

# Doctor of Philosophy in Mathematics

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## Why study mathematics?

Because mathematics is a framework upon which humanity builds an understanding of the world.

## Mission of the Graduate Program:

The mission of the Graduate Program of the Department of Mathematics is to prepare students for leadership roles in meeting the mathematical needs of our society and to produce professional mathematicians for positions in universities, colleges, industry, governmental agencies, and research centers.

## Doctor of Philosophy in Mathematics:

The Mathematics Department offers the degree of Doctor of Philosophy (Ph.D.) in Mathematics. The Ph.D. program provides broad and deep expertise in mathematics, culminating in a dissertation that includes significant original work. It is intended for students with a strong mathematical background who plan a career in research in academia or industry. A broad range of specialties is possible; research interests of department faculty include algebra, analysis, combinatorics, control theory, dynamical systems, geometry, numerical analysis, partial differential equations, probability, and statistics. There are two tracks: Pure Mathematics and Applied Mathematics. The requirements for each track are listed in the section Degree Requirements. College-wide requirements for graduate students may be found in the Graduate School Catalog (<http://catalog.ku.edu/liberal-arts-sciences/#graduatetext>).

## Admission to Graduate Studies

An applicant seeking to pursue graduate study in the College may be admitted as either a degree-seeking or non-degree seeking student. Policies and procedures of Graduate Studies govern the process of Graduate admission. These may be found in the Graduate Studies (<https://catalog.ku.edu/graduate-studies/>) section of the online catalog.

Please consult the Departments & Programs (<https://catalog.ku.edu/liberal-arts-sciences/>) section of the online catalog for information regarding program-specific admissions criteria and requirements. Special admissions requirements pertain to Interdisciplinary Studies degrees, which may be found in the Graduate Studies section of the online catalog.

## Admission to the Ph.D. in Mathematics

The minimum prerequisites for admission are:

- an undergraduate degree from an accredited institution with a program of study in mathematics;
- a record of achievement that shows strong promise of success in graduate school, including a 3.0 cumulative grade-point average in undergraduate studies and a 3.0 grade-point average in mathematics (department requirement);
- course work in abstract algebra, linear algebra, and advanced calculus or introduction to analysis (comparable to KU courses MATH 500, MATH 558, and MATH 590).

It is beneficial to have preparation in probability/statistics (comparable to MATH 627/MATH 628) and/or numerical analysis (comparable

to MATH 581). Although not required, it is also helpful to have taken introductory courses in complex analysis (comparable to MATH 646), partial differential equations (comparable to MATH 647), geometry (comparable to MATH 660/MATH 661), and/or topology.

The Mathematics Department currently does not require the general or subject Graduate Record Examination (GRE), although applicants may submit scores if they wish. International students whose native language is not English must fulfill English language requirements specified by university policies.

Applicants must submit a graduate application online (<https://gradapply.ku.edu/apply/>), including the following required materials:

- Transcript from each college or university the applicant has attended (an official transcript must be sent upon acceptance and completion of degree).
- Applicant's résumé/curriculum vitae.
- A list of the textbooks used in mathematics courses beyond calculus.
- A statement of purpose indicating the applicant's mathematical preferences and interests.
- 3 letters of reference.
- International applicants must fulfill the University's requirements for English proficiency (<https://gradapply.ku.edu/english-requirements/>).

Incomplete applications will not be considered. The minimum admission requirements do not guarantee admission. The Department of Mathematics evaluates candidates and makes recommendations to the Office of Graduate Studies regarding admission. The number of students admitted to the program changes from year to year, and admissions are competitive based on all application materials.

There are no additional application forms for financial support. Students are considered for support based on merit. Most Ph.D. students accepted by the program receive an offer of financial support in the form of a Graduate Teaching Assistantship. The number of GTAs available is limited. Further information about applications and admissions is available from the Department of Mathematics (<https://math.ku.edu/admission-graduate-program/>).

Contact the department:

**Michelle Morrison**  
**Graduate Program Coordinator**  
**Department of Mathematics**  
**433 Snow Hall**  
 michmor@ku.edu

## Ph.D. Degree Requirements

The department requires the student to meet the following requirements before taking the comprehensive examination.

1. Pass two written qualifying examinations: one exam in either algebra or analysis and a second exam in either numerical analysis or probability/statistics. Both qualifying examinations must be completed by the beginning of the student's fifth semester.
2. Complete the required qualifying exam coursework: MATH 727 (Probability), MATH 765 (Analysis I), MATH 781 (Numerical Analysis I), MATH 791 (Abstract Algebra I). Passing a qualifying exam exempts a student from the corresponding course. This coursework must be completed before the preliminary examination.

3. Pass a preliminary examination in an area close to the focus of the eventual doctoral dissertation. The preliminary examination must be completed by the beginning of the student's eighth semester.
4. Satisfy the Research Skills and Responsible Scholarship requirement.
  - a. To meet the Research Skills requirement, students must complete an introductory programming language course approved by the Graduate Committee. The course may have been taken at KU or at another university, either as a graduate or undergraduate. Students may meet the Research Skills requirement by passing EECS 138 or EECS 168. Alternatively, students may complete a computing project approved by their advisor and the Graduate Committee demonstrating competence in either a programming language or the use of specialized software that supports the student's research.
  - b. The Responsible Scholarship requirement must be met by completing the departmental training in responsible scholarship for mathematicians. The training is offered every spring semester. Students must have passed the qualifying exams and be working with an advisor in order to participate.
5. Complete the course requirements for a track in either Pure Mathematics or Applied Mathematics, as outlined below.

**Note:** Contact your department or program for more information about the qualifying exam coursework requirement, the research skills and responsible scholarship, and the current requirements for doctoral students. Current policies on Doctoral Research Skills and Responsible Scholarship are listed in the Graduate Studies section of the online catalog and in the KU Policy Library.

## Pure Mathematics

This track requires:

Code	Title	Hours
MATH 800	Complex Analysis I	3
MATH 810	Real Analysis and Measure Theory I	3
MATH 830	Abstract Algebra	3
MATH 820	Introduction to Topology	3
or		
MATH 821	Algebraic Topology I	
Select an approved course in geometry, e.g.:		3
MATH 840	Differentiable Manifolds	
MATH 920	Lie Groups and Lie Algebras	

In addition, the pure-track student must complete four additional MATH courses at the 800 level or above before the final examination. MATH 896, MATH 899, MATH 993 and MATH 999 may not be used to satisfy this requirement. MATH 990 may be used to satisfy this requirement only with Graduate Committee approval. Courses outside Mathematics may be used to satisfy this requirement only with Graduate Committee approval.

## Applied Mathematics

This track requires:

Code	Title	Hours
MATH 800	Complex Analysis I	3
MATH 810	Real Analysis and Measure Theory I	3
Select one of the following:		6

MATH 881 & MATH 882	Topics in Advanced Numerical Linear Algebra: _____ and Topics in Advanced Numerical Differential Equations: _____
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MATH 865 & MATH 866	Stochastic Processes I and Stochastic Processes II
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MATH 850 & MATH 851	Differential Equations and Dynamical Systems and Topics in Dynamical Systems: _____
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Select one of the following:

3

MATH 840	Differentiable Manifolds
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MATH 850	Differential Equations and Dynamical Systems
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MATH 950	Partial Differential Equations
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In addition, the applied-track student must complete four additional MATH courses at the 800 level or above before the final examination. MATH 896, MATH 899, MATH 993 and MATH 999 may not be used to satisfy this requirement. MATH 990 may be used to satisfy this requirement only with Graduate Committee approval. Courses outside Mathematics may be used to satisfy this requirement only with Graduate Committee approval.

## Examination Preparation

Normally the work required to prepare a student for the oral comprehensive examination (and to do research) includes one or more semesters of advanced courses, directed readings, and seminars. In the oral comprehensive examination, a student must show proficiency in the chosen area of mathematics. Precise areas of responsibility on this examination are discussed in detail with the advisory committee (the student's advisor and two other members of the department's Graduate Faculty).

## Ph.D. Degree Requirements

In addition to meeting general requirements, the Ph.D. candidate in mathematics must complete a minimum of 28 credit hours of mathematics coursework (this number includes 1 credit hour of MATH 999). The minimum amount of credit hours is possible only if a student passes all Ph.D. qualifying exams in lieu of the preparatory coursework (MATH 727, MATH 765, MATH 781, MATH 791). The program routinely takes 12 semesters to complete when factoring in research and milestone exams. A typical student completes 72 or more credit hours when enrolled full-time.