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/operations 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 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.

Entry to the Mathematical Sciences Secondary Education option requires the following 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 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 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:
General Education
Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferrable 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

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
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)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 202C</td>
<td>Effective Writing: Technical Writing</td>
<td>3</td>
</tr>
</tbody>
</table>

Prescribed Courses: Require a grade of C or better

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 140</td>
<td>Calculus With Analytic Geometry I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 141</td>
<td>Calculus with Analytic Geometry II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 311W</td>
<td>Concepts of Discrete Mathematics</td>
<td>3-4</td>
</tr>
<tr>
<td>MATH 430</td>
<td>Linear Algebra and Discrete Models I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 401</td>
<td>Introduction to Analysis I</td>
<td>3</td>
</tr>
</tbody>
</table>

Requirements for the Option
Select an option

63-75

Requirements for the Option
General Mathematical Sciences Option (64-65 credits)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPSC 121</td>
<td>Introduction to Programming Techniques</td>
<td>3</td>
</tr>
<tr>
<td>MATH 230</td>
<td>Calculus and Vector Analysis</td>
<td>4</td>
</tr>
<tr>
<td>MATH 220</td>
<td>Matrices</td>
<td>2-3</td>
</tr>
<tr>
<td>MATH 251</td>
<td>Ordinary and Partial Differential Equations</td>
<td>4</td>
</tr>
<tr>
<td>MATH 318</td>
<td>Elementary Probability</td>
<td>3</td>
</tr>
<tr>
<td>MATH 435</td>
<td>Basic Abstract Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH 475Y</td>
<td>History of Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>STAT 301</td>
<td>Statistical Analysis I</td>
<td>3</td>
</tr>
</tbody>
</table>

Prescribed Courses: Require a grade of C or better

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 455</td>
<td>Introduction to Numerical Analysis I</td>
<td>3</td>
</tr>
</tbody>
</table>
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 needed 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

Ronald A. Walker
Associate Program Chair
Olmsted Building, W255K
Middletown, PA 17057
717-948-6673
raw40@psu.edu

Suggested Academic Plan

The suggested academic plan(s) listed on this page are the plan(s) that are in effect during the 2020-21 academic year. To access previous years’ suggested academic plans, please visit the archive (http://bulletins.psu.edu/undergraduate/archive/) to view the appropriate Undergraduate Bulletin edition (Note: the archive only contain suggested academic plans beginning with the 2018-19 edition of the Undergraduate Bulletin).

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

<table>
<thead>
<tr>
<th>Semester</th>
<th>Credits</th>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fall</strong></td>
<td></td>
<td><strong>Credits Spring</strong></td>
<td></td>
</tr>
<tr>
<td>ENGL 15 or 30†</td>
<td>3</td>
<td>CAS 100†</td>
<td>3</td>
</tr>
<tr>
<td>MATH 140**#†</td>
<td>4</td>
<td>MATH 141**#†</td>
<td>4</td>
</tr>
<tr>
<td>General Education Course</td>
<td>3</td>
<td>General Education Course</td>
<td>3</td>
</tr>
<tr>
<td>General Education Course</td>
<td>3</td>
<td>General Education Course</td>
<td>3</td>
</tr>
<tr>
<td>General Education Course (GHW)</td>
<td>1.5</td>
<td>General Education Course</td>
<td>3</td>
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</table>

**Total Credits: 14.5**

### Second Year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Credits</th>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fall</strong></td>
<td></td>
<td><strong>Credits Spring</strong></td>
<td></td>
</tr>
<tr>
<td>CMPSC 121</td>
<td>3</td>
<td>ENGL 202C‡</td>
<td>3</td>
</tr>
<tr>
<td>MATH 230</td>
<td>4</td>
<td>MATH 220</td>
<td>2</td>
</tr>
<tr>
<td>General Education Course</td>
<td>3</td>
<td>MATH 251</td>
<td>4</td>
</tr>
<tr>
<td>General Education Course</td>
<td>3</td>
<td>General Education Course</td>
<td>3</td>
</tr>
<tr>
<td>General Education Course (GHW)</td>
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<td>General Education Course</td>
<td>3</td>
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</tbody>
</table>

**Total Credits: 15**

### Third Year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Credits</th>
<th>Course</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td><strong>Fall</strong></td>
<td></td>
<td><strong>Credits Spring</strong></td>
<td></td>
</tr>
<tr>
<td>MATH 311W†</td>
<td>3-4</td>
<td>MATH 455*</td>
<td>3</td>
</tr>
<tr>
<td>MATH 318</td>
<td>3</td>
<td>STAT 301</td>
<td>3</td>
</tr>
<tr>
<td>MATH 430†</td>
<td>3</td>
<td>200-level General Elective</td>
<td>3</td>
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<tr>
<td>200-400-level Mathematics</td>
<td>3</td>
<td>300-400-level Mathematics</td>
<td>3</td>
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<tr>
<td>300-400-level Mathematics</td>
<td>3</td>
<td>300-400-level Mathematics</td>
<td>3</td>
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</table>

**Total Credits: 15-16**

### Fourth Year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Credits</th>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td><strong>Fall</strong></td>
<td></td>
<td><strong>Credits Spring</strong></td>
<td></td>
</tr>
<tr>
<td>MATH 412 or 425</td>
<td>3</td>
<td>MATH 401*</td>
<td>3</td>
</tr>
<tr>
<td>MATH 435</td>
<td>3</td>
<td>300-400-level Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>MATH 475Y</td>
<td>3</td>
<td>300-400-level Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>300-400-level Mathematics</td>
<td>3</td>
<td>300-400-level General Elective</td>
<td>3</td>
</tr>
<tr>
<td>300-400-level General Elective</td>
<td>3</td>
<td>300-400-level General Elective</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credits: 15**

**Total Credits: 120-121**

* 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
† Course satisfies General Education and degree requirement

### 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 audit or a 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.
Students to teach middle school and high school mathematics and has education, or statistics. The secondary education option prepares actuarial science, management science/operations research, secondary and concentrations within the program provide preparation for careers in employment in business, industry, and government. The various options The Mathematical Sciences program is designed to prepare students for 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.

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.

Contact
Harrsiburg
SCHOOL OF SCIENCE, ENGINEERING, AND TECHNOLOGY
Olmsted Building, W255
Middletown, PA 17057
717-948-6081
jmb84@psu.edu

University Requirements and General Education Notes:

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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, GH, GN, GA, GH, and GS are abbreviations used to identify General Education program courses. General Education includes Foundations (GWS and GQ) and Knowledge Domains (GH, 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.