

## GRADUATE PROGRAM IN MATHEMATICS EDUCATION

The Department of Mathematical Sciences at IUPUI offers a graduate program leading to the Purdue University Master of Science (M.S.) degree in Mathematics with a specialization in Mathematics Education. This program is designed for the mathematics teaching professional who would like to strengthen or enhance his/her mathematics background while completing a graduate degree. The curriculum is structured around the Indiana Professional Standards Board's competencies for high school mathematics teachers. The program aims to provide students with broad experiences in the range of applications of mathematics, and help students extend and formalize their thinking and reasoning skills.

Students in this program will complete a core curriculum that includes courses in abstract algebra, analysis, geometry, discrete mathematics, and probability and statistics. In addition, a student will choose from a variety of mathematics electives, as well as participate in seminars and develop an individual project involving innovative pedagogy, such as the use of technology in the mathematics classroom.

Most courses are offered in the late afternoon or evening or during the summer to accommodate students who are engaged in professional development while maintaining full-time teaching careers.

### Admission to the Program

Any applicant who has a bachelor's degree from an accredited institution and shows promise of successfully completing the degree requirements will be considered for admission. The minimal mathematics background includes undergraduate coursework equivalent to MATH 262 (differential equations), MATH 351 (linear algebra) and MATH 453 (algebra). Application materials are available on the departmental website: [www.math.iupui.edu](http://www.math.iupui.edu).

Students not seeking an M.S. degree, but desiring to take graduate courses in mathematics for personal/professional development or for licensing requirements may receive approval to take courses in this program under continuing non-degree graduate student classification.

For further information about the Mathematics Education Program, please contact: Professor Jeffrey Watt, 317-274-4070, [jwatt@math.iupui.edu](mailto:jwatt@math.iupui.edu).

**For students with disabilities who need assistance reading the information in this brochure, special arrangements can be made to accommodate most needs by contacting the Mathematics Department Office (LD 270 or 274-6918).**

### Requirements for the Degree

To fulfill the degree requirements for the Master of Science in Mathematics with specialization in Mathematics Education, the student must complete a program of at least 30 credit hours of coursework. All course grades must be A or B with the possible exception of at most two grades of C. The coursework should include:

**Core Requirements (18 credits):** One course from each of six required areas:

Abstract Algebra	MATH 505
Analysis	MATH 547 or 504
Geometry	MATH 561, 562 or 563
Discrete Mathematics	MATH 517
Probability	STAT 516
Statistics	STAT 517

**Math Electives (6 credits):** Two additional courses from the following list (other courses may be substituted with the advisor's consent):

Complex Analysis	MATH 525
Applied Mathematics	MATH 549
History of Mathematics	MATH 583
Logic	MATH 581 or 585

**Mathematics Education Seminar, Math 598 (3 credits):** Seminar including a project involving innovative pedagogy, such as the use of technology in the mathematics classroom.

**Elective (3 credits):** One advanced course in a related area of mathematics, mathematics education, psychology, or education that is approved by the student's faculty advisor or committee.

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## Partial List of Courses

**MATH 505 Intermediate Abstract Algebra** (3 cr.) P: 453 or consent of the instructor. Group theory with emphasis on concrete examples and applications. Field theory: ruler and compass constructions, Galois theory, solvability of equations by radicals.

**STAT 516 Basic Probability and Applications** (3 cr.) P: MATH 261 or equivalent. A first course in probability intended to serve as a foundation for statistics and other applications. Intuitive background; sample spaces and random variables; joint, conditional, and marginal distributions; special distributions of statistical importance; moments and moment generating functions; statement and application of limit theorems; introduction to Markov chains.

**STAT 517 Statistical Inference** (3 cr.) P: STAT 516. A basic course in statistical theory covering standard statistical methods and their applications. Includes unbiased, maximum likelihood, and moment estimation; confidence intervals and regions; testing hypotheses for standard distributions and contingency tables; introduction to nonparametric tests and linear regression.

**MATH 517 Discrete Modeling and Game Theory** (3 cr.) P: 262 and 351 or 511 or consent of instructor. Linear programming; mathematical modeling of problems in economics, management, urban administration, and the behavioral sciences.

**MATH 525 Introduction to Complex Analysis** (3 cr.) P: 261 and 262. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

**MATH 547 Analysis for Teachers I** (3 cr.) P: 261. Set theory, logic, relations, functions, Cauchy's inequality, metric spaces, neighborhoods, Cauchy sequence.

**MATH 549 Applied Mathematics for Secondary School Teachers** (3 cr.) P: 262 and 351. Applications of mathematics to problems in the physical sciences, social sciences, and the arts. Content varies. May be repeated for credit with the consent of the instructor.

**MATH 561 Projective Geometry** (3 cr.) P: 351. Projective invariants, Desargues' theorem, cross-ratio, axiomatic foundation, duality, consistency, independence, coordinates, conics.

**MATH 562 Introduction to Differential Geometry and Topology** (3 cr.) P: 351 and 442. Smooth manifolds, tangent vectors, inverse and implicit function theorems, submanifolds, vector fields, integral curves, differential forms, the exterior derivative, DeRham cohomology groups, surfaces in  $E^3$ , Gaussian curvature, two-dimensional Riemannian geometry, Gauss-Bonnet and Poincaré theorems on vector fields.

**MATH 563 Advanced Geometry** (3 cr.) P: 300 or consent of instructor. Topics in Euclidean and non-Euclidean geometry.

**MATH 581 Introduction to Logic for Teachers** (3 cr.) P: 351. Not open to students with credit in 385. Logical connectives, rules of sentential inference, quantifiers, bound and free variables, rules of inference, interpretations and validity, theorems in group theory, introduction to set theory.

**MATH 583 History of Elementary Mathematics** (3 cr.) P: 261. A survey and treatment of the content of major developments of mathematics through the eighteenth century, with selected topics from more recent mathematics, including non-Euclidean geometry and the axiomatic method.

## Prerequisite Courses

**MATH 262 Linear Algebra and Differential Equations** (4 cr.) P: 164. R: 261. First-order equations, higher-order linear equations, initial and boundary value problems, power series solutions, systems of first-order equations, Laplace transforms, applications. Requisite topics of linear algebra: vector spaces, linear independence, matrices, eigenvalues, and eigenvectors.

**MATH 351 Elementary Linear Algebra** (3 cr.) P: 261. Not open to students with credit in 511. Systems of linear equations, matrices, vector spaces, linear transformations, determinants, inner product spaces, eigenvalues, applications.

**MATH 453 Beginning Abstract Algebra** (3 cr.) P: 351 or consent of the instructor. Basic properties of groups, rings, and fields, with special emphasis on polynomial rings.

## Master Schedule of Course Offerings

Fall (even year)	STAT 516, MATH 525
Spring (odd year)	STAT 517, MATH 517,
Summer II (odd year)	MATH 583, MATH 547, MATH 581
Fall (odd year)	STAT 516, MATH 525
Spring (even year)	STAT 517, MATH 583, MATH 562
Summer II (even year)	MATH 561, MATH 505, MATH 549

## Sample Plans of Study

Summer odd	MATH 547, MATH 581
Fall odd	STAT 516
Spring even	STAT 517
Summer even	MATH 505, MATH 561
Fall even	MATH 525
Spring odd	MATH 517
Summer odd	MATH 583, MATH 598

Summer even	MATH 505, MATH 561
Fall even	MATH 525
Spring odd	MATH 517
Summer odd	MATH 547, MATH 581
Fall odd	STAT 516
Spring even	STAT 517
Summer even	MATH 549, MATH 598

## M.S. Degree Rules and Procedures

Course grades must be A or B, with the exception of at most two grades of C.

Any course used to meet a minimum requirement for a B.S./B.A. degree will not count for this degree.

Students may take up to 12 credits toward the degree before obtaining formal admission to the program.

Students who are inactive for 3 or more academic sessions must submit a new application.

Students who have been inactive for more than 5 years cannot use previous courses for this degree.

Math T500, Workshop for Math Teachers may be taken for in-service professional development, but this course **cannot** be used for the M.S. degree program.