

Ph.D. in Mathematics - Mathematics Education Emphasis

Program Overview

The Ph.D. in Mathematics with an emphasis in mathematics education combines study in advanced mathematics, mathematics education, and quantitative and qualitative research methods in education. This pathway is designed for candidates who plan a future of teaching, research, and service relevant to mathematics education in a variety of settings. The program focuses on the teaching and learning of mathematics including curriculum, instruction, assessment, and teacher preparation or professional development in the K-12 education system. Graduates typically go on to faculty positions in mathematics departments that support K-12 teacher preparation and research in mathematics education. Applicants are expected to possess K-12 teaching experience or to gain such experience through internships.

Admission (preferred qualifications)

- An earned master's degree in mathematics, statistics, or mathematics education, including graduate-level mathematics coursework in topics such as algebra and analysis. Applicants with a strong undergraduate degree in mathematics teaching may start in the M.S. in Mathematics program and earn an M.S. before continuing on to the Ph.D., usually after 2 years.
- One of the following:
 - Teacher licensure in secondary mathematics
 - Two years K-16 teaching experience

Required Equivalencies (upon completion of coursework)

Provisional Licensure: All graduates of this program are expected to acquire a minimum level of competency in secondary mathematics instruction, comparable to satisfying the requirements for Montana's provisional license to teach mathematics. This includes a Bachelor of Science degree in mathematics and at least six credit hours of education coursework. Ph.D. candidates who fall short of the six-credit requirement will select courses from the following:

- Complete a secondary mathematics methods course Methods: 9-12 Mathematics (EDM 405) or Methods: 5-8 Mathematics (EDM 404)
- Complete either Access and Equity in Mathematics Teaching (M 520), Mathematics Learning Theory for Teaching (M 521), or another approved course.

K-12 Classroom Experience: Students who lack sufficient exposure to instruction at the elementary or secondary level in U.S. contexts will be required to complete school-based internships prior to beginning dissertation research. Each internship calls for 135 hours of field experience as well as participation in a spring seminar that may address reviews of research, lesson study, analysis of student work, and reflection on classroom experiences.

- Elementary internship: teach, tutor, and observe students in a K-8 classroom
- Secondary internship: teach one or more courses at the high school level

Required Course Work (60 credits)

Mathematics - required (minimum 15 credits at MSU)

M 503	Advanced Linear Algebra
M 505	Principles of Mathematical Analysis
One two-course doctoral sequence from the list below (6 credits)	
Additional mathematics courses to be selected (3+ credits)	

Mathematics Education - required (minimum 9 credits)

M 528	Curriculum Design
M 529	Assessment Models and Issues
M 534	Research in Mathematics Education

Research Methods and Statistics - required (minimum 12 credits)

STAT 511	Methods of Data Analysis I
STAT 512	Methods of Data Analysis II
EDCI 506	Applied Educational Research
EDU 610	Qualitative Educational Research

Seminars and Internships - see explanation above (0 to 6 credits)

M 576	Internship	2-12
M 594	Seminar	1

Supporting Coursework - to be approved by committee (3+ credits)

May include specialized research courses or additional mathematics education coursework

Dissertation - required (21 credits)

M 689	Doctoral Reading & Research
M 690	Doctoral Thesis

Doctoral Mathematics - choose one two-course sequence from the following:

M 544	Partial Differential Equations I
M 545	Partial Differential Equations II
M 547	Measure Theory
M 551	Complex Analysis
M 560	Methods of Applied Mathematics I
M 561	Methods of Applied Mathematics II
M 581	Numerical Solution of Partial Differential Equations I
M 582	Numerical Solution of Partial Differential Equations II
M 584	Functional Analysis I
M 585	Functional Analysis II
M 586	Probability Theory
M 591	Topics in Applied Math I
M 592	Topics in Applied Math II
M 595	Dynamical Systems I
M 596	Dynamical Systems II

Comprehensive Examinations

Graduates of the program earn the equivalent of a master's degree in mathematics and must successfully complete three components of a written comprehensive exam: one component in mathematics, one component addressing knowledge related to research on K-12 mathematics teaching and learning, and one component addressing knowledge of research design and analysis for studies in mathematics education.

- One component of the written comprehensive exam is in Mathematics. This exam will be determined by the graduate committee and administered according to the guidelines for mathematics.
- One component of the written comprehensive exam is in Foundations of Mathematics Education. This exam will be determined by the mathematics education faculty based on the graduate coursework in mathematics education on the student's program of study.
- One component of the written comprehensive exam is in Research Methods in Mathematics Education. This exam is collaboratively developed by mathematics education faculty and appropriate research methods faculty.

Students also complete an oral comprehensive examination, which consists of a written proposal of dissertation research and the oral defense of that proposal.

- The proposal of dissertation research is a professional document, written by the student that is intended to inform the first three chapters (Introduction, Literature Review, and Research Design) of a student's dissertation. It is submitted to the student's Graduate Committee a minimum of two weeks prior to the oral presentation.
- The oral defense is a 1-hour presentation followed by a 1-hour oral examination. The presentation includes an audience of all members of the student's Graduate Committee and the general public. The oral examination is closed to the general public. Students should expect to make adjustments to their dissertation research based on input and requirements from the committee.

Before attempting the Oral Comprehensive exam, a Ph.D. student must pass the Ph.D. Written Comprehensive exam. Refer to Graduate School policy regarding comprehensive exams.

Dissertation Research Component

The dissertation is a study in mathematics education. Scholarship in mathematics education examines teaching and learning, with roots in the disciplines of mathematics and educational theory and practice. It is grounded in mathematics content through the study of curriculum and mathematical practice and is generally carried out through social science research methods, including both qualitative and quantitative analysis. Doctoral students conduct research in areas relevant to current faculty research expertise.