MATHEMATICS, PHD

The Department of Mathematical Sciences offers graduate programs of study in mathematics with specializations in the fields of algebra, analysis, topology, applied mathematics, probability and statistics, and actuarial science.

A student may prepare for a career in teaching at the secondary or college level, and for a career in research in the academic, industrial, government, or business communities.

The programs of study at the master's level are designed to suit both the student intending to continue toward a PhD, as well as the student who wishes to begin a professional career upon completion of the master's program.

The Department has a vibrant PhD program. Mathematics research specialties available to students include:

- Actuarial Science (http://uwm.edu/math/research/actuarial-science/)
- Algebra (http://uwm.edu/math/research/algebra/)
- Analysis (http://uwm.edu/math/research/analysis/)
- Applied Mathematics (http://uwm.edu/math/research/applied-mathematics/)
- Differential Equations (http://uwm.edu/math/research/differential-equations/)
- Numerical Analysis (http://uwm.edu/math/research/numerical-analysis/)
- Probability (http://uwm.edu/math/research/probability/)
- Statistics (http://uwm.edu/math/research/statistics/)
- Topology (http://uwm.edu/math/research/topology/)

For more details on the Department's research groups and the research interests of its faculty members click here (http://uwm.edu/math/research/).

Admission Requirements

Application Deadlines

Application deadlines vary by program, please review the application deadline chart (http://uwm.edu/graduateschool/program-deadlines/) for specific programs. Other important dates and deadlines can be found by using the One Stop calendars (https://uwm.edu/onestop/dates-and-deadlines/).

Admission

Applicant must meet Graduate School requirements (http://uwm.edu/graduateschool/admission/) plus departmental requirements as given for admission to the master's program. A master's degree is not a prerequisite for admission to this PhD program.

Application materials require a Reason Statement.

Reapplication

A student who receives the master's degree must formally reapply for admission to the Graduate School before continuing studies toward the PhD.

Credits and Courses

Minimum degree requirement is 54 graduate credits beyond the bachelor's degree, at least 27 of which must be earned in residence at UWM. In addition, at least half of the credits earned toward the degree must be in courses numbered 700 or above.

The student, in consultation with the major professor, must select both a primary and a secondary area of specialization. The primary area may be chosen from one of the following seven fields:

Transcript Designated Concentrations

Applied Mathematics Field

Code	Title	Credits
3 Credits in Algebra		3
6 Credits in Complex Analysis		6
3 Credits in Real Analysis		3
12 Credits in Applied Mathematics		12
3 Credits Outside the Field		3

Probability and Statistics Field

Code	Title	Credits
3 Credits in Complex Analysis		3
6 Credits in Real Analysis		6
12 Credits in Probability and Statistics		12
3 Credits in Applied Mathematics		3

Actuarial Science Field

Code	Title	Credits
6 Credits in Actuarial Science		6
6 Credits in Applied Mathematics		6
6 Credits in Probability and Statistics		6
6 Credits in Real Analysis		6
3 Credits in Business or Economics		3

NOTE: Admission to this program is limited to students who have made significant progress towards and are close to achieving a professional designation from an internationally recognized actuarial organization.

Non-Transcript Designated Specializations

Algebra Field

Code	Title	Credits
12 Credits in Algebra		12
3 Credits in Complex Analysis		3
3 Credits in Real Analysis		3
3 Credits in Topology		3
3 Credits in Applied Mathematics		3
3 Credits Outside the Field		3

Analysis Field

Code	Title	Credits
3 Credits in Algebra		3
6 Credits in Complex Analysis		6
6 Credits in Real Analysis		6
3 Credits in Topology		3
3 Credits in Applied Mathematics		3
3 Credits Outside the Field		3

Topology Field

Code	Title	Credits
3 Credits in Algebra		3
3 Credits in Complex Analysis		3
3 Credits in Real Analysis		3
12 Credits in Topology		12
3 Credits in Applied Mathematics		3
3 Credits Outside the Field		3

Industrial Mathematics Field

Code	Title	Credits
3 Credits in Algebra or Topology		3
3 Credits in Complex Analysis		3
3 Credits in Real Analysis		3
9 Credits in Applied Mathematics		9
6 Credits in Probability and Statistics		6
6 Credits in Approved Credits Outside Math and MthStat		6

The secondary area may be chosen from another of these fields or may be chosen from another appropriate department. Minimum course requirements for all work in both areas of specialization require approximately two full years of study.

Additional Requirements

Major Professor as Advisor

The student must have a major professor to advise and supervise the student's studies as specified in Graduate School regulations. The entering graduate student is assigned a temporary advisor by the Department Graduate Program Coordinator.

Computer Proficiency

The student shall pass an examination on a higher programming language and/or other appropriate advanced computer skills; the examinations are administered by the Department's Computer Committee. The Computer Committee may accept advanced computer science coursework in lieu of the examination.

Residence

The student must meet minimum Graduate School residence requirements.

Doctoral Preliminary Examination

When the student is sufficiently prepared — normally when the student has earned 24 credits in specified areas above the 800 level — a doctoral preliminary examination to determine the student's knowledge and achievement is taken. For students in mathematics, the exam evaluates the student's general knowledge of mathematics, as well as the student's knowledge of the major area of concentration. Students must pass this examination to continue in the program. With permission of the examination committee, the student may repeat this examination once. If the student does not have a master's degree in mathematics before this examination, the committee will determine whether the student's performance is sufficient to qualify for the master's degree.

Doctoral Dissertation Proposal Hearing

After passing the language requirements and the doctoral preliminary examination, the student participates in a doctoral dissertation proposal hearing. At this hearing, the student is examined on the student's chosen area of research and a dissertation topic is approved.

Dissertation

The primary requirement for the PhD in mathematics is the candidate's completion, under the supervision of the Department advisor, of an original and significant mathematical investigation presented in the form of a dissertation. The investigation is to be in the field of algebra, analysis, applied mathematics, probability and statistics, topology, or actuarial science. A dissertation for the industrial mathematics field must involve an industrial problem requiring a mathematical solution.

Dissertation Defense

The candidate must, as the final step toward the degree, present a colloquium based on the dissertation and must pass an oral examination in defense of the dissertation. If the candidate does not successfully defend a thesis within five years of admission to candidacy, the candidate may be required to take another doctoral preliminary examination and be readmitted to candidacy.

Time Limit

All degree requirements must be completed within ten years from the date of initial enrollment in the doctoral program. Note that students seeking the PhD are limited to a maximum of seven years, inclusive of time spent in pursuit of an initial MS degree, of departmental financial support.

Minor Area for Other PhD Majors

A doctoral student planning a physical science major other than mathematics may fulfill requirements for mathematics as the minor area of concentration by completing 12 credits of approved mathematics courses with a grade of B or better, at least 6 credits of which must be in courses 800 or above.

A doctoral student planning a non-physical science major may fulfill requirements for mathematics as the minor area of concentration by completing 12 credits with a grade of B or better in approved mathematics courses 300 or above.

For additional information on the PhD, see the Graduate School Doctoral Requirements (https://uwm.edu/graduateschool/students/academic-policies-and-procedures/doctoral-resources/doctoral-requirements/) page.

Mathematics PhD Learning Outcomes

Students graduating from the program will be able to:

1. **apply** advanced knowledge of a broad range of topics in Mathematics or related fields, in the context of the chosen specialization.
2. **apply** expertise in an area of Mathematics or related field.
3. **conduct** original research in the chosen field of specialization.
4. **communicate** mathematical concepts.