. Analysis II. 4 Credits.**

Differentiable mappings, the inverse and implicit function theorems and related topics, integration on Euclidean space, Fubini's theorem and the change of variables formula, and Fourier Analysis.

P: Math 323 with at least a C grade.

Spring.

**MATH 328. Introduction to Algebraic Structures. 3 Credits.**

Groups, rings, and fields as organizing ideas. Basic structure theorems. Applications.

P: Math 314 with at least a C grade and 320 with at least a C grade.

Fall Only.

**MATH 355. Applied Mathematical Optimization. 3 Credits.**

Analytical and numerical optimization techniques; linear, nonlinear, integer, and dynamic programming. Techniques applied to problems of water, forest, air and solid-waste management.

P: Math 320 with at least a C grade or conc enr.

Fall Even.

**MATH 360. Theory of Probability. 3 Credits.**

Probability as a mathematical system, with applications; basic probability theory; combinatorial analysis; distribution functions and probability laws; mean and variance of a probability law; expectation related probability laws; random variables.

P: Math 209 with at least a C grade.

Fall Even.

**MATH 361. Mathematical Statistics. 3 Credits.**

Sample moments and their distributions; tests of hypotheses; point and interval estimation; regression and linear hypotheses; nonparametric methods; sequential methods.

P: Math 320 with at least a C grade and 360 with at least a C grade.

Spring Odd.

**MATH 385. Foundations of Geometry. 3 Credits.**

Intuitive and deductive introductions to Euclidean, non-Euclidean, transformation, fractal, and projective geometries and their applications

P: Math 314 with at least a C grade.

Spring.

**MATH 410. Complex Analysis. 3 Credits.**

Algebra and geometry of complex numbers; analytic functions, elementary transformations, integration, Taylor and Laurent series, contour integration, residues, conformal mapping.

P: Math 209 with at least a C grade.

Fall Even.

**MATH 425. Dynamical Systems. 3 Credits.**

Fundamental concepts and techniques of discrete and continuous dynamical systems; asymptotic behavior, structural stability, elementary bifurcations, strange attractors, fractals, chaos. Applications to physical and biological systems.

P: Math 209 with at least a C grade and 320 with at least a C grade; and 305 with at least a C grade or conc enr.

Spring Even.

**MATH 430. Design of Experiments. 4 Credits.**

Statistical theory and practice underlying the design of scientific experiments, and methods of analysis. Replication, randomization, error, linear models, least squares, crossed and nested models, blocking, factorial experiments, Latin squares, confounding, incomplete blocks, split-plots.

P: Math 202 with at least a C grade; and Math 260 with at least a C grade or Bus Adm 216 with at least a C grade.

Spring Even.

**MATH 431. Multivariate Statistical Analysis. 4 Credits.**

Principles and practice in the analysis of multivariate data. Correlation, partial correlation, principle components, factor analysis discriminate functions, canonical correlation, cluster analysis, multidimensional scaling. Emphasis on computer analysis of actual data.

P: Math 202 with at least a C grade and 320 with at least a C grade; and Math 260 with at least a C grade or Bus Adm 216 with at least a C grade.

Spring Odd.

**MATH 467. Applied Regression Analysis. 4 Credits.**

Techniques for fitting linear regression models are developed and applied to data. Topics include simple linear regression, multivariate regression, curvilinear regression and linearizable models.

P: Math 260 with at least a C grade or Bus Adm 216 with at least a C grade; and Math 202 with at least a C grade and 320 with at least a C grade; REC: knowledge of Excel.

Fall Only.

**MATH 478. Honors in the Major. 3 Credits.**

Honors in the Major is designed to recognize student excellence within interdisciplinary and disciplinary academic programs.

P: min 3.50 all cses req for major and min gpa 3.75 all UL cses req for major.

Fall and Spring.

**MATH 492. Special Topics in Mathematics. 1-4 Credits.**

This course brings together students and professors who have a mutual interest in some topic not otherwise available among the usual mathematics and statistics offerings.

**MATH 497. Internship. 1-12 Credits.**

Supervised practical experience in an organization or activity appropriate to a student's career and educational interests. Internships are supervised by faculty members and require periodic student/faculty meetings.

P: jr st.

Fall and Spring.

**MATH 498. Independent Study. 1-4 Credits.**

Independent study is offered on an individual basis at the student's request and consists of a program of learning activities planned in consultation with a faculty member. A student wishing to study or conduct research in an area not represented in available scheduled courses should develop a preliminary proposal and seek the sponsorship of a faculty member. The student's advisor can direct him or her to instructors with appropriate interests. A written report or equivalent is required for evaluation, and a short title describing the program must be sent early in the semester to the registrar for entry on the student's transcript.

P: fr or so st with cum gpa  $\geq$  2.50; or jr or sr st with cum gpa  $\geq$  2.00.

Fall and Spring.

**MATH 499. Travel Course. 1-6 Credits.**

Travel courses are conducted to various parts of the world and are led by one or more faculty members. May be repeated to different locations.

P: cons of instr & prior trip arr & financial deposit.