

MATHEMATICS

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The major in mathematics includes courses in pure and applied mathematics, offering a broad and in-depth foundation for students with diverse interests and backgrounds. All courses in the curriculum develop logical thinking, quantitative reasoning, and deductive analysis, making majors and minors highly attractive to graduate schools and employers in industry.

Combined with complementary course work, a mathematics major gives strong preparation for graduate study in an increasingly wide variety of disciplines. These include biostatistics, computer science, economics, forestry, genetics, meteorology, operations research, physics, psychology, pure and applied mathematics, sociology, and most engineering fields.

Career opportunities for those with a mathematics major are equally varied. These include positions in the fields of actuarial science, banking and financial services, communications, computer science, consulting, government, health services, management, public policy, research organizations, utilities, and transportation.

The major in mathematics is approved by the Wisconsin Department of Public Instruction for certification in mathematics.¹

Please see page 20 of this catalog for information about how retroactive credits in calculus may be earned.

Learning Outcomes for Mathematics

Students majoring in mathematics are expected to:

1. Learn to read, write, speak and do mathematics.
2. Demonstrate competence in the use of appropriate technology in support of mathematical calculation, symbolic manipulation and graphical analysis.
3. Demonstrate their understanding of the nature of mathematical proof.

¹ Students must normally maintain a 2.75 grade point average in the major to remain in good standing in the Teacher Education Program.

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4. Apply mathematics to a variety of problems in the natural, computational and social sciences.
5. Learn the contributions of mathematics and mathematicians to the growth of knowledge.
6. Prepare for advanced studies in mathematics or for a profession.
7. Develop an appreciation for mathematics as an art.

Mathematics Major (B.A.)

Bachelor of Arts

Courses in the Major

Mathematics 160, 161, 207, Calculus I, II, III

Mathematics 206, Transition to Advanced Mathematics

Mathematics 208, Linear Algebra

Two of the following six courses:

Mathematics 250, Mathematics Seminar

Mathematics 305, Modern Geometry*

Mathematics 309, Differential Equations

Mathematics 312, Theory of Probability and Statistics*

Mathematics 324, Numerical Analysis

Mathematics 350, Mathematics Seminar

Mathematics 320, Abstract Algebra

Mathematics 409, Mathematical Analysis

Mathematics 450, Senior Capstone

Required Support Courses (Required for primary majors only)

Completion of a Modern Language through 202

*To be certified by the DPI, student must take Mathematics 305 and 312.

Mathematics Major (B.S.)

Bachelor of Science

Courses in the Major

Mathematics 160, 161, 207, Calculus I, II, III

Mathematics 206, Transition to Advanced Mathematics

Mathematics 208, Linear Algebra

Three of the following four courses:

Mathematics 305, Modern Geometry*

Mathematics 309, Differential Equations

Mathematics 312, Theory of Probability and Statistics*

Mathematics 324, Numerical Analysis

Mathematics 320, Abstract Algebra

Mathematics 409, Mathematical Analysis

Mathematics 450, Senior Capstone

Required Support Courses (Required for primary majors only)

Computer Science 110, Problem Solving through Programming

Physics 203, General Physics

Physics 204, General Physics, or Biological Science*

*To be certified by the DPI, students must take Mathematics 305 and 312, and a biological science. Students not minoring in secondary education must take Physics 204.

Mathematics Minor

Mathematics 160, 161, Calculus I, II

Three additional courses in Mathematics at the 200-level or higher excluding Mathematics 201, 205

Secondary Education

Mathematics Minor

Mathematics 160, 161, Calculus I, II

Mathematics 206, Transition to Advanced Mathematics

Mathematics 207, Calculus III

Mathematics 305, Modern Geometry

Mathematics 312, Theory of Probability and Statistics

Elementary Education

Mathematics Minor

Required Courses

Mathematics 104, Foundations of Elementary Mathematics I

Mathematics 140, Calculus and Its Applications or
Mathematics 160, Calculus

Mathematics 112, Introduction to Statistics

Mathematics 201, Foundations of Elementary Mathematics II

Mathematics 206, Transition to Advanced Mathematics

Mathematics 305, Modern Geometry

098. Pre-Algebra

4 credits

Intended for students who need an intensive review of high school Algebra I, content includes basic arithmetic, algebra, and geometry with an emphasis on study skills. Credits earned in this course do not count toward the 128 credits needed for graduation. (*Fa, Su*) Pre-requisites: placement recommendation.

101. Intermediate Algebra

4 credits

101L Intermediate Algebra Laboratory

Building on MAT 098 skills, this course is equivalent to high school Algebra II. Topics include number systems, theory of equations and inequalities, introduction to functions and their graphs, applications of algebra. This course is the prerequisite to MAT 104, 106, 112 and 130. (*Fa, Sp, Su*) Prerequisites: one year of high school algebra and one year of high school geometry or MAT 098 or placement recommendation.

104. Foundations of Elementary Mathematics I

4 credits

An introduction to problem solving, sets, number theory, numeration systems, and the structure of the real number system. Course material will be presented in a manner consistent with the NCTM Principles and Standards for School Mathematics. Recommended for education students only. (*Fa, Sp, Su*) Prerequisite: MAT 101 or placement recommendation.

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106. Mathematics for the Liberal Arts

4 credits

This elementary course in contemporary mathematics introduces the Bachelor of Arts student to the usefulness of mathematics. Real current-day problems are presented along with some of the mathematics techniques which have been used to solve them. Problems discussed will involve such topics as "the traveling salesman problem," exponential growth, voting systems, analysis of arguments and fractal geometry. (*Fa, Sp, Su*) Prerequisites: MAT 101 or placement recommendation.

112. Introduction to Statistics

4 credits

An introductory statistics course emphasizing applications to business, science and the social sciences. Topics include: statistical description of data, distributions, random variables and sample spaces, probability, sampling and sampling distributions, the Central Limit Theorem, estimation of parameters, hypothesis testing, confidence intervals, goodness of fit, correlation and regression, one-way ANOVA, and use of a statistical calculator. (*Fa, Sp, Su*) Prerequisite: MAT 101 or placement recommendation and FYS level computer literacy.

130. Elementary Functions

4 credits

A study of rational, radical, exponential, logarithmic, and trigonometric functions designed to prepare students for MAT 140 or 160 (*Fa, Sp, Su*) Prerequisites: MAT 101 or placement recommendation.

140. Calculus and Its Applications

4 credits

A compact version of Calculus I, II stressing problem-solving techniques and applications. Designed for students who need only one semester of calculus. Numerous examples are presented from accounting, biology, business, economics, and other fields. (*Fa, Sp, Su*) Prerequisite: MAT 130 or placement recommendation. May not be taken for credit by those who have completed MAT 160.

160. Calculus I

4 credits

A brief review of inequalities, functions and plane analytic geometry; limits and continuity; the derivative and the differential; applications of differentiation; L'Hospital's Rule; introduction to the Riemann integral. Includes differentiation of logarithmic and exponential functions, and indeterminate forms. History of selected topics is studied. Four hours of lecture and one hour of laboratory/recitation. (*Fa, Sp*) Prerequisite: MAT 130 or placement recommendation.

161. Calculus II

4 credits

Applications of the Riemann integral; calculus of the natural logarithm and exponential functions; formal techniques of integration; improper integrals; series and sequences. History of selected topics is studied. Four hours of lecture and one hour of laboratory/recitation. (*Fa, Sp*) Prerequisite: MAT 160 or placement recommendation.

201. Foundations of Elementary Mathematics II**4 credits**

A study of introductory geometry, measurement, algebra, coordinate and transformation geometry, statistics and probability. Students will also be introduced to geometry computer software. Designed for the elementary education major. (*Fa, Sp, Su*) Prerequisite: MAT 104.

205. Discrete Mathematics**4 credits**

A study of set theory, propositional calculus, algorithms, relations, functions, combinatorics, recursion, discrete graphs, trees, automata. Intended for Computer Science majors only. (*Sp*) Prerequisites: CSC 226, MAT 140 or 160. May not be taken for credit by those who have completed MAT 206.

206. Transition to Advanced Mathematics**4 credits**

An introduction to fundamental concepts, structures and style of mathematics. Core topics are logic, sets, mathematical induction, relations, functions and graph theory. Special topics may include number theory, cardinality, or the construction of the real numbers. Special emphasis will be placed on developing and communicating mathematical arguments. (*Fa*) Prerequisites: MAT 140 or 160. May not be taken for credit by those who have completed MAT 205.

207. Calculus III**4 credits**

Vectors in the plane and in space, solid analytic geometry; calculus of functions of two variables; partial derivatives; divergence and gradient; multiple integrals, vector fields, line integrals, and surface integrals, Green's Theorem, Stoke's Theorem, Divergence Theorem. History of selected topics is studied. (*Fa*) Prerequisite: MAT 161 or placement recommendation.

208. Linear Algebra**4 credits**

Vector spaces; linear transformations and matrices; systems of linear equations; applications. (*Sp*) Prerequisite: MAT 161 or 206.

250. Mathematics Seminar**4 credits**

Mathematics Seminar topics vary by year. The course meets concurrent with MAT 350 and MAT 450, the Capstone Experience. The course is designed to give students exposure to the Capstone Experience and to give all mathematics students the opportunity to increase their breadth of study. (*Sp*) Prerequisite: MAT 206 or instructor approval.

305. Modern Geometry**4 credits**

A study of elementary geometry from an advanced standpoint; includes distance and congruence axioms, parallelism, incidence and order, and non-Euclidean geometries. History of selected topics is studied. (*Sp*) Prerequisite: MAT 206.

309. Differential Equations**4 credits**

An introduction to the theory and solution of ordinary differential equations and their applications; power series solution; introduction to numerical methods; and other topics. Prerequisites: MAT 161.

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312. Theory of Probability and Statistics

4 credits

An introduction to the mathematical theory of probability and statistics. Topics include: sample spaces; probability distribution functions; regression and correlation; hypothesis testing. History of selected topics is studied. (*Sp, even years*) Prerequisite: MAT 207. May not be taken for credit by those who have completed ASC 302.

320. Abstract Algebra

4 credits

An introduction to modern abstract algebra to include topics in the theory of groups, rings and fields. Required of all mathematics majors. History of selected topics is studied. (*Fa, odd years*) Prerequisites: MAT 206 and 208.

324. Numerical Analysis

4 credits

Introduction to the numerical methods and algorithms fundamental to mathematical and scientific analysis. Error analysis and efficient programming techniques are stressed. Includes solving equations, linear and nonlinear systems, curve fitting, function approximation, interpolation, differentiation, integration and numerical solutions to differential equations. (*Fa, odd years*) Prerequisites: MAT 161 and 208, CSC 110.

350. Mathematics Seminar

4 credits

Mathematics Seminar topics vary by year. The course meets concurrent with MAT 350 and MAT 450, the Capstone Experience. The course is designed to give students exposure to the Capstone Experience and to give all mathematics students the opportunity to increase their breadth of study. (*Sp*) Prerequisite: MAT 206 or instructor approval.

391/491. Advanced Topics in Mathematics

2-4 credits

These courses are designed to meet the special needs of students who have completed the prescribed courses for a major and wish to extend their study in specific areas. Students planning on graduate study should take courses in topology and other appropriate topics. Students interested in actuarial science should arrange for additional study in probability and statistics. Courses in applied mathematics can also be arranged. These courses may not be taken in lieu of courses specified for the major or minor. (*Fa, Sp, Su with instructor consent*) Prerequisites: Junior or senior standing, approval of the divisional dean and consent of the instructor.

409. Mathematical Analysis

4 credits

The study of theory and applications of analysis on the real line. Limits; continuity; differentiation; sequences and series of functions; integration. (*Fa, even years*) Prerequisites: MAT 206 and 207.

450. Mathematics Senior Capstone

4 credits

All majors will complete a mathematics-related project. Projects may involve original or expository research in applied mathematics, pure mathematics, or mathematics education. Applied mathematics projects may involve mathematical consultancy work for area businesses. (*Sp*) Prerequisite: 80 credit hours completed.