

Mission and Vision Statements

Department of Mathematical Sciences

Mission

The Department of Mathematical Sciences prepares majors for graduate study, for secondary teaching, or for employment in mathematically-related fields. It provides students in the physical, managerial, social, and life sciences with the mathematical tools essential for their respective fields. The Department strives to instill in all students an appreciation for the cultural significance of mathematics and its contribution to the modern world.

Principal Goals

What should Mathematics Majors know, value, and be able to do?

Elizabethtown College graduates with a major in mathematics will

1. Know and have a working knowledge of foundational mathematics;
2. Value rigorous, deductive reasoning and mathematical proofs and be able to critique the proofs of others;
3. Be able to solve problems and apply mathematical methods in a variety of areas;
4. Be able to communicate mathematical arguments, procedures, and results verbally and/or in writing;
5. Be able to use appropriate technological tools;
6. Be highly marketable to industry and adequately prepared for graduate work in mathematics or a related field.

Vision

The Department of Mathematical Sciences is a leader in the mathematical community, known for excellent teaching, individual attention to students, student/faculty scholarship, technological innovation, and its modern and diversified curriculum. Graduates are highly sought after by employers in a wide variety of areas.

Vision Themes and Objectives

Curriculum

General considerations

- There are established procedures for periodic review of the curriculum. These reviews include careful scrutiny of course syllabi, prerequisites, and textbooks, and examine the curriculum in the context of the departmental goals and institutional mission.
- Each student's progress is evaluated yearly to assure adequate progress toward successful completion of the major requirements.

Core and service courses

- Core and service courses develop an awareness and appreciation for the cultural significance of mathematics, its contribution to the modern world, and its power in shaping current thought.
- Core and service courses present concepts that encourage critical thinking. Students are able to construct sophisticated responses to arguments and positions that depend on symbolic logic and/or numbers and statistics.
- Core and service courses stress ways in which numerical data and/or symbolic interpretations make accessible more profound levels of knowledge and understanding.
- Core and service courses develop the ability to model real world phenomena logically and mathematically.
- Core and service courses develop problem solving strategies that are applicable to a wide variety of disciplines.

Mathematics Education concentration

- Future teachers gain an understanding of mathematics at a level well beyond that at which they will teach.
- Future teachers are able to teach students how to apply mathematical procedures to solve problems in the physical, biological, or social sciences, as well as business situations.
- Future teachers are aware of available technology, and are able to use technological tools in the teaching and doing of mathematics.
- Future teachers are able to interest and involve students in using mathematical concepts, skills and tools appropriate to their students' age and ability in order to recognize, construct, and solve problems in mathematics and other disciplines.
- The Middle-School Mathematics Education Program is well known for its high quality innovative curriculum.

Actuarial concentration

- Nearly all students pass both the Course 1 and Course 2 Actuarial Examinations before graduation.
- Students graduate with excellent business and communications skills.
- All students take at least one internship designed to expose them to the expectations of employers of actuaries.
- Students graduating from this program are highly sought for employment by actuarial firms.

Applied Mathematics concentration

- By developing a strong foundation in applied mathematics, graduates are well trained for careers in government and industry.
- Students are well prepared to pursue graduate work leading to college teaching careers or employment as applied research mathematicians.
- Students with an applied mathematics concentration have the opportunity to participate in summer research programs and internships during the academic year.
- Numerous students in this area go on to obtain advanced degrees in applied mathematics or statistics, and achieve distinguished careers in these fields.

Pure Math concentration

- Students are well prepared for graduate study in both pure and applied mathematics.
- Nearly all students pursue opportunities for Summer Research Experiences for Undergraduates.
- Students develop an appreciation for the beauty and inner harmony of mathematics.

Technology

- Computers are used for instruction in nearly every mathematics course.
- All classrooms are fully equipped for the utilization of technology.
- Students have adequate access to computer hardware and software needed for their learning.
- Students are instructed in the appropriate use of technology.

Student Recruitment, Advising, and Retention

- All students admitted to Elizabethtown College will have had at least three years of standards-based mathematics courses and therefore are prepared for at least one college-level mathematics course.
- A significant percentage of Elizabethtown College students matriculate with A.P. credit for mathematics courses.
- Elizabethtown College Mathematics faculty show sufficient flexibility in teaching methodology to ensure that all students have the opportunity to learn mathematics.
- Elizabethtown College Mathematics Faculty share responsibility with students for student learning.

Student and Faculty Research

- The culture of the Mathematical Sciences Department respects and rewards pedagogical, expository, and original research and scholarship.
- Elizabethtown College Mathematics faculty publish papers in refereed journals, write books, and give presentations at local seminars, regional meetings, and national conferences.

- Elizabethtown College Mathematics Faculty are involved in professional organizations, and attend meetings of these organizations regularly.
- The Mathematical Sciences Department occasionally hosts local professional meetings.
- Students and faculty collaborate on research projects, many of which are grant-supported.
- Students regularly give talks at local professional meetings, such as the Eastern Pennsylvania and Delaware section meetings of the Mathematical Association of America.
- Elizabethtown College Mathematical Sciences Faculty actively pursue interdisciplinary work with members of other departments.
- Library holdings and other learning resources related to mathematical sciences are sufficient and well-used. Students and faculty have adequate access to professional journals needed for their collaborative research.
- Students and faculty have adequate access to computer hardware and software needed for their collaborative research.
- Elizabethtown College Mathematics Faculty, often in collaboration with members of other departments, write grant proposals appropriate to the missions of the Mathematical Science Department and Elizabethtown College as a whole.
- The department hosts and has sufficient funding for several outside speakers per year.

Pedagogy and Faculty/Student Relationships

- The culture of the department includes an expectation that students will work hard.
- The Mathematical Sciences Department provides effective undergraduate instruction for all students.
- The culture of the department respects and rewards effective teaching.
- The Mathematical Sciences Department has a well-defined system of peer review, which facilitates mentoring and sharing of teaching ideas.
- The Mathematical Sciences Department employs a variety of instructional approaches, including traditional lectures, group methods, writing, and computer laboratory projects.
- The Mathematical Sciences Department encourages experimentation in both curriculum and instructional methods.

- The Mathematical Sciences Department provides effective advising for all mathematics majors and assigned first-year students.
- The culture of the Mathematical Sciences Department encourages cooperative learning by students outside of class. Students can frequently be seen studying in small groups in the vicinity of the department, in classrooms, conference rooms, and computer labs.
- The Math Club is an effective and well-used vehicle for academic, service, and social activities of math majors and minors, and any other students interested in mathematics.

Relationships with Other Departments

- The Mathematical Sciences department recognizes that its mission is inherently interdisciplinary, and strives to maintain open communication and good cooperation with other departments regarding interdisciplinary programs, core and service courses, and collaborative research.
- The Mathematical Sciences Department resides in close geographical proximity to the Department of Physics and Engineering and the Department of Computer Science, which facilitates interaction among students in all three departments, coordinated curricula, team teaching of special courses, guest lecturing, co-advising of students, and collaborative research.
- A mechanism is in place for frequent communication between the Education Department and the Mathematical Sciences Department to ensure a well-coordinated program in Mathematics Education.
- A mechanism is in place for frequent communication between the Business Department and the Mathematical Sciences Department to ensure an effective program in Actuarial Science.
- The Mathematical Sciences Department maintains frequent communication with client departments and programs including the social sciences, Occupational Therapy, Music Therapy, Allied Health, Business, and Biology, regarding effective packaging and timing of core and service courses.
- The Mathematical Sciences Department is responsive to opportunities for the creation of new interdisciplinary programs, in cooperation with other departments.

Experiential Learning

- Mathematics Education concentrators are required to engage in at least one semester of

supervised student teaching.

- Actuarial concentrators pursue summer internships at actuarial firms.
- Applied Mathematics concentrators engage in experiential learning through internships, summer employment in industry or government, and/or Research Experiences for Undergraduates.
- Pure mathematics concentrators apply for summer Research Experiences for Undergraduates and/or collaborative research with faculty members.

Overview of the Mathematical Sciences Department

Concentrations within the major

Mathematical Sciences majors can elect one (or more) of the following concentrations:

- **Mathematics Education.** Mathematical Sciences graduates who complete the Mathematics Education concentration are certified to teach secondary mathematics in Pennsylvania public schools. Elizabethtown College Mathematics Education concentrators are among the best-prepared secondary mathematics teachers in the state, as evidenced by performance on statewide teacher examinations, and by their success in obtaining highly desirable teaching positions.
- **Actuarial Science.** Mathematical Sciences graduates who complete the Actuarial Science concentration are well-prepared for immediate employment at insurance companies, financial services companies, pension firms, and economic agencies at both the state and federal level. Preparation is attained by both coursework and professional internships, and is evidenced by the passing of one or more examinations administered by the national actuarial organizations.
- **Applied Mathematics.** Mathematical Sciences graduates who complete the Applied Mathematics concentration are well-prepared to join the technological workforce, employed in companies and government agencies at the cutting edge of research and development. Specific skill areas include statistics, operations research, and software development. Applied Mathematics concentrators may also apply to graduate programs in statistics, operations research, computer science, or applied mathematics. Many Applied Mathematics concentrators also minor in Computer Science.
- **Pure Mathematics.** Mathematical Sciences graduates who complete the Pure Mathematics concentration are well-prepared for graduate programs in either pure or applied mathematics. Pure math concentrators are intensively advised on the process of choosing and applying to graduate programs.

Minor in Mathematical Sciences

The Mathematical Sciences Department offers a seven-course minor (four foundational courses and three upper-level electives) that can add a component of mathematical expertise to another major (thereby adding interdisciplinary value to that major). The minor works particularly well as (and is most often invoked as) a complement to a physics, engineering, computer science, or elementary education major. Chemistry and business majors have also been known to minor in mathematics.

Number of Students

On the average, Mathematical Sciences graduates 12 to 15 majors and 10 to 12 minors each year. About half of the majors are Secondary Education concentrators.

Number of Faculty

- 7 full-time regular faculty
- 1 full-time adjunct with rank of lecturer, shared with the Education department
- 2 or 3 part-time adjuncts used as needed for lower-division or remedial courses
- 1/3 time secretary (shared with two other departments)

Mathematical Sciences Faculty: Education and Research/Experience

Leyla Batakci

Degree: Ph.D. (2002) in Mathematics and M.S. in Statistics from Lehigh University

Research: Algebraic topology

Carl Graber

Degree: Ph.D. (1975) in Mathematics Education from Texas A&M University

Research/Experience: Mathematics Education/31 years secondary teaching experience

James Hughes

Degree: Ph.D. (1991) in Mathematics from Brandeis University

Research: Topology; knot theory and related algebra; chaos and fractals

Robert Morse

Degree: M.A. (1969) in Mathematics from Temple University

Research: Incorporating recreational mathematics into the liberal arts curriculum

Gabriela Sanchis

Degree: Ph.D. (1991) in Mathematics from Rochester University

Research/Experience: Probability theory, history of mathematics/ four years as full-time actuary

Ronald Shubert

Degree: Ed.D. (1964) from the Pennsylvania State University

Research: Mathematics education, operations research

Bobette Thorsen

Degree: Ph.D. (1993) in Mathematics from the University of California at Santa Cruz

Research/Experience: Complex analysis/ three years secondary teaching

Joseph Walker

Degree: M.Ed. (1970) in Mathematics Education from Shippensburg University

Experience: 31 years secondary teaching in Pennsylvania

Recent Curricular Changes

The Mathematical Sciences department recently undertook an extensive curricular review and revision, in response to changes in the overall College curriculum, as well as departmental scrutiny of local and national trends. Some highlights are as follows:

- Probability and Statistics upgraded from a first-year, 3-credit course to a 4-credit course that students in most client disciplines will take as sophomores, closer to the point in their programs where probability and statistics is invoked as a research tool. A task force of Mathematical Sciences faculty (Batakci, Graber, and Hughes) has initiated meetings with representative faculty from client disciplines that require Probability and Statistics in order to tie the course more closely to the clients' programs. The new course will emphasize critical thinking in connection with appropriate use of statistical tools.
- The "transition" course in which most mathematics majors and minors first encounter formal proofs has been upgraded from a 3-credit course (Foundations of Abstract Mathematics) to a 4-credit course (Discrete Mathematics with Proofs) explicitly incorporating topics that are important in both mathematics and computer science.
- The Real Analysis course that all mathematics majors take has been upgraded from 3 to 4 credits, and will delve more deeply into fundamental notions of compactness, closure, differentiation, integration, and other topics in analysis.
- The Abstract Algebra course has also been upgraded from 3 to 4 credits, and will now be required of all mathematics majors. The new course will cover key areas more deeply.
- After a successful trial offering in spring 2002, a course in Topology has been made a regular part of the curriculum. This course will be required of Pure Mathematics concentrators, and an elective for all other concentrators. Much of the impetus for the trial offering came from Physics majors (and the trial offering was audited by a Physics faculty member), so it is expected that this course will also function as a service course for the Physics and Engineering department.
- Math 111 (Calculus with Review I) has been replaced by Math 110 (College Algebra and Trigonometry), and will now fulfill the College Core requirement in mathematics. Also, Math 117 (Concepts of Calculus) will now fulfill the Core requirement as well. These changes will afford students greater flexibility in their academic programs, and (specifically) in changing between majors.
- The two former concentrations of Statistics and Computer Science have been replaced with a single concentration in Applied Mathematics. This change reflects the eclectic academic and professional path that many of our graduates in recent years have followed. In particular, many mathematics majors elect to take a minor in computer science along with advanced mathematics courses in statistics and other applied areas.

Student Successes

Honors in the Discipline

Since its inception in 1997, twenty mathematics majors have earned Honors in the Discipline in Mathematical Sciences by fulfilling a rigorous Senior Thesis requirement, and presenting thesis results orally to the collective Mathematical Sciences faculty. Many of these students have also presented their results at regional meetings of the Mathematical Association of America (MAA-EPADEL). Topics have included cryptography, abstract algebra related to the Rubik's cube puzzle, knight's tours on a chessboard, the mathematics of Julia sets and the Mandelbrot set, and innovative techniques of secondary school mathematics instruction.

Successful Employment

Recent graduates with Mathematics Education concentrations have been very successful in obtaining teaching positions at area high schools, including Hempfield High School, Hershey High School, Middletown High School (Gifted Programs Coordinator), Pocono Mountain West High School, and many others. Many of our recent graduates have been hired by top-notch technology firms such as Lockheed-Martin. Actuarial Science concentrators have obtained employment at firms such as Conrad-Siegel, Ace Insurance, Deutsche Asset Management, Keystone Insurance, and Blue Cross of Northeast Pennsylvania.

Graduate and Professional School

Recent graduates have gone on to Master's and Ph.D. programs at universities such as SUNY Stonybrook, Carnegie-Mellon, and RPI.