MATHEMATICS, B.A.

Begin Campus: Any Penn State Campus

End Campus: University Park

Program Description

Two degrees are offered in mathematics: the Bachelor of Arts and the Bachelor of Science. Both programs have a common core of mathematics courses; both programs prepare students for graduate work in mathematics. In addition, the Bachelor of Arts degree is oriented toward applications of mathematics in the arts and the humanities. The Bachelor of Science degree has a number of options. These options are oriented toward actuarial science, applied and industrial mathematics, computational mathematics, graduate study and systems analysis.

Many of the options are designed for students who want to use mathematics in industry, commerce, or government. In short, the degree requirements have the flexibility to fit many individual interests. The student, with the assistance of a faculty adviser, should select an option by the end of the sophomore year.

What is Mathematics?

The study of mathematics emphasizes careful problem analysis, precision of thought and expression, and the development of mathematical skills needed for work in many other areas. Theoretical mathematicians increase basic knowledge in "pure" fields like abstract algebra, analysis, or topology. Applied mathematicians use tools growing out of calculus, analysis, computing, statistics, and operations research to solve problems in science, industry, government, and other areas.

You Might Like This Program If...

- You want to take a broad liberal arts program with a strong mathematical foundation.
- You want mathematics to complement your study of other subjects.
- You like mathematics, like to think, like a challenge, and like to know why things are true.
- You want to develop strong problem-solving skills, comprehension of abstract concepts, and creative thinking ability.

Entrance to Major

In order to be eligible for entrance to the Mathematics major, a student must have:

1. attained at least a 2.00 cumulative grade-point average; and
2. completed MATH 140 and MATH 141 and earned a grade of C or better in each of these courses.

Degree Requirements

For the Bachelor of Arts degree in Mathematics, a minimum of 120 credits is required:

Requirement	Credits
General Education	45
Electives	0-4
Bachelor of Arts Degree Requirements	24
Requirements for the Major	53-59

6 of the 45 credits for General Education are included in the Requirements for the Major. This includes 6 credits of GQ courses.

3 of the 24 credits for Bachelor of Arts Degree Requirements are included in the Requirements for the Major, General Education, or Electives and 0-12 credits are included in Electives if foreign language proficiency is demonstrated by examination.

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).

Code	Title	Credits
Prescribed Courses		
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 220	Matrices	2-3
MATH 230	Calculus and Vector Analysis	4
MATH 311W	Concepts of Discrete Mathematics	3-4
MATH 312	Concepts of Real Analysis	3
MATH 403	Classical Analysis I	3
STAT 200	Elementary Statistics	4
Additional Courses		
Additional Courses: Require a grade of C or better		
MATH 250	Ordinary Differential Equations	3-4
or MATH 251	Ordinary and Partial Differential Equations	
MATH 435	Basic Abstract Algebra	3
or MATH 436	Linear Algebra	
Select 3 credits from the following:		3
CMPSC 101	Introduction to Programming	
CMPSC 121	Introduction to Programming Techniques	
CMPSC 131	Programming and Computation I: Fundamentals	
CMPSC 201	Programming for Engineers with C++	
Select 3 credits from the following:		3
MATH 411	Ordinary Differential Equations	
MATH 412	Fourier Series and Partial Differential Equations	
MATH 417	Qualitative Theory of Differential Equations	
MATH 419	Theoretical Mechanics	
MATH 421	Complex Analysis	
Select 6 credits of 400-level MATH courses except MATH 401, MATH 405, MATH 406, MATH 418, MATH 441, MATH 470, MATH 471		6
Supporting Courses and Related Areas		
Select 8-11 credits from department list		8-11

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.

B.A. Degree Requirements

World Language (0-12 credits): Student must attain 12th credit level of proficiency in one world language in addition to English. This proficiency must be demonstrated by either examination or course work. See the Placement Policy for Penn State World Language Courses (https://bulletins.psu.edu/undergraduate/general-information/academic-information/advising-planning-degree-program/course-placements/placement-policy-world-language-courses/).

B.A. Fields (9 credits): Humanities, Social and Behavioral Sciences, Arts, World Languages, Natural Sciences, Quantification (may not be taken in the area of the student's primary major; world language credits in this category must be in a second world language in addition to English or beyond the 12th credit level of proficiency in the first language). Credits must be selected from the list of approved courses.

World Cultures (0-3 credits): Select 3 credits from approved list. Students may count courses in this category in order to meet other major, minor, elective, or General Education requirements, except for the University Cultural Diversity (US/IL) requirement.

Integrated B.A. or B.S. in Mathematics and M.A.S. in Applied Statistics

Available at the following campuses: University Park

Requirements for the Integrated B.A. or B.S. in Mathematics and M.A.S. in Applied Statistics can be found in the Graduate Bulletin (https://bulletins.psu.edu/graduate/programs/majors/statistics/#integratedundergradgradprogramstext).

Program Learning Objectives

- Students will demonstrate technical expertise within major areas of mathematics, recognizing connections between different branches of mathematics, and understanding and appreciating the relationship of mathematics to other disciplines and fields.
- Students will demonstrate a breadth and depth of knowledge within mathematics, linking applications and theory, applying mathematics in a wide variety of settings, and demonstrating the ability to use mathematics as a tool to solve problems in disciplinary and interdisciplinary settings.
- Students will demonstrate an understanding and appreciation for the integration of technology in mathematical settings to explore mathematical problems and interpret the results.
- Students will demonstrate an ability to communicate mathematics effectively, presenting full and cogent solutions that include appropriate justification for their reasoning, describing mathematical

ideas from multiple perspectives, and writing/presenting explanations clearly and precisely to an audience of peers and faculty.

- Students will demonstrate an ability for assessing and interpreting complex situations, choosing among several potentially appropriate mathematical methods of solution, understanding the differences between proofs and other less formal arguments, and making vague ideas precise by formulating them in mathematical language.

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/)

University Park

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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.

Mathematics, B.A. at University Park 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
MATH 140[*‡#†]	4	MATH 141[*‡#†]	4
STAT 200[*]	4	MATH 220[*]	3
ENGL 15, 30H, or ESL 15[‡]	3	World Language Level 2	4
World Language Level 1	4	General Education Course	3
PSU 16	1	General Education Course	3
	16		**17**

Second Year

Fall	Credits	Spring	Credits
MATH 230[*]	4	MATH 250 or 251[*]	3-4
MATH 311W[*]	3	MATH 312[*]	3
World Language Level 3	4	CMPSC 101, 121, 131, 200, or 201[*]	3
General Education Course	3	General Education Course	3
		Supporting Course (Chosen in consultation wtih an academic adviser)	3
	14		**15-16**

Third Year

Fall	Credits	Spring	Credits
MATH 411, 412, 417, 419, or 421[*1]	3	MATH 435 or 436[*]	3
CAS 100A, 100B, or 100C[‡]	3	ENGL 202C, 202A, 202B, or 202D[‡]	3
BA World Cultures	3	Supporting Course (Chosen in consultation wtih an academic adviser)	3-4
General Education Course	3	BA Fields	3
General Education Course	3	General Education Course (GHW)	1.5
General Education Course (GHW)	1.5		
	16.5		**13.5-14.5**

Fourth Year

Fall	Credits	Spring	Credits
MATH 403[*]	3	MATH 400-Level[*2]	3
MATH 400-Level[*2]	3	BA Fields	3
BA Fields	3	General Education Course	3
Supporting Course (Chosen in consultation wtih an academic adviser)	3	General Education Course	3
General Education Course	3		
	15		**12**

Total Credits 119-121

* 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 To take MATH 412 or MATH 417 in a Spring semester, swap it with MATH 435 or MATH 436 in Third Year Spring or with a MATH 400-level in Fourth Year Spring. To take MATH 421, swap it with MATH 403 in Fourth Year Fall.
2 Excluding MATH 401, MATH 405, MATH 406, MATH 441, MATH 470, MATH 471. At most 2 credits of MATH 400 or MATH 497 Learning Assistant Experience may be used.

Bachelor of Arts Requirements:

Bachelor of Arts students must take 9 credits in Bachelor of Arts (B.A.) Fields (Humanities; Social and Behavioral Sciences; Arts; World Languages [2nd language or beyond the 12th credit level of proficiency

in the 1st]; Natural Sciences; Quantification). The B.A. Fields courses may not be taken in the area of the student's primary major. See your adviser and the Degree Requirements section (https://bulletins.psu.edu/undergraduate/general-information/academic-information/) of this Bulletin.

Bachelor of Arts students must take 3 credits in World Cultures. See your adviser and the full list of courses approved as World Cultures courses (https://bulletins.psu.edu/undergraduate/general-education/course-lists/ba-world-cultures/).

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.

All incoming Schreyer Honors College first-year students at University Park will take ENGL 137H/CAS 137H in the fall semester and ENGL 138T/CAS 138T in the spring semester. These courses carry the GWS designation and satisfy a portion of that General Education requirement. If the student's program prescribes GWS these courses will replace both ENGL 15/ENGL 30H and CAS 100A/CAS 100B/CAS 100C. Each course is 3 credits.

Career Paths

Students with an undergraduate degree in mathematics pursue graduate study or careers in business and industry.

Careers

Students with an undergraduate degree in mathematics pursue careers in the fields of science and technology, business and consulting, research and industry, and teaching.

MORE INFORMATION ABOUT POTENTIAL CAREER OPTIONS FOR GRADUATES OF THE MATHEMATICS PROGRAM (https://science.psu.edu/math/undergraduate/advising/careers/)

Opportunities for Graduate Studies

Students with an undergraduate degree in mathematics pursue graduate study in a variety of different fields such as mathematics, statistics, economics, finance, computer science, or operations research.

MORE INFORMATION ABOUT OPPORTUNITIES FOR GRADUATE STUDIES (https://science.psu.edu/math/undergraduate/advising/careers/)

Professional Resources

- Mathematical Association of America (https://www.maa.org)
- American Mathematical Society (https://www.ams.org/home/page/)
- Society of Industrial and Applied Mathematics (https://www.siam.org)

Contact

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