

# Mathematics

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## Degrees Offered

- Master of Science
- Doctor of Philosophy

## Nature of the Program

The Department of Mathematics offers graduate programs leading to the Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees. The master's degree program offers specializations in pure and applied mathematics. The Ph.D. program provides for a common core of fundamental mathematics followed by specialized studies culminating in an original research dissertation directed by a faculty advisor. Depending on the student's program and interests, there are diverse career opportunities available in education, government, and industry.

## Financial Support

Many graduate students receive financial support in the form of a graduate teaching assistantship, which provides a stipend and a full waiver of university tuition. These are awarded taking into account primarily the student's academic record along with the letters of recommendation and any supplementary information reflecting on the student's potential for success in the program. In some cases, teaching experience and/or the potential for outstanding teaching can be a consideration. Teaching assistants have the opportunity to work with the faculty in the Department's Institute for Mathematics Learning (IML). A small number of research assistantships are also available, usually through external funding.

Applications to the graduate program received by the January 15 deadline will receive full consideration for financial support for the subsequent fall semester. Late applications are accepted, but students are advised to check with the graduate director as to the availability of assistantships. Other financial aid includes partial university tuition waivers and part-time positions such as grading assisting in the instructional computer labs. TOEFL/IELTS scores are required for international students whose native language is not English, and passing the university SPEAK test is required for international students to be awarded teaching assistantships.

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## FACULTY

### DIRECTOR OF THE SCHOOL OF MATHEMATICAL AND DATA SCIENCES

- Earl Scime - Ph.D. (University of Wisconsin-Madison)  
Plasma Physics

### ASSOCIATE DIRECTOR FOR MATHEMATICS

- Adrian Tudorascu - Ph.D. (Carnegie Mellon University)  
Partial Differential Equations

### ASSISTANT DIRECTOR FOR GRADUATE STUDIES

- Adam Halasz - Ph.D. (State University of New York at Stony Brook)  
Mathematical Biology, Swarm Robotics

## PROFESSORS

- Krzysztof Ciesielski - Ph.D. (Warsaw University)  
Analysis, Topology, Set Theory
- Marjorie Darrah - Ph.D. (West Virginia University)  
Educational technology, algorithms
- Jessica Deshler - Ph.D. (University of New Mexico)  
Undergraduate Mathematics Education
- Harvey Diamond - Ph.D. (MIT)  
Approximation Theory, Applied Mathematics
- Harry Gingold - D.Sc. (Israel Institute of Technology)  
Differential Equations, Asymptotic Methods
- John Goldwasser - Ph.D. (University of Wisconsin-Madison)  
Combinatorics, Graph Theory
- Harumi Hattori - Ph.D. (Rensselaer Polytechnic Institute)  
Differential Equations, Continuum Mechanics
- Snehalata Huzurbazar - Ph.D. (Colorado State University)  
Statistics, Data Science

- Hong-Jian Lai - Ph.D. (Wayne State University)  
Associate Chair, Graph Theory, Matroid Theory
- Dening Li - Ph.D. (Fudan University)  
Partial Differential Equations
- Rong Luo - Ph.D. (West Virginia University)  
Discrete Mathematics
- David Miller - Ph.D. (Oklahoma State University)  
Undergraduate mathematics education
- Robert Mnatsakanov - Ph.D. (Moscow Inst. of Electronics and Mathematics)  
Statistics
- Laura Pyzdrowski - Ed.D. (West Virginia University)  
Mathematics Education, Instructional Technology
- Adrian Tudorascu - Ph.D. (Carnegie Mellon University)  
Partial Differential Equations
- Jerzy Wojciechowski - Ph.D. (University of Cambridge)  
Combinatorics, Graph Theory
- Cun-Quan Zhang - Ph.D. (Simon Fraser University)  
Graph Theory, Combinatorics

## **ASSOCIATE PROFESSORS**

- Olgur Celikbas - Ph.D. (University of Nebraska)  
Commutative Algebra
- Adam Halasz - Ph.D. (State University of New York at Stony Brook)  
Mathematical Biology; Swarm Robotics
- Kevin Milans - Ph.D. (University of Illinois)  
Combinatorics, Graph Theory
- Casian Pantea - Ph.D. (University of Wisconsin-Madison)  
Mathematical Biology; Dynamical Systems
- Vicki Sealey - Ph.D. (Arizona State University)  
Mathematics Education
- Charis Tsikkou - Ph.D. (Brown University)  
Nonlinear PDE

## **ASSISTANT PROFESSORS**

- Ela Celikbas - Ph.D. (University of Nebraska)  
Commutative Algebra, Representation Theory
- Qingtian Zhang - Ph.D. (Pennsylvania State University)  
Analysis of PDEs

## **PROFESSORS EMERITI**

- Gary H. Ganser  
Applied Mathematics, Fluid Mechanics, Numerical Analysis
- Henry W. Gould - M.A. (University of Virginia)  
Combinatorics, Number Theory, Special Functions
- Michael E. Mays - Ph.D. (Penn State University)  
Number Theory
- Sherman D. Riemenschneider - Ph.D. (Syracuse University)  
Approximation Theory, Wavelet Theory

## **Admissions**

The Mathematics program admits students into both the M.S. and the Ph.D. program. The GRE is not required for admission to this program.

## **M.S. IN MATHEMATICS**

Programs are available for students to study pure and applied mathematics. In addition to the university requirements for admission (<http://catalog.wvu.edu/graduate/graduateeducationatwestvirginiauniversity/#classificationtext>), applicants to the master's program must have a bachelor's

degree ([http://catalog.wvu.edu/undergraduate/eberlycollegeofartsandsciences/mathematics/mathematics\\_bs/](http://catalog.wvu.edu/undergraduate/eberlycollegeofartsandsciences/mathematics/mathematics_bs/)) in mathematics (or a strongly allied field). It is generally expected that incoming students have passed at least one semester each of real analysis, linear algebra, and modern algebra.

## PH.D. IN MATHEMATICS

In addition to the university requirements for admission (<http://catalog.wvu.edu/graduate/graduateeducationatwestvirginiauniversity/#classificationtext>), applicants to the Ph.D. program are expected to have earned an M.S. in Mathematics (<http://catalog.wvu.edu/graduate/eberlycollegeofartsandsciences/mathematics/ms/>) or a closely related field. Well-qualified students without an M.S. but with at least 12-18 hours of advanced mathematics coursework beyond the level of a B.S. in Mathematics at WVU ([http://catalog.wvu.edu/undergraduate/eberlycollegeofartsandsciences/mathematics/mathematics\\_bs/](http://catalog.wvu.edu/undergraduate/eberlycollegeofartsandsciences/mathematics/mathematics_bs/)) will be considered for direct admission to the Ph.D. program.

### List of Admission Requirements for both programs:

- See the steps to apply for admissions and access the application here (<https://graduateadmissions.wvu.edu/how-to-apply/>).
- Transcripts from all institutions attended.
- Three letters of recommendation from individuals having experience with the applicant's mathematical ability.
- A personal statement that indicates the applicant's mathematical interests and how those align with research interests of faculty within the department, as well as any experience relevant to potential teaching opportunities. The personal statement should indicate if a student has an interest in pursuing a Ph.D. after completion of the master's degree.

### International Applicants:

- See the steps to apply for admissions and access the application here (<https://graduateadmissions.wvu.edu/how-to-apply/>).
- International applicants should view additional requirements here (<http://catalog.wvu.edu/graduate/graduateeducationatwestvirginiauniversity/#internationaltext>) and here (<https://graduateadmissions.wvu.edu/information-for/international-students/>).
- Language proficiency is required in order to hold a graduate teaching assistantship. See here (<https://elli.wvu.edu/testing-resources/english-proficiency-gtas/>).

### Application Deadlines:

- The Mathematics programs admit students for the Fall and Spring semesters.
- For Fall admission, completed applications should be submitted no later than January 15<sup>th</sup>.
- For Spring admission, completed applications should be submitted no later than October 15<sup>th</sup>.
- Applications submitted after the deadline may be considered on a space-available basis.
- Exceptional Ph.D. applicants may be nominated by the Mathematics program for competitive University Fellowships. Qualified applicants will be notified if they are nominated. More information on WVU fellowships can be found here (<https://graduateeducation.wvu.edu/finances/fellowships/>).

### Assistantships

All interested applicants will be considered for financial support in the form of Graduate Teaching Assistantships (GTAs) and Graduate Research Assistantships (GRAs). *Priority will be given to applicants committed to pursuing a PhD (irrespective of their current program level)*.

Certain application requirements may be waived based on a preliminary review of an application by the program.

## ADMISSION REQUIREMENTS 2024-2025

The Admission Requirements above will be the same for the 2024-2025 Academic Year.

M.S. and Ph.D. Major Code: 1457

### For specific information on the following program, please see the link to the right:

- Mathematics, M.S.

### For specific information on the following program, please see the link to the right:

- Mathematics, Ph.D.

## Degree Progress

All Students will have a plan of study and will receive, at minimum, a yearly letter of evaluation.

## MASTER OF SCIENCE

The M.S. program usually requires two years of full-time study. In their first year, students will normally complete the Linear Algebra and the Real Analysis requirements. Ideally, students in the Pure Mathematics Area of Emphasis take at least one of the subject areas of the M.S. Advanced Exam

by no later than August at the beginning of their second year. To be in good standing, a student is expected to maintain at least a 3.0 average (B) in mathematics courses and to present at least a 3.0 average in all work offered in fulfillment of the degree program.

## ADVISING

Each student will be assigned to be advised by the Graduate Program Director upon entry to the program who will assist the student in designing a written plan of study that takes into account the student's interests and needs as well as the aims of the department's graduate programs. Later changes in the plan are possible only through mutual agreement of the student and the Director.

## PROGRAMS

The student's plan of study is developed in one of these areas of emphasis: pure mathematics or applied mathematics. The programs are designed either for students who intend to pursue a doctor of philosophy in mathematics or the mathematical sciences or for those planning to seek employment in education, government, or industry. At least thirty-one semester hours of approved coursework are required.

Note: MATH 590/690/696/697/790/797 may not be counted for credit to satisfy graduate course requirements.

## EXAMINATIONS/THESES/PROJECTS

Upon beginning graduate study, all M.S. students are given a basic exam in advanced calculus and linear algebra for purposes of course placement. Depending on the program chosen, students must complete examinations, a thesis, or a project as a graduation requirement.

## DOCTOR OF PHILOSOPHY

The doctor of philosophy is a research program in which the final product is an original, publishable research thesis. For students entering with regular admission status, the program requires a minimum of twenty-four hours of approved coursework along with research and graduate seminar requirements. As reflected in the interests and expertise of the faculty, students may specialize in a variety of areas of pure, applied, and discrete mathematics as well as research in undergraduate mathematics education. Beyond any coursework taken to remove deficiencies while a provisional student, a minimum of twenty-four hours of approved coursework (not including research or one-credit seminar courses) is required of all doctoral students, which must include a major area of four courses and two minor areas of two courses each. Certain level and distribution requirements apply to a student's program. Six credits of seminar (Five credits of Math 696 and one credit of Math 694) are required.

## DISSERTATION COMMITTEE

Students normally select a dissertation advisor at the end of their first year in the program, though this can also be done in the second year. Upon selecting a dissertation advisor, a student must request that the Director of Graduate Studies select a dissertation committee of at least five members (with a dissertation advisor as chairperson and one member from outside the department) for them.

## EXAMINATIONS AND DISSERTATION

All doctoral students must demonstrate that they are prepared to undertake doctoral work and research by passing an entrance examination, given each year in April and August, within two years after enrolling. Specifically, students entering the program in a given calendar year must pass the entrance examinations by the end of the spring semester in the calendar year two years after. Students must pass examinations in two areas from among the four areas of algebra, real analysis, topology, and differential equations. During the fourth year after enrolling, the student is expected to pass a qualifying oral and written examination and present an approved dissertation prospectus. Any minor area in which the student has not achieved a GPA of at least 3.5 also requires a written examination. If the qualifying examination results are unsatisfactory, the dissertation committee may reexamine the student once. After the Qualifying Examination is successfully completed the student is considered a Candidate for the Ph.D. The dissertation typically requires from one to two years of research and writing, with the defense completed by the end of the fifth year.