

Mathematics, Ph.D.

Degree Requirements

- **Credit Hours:** Students are required to complete a minimum number of 54 graduate credit hours in Mathematics at the 500 level or above, with a minimum of 18 credits at the 700 level (excluding seminar and MATH 797), with at least 12 from discrete mathematics, algebra, foundations, applied mathematics, and topology.
- **Grade Point Average:** Students must earn a minimum cumulative GPA of 2.75 and a minimum GPA of 3.0 in courses applied to the degree.
- **Program of Study:** The Ph.D. program assumes an M.S.-level background in graduate mathematics for admission. The program provides for a common core of fundamental mathematics followed by specialized studies culminating in an original research dissertation directed by a faculty advisor.
- **Qualifying Examination:** The qualifying examination consists of two parts. For students with research areas in discrete mathematics, algebra, foundations, analysis, applied mathematics, or topology, a written exam is given in the students research area, based on the corresponding course work and other specialized knowledge needed for the dissertation. Paired with the written exam is an oral exam, to be given within one week of the written exam and covering similar material. These exams are led by the dissertation supervisor in consultation with the student's committee. Students whose research area is in research in undergraduate mathematics education are assigned a written research project, whose results are examined at an oral presentation. The second part of the qualifying examination is the public presentation of the dissertation prospectus, followed by questioning by the student's committee. The purpose of this is to demonstrate that the student has mastered the relevant literature in his or her field, and has developed a clear, realizable and program-suitable research topic, along with a research plan to achieve the desired results. The qualifying exam is considered to have been passed when both parts have been successfully completed. In case a student fails to achieve a 3.5 GPA overall in one or both of their elective sequences, a written examination will be prepared in the corresponding elective courses, which the student must pass in the judgement of the committee.
- **Dissertation:** The research upon which the dissertation is based must conform to scholastic standards and constitute an original and publishable contribution to mathematics.
- **Benchmarks:** Students must demonstrate that they have mastered basic graduate mathematics by passing the Department's Ph.D. Entrance Examination by no later than the spring of their second full academic year in the program. The examination is over two subjects selected by the student from the four areas of algebra, real analysis, differential equations, and topology. The exams are given twice a year, in August and April. The student's dissertation committee is appointed after the Ph.D. Entrance Examination has been passed, and upon selection of an advisor, typically by the end of the second year. The Qualifying Examination is normally taken at the end of the third year of study, or in the first semester of the fourth year. The dissertation defense should occur by the end of the fifth year in the program.

Curriculum Requirements

Code	Title	Hours
RESEARCH AREA CONCENTRATION		12
Discrete Mathematics, Algebra and Foundations *		
MATH 573 & MATH 773	Graph Theory and Advanced Topics in Graph Theory	
MATH 683 & MATH 783	Set Theory and Applications 1 and Set Theory and Applications	
MATH 745 & MATH 746	Analytic Number Theory 1 and Analytic Number Theory 2	
MATH 747 & 747	Advanced Topics in Modern Algebra and Advanced Topics in Modern Algebra	
MATH 771 & MATH 772	Matroid Theory 1 and Matroid Theory 2	
Analysis, Applied Mathematics, and Topology *		
MATH 751 & MATH 752	Functional Analysis 1 and Functional Analysis 2	
MATH 757 & MATH 758	Theory of Partial Differential Equations 1 and Theory of Partial Differential Equations 2	
MATH 780 & 780	Seminar in Topology and Seminar in Topology	
Research in Undergraduate Mathematic Education		
MATH 631	RUME 1: Introduction to Undergraduate Mathematics Education Research	
MATH 732	RUME 2: Learning Theories	
MATH 733	RUME 3: Advanced Learning Theories	

MATH 734	RUME 4: Advanced Research in Undergraduate Mathematics Education	
SEMINARS AND RESEARCH:		
Professional Seminar		1
MATH 696	Graduate Seminar	
Graduate Seminar		5
MATH 796	Graduate Seminar **	
Research		24
MATH 797	Research	
ELECTIVE COURSES ***		12
Discrete Mathematics, Algebra and Foundations		
MATH 573 & MATH 773	Graph Theory and Advanced Topics in Graph Theory	
MATH 683 & MATH 783	Set Theory and Applications 1 and Set Theory and Applications	
MATH 745 & MATH 746	Analytic Number Theory 1 and Analytic Number Theory 2	
MATH 747 & 747	Advanced Topics in Modern Algebra and Advanced Topics in Modern Algebra	
MATH 771 & MATH 772	Matroid Theory 1 and Matroid Theory 2	
Analysis, Applied Mathematics, and Topology		
MATH 751 & MATH 752	Functional Analysis 1 and Functional Analysis 2	
MATH 757 & MATH 758	Theory of Partial Differential Equations 1 and Theory of Partial Differential Equations 2	
Total Hours		54

*

Select two pairs rather than four individual courses to satisfy the requirement.

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MATH 796 must be taken at 1 credit hours for 5 semesters.

Choose at least one pair outside of Research Area Concentration. May not select courses already chosen to satisfy a Research Area Concentration requirement. Students who choose RUME as their research area must select at least two courses from the Discrete Mathematics, Algebra, and Foundation group, and two courses from the Analysis, Applied Mathematics, and Topology group.

Major Learning Outcomes

MATHEMATICS

Ph.D. students are expected to:

- Conduct independent, original research in mathematics under the supervision of a faculty advisor.
- Produce and defend an original contribution to knowledge, as evidenced by the writing and defense of a dissertation involving significant original research leading to a significant contribution in their field of study.
- Demonstrate mastery of subject material, as evidenced by quality of performance in coursework, and on written and oral examinations in mathematics
- Become familiar with a breadth of modern mathematics, by successful completion of a range of advanced courses in various fields as required by the degree program
- Communicate mathematics clearly and coherently through multiple research presentations at department colloquium and at research conferences.