

# Mathematics

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## Program and Application Information

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| Department Chair:                 | Dr. Benton Duncan                                                                              |
| Graduate Coordinator:             | Dr. Indranil Sengupta                                                                          |
| Department Location:              | 412 Minard                                                                                     |
| Department Phone:                 | (701) 231-8171                                                                                 |
| Department Web Site:              | <a href="http://www.ndsu.edu/math/graduate_program/">www.ndsu.edu/math/graduate_program/</a>   |
| Application Deadline:             | March 1 to be considered for assistantships for fall. Openings may be very limited for spring. |
| Degrees Offered:                  | Ph.D., M.S.                                                                                    |
| English Proficiency Requirements: | TOEFL iBT 71; IELTS 6                                                                          |

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## Program Description

The Department of Mathematics offers graduate study leading to the degrees of Master of Science (M.S.) and Doctor of Philosophy (Ph.D.). Advanced work may be specialized among the following areas:

- algebra, including algebraic number theory, commutative algebra, and homological algebra
- analysis, including analytic number theory, approximation theory, ergodic theory, harmonic analysis, and operator algebras
- applied mathematics, differential equations, dynamical systems,
- combinatorics and graph theory
- geometry/topology, including differential geometry, geometric group theory, and symplectic topology

Beginning with their first year in residence, students are strongly urged to attend research seminars and discuss research opportunities with faculty members. By the end of their second semester, students select an advisory committee and develop a plan of study specifying how all degree requirements are to be met. One philosophical tenet of the Department of Mathematics graduate program is that each mathematics graduate student will be well grounded in at least two foundational areas of mathematics. To this end, each student's background will be assessed, and the student will be directed to the appropriate level of study.

## Admissions Requirements

The Department of Mathematics graduate program is open to all qualified graduates of universities and colleges of recognized standing. In addition to the Graduate School requirements (<http://bulletin.ndsu.edu/past-bulletin-archive/2017-18/graduate/admission-information>), applicants must have earned a cumulative grade point average (GPA) of at least 3.0 or equivalent in all advanced mathematics courses at the baccalaureate level.

## Financial Assistance

Teaching assistantships and a small number of research assistantships are available. Graduate tuition is waived for research and teaching assistants.

All students in full standing and, in certain situations, students in conditional status are eligible for assistantships. International students must show proficiency in reading, writing, and speaking English. In particular, they must pass an oral proficiency interview, which is a Test of Spoken English (TSE) prior to receiving a teaching assistantship. This interview is the culmination of the five-week Intensive English Language Program (IELP) available each summer. An indication, but not a guarantee, of being able to pass this interview is a TOEFL score of at least 600 (paper test) or 247 (computer test). All international students applying from outside the United States for a teaching assistantship must expect to take the IELP.

Assistantship applications will be considered at any time. However, opportunities are improved for those received by March 1 preceding the fall semester of intended enrollment.

At least one year of academic work must be spent in residence at NDSU in fulfilling graduate requirements for each graduate degree earned. The M.S. customarily takes two years to complete; the Ph.D. usually last three years beyond the master's. Students must maintain a cumulative GPA of at least 3.0 throughout their graduate career.

## Master of Science

The Master of Science degree is offered in two options: the Thesis Option or the Comprehensive Study Option. The Thesis Option emphasizes research and preparation of a scholarly thesis, whereas the Comprehensive Study Option emphasizes a broader understanding of a major area of mathematics.

## Departmental Requirements

- At least 30 credit hours in approved graduate-level mathematics course work, depending on the degree option.
  - Thesis Option: At least 6 credit hours of MATH 798 Master's Thesis, in addition to at least 18 credit hours in courses numbered 700-789. These 18 credit hours must include six foundational courses.
  - Comprehensive Study Option: At least 2 credit hours of MATH 797 Master's Paper, in addition to at least 24 credit hours in courses numbered 700-789. These 24 credit hours must include six foundational courses. Subject to the approval of the Supervisory Committee, at most 6 of the required 30 credits may be earned in 600-level mathematics courses (excluding 620, 621, 650, and 651) or in courses outside the Mathematics Department.
- A grade of Master's Pass in two of the four written preliminary examinations offered by the department. These examinations are offered in four areas: Algebra, Analysis, Applied Mathematics, and Geometry/Topology.
- Demonstrated proficiency in a computer programming language.
- A thesis or expository paper written under the supervision of a faculty member and defended at an oral examination administered by the student's supervisory committee.

## Timelines

A candidate has three calendar years from the time of enrollment in the Graduate School to complete the Master's degree. Extensions may be granted after review and approval by the Graduate Committee, subject to Graduate School Policy.

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## Doctor of Philosophy

The Doctor of Philosophy degree is awarded in recognition of high scholarly attainment as evidenced by a period of successful advanced study, the satisfactory completion of prescribed examinations, and the development of an acceptable dissertation covering a significant, original aspect of mathematics.

## Departmental Requirements

- A total of at least 90 credit hours in approved graduate-level mathematics course work, including:
  - At least 42 credit hours in courses numbered 700-789 or as approved by the Graduate Program Director. These 42 credit hours must include six foundational courses. The advisor should in consultation with the graduate chair ensure that the 42 credit hours contain a broad spectrum of courses (at least 12 credit hours) outside the student's area of emphasis as well as depth in a specific area of mathematics.
  - At least 3 credit hours of MATH 790 Graduate Seminar.
  - At least 6 credit hours of MATH 799 Doctoral Dissertation. Subject to the approval of the supervisory committee, at most 12 of the required 42 credit hours may be earned in 600-level mathematics courses (excluding 620, 621, 650, and 651) or in courses outside the Mathematics Department. Credits used to satisfy the requirements of a Master's degree at NDSU may be included in the 90 credit hours required for the Ph.D. A student entering the Doctoral program with a Master's degree from another institution need only complete 60 credit hours to complete the Ph.D. degree. Half of these 60 credits must be in courses numbered 700-789 excluding those courses numbered 720, 721, 750, and 751.
- A grade of Ph.D. Pass in two of the four written preliminary examinations offered by the department. These examinations are offered in four areas: Algebra, Analysis, Applied Mathematics, and Geometry/Topology.
- Demonstrated reading proficiency of mathematical writing in French, German, or Russian. A student's supervisory committee may require a second foreign language.
- Demonstrated proficiency in a computer programming language.
- A passing grade in a preliminary oral examination administered by the student's supervisory committee after completion of the Preliminary Examinations.
- A dissertation consisting of a written presentation of original and significant research completed by the student under the supervision of a faculty member and defended at an oral examination administered by the candidate's supervisory committee.
- A dissertation video describing the candidate's research, evaluated by the candidate's supervisory committee.

## Timelines

Ph.D. students have 3 years from first enrolling in a 700 level Mathematics course as a graduate student to complete the written Preliminary Examination requirement.

A student advances to candidacy after completion of the preliminary oral examination. All students must advance to candidacy no later than the start of their fourth year in the graduate program of the Department of Mathematics. Extensions may be granted after review and approval by the Graduate Committee, subject to Graduate School Policy.

**Azer Akhmedov, Ph.D.**

Yale University, 2004

Research Interests: Group Theory, Low Dimensional Topology

**Maria Angeles Alfonseca, Ph.D.**

Universidad Autonoma de Madrid, Spain, 2003

Research Interests: Fourier Analysis, Partial Differential Equations

**Abraham Ayebo, Ph.D.**

University of Nevada, Reno, 2010

Research Interests: Mathematics Education

**Nikita Barabanov, Ph.D.**

University of Kiev, 1979

Research Interests: Differential Equations, Control Theory, Optimization, Neural Networks

**Jason Boynton, Ph.D.**

Florida Atlantic University, 2006

Research Interests: Algebra

**Leo Butler, Ph.D.**

Queen's University, 2000

Research Interests: Hamiltonian Mechanics and Geometry

**Catalin Ciuperca, Ph.D.**

University of Kansas, 2001

Research Interests: Commutative Algebras, Algebraic Geometry

**Michael Cohen, Ph.D.**

University of North Texas, 2013

Research Interests: Groups, Dynamics Descriptive Set Theory

**Dogan Comez, Ph.D.**

University of Toronto, 1983

Research Interest: Ergodic Theory, Measureable Dynamics, Operator Theory

**Susan Cooper, Ph.D.**

Queen's University, 2005

Research Interests: Commutative Algebra and Algebraic Geometry

**Davis Cope, Ph.D.**

Vanderbilt University, 1980

Research Interests: Partial Differential Equations, Numerical Methods, Applied Mathematics

**Josef Dorfmeister, Ph.D.**

University of Minnesota, 2009

Research Interests: Symplectic Topology

**Benton Duncan, Ph.D.**

University of Nebraska, 2004

Research Interests: Operator Algebras, Noncommutative Functional Analysis, K-theory

**Friedrich Littmann, Ph.D.**

University of Illinois, Urbana, 2003

Research Interests: Approximation theory, Number theory

**William Martin, Ph.D.**

University of Wisconsin, 1993

Research Interests: Mathematics Education

**Artem Novozhilov, Ph.D.**

Moscow State University of Communication Means, 2002

Research Interests: Mathematical Biology

**Indranil Sengupta, Ph.D.**

Texas A&M University, 2010

Research Interests: Mathematical Finance and Mathematical Physics

**Jessica Striker, Ph.D.**

University of Minnesota, 2008

Research Interests: Enumerative, Algebraic, Geometric and Bijective Combinatorics

**Abraham Ungar, Ph.D.**

Tel-Aviv University, 1973

Research Interests: Differential Equations, Integral Transforms, Wave Propagation, Special Relativity