

School of Arts and Sciences

MATHEMATICS

www.math.pitt.edu

The University of Pittsburgh Department of Mathematics offers programs leading to Bachelor of Science degrees in mathematics and applied mathematics, as well as joint degree programs in mathematics/economics and mathematics/philosophy.

As a mathematics major, you will be thoroughly trained in classical mathematics, use the latest technological tools. You also will be exposed to ideas on the cutting edge of current research. Department faculty participate in research in topics such as relativity theory, graph theory, scientific computing, math finance, ordinary and partial differential equations, algebra, and topology.

A degree in mathematics provides an excellent base on which to build a career in virtually any high-technology field and provides a particularly strong foundation for advanced study in science or engineering. Fields open to graduates include management, quality control and assurance, computer programming, software engineering, accounting, technical marketing, actuarial sciences (determining insurance costs), information sciences, and research and development. Employers who hire mathematics graduates in these areas include manufacturing firms, oil companies, finance houses, insurance companies, computing firms, government agencies, industrial research firms, communications companies, schools, and banks.

Note: If you are interested in the computer field and programming specifically, you should become familiar with systems and programs such as C, C++, UNIX, Windows XP, Windows NT, Visual C++, Visual Basic, Oracle DBMS, Microsoft Access, Java, and HTML.

I. Mathematics Major Requirements

These requirements are flexible to enable students to follow their interests and study the subject for its own sake. After taking a calculus sequence and a sequence of three basic theoretical courses, students complete the major with six or more upper-level courses. No single course may be used to fulfill two requirements. Students must take 43 credits of required courses, distributed as follows (note: courses are worth 3 credits unless indicated otherwise):

Analytic Geometry and Calculus (12 credits):

MATH 0220 Analytic Geometry and Calculus 1: This course covers the derivative and integral of functions of one variable and their applications. It includes a computer lab section where you apply numeric, algebraic, and graphing technologies to calculus problems.

MATH 0230 Analytic Geometry and Calculus 2: This course covers the calculus of transcendental functions, techniques of integration, series of numbers and functions, polar coordinates, and conic sections. It also includes a computer lab section where you continue to solve problems by applying various programs.

MATH 0240 Analytic Geometry and Calculus 3: This course covers vectors and surfaces in space and the calculus of functions of several variables including partial derivatives and multiple integrals, Stokes' theorem, and first order differential equations.

Highly qualified students may replace the sequence MATH 0220–0230 with a single honors course, MATH 0235 Honors 1-Variable Calculus.

Three intermediate mathematics courses (10 credits):

MATH 0413 Introduction to Theoretical Mathematics (4 credits): This course is an introduction to the theoretical treatment of sets, functions, relations, numbers, sequences, and limits. Classwork and homework concentrate on reading and writing proofs of theorems centered on these topics.

MATH 0420 Introductory Theory (3 credits): 1-Variable Calculus: The course provides a careful treatment of the theoretical concepts of limit, continuity, derivative, and integral, including the fundamental theorem of calculus.



MATH 0430 Introduction to Abstract Algebraic Systems (3 credits): This course introduces you to abstract algebraic concepts; rings; integral domains; fields; integers; rational, real, and complex numbers; and polynomials. Many examples will be presented during class and in the homework. You are expected to enhance your proof writing techniques.

Highly qualified students may replace the sequence MATH 0413 and 0420 with a single honors course, MATH 0450 Introduction to Analysis.

These three courses (10 credits):

MATH 1180 Linear Algebra 1 (3 credits): This course stresses the theoretical and rigorous development of linear algebra. Major topics include the theory of vector spaces, linear transformations, matrices, characteristic polynomials, bases, and canonical forms.

MATH 1270 Ordinary Differential Equations (3 credits): This course covers methods of solving ordinary differential equations, which are frequently encountered in applications. General methods will be taught for single n-th order equations and systems of first order nonlinear equations. These will include phase plane methods and stability analysis. Computer experimentation will be used to illustrate the behavior of solutions to various equations.

PHYS 0174 Basic Physics for Science and Engineering (4 credits): This is the first term of a three-term, calculus-based sequence in introductory physics. This term deals with mechanics.

Electives

At least one of the following courses (3 credits):

MATH 1020 Applied Elementary Number Theory

MATH 1050 Combinatorial Mathematics

MATH 1240 Linear Algebra 2

MATH 1250 Abstract Algebra

Three courses chosen from this list (9 credits):

MATH 1020 Applied Elementary Number Theory

MATH 1050 Combinatorial Mathematics

MATH 1070 Numerical Analysis

MATH 1080 Numerical Linear Algebra

MATH 1100 Linear Programming

MATH 1110 Industrial Numerical Analysis

MATH 1240 Linear Algebra 2

MATH 1250 Abstract Algebra

MATH 1280 Ordinary Differential Equations 2

MATH 1290 Topics in Geometry

MATH 1310 Graph Theory

MATH 1330 Projective Geometry

MATH 1350 Introduction to Differential Geometry

MATH 1360 Modeling in Applied Mathematics

MATH 1410 Introduction to Foundations of Mathematics

MATH 1470 Partial Differential Equations and Applications

MATH 1530 Advanced Calculus 1

MATH 1540 Advanced Calculus 2

MATH 1550 Vector Analysis and Applications

MATH 1560 Complex Variables and Applications

MATH 1570 Transform Methods in Applied Math

MATH 1700 Introduction to Topology

MATH 1800 or 1801 Advanced Topics in Mathematics

STAT 1631 Intermediate Math Statistics 1

STAT 1632 Intermediate Math Statistics 2

II. Applied Mathematics Major Requirements

Applied mathematics deals with real-world applications of mathematics, including applications in the natural and social sciences, business, finance, statistics, and industry. This major consists of 49 credits of mathematics and statistics courses. The requirements follow those of the mathematics major, with the following differences:

Two intermediate mathematics courses (7 credits):

MATH 0413 Introduction to Theoretical Mathematics

MATH 0420 Introductory Theory: 1-Variable Calculus

Highly qualified students may replace the sequence MATH 0413 and 0420 with a single honors course, MATH 0450 Introduction to Analysis.

Two upper-level mathematics courses (6 credits):

MATH 1180 Linear Algebra I

MATH 1270 Ordinary Differential Equations I

Electives

One course from each of the following groups:

Numerical Analysis

MATH 1070 Numerical Analysis

MATH 1080 Numerical Linear Algebra

MATH 1100 Linear Programming

MATH 1110 Industrial Mathematics

Applied Analysis

MATH 1550 Vector Analysis and Applications

MATH 1560 Complex Variables and Applications

MATH 1570 Transform Methods in Applied Mathematics

*Students who are interested in graduate study in mathematics are strongly advised to take MATH 1530 and 1540, Advanced Calculus 1 and 2. These two courses can be substituted for the course in the **applied analysis** group above and for the "one additional course" specified below, respectively. Note that no single course may fulfill two requirements simultaneously.*

One additional course from one of the two groups above or one course from the following group:

Differential Equations

MATH 1280 Ordinary Differential Equations 2

MATH 1470 Partial Differential Equations and Applications

MATH 1480 Partial Differential Equations 2

One of the following two courses:

MATH 1110 Industrial Numerical Analysis: This course is concerned with the approximate numerical solutions of problems that arise in an industrial environment. Topics covered include physical interpretation of a mathematical model, use of library software, preparation of software, analysis of results, and reporting on findings.

MATH 1360 Modeling in Applied Mathematics: This course introduces some of the fundamental approaches of applied mathematics. The emphasis is on the model-building process and on developing an understanding of some of the unifying themes of applied mathematics such as equilibria, stability, and conservation laws. The material is presented in the form of case studies.

Basic Physics (8 credits):

PHYS 0174 Basic Physics for Science and Engineering 1

PHYS 0175 Basic Physics for Science and Engineering 2

Computer Science (3 credits): Choose one of the following courses:

CS 0002 Introduction to Computer Programming: FORTRAN

CS 0007 Introduction to Computer Programming: PASCAL

CS 0132 Programming in C and a Guide to the UNIX Operating System

Statistics, one of the following two courses (3–4 credits):

STAT 1000 Applied Statistical Methods (4 credits)

STAT 1151 Introduction to Probability/Mathematical Statistics 1 (3 credits)

III. Actuarial Mathematics Major Requirements

The Bachelor of Science program in actuarial mathematics is designed to prepare students for careers as professional actuaries. The curriculum covers the materials recommended as preparation for the first, second, and third level Society of Actuaries exams, and affords the opportunity to earn up to three Society of Actuaries Validation by Educational Experience credits.

Requirements include 63 credits, of which 45 will be in mathematics and statistics. The four required economics courses will satisfy the School of Arts and Sciences related area requirement. Specific requirements are:

1. (12 cr.) Calculus I, II, III: MATH 0220, 0230, 0240
2. (3 cr.) Linear Algebra: MATH 0280 or 1180 or 1185
3. (3 cr.) Ordinary Differential Equations: MATH 0290 or 1270
4. (6 cr.) Actuarial Mathematics: MATH 1120 and 1121
5. (3 cr.) Numerical Methods: MATH 1070 or 1080
6. (6 cr.) Applied Mathematics: two courses from among MATH 1280, 1360, 1470, 1480

7. (3 cr.) Industrial Mathematics: MATH 1100
8. (12 cr.) Economics: ECON 0100, 0110, 1100, and 1110
9. (3 cr.) Computer Science: CS 0132
10. (9 cr.) Statistics: STAT 1151, STAT 1152, and either 1631 or 1731
11. (3 cr.) Business: BUSFIN 1030 or ECON 1440

IV. Joint Majors

Bachelor of Science in Mathematics–Economics: This joint major provides a program of study for above-average students who seek the option of taking a quantitatively oriented job in industry or who intend to enter graduate school in applied mathematics, statistics, economics, business, or a related area such as operations research or management science. The program is advantageous to students who otherwise would take a double major or a single major in mathematics and/or economics. The joint major provides not only a set of requirements but also suggested course sequences of mathematics and economics courses that are compatible with each other and that prepare students for various specialties.

Bachelor of Science in Mathematics–Philosophy: This joint major combines study in mathematics with a background in philosophy. Students take courses in symbolic logic, the philosophy of mathematics, and the philosophy of science. In the mathematics department, students take courses in theoretical mathematics, algebra, and geometry or topology.

V. Other Information

Bachelor of Science in Scientific Computing: The solution of large-scale scientific and engineering projects is frequently critically dependent upon some aspects of the mathematical and computational sciences. These include a knowledge of mathematical modeling, state-of-the-art numerical analysis, symbolic and logic analysis, software development tools for high-performance computer architectures and, especially, parallel and vector computers, graphical analysis, visualization, and networking.

There is a growing call for more people trained in this increasingly important, interdisciplinary field now variably called scientific computing or computational science. In response to this call, the Department of Mathematics and the Department of Computer Science have introduced the Bachelor of Science degree in the discipline of scientific computing.

Foreign Language: If you are considering graduate work in mathematics or statistics, be aware that many programs require a reading knowledge of two foreign languages selected from French, German, and Russian.

For more information on the math program, please contact:

University of Pittsburgh
School of Arts and Sciences
Department of Mathematics
301 Thackeray Hall
Pittsburgh, PA 15260
412-624-8375

For information on other majors, please contact:

University of Pittsburgh
Office of Admissions and Financial Aid
Alumni Hall, 4227 Fifth Avenue
Pittsburgh, PA 15260-6601
412-624-PITT
E-mail: oafa@pitt.edu
www.oafa.pitt.edu

Special Opportunities

Internships

Mathematics majors have the opportunity to participate in internships related to their studies, such as with Wolfram Research Inc., creator of Mathematica software, and the Carnegie Science Center.

Study Abroad

Studying abroad is an exciting way to add an international perspective to your undergraduate education and strengthen your credentials as a graduate. Since only about 4 percent of American students have studied abroad, this experience distinguishes you as a candidate in the job market. While earning credits toward your degree, you also broaden your personal experience and gain an appreciation of other cultures. There are many programs at universities across the globe that offer strong programs in math, computer science, and statistics. Scholarships are available, and financial aid is applicable.

Undergraduate Teaching

Undergraduate students can apply for positions as undergraduate teaching assistants in entry-level mathematics courses. Peer tutoring opportunities are also available in the Math Assistance Center.