MATHEMATICAL SCIENCES, B.S.

Begin Campus: Any Penn State Campus

End Campus: Harrisburg

Program Description

The three 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 enjoy understanding the justification of why a mathematical method works.
- You like analyzing methods of solution in order to make those methods more effective.
- You enjoy helping others to learn mathematics and to grasp both its utility and beauty.

Entrance to Major

Entry to the Mathematical Sciences General Option requires the following:

1. completion of MATH 140 and MATH 141 each with a grade of C or higher
2. a cumulative grade-point average of 2.0 or higher

Entry to the Mathematical Sciences Data Science Option requires the following:

- completion of CMPSC 131, CMPSC 132, MATH 140, MATH 141 each with a grade of C or higher
- a cumulative grade-point average of 2.0 or higher

Entry to the Mathematical Sciences Secondary Education Option requires the following:

1. completion of ENGL 15 or ENGL 30H, three credits of literature from approved list, MATH 140 and MATH 141 each with a grade of C or higher
2. a cumulative grade-point average of 3.0 or higher
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
4. submission to the Teacher Education Office of current and clear background checks as required by the Pennsylvania Department of Education
5. submission of documentation of 20 pre-major field observation hours

Retention Requirements

Following entrance to the major, students in the Mathematical Sciences Secondary Education option 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 Professional Dispositions for Teacher Education.[1]
4. current and clear background checks as required by the Pennsylvania Department of 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 Professional Dispositions for Teacher Education.[1]
5. have current and clear background checks as required by the Pennsylvania Department of 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 2.0 or higher for degree completion
3. maintain a cumulative GPA of 3.0 or higher for Pennsylvania teacher certification
4. complete all required Content and Education Courses with a C or higher grade;
5. complete a program portfolio
6. for Pennsylvania teacher certification, be rated acceptable or above for all criteria on the Final Professional Dispositions Review for Teacher Education.[1]

[1] For more detailed information see the Secondary Education Handbook.

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	84-99

9-21 of the 45 credits for General Education are included in the Requirements for the Major. This includes: 3 credits of GWS courses; 6 credits of GQ courses. In addition, the Secondary Education option includes 6 credits of GH courses and 6 credits of GS courses.

Requirements for the Major

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 (https://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		
Prescribed Courses: Require a grade of C or better		
ENGL 202C	Effective Writing: Technical Writing	3
MATH 140	Calculus With Analytic Geometry I	4
MATH 141	Calculus with Analytic Geometry II	4
MATH 311W	Concepts of Discrete Mathematics	3
MATH 401	Introduction to Analysis I	3
MATH 430	Linear Algebra and Discrete Models I	3
Requirements for the Option		
Select an option		64-77

Requirements for the Option
Data Science Option (64 credits)

Code	Title	Credits
Prescribed Courses		
CMPSC 445	Applied Machine Learning in Data Science	3
DS 220	Data Management for Data Sciences	3
MATH 230	Calculus and Vector Analysis	4
MATH 251	Ordinary and Partial Differential Equations	4
STAT 401	Experimental Methods	3
STAT/MATH 414	Introduction to Probability Theory	3
STAT/MATH 415	Introduction to Mathematical Statistics	3
STAT 462	Applied Regression Analysis	3
Prescribed Courses: Require a grade of C or better		
CMPSC 131	Programming and Computation I: Fundamentals	3
CMPSC 132	Programming and Computation II: Data Structures	3
MATH 220	Matrices	2
MATH/CMPSC 455	Introduction to Numerical Analysis I	3

Supporting Courses and Related Areas

Select 15 credits of 300-400 level Mathematics courses.	15
Select 6 credits of 100-400 level courses.	6
Select 6 credits of 300-400 level courses in consultation with an academic adviser and in support of the student's interests.	6

General Mathematical Sciences Option (64 credits)

Code	Title	Credits
Prescribed Courses		
MATH 220	Matrices	2
MATH 230	Calculus and Vector Analysis	4
MATH 251	Ordinary and Partial Differential Equations	4
MATH 425	Introduction to Operations Research	3
MATH 435	Basic Abstract Algebra	3
MATH 475Y	History of Mathematics	3
STAT 401	Experimental Methods	3
Prescribed Courses: Require a grade of C or better		
MATH/CMPSC 455	Introduction to Numerical Analysis I	3
Additional Courses		
CMPSC 121 or CMPSC 131	Introduction to Programming Techniques Programming and Computation I: Fundamentals	3
STAT/MATH 318 or STAT/MATH 414	Elementary Probability Introduction to Probability Theory	3

Supporting Courses and Related Areas

Select 6 credits of 100-400 level courses.	6
Select 18 credits of 300-400 level Mathematics courses in consultation with an academic adviser. Up to 6 of these credits may be replaced by any 300 or greater level CMPSC course (except CMPSC 360), CMPSC 221 or CMPSC 122.	18
Select 9 credits of 300-400 level courses in consultation with an academic adviser and in support of the student's interests.	9

Secondary Education in Mathematical Sciences Option (77 credits)

Code	Title	Credits
Prescribed Courses		
HDFS 239	Adolescent Development	3
Prescribed Courses: Require a grade of C or better		
EDPSY 14	Learning and Instruction	3
EDUC 313	Secondary Education Field Experience	2
EDUC 314	Learning Theory and Instructional Procedures	3
EDUC 315Y	Social and Cultural Factors in Education	3
EDUC 400	Diversity and Cultural Awareness Practices in the K-12 Classroom	3
EDUC 417	Teaching Secondary Mathematics	3
EDUC 458	Behavior Management Strategies for Inclusive Classrooms	3
EDUC 459	Strategies for Effective Teaching in Inclusive Classrooms	3
EDUC 466N	Foundations of Teaching English as a Second Language	3
EDUC 490	Student Teaching	12
MATH 220	Matrices	2
MATH 230	Calculus and Vector Analysis	4

MATH 250	Ordinary Differential Equations	3
MATH 425	Introduction to Operations Research	3
MATH 427	Foundations of Geometry	3
MATH 435	Basic Abstract Algebra	3
MATH 475Y	History of Mathematics	3
STAT 401	Experimental Methods	3
Additional Courses		
Additional Courses: Require a grade of C or better		
CMPSC 121	Introduction to Programming Techniques	3
or CMPSC 131	Programming and Computation I: Fundamentals	
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

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 (https://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 and Inter-Domain courses do not meet this requirement.)
- **Quantification (GQ):** 6 credits
- **Writing and Speaking (GWS):** 9 credits

Breadth in the Knowledge Domains (Inter-Domain courses do not meet this requirement.)
- **Arts (GA):** 3 credits
- **Health and Wellness (GHW):** 3 credits
- **Humanities (GH):** 3 credits
- **Social and Behavioral Sciences (GS):** 3 credits
- **Natural Sciences (GN):** 3 credits

Integrative Studies
- **Inter-Domain Courses (Inter-Domain):** 6 credits

Exploration
- **GN,** may be completed with Inter-Domain courses: 3 credits
- **GA, GH, GN, GS, Inter-Domain courses.** This may include 3 credits of World Language course work beyond the 12th credit level or the requirements for the student's degree program, whichever is higher: 6 credits

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 (https://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.

Program Learning Objectives

- Restate and write mathematical statements, proofs, or solutions; produce presentations and reports that explain the statements, proofs, or solutions to others.
- Model real world phenomena mathematically.
- Restate and summarize theoretical concepts and axiomatic underpinnings of mathematics and construct proofs at the appropriate level.
- Demonstrate functional proficiency in techniques, algorithms and analysis.
- Analyze data and interpret results.

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 needed to plan the chosen program of study, and referrals to other specialized resources.

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

Harrisburg

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Suggested Academic Plan

The suggested academic plan(s) listed on this page are the plan(s) that are in effect during the 2024-25 academic year. To access previous years' suggested academic plans, please visit the archive (https://bulletins.psu.edu/undergraduate/archive/) to view the appropriate Undergraduate Bulletin edition.

Data Science Option: Mathematical Sciences, B.S. at Harrisburg Campus

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
CMPSC 131*#	3	CAS 100A or 100S‡	3
ENGL 15, 15S, 30T, or ESL 15‡	3	CMPSC 132*#	3
MATH 140*#†	4	MATH 141*#†	4
General Education Course	3	MATH 220	2
General Education Course	3	General Education Course	3
	16		**15**

Second Year

Fall	Credits	Spring	Credits
DS 220	3	ENGL 202C‡	3
MATH 230	4	MATH 251	4
MATH 311W*	3	STAT 401	3
General Education Course	3	General Education Course	3
General Education Course	3	General Education Course	1.5
	16		**14.5**

Third Year

Fall	Credits	Spring	Credits
General Education Course	3	CMPSC 445	3
MATH 430*	3	MATH 414	3
100-400 level General Elective	3	MATH 455*	3
300-400 level Mathematics	3	100-400 level General Elective	3
General Education Course	3	300-400 level Mathematics	3
	15		**15**

Fourth Year

Fall	Credits	Spring	Credits
MATH 415	3	MATH 401*	3
STAT 462	3	300-400 level General Elective	3
300-400 level General Elective	3	300-400 level Mathematics	3
300-400 level Mathematics	3	General Education Course	3
General Education Course	3	General Education Course	1.5
	15		**13.5**

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

University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy Cultural Diversity 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.

General Education includes Foundations (GWS and GQ), Knowledge Domains (GHW, GN, GA, GH, GS) and Integrative Studies (Inter-domain) requirements. N or Q (Honors) is the suffix at the end of a course number used to help identify an Inter-domain course, but the inter-domain attribute is used to fill audit requirements. Foundations courses (GWS and GQ) require a grade of 'C' or better.

General Option: Mathematical Sciences, B.S. at Harrisburg Campus

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, 15S, 30T, or ESL 15[‡]	3	CAS 100A or 100S[‡]	3
MATH 140[*#†]	4	MATH 141[*#†]	4
General Education Course	3	MATH 220	2
General Education Course	3	General Education Course	3
General Education Course	3	General Education Course	3
		General Education Course (GHW)	1.5
	16		**16.5**

Second Year

Fall	Credits	Spring	Credits
CMPSC 121 or 131	3	ENGL 202C[‡]	3
MATH 230	4	MATH 251	4
MATH 311W[*]	3	STAT 401	3
General Education Course	3	100-400 level General Elective	3
General Education Course (GHW)	1.5	General Education Course	3
	14.5		**16**

Third Year

Fall	Credits	Spring	Credits
MATH 318 or 414	3	MATH 455[*]	3
MATH 425	3	100-400 level General Elective	3
MATH 430[*]	3	300-400 level Mathematics[1]	3
300-400 level Mathematics[1]	3	300-400 level Mathematics[1]	3
General Education Course	3	General Education Course	3
	15		**15**

Fourth Year

Fall	Credits	Spring	Credits
MATH 435	3	MATH 401[*]	3
MATH 475Y	3	300-400 level Mathematics[1]	3
300-400 level Mathematics[1]	3	300-400 level General Elective	3
300-400 level Mathematics[1]	3	300-400 level General Elective	3
300-400 level General Elective	3		
	15		**12**

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 Cultural Diversity 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.

General Education includes Foundations (GWS and GQ), Knowledge Domains (GHW, GN, GA, GH, GS) and Integrative Studies (Inter-domain) requirements. N or Q (Honors) is the suffix at the end of a course number used to help identify an Inter-domain course, but the inter-domain attribute is used to fill audit requirements. Foundations courses (GWS and GQ) require a grade of 'C' or better.

Secondary Education Option: Mathematical Sciences, B.S. at Harrisburg Campus

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, 15S, 30T, or ESL 15*#†	3	CAS 100A or 100S‡	3
HDFS 239†	3	MATH 141*#†	4
MATH 140*#†	4	MATH 220*	2
General Education Course	3	Select English Literature*#†	3
General Education Course	3	General Education Course	3
		General Education Course (GHW)	1.5
	16		**16.5**

Second Year

Fall	Credits	Spring	Credits
CMPSC 121 or 131*	3	ENGL 202C‡	3
EDPSY 14*†	3	MATH 250*	3
MATH 230*	4	STAT 401*	3
MATH 311W*	3	100-400 level support course	3
General Education Course	3	General Education Course	3
		General Education Course (GHW)	1.5
	16		**16.5**

Third Year

Fall	Credits	Spring	Credits
EDUC 313*	2	EDUC 315Y*	3
EDUC 314*	3	EDUC 458*	3
MATH 425*	3	EDUC 466N*†	3
MATH 430*	3	MATH 401*	3
MATH 435*	3	MATH 427*	3
MATH 475Y*	3		
	17		**15**

Fourth Year

Fall	Credits	Spring	Credits
EDUC 400*	3	EDUC 490*1	12
EDUC 417*	3		
EDUC 459*	3		
300-400 level support course in Computer Science, Education, Mathematics, or Statistics (EDUC 495 recommended for those in residency program)*	3		
	12		**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 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 Cultural Diversity 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.

General Education includes Foundations (GWS and GQ), Knowledge Domains (GHW, GN, GA, GH, GS) and Integrative Studies (Inter-domain) requirements. N or Q (Honors) is the suffix at the end of a course number used to help identify an Inter-domain course, but the inter-domain attribute is used to fill audit requirements. Foundations courses (GWS and GQ) require a grade of 'C' or better.

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 or for graduate studies. The general option provides a core mathematics degree along with flexibility to incorporate courses relevant to other areas such as actuarial science, operations research, statistics, or pure mathematics. The data science option is oriented towards the area of data science. 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 ABOUT POTENTIAL CAREER OPTIONS FOR GRADUATES OF THE MATHEMATICAL SCIENCES PROGRAM (https://

harrisburg.psu.edu/science-engineering-technology/mathematical-sciences-bs/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 further opportunities within higher education, business, and industry.

MORE INFORMATION ABOUT OPPORTUNITIES FOR GRADUATE STUDIES (https://harrisburg.psu.edu/science-engineering-technology/mathematical-sciences-bs/)

Professional Resources

- Mathematical Association of America (https://www.maa.org)
- American Mathematical Society (https://www.ams.org/home/page/)
- Society for Industrial and Applied Mathematics (https://siam.org)
- National Council of Teachers of Mathematics (https://www.nctm.org)
- Pennsylvania Council of Teachers of Mathematics (https://pctm.org)

Accreditation

The program is approved by the Pennsylvania Department of Education. This program is recognized by the Pennsylvania Department of Education (PDE) and the National Council of Teachers of Mathematics (NCTM).

MORE INFORMATION ABOUT ACCREDITATION (https://harrisburg.psu.edu/science-engineering-technology/mathematical-sciences-bs/)

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (https://www.psu.edu/state-licensure-disclosures/) interactive map.

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