MATHEMATICAL SCIENCES, B.S.

Begin Campus: Any Penn State Campus

End Campus: Harrisburg

Program Description

The two options and the variety of the course offerings provide concentrations in various areas such as actuarial science, management science/operation research, statistics, education, and preparation for graduate studies.

Small classes, excellent faculty, opportunities to work with faculty on projects, and strong employment prospects are just some of the strengths of the program. Students will be helped to develop:

- a solid foundation in mathematical studies;
- an awareness of the utility of mathematics, statistics, and computers;
- skills in translating practical problems into mathematical terms;
- a competency in the use of modern mathematical tools;
- problem-solving skills; and
- an awareness of the importance of mathematics in society.

The program is designed to prepare students for employment in business, industry, government, and education immediately after graduation, but graduate study in mathematics or related disciplines is also a viable alternative. Mathematical modeling is emphasized, and all students are required to take courses in statistics and computer science.

What is Mathematical Sciences?

Mathematical Sciences is the study of mathematics and its application to problems in the real world. This discipline includes both theoretical topics such as calculus, abstract algebra, real analysis, and number theory and applied topics such as statistics, math modeling, operations research, and quantitative finance.

You Might Like This Program If...

- You like mathematics and learning how to apply it to real-life problems.
- You enjoy logical and analytical reasoning.
- You like solving new problems.
- You like analyzing methods of solution in order to make those methods more effective. (For the secondary education option especially)
- You enjoy helping others to grasp the utility and beauty of mathematics.

Entrance to Major

Entry to the Mathematical Sciences major requires that the student has completed with a grade of C or higher: MATH 140, MATH 141. A 2.00 or higher cumulative grade-point average is required.

The Mathematical Sciences Secondary Education Option prepares students to meet the requirements, as established by the Pennsylvania Department of Education, to be certified for the Instructional I Certificate in Mathematics at the secondary level.

Students admitted to the program must have the appropriate clearances. These include FBI fingerprint check, Act 151 child abuse history clearance, and Act 34 criminal record check.

Students thinking seriously about entering the education program should plan their freshman and sophomore years carefully. Semesters 5 through 8 are very structured.

Mathematical Sciences Secondary Education Option

Additional Requirements

1. a minimum cumulative grade-point average of 3.0
2. completion of ENGL 15 or ENGL 30 and three credits of literature from approved list with a C or higher grade
3. Satisfaction of any entrance testing requirements set out by the Pennsylvania Department of Education in effect at the time of application for the major

Selective Retention

Following entrance to the major, students will be evaluated for retention in the program based on:

1. maintaining a cumulative GPA of 3.0 or higher;
2. completion of required courses with a C or higher grade;
3. an acceptable or above rating on the Penn State Harrisburg Professional Dispositions for Teacher Education.

To be eligible to student teach, students must:

1. maintain a cumulative GPA of 3.0 or higher;
2. complete all required Content and Education Courses with a C or higher grade;
3. satisfy any entrance testing requirements set out by the Pennsylvania Department of Education in effect at the time of application for entrance to major;
4. be rated acceptable or above on the Penn State Harrisburg Professional Dispositions for Teacher Education.

In order to successfully complete the Secondary Education Mathematics Program, students must:

1. complete EDUC 490 with a grade of C or higher;
2. maintain a cumulative GPA of 3.0 or higher;
3. complete all required Content and Education Courses with a C or higher grade;
4. pass the Penn State Harrisburg Mathematics Content Exam with an 80% or higher
5. complete a presentation portfolio; and
6. be rated acceptable or above on the Penn State Harrisburg Professional Dispositions for Teacher Education.

Degree Requirements

For the Bachelor of Science degree in Mathematical Sciences, a minimum of 120 credits is required; for the Bachelor of Science degree in Mathematical Sciences with the Secondary Education option, a minimum of 121 credits is required:

Requirement	Credits
General Education	45
Requirements for the Major	83-96

General Education

Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (http://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

Foundations (grade of C or better is required.)

- **Quantification (GQ):** 6 credits
- **Writing and Speaking (GWS):** 9 credits

Knowledge Domains

- **Arts (GA):** 6 credits
- **Health and Wellness (GHW):** 3 credits
- **Humanities (GH):** 6 credits
- **Social and Behavioral Sciences (GS):** 6 credits
- **Natural Sciences (GN):** 9 credits

Integrative Studies (may also complete a Knowledge Domain requirement)

- **Inter-Domain or Approved Linked Courses:** 6 credits

9-18 of these 45 credits are included in the Requirements for the Major.

University Degree Requirements

First Year Engagement

All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.

Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.

First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

Cultures Requirement

6 credits are required and may satisfy other requirements

- United States Cultures: 3 credits
- International Cultures: 3 credits

Writing Across the Curriculum

3 credits required from the college of graduation and likely prescribed as part of major requirements.

Total Minimum Credits

A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits. Students should consult with their college or department adviser for information on specific credit requirements.

Quality of Work

Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

Limitations on Source and Time for Credit Acquisition

The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or within time constraints (see Senate Policy 83-80 (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#83-80)). For more information, check the Suggested Academic Plan for your intended program.

Requirements for the Major

This includes 9-18 credits of General Education courses: 3 credits of GWS courses; 6 credits of GQ courses. In addition, the Secondary Education option includes 6 credits of GH courses and 3 credits of GS courses.

To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44 (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44).

Common Requirements for the Major (All Options)

Code	Title	Credits
Prescribed Courses		
ENGL 202C	Effective Writing: Technical Writing	3
Prescribed Courses: Require a grade of C or better		
MATH 140	Calculus With Analytic Geometry I	4
MATH 141	Calculus with Analytic Geometry II	4
MATH 311W	Concepts of Discrete Mathematics	3-4
MATH 430	Linear Algebra and Discrete Models I	3
MATH 401	Introduction to Analysis I	3
Requirements for the Option		
Select an option		63-75

Requirements for the Option

General Mathematical Sciences Option (64-65 credits)

Code	Title	Credits
Prescribed Courses		
CMPSC 121	Introduction to Programming Techniques	3
MATH 230	Calculus and Vector Analysis	4
MATH 220	Matrices	2-3
MATH 251	Ordinary and Partial Differential Equations	4
MATH 318	Elementary Probability	3
STAT 301	Statistical Analysis I	3
MATH 435	Basic Abstract Algebra	3
MATH 475	History of Mathematics	3
Prescribed Courses: Require a grade of C or better		
MATH 455	Introduction to Numerical Analysis I	3

Additional Courses		
MATH 412	Fourier Series and Partial Differential Equations	3
or MATH 425	Introduction to Operations Research	
Supporting Courses and Related Areas		
Select 6 credits of 200 level or above courses		6
Select 18 credits of 300-400 level Mathematics courses in consultation with an academic adviser [1]		18
Select 9 credits of 300-400 level courses in consultation with an academic adviser and in support of the student's interests		9

[1] Up to 6 of these credits may be replaced by any 200 or greater level CMPSC courses or CMPSC 122.

Secondary Education in Mathematical Sciences Option (63-75 credits)

Code	Title	Credits
Prescribed Courses		
HDFS 239	Adolescent Development	3
Prescribed Courses: Require a grade of C or better		
CMPSC 121	Introduction to Programming Techniques	3
EDPSY 14	Learning and Instruction	3
MATH 230	Calculus and Vector Analysis	4
CI 280	Introduction to Teaching English Language Learners	3
MATH 220	Matrices	2-3
MATH 250	Ordinary Differential Equations	3
EDUC 313	Field Observation	2
EDUC 314	Learning Theory and Instructional Procedures	3
EDUC 315	Social and Cultural Factors in Education	3
EDUC 458	Behavior Management Strategies for Inclusive Classrooms	3
MATH 427	Foundations of Geometry	3
STAT 301	Statistical Analysis I	3
EDUC 417	Teaching Secondary Mathematics	3
EDUC 459	Strategies for Effective Teaching in Inclusive Classrooms	3
MATH 435	Basic Abstract Algebra	3
MATH 475	History of Mathematics	3
EDUC 490	Student Teaching	1-12
Additional Courses		
MATH 412	Fourier Series and Partial Differential Equations [1]	3
or MATH 425	Introduction to Operations Research	
Supporting Courses and Related Areas		
Select 3 credits of 100-400 level courses		3
Supporting Courses and Related Areas: Require a grade of C or better		
Select 3 credits of literature (GH) from department list		3
Select 3 credits of 300-400 level courses in Mathematics, Computer Science, Statistics, or Education		3

[1] MATH 412 requires a grade of C or better.

Program Learning Objectives

1. Have the ability to construct a written mathematical proofs supporting the work they do.
   a. Demonstrate an understanding of the logical structure of a direct proof, a proof of the contrapositive statement, a proof by contradiction, and a proof by induction.
2. Be effective communicators, with an ability to communicate mathematical ideas.
   a. Demonstrate the ability to communicate mathematical ideas clearly both orally and in writing.
3. Effectively be able to reason both qualitatively and abstractly.
   a. Demonstrate knowledge of axioms, definitions, and major theorems of a given mathematical topic and the ability to reason therefrom.
4. Understand mathematical methods computationally and analytically to solve problems in the workplace.
   a. Demonstrate the ability to use and understand the results of standard computational algorithms.
5. Understand how to model real world phenomena mathematically.
   a. Demonstrate the ability to model real world phenomena mathematically.

Academic Advising

The objectives of the university's academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of both in-and out-of class educational opportunities in order that they become self-directed learners and decision makers.

Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The advisee's unit of enrollment will provide each advisee with a primary academic adviser, the information need to plan the chosen program of study, and referrals to other specialized resources.

READ SENATE POLICY 32-00: ADVISING POLICY (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/32-00-advising-policy)

Harrisburg

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Suggested Academic Plan

Harrisburg Campus

General Option

The course series listed below provides **only one** of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an **Academic Requirements** or **What If** report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

First Year

Fall	Credits	Spring	Credits
ENGL 15 or 30[‡]	3	CAS 100[‡]	3
MATH 140[*#†]	4	MATH 141[*#†]	4

General Education Course	3 General Education Course	3
General Education Course	3 General Education Course	3
General Education Course (GHW)	1.5 General Education Course	3
	14.5	16

Second Year

Fall	Credits	Spring	Credits
CMPSC 121	3	ENGL 202C‡	3
MATH 230	4	MATH 220	2
General Education Course	3	MATH 251	4
General Education Course	3	General Education Course	3
General Education Course (GHW)	1.5	General Education Course	3
	14.5		15

Third Year

Fall	Credits	Spring	Credits
MATH 315*	3	MATH 401*	3
MATH 318	3	MATH 455*	3
MATH 430*	3	STAT 301	3
200-400-level General Elective	3	200-level General Elective	3
300-400-level Mathematics	3	300-400-level Mathematics	3
	15		15

Fourth Year

Fall	Credits	Spring	Credits
MATH 435	3	MATH 449	3
MATH 475W	3	300-400-level Mathematics	3
300-400-level Mathematics	3	300-400-level Mathematics	3
300-400-level Mathematics	3	300-400-level General Elective	3
300-400-level General Elective	3	300-400-level General Elective	3
	15		15

Total Credits 120

* Course requires a grade of C or better for the major

‡ Course requires a grade of C or better for General Education

Course is an Entrance to Major requirement

† Course satisfies General Education and degree requirement

[1] Select any 300-400 level Mathematics
In consultation with adviser, select 18 credits of 300-400 level Mathematics courses or SSET 295. Up to six credits may be replaced by an 200 or greater level CMPSC courses or CMPSC 122.

University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy University Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

GWS, GQ, GHW, GN, GA, GH, and GS are abbreviations used to identify General Education program courses. General Education includes Foundations (GWS and GQ) and Knowledge Domains (GHW, GN, GA, GH, GS, and Integrative Studies). Foundations courses (GWS and GQ) require a grade of 'C' or better.

Integrative Studies courses are required for the General Education program. N is the suffix at the end of a course number used to designate an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.

Secondary Education Option

The course series listed below provides **only one** of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an **Academic Requirements** or **What If** report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

First Year

Fall	Credits	Spring	Credits
ENGL 15 or 30‡	3	CAS 100‡	3
MATH 140*#†	4	MATH 141	4
General Education Course	3	HDFS 239	3
General Education Course	3	General Education Course	3
General Education Course (GHW)	1.5	General Education Course	3
	14.5		16

Second Year

Fall	Credits	Spring	Credits
CMPSC 121	3	CI 280*†	3
EDPSY 14	3	ENGL 202C‡	3
MATH 230	4	MATH 220*	2
Select English Literature*#†	3	MATH 250*	3
General Education Course	3	100-400 level support course	3
		General Education Course (GHW)	1.5
	16		15.5

Third Year

Fall	Credits	Spring	Credits
EDUC 313*	2	EDUC 315W*	3
EDUC 314*	3	EDUC 458*	3
MATH 315*	3	MATH 401*	3
MATH 430*	3	MATH 427*	3
300-400 level support course in Computer Science, Education, Mathematics, or Statistics*	3	STAT 301*	3
General Education Course	3		
	17		15

Fourth Year

Fall	Credits	Spring	Credits
EDUC 417*	3	EDUC 490*	12
EDUC 459*	3		
MATH 425 or 449*	3		

MATH 435*	3	
MATH 475W*	3	
	15	12

Total Credits 121

* Course requires a grade of C or better for the major

‡ Course requires a grade of C or better for General Education

Course is an Entrance to Major requirement

† Course satisfies General Education and degree requirement

1 MATH 475W - Introduction tot he History of Mathematics (US:IL)

2 In consultation with adviser, select 18 credits of 300-400 level Mathematics courses or SSET 295.

3 Up to six credits may be replaced by an 200 or greater level CMPSC courses or CMPSC 122.

4 EDUC 490 - Student Teaching
A minimum GPA of 3.00 in all previous work is required for admission to EDUC 490.

University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy University Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

GWS, GQ, GHW, GN, GA, GH, and GS are abbreviations used to identify General Education program courses. General Education includes Foundations (GWS and GQ) and Knowledge Domains (GHW, GN, GA, GH, GS, and Integrative Studies). Foundations courses (GWS and GQ) require a grade of 'C' or better.

Integrative Studies courses are required for the General Education program. N is the suffix at the end of a course number used to designate an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.

Program Notes

Students must complete, with a grade of "C" or higher, six (6) credit of college level mathematics, three (3) credits of college level English literature and three (3) credits of college level English composition. Students must also complete MATH 140 and MATH 141 for entrance to Secondary Education Option of Mathematical Sciences.

Career Paths

The Mathematical Sciences program is designed to prepare students for employment in business, industry, and government. The various options and concentrations within the program provide preparation for careers in actuarial science, management science/operations research, secondary education, or statistics. The secondary education option prepares students to teach middle school and high school mathematics and has been recognized by the National Council of Teachers of Mathematics (NCTM) and is approved by the Pennsylvania Department of Education.

Careers

According to projections by the U.S. Bureau of Labor Statistics, employment in occupations that require at least a bachelor's degree in mathematics is expected to grow faster than employment in other sectors of the American labor market. Computer-related occupations are predicted to grow at a rate of more than 100 percent. The demand for secondary math school teachers is projected to increase by 22 percent. Insurance, securities, real estate, and business service occupations are projected to add more than 100,000 jobs, yielding an employment growth rate of 17 percent.

MORE INFORMATION (https://harrisburg.psu.edu/science-engineering-technology/computer-science-and-mathematics/bachelor-science-mathematical-sciences/career-opportunities)

Opportunities for Graduate Studies

The mathematical sciences general option provides the broad mathematical background requisite for postgraduate studies in mathematical sciences, statistics, or related disciplines. Advanced study will lead to increased opportunities formed within higher education, business, and industry.

MORE INFORMATION (https://harrisburg.psu.edu/science-engineering-technology/computer-science-and-mathematics/bachelor-science-mathematical-sciences)

Accreditation

The secondary education option prepares students to teach middle school and high school mathematics and been recognized by the National Council of Teachers of Mathematics (NCTM) and is approved by the Pennsylvania Department of Education.

MORE INFORMATION (http://www.nctm.org)

Contact

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