

MATHEMATICS, B.S. (ALTOONA)

Begin Campus: Any Penn State Campus

End Campus: Altoona

Degree Requirements

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

Requirement	Credits
General Education	45
Electives	0-1
Requirements for the Major	80-83

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

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

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)

Code	Title	Credits
Prescribed Courses		
STAT 200	Elementary Statistics	4
<i>Prescribed Courses: Require a grade of C or better</i>		
MATH 140	Calculus With Analytic Geometry I	4
MATH 141	Calculus with Analytic Geometry II	4
MATH 220	Matrices	2
MATH 230	Calculus and Vector Analysis	4
MATH 311W	Concepts of Discrete Mathematics	3-4
MATH 312	Concepts of Real Analysis	3
Additional Courses		
Select one of the following:		3
CMPSC 101	Introduction to Programming	
CMPSC 121	Introduction to Programming Techniques	
CMPSC 201	Programming for Engineers with C++	

Additional Courses: Require a grade of C or better

MATH 250	Ordinary Differential Equations	3-4
or MATH 251	Ordinary and Partial Differential Equations	

Requirements for the Option

Select an option	50-51
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Requirements for the Option

Actuarial Mathematics Option (50-51 credits)

Available at the following campuses: University Park

Code	Title	Credits
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Prescribed Courses

Prescribed Courses: Require a grade of C or better

IE 425	Stochastic Models in Operations Research	3
MATH 414	Introduction to Probability Theory	3
MATH 415	Introduction to Mathematical Statistics	3
MATH 416	Stochastic Modeling	3
MATH 484	Linear Programs and Related Problems	3
RM 302	Risk and Insurance	3
RM 410	Financial Mathematics for Actuaries	3
RM 411	Actuarial Mathematics I	3
RM 412	Actuarial Mathematics II	3
STAT 462	Applied Regression Analysis	3

Additional Courses

Additional Courses: Require a grade of C or better

MATH 451	Numerical Computations	3
or MATH 486	Mathematical Theory of Games	
STAT 463	Applied Time Series Analysis (or 400-level MATH course) ¹	3

Supporting Courses and Related Areas

Select 14-15 credits from department list	14-15
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¹ Select 3 credits from STAT 463 or 400-level MATH courses except:

- MATH 401
- MATH 405
- MATH 406
- MATH 441
- MATH 470
- MATH 471

Applied and Industrial Mathematics Option (50-51 credits)

Available at the following campuses: University Park

Code	Title	Credits
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Prescribed Courses

Prescribed Courses: Require a grade of C or better

MATH 403	Classical Analysis I	3
MATH 412	Fourier Series and Partial Differential Equations	3
MATH 414	Introduction to Probability Theory	3
MATH 415	Introduction to Mathematical Statistics	3
MATH 436	Linear Algebra	3
MATH 450	Mathematical Modeling	3
MATH 455	Introduction to Numerical Analysis I	3

Additional Courses

Additional Courses: Require a grade of C or better

Select 12 credits of the following:	12
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MATH 411	Ordinary Differential Equations
MATH 416	Stochastic Modeling
MATH 417	Qualitative Theory of Differential Equations
MATH 419	Theoretical Mechanics
MATH 421	Complex Analysis
MATH 456	Introduction to Numerical Analysis II
MATH 461	
MATH 467	Factorization and Primality Testing
MATH 468	Mathematical Coding Theory
MATH 479	Special and General Relativity
MATH 484	Linear Programs and Related Problems
MATH 485	Graph Theory
MATH 486	Mathematical Theory of Games

Supporting Courses and Related Areas

Select 17-18 credits from department list	17-18
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Computational Mathematics Option (50-51 credits)

Available at the following campuses: University Park

Code	Title	Credits
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Prescribed Courses

CMPSC 122	Intermediate Programming	3
CMPSC 465	Data Structures and Algorithms	3

Prescribed Courses: Require a grade of C or better

MATH 414	Introduction to Probability Theory	3
MATH 415	Introduction to Mathematical Statistics	3
MATH 455	Introduction to Numerical Analysis I	3
MATH 456	Introduction to Numerical Analysis II	3
MATH 467	Factorization and Primality Testing	3
MATH 484	Linear Programs and Related Problems	3

Additional Courses

Additional Courses: Require a grade of C or better

Select 3 credits of the following:	3
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MATH 411	Ordinary Differential Equations
MATH 412	Fourier Series and Partial Differential Equations
MATH 417	Qualitative Theory of Differential Equations

Select 6 credits of the following:	6
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MATH 310	Elementary Combinatorics
MATH 468	Mathematical Coding Theory
MATH 485	Graph Theory

Supporting Courses and Related Areas

Select 17-18 credits from department list	17-18
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General Mathematics Option (50-51 credits)

Available at the following campuses: Altoona, University Park

Code	Title	Credits
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Prescribed Courses

Prescribed Courses: Require a grade of C or better

MATH 403	Classical Analysis I	3
MATH 414	Introduction to Probability Theory	3
MATH 415	Introduction to Mathematical Statistics	3

Additional Courses

Additional Courses: Require a grade of C or better

MATH 435	Basic Abstract Algebra	3
or MATH 436	Linear Algebra	
Select 3 credits of 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 ¹		6
Supporting Courses and Related Areas		
Select an approved sequence of 12 credits in MATH or a related area or an area of application		12
Select 17-18 credits from department list		17-18

- ¹ Select 6 credits of 400-level MATH courses except:
- MATH 401
 - MATH 405
 - MATH 406
 - MATH 441
 - MATH 470
 - MATH 471

Graduate Study Option (50-51 credits)
Available at the following campuses: University Park

Code	Title	Credits
Prescribed Courses		
<i>Prescribed Courses: Require a grade of C or better</i>		
MATH 403	Classical Analysis I	3
MATH 404	Classical Analysis II	3
MATH 414	Introduction to Probability Theory	3
MATH 415	Introduction to Mathematical Statistics	3
MATH 421	Complex Analysis	3
MATH 429	Introduction to Topology	3
MATH 435	Basic Abstract Algebra	3
MATH 436	Linear Algebra	3
Additional Courses		
<i>Additional Courses: Require a grade of C or better</i>		
Select 9 credits of 400-level MATH courses ¹		9
Supporting Courses and Related Areas		
Select 17-18 credits from department list		17-18

- ¹ Select 9 credits of 400-level MATH courses except:
- MATH 401
 - MATH 405
 - MATH 406
 - MATH 441
 - MATH 470
 - MATH 471

Systems Analysis Option (50-51 credits)
Available at the following campuses: Altoona, University Park

Code	Title	Credits
Prescribed Courses		
<i>Prescribed Courses: Require a grade of C or better</i>		

MATH 414	Introduction to Probability Theory	3
MATH 415	Introduction to Mathematical Statistics	3
MATH 436	Linear Algebra	3
MATH 484	Linear Programs and Related Problems	3

Additional Courses		
<i>Additional Courses: Require a grade of C or better</i>		
Select 6 credits of the following:		6
MATH 310	Elementary Combinatorics	
MATH 451	Numerical Computations	
MATH 485	Graph Theory	
MATH 486	Mathematical Theory of Games	
Select 3 credits from 400-level MATH courses ¹		3

Supporting Courses and Related Areas		
Select an approved sequence of 12 credits in an area of application; possible areas include business, economics, industrial engineering, social sciences		12
Select 17-18 credits from department list		17-18

- ¹ Select 3 credits of 400-level MATH courses except:
- MATH 401
 - MATH 405
 - MATH 406
 - MATH 441
 - MATH 470
 - MATH 471