

# MATHEMATICS, B.S. (BEHREND)

**Begin Campus:** Any Penn State Campus

**End Campus:** Erie

## Degree Requirements

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

Requirement	Credits
General Education	45
Electives	7-8
Requirements for the Major	85-92

**18-24 of the 45 credits for General Education are included in the Requirements for the Major. This includes: 9 credits of GN courses; 6 credits of GQ courses; 0-6 credits of GS courses; 3 credits of GWS courses.**

Per Senate Policy 83.80.5, the college dean or campus chancellor and program faculty may require up to 24 credits of coursework in the major to be taken at the location or in the college or program where the degree is earned.

## Requirements for the Major

A student enrolled in this major must earn at least a grade of C in each 300- and 400-level course in 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
<b>Prescribed Courses</b>		
ENGL 202C	Effective Writing: Technical Writing	3
<i>Prescribed Courses: Require a grade of C or better</i>		
CMPSC 121	Introduction to Programming Techniques	3
CMPSC 122	Intermediate Programming	3
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 251	Ordinary and Partial Differential Equations	4
MATH 311W	Concepts of Discrete Mathematics	4
MATH 312	Concepts of Real Analysis	3
STAT 301		3
STAT 401	Experimental Methods	3

### Additional Courses

Select 1 credit of GN designated course and 8 additional credits in one of the following sequences:

BIOL 110 & BIOL 220W	Biology: Basic Concepts and Biodiversity and Biology: Populations and Communities
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CHEM 110 & CHEM 111 & CHEM 112 & CHEM 113	Chemical Principles I and Experimental Chemistry I and Chemical Principles II and Experimental Chemistry II
PHYS 211 & PHYS 212	General Physics: Mechanics and General Physics: Electricity and Magnetism
PHYS 250 & PHYS 251	Introductory Physics I and Introductory Physics II

### Requirements for the Option

*Requirements for the Option: Require a grade of C or better*

Select an option 36-43

### Requirements for the Option

#### Applied Mathematics Option (36 credits)

Code	Title	Credits
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#### Additional Courses

*Additional Courses: Require a grade of C or better*

Select 6 credits from CMPSC 221 or higher, except CMPSC 360 6

Select five of the following: 15

MATH 310	Elementary Combinatorics
MATH 412	Fourier Series and Partial Differential Equations
MATH 449	Applied Ordinary Differential Equations
MATH 455	Introduction to Numerical Analysis I
MATH 456	Introduction to Numerical Analysis II
MATH 482	Mathematical Methods of Operations Research
STAT 414	Introduction to Probability Theory
STAT 461	Analysis of Variance
STAT 462	Applied Regression Analysis
STAT 464	Applied Nonparametric Statistics
STAT 466	Survey Sampling

Select two of the following: 6

MATH 421	Complex Analysis
MATH 426	Introduction to Modern Geometry
MATH 427	Foundations of Geometry
MATH 429	Introduction to Topology
MATH 435	Basic Abstract Algebra
MATH 436	Linear Algebra
MATH 465	Number Theory

### Supporting Courses and Related Areas

*Supporting Courses and Related Areas: Require a grade of C or better*

Select 9 credits from a school-approved list 9

### Business Option (43 credits)

A maximum of 30 credits through the School of Business may be used to fulfill General Education, Major Requirements and Option Requirements.

Code	Title	Credits
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#### Prescribed Courses

*Prescribed Courses: Require a grade of C or better*

ACCTG 211	Financial and Managerial Accounting for Decision Making	4
ECON 102	Introductory Microeconomic Analysis and Policy	3
ECON 104	Introductory Macroeconomic Analysis and Policy	3
MIS 204	Introduction to Management Information Systems	3

#### Additional Courses

**Additional Courses: Require a grade of C or better**

Select 6 credits from CMPSC 221 or higher, except CMPSC 360, and MIS 336 6

Select two of the following: 6

ECON 481 Business Forecasting Techniques

ECON 485 Econometric Techniques

FIN 301 Corporation Finance

FIN 405 Advanced Financial Management

FIN 420 Investment and Portfolio Analysis

FIN 427 Derivative Securities

MGMT 301 Basic Management Concepts

MGMT 331 Management and Organization

MGMT 341 Human Resource Management

MKTG 301 Principles of Marketing

Select two of the following: 6

MATH 482 Mathematical Methods of Operations Research

MIS 336 Database Management Systems

MIS 430 Systems Analysis

MIS 435 Systems Design and Implementation

MIS 445 Business Intelligence

STAT 414 Introduction to Probability Theory

STAT 461 Analysis of Variance

STAT 462 Applied Regression Analysis

STAT 464 Applied Nonparametric Statistics

STAT 466 Survey Sampling

Select two of the following: 6

MATH 421 Complex Analysis

MATH 426 Introduction to Modern Geometry

MATH 427 Foundations of Geometry

MATH 429 Introduction to Topology

MATH 435 Basic Abstract Algebra

MATH 436 Linear Algebra

MATH 465 Number Theory

**Supporting Courses and Related Areas**

*Supporting Courses and Related Areas: Require a grade of C or better*

Select 6 credits from a school-approved list 6

**Computer Science Option (36 credits)**

Code	Title	Credits
<b>Prescribed Courses</b>		
<i>Prescribed Courses: Require a grade of C or better</i>		
CMPSC 455	Introduction to Numerical Analysis I	3
CMPSC 465	Data Structures and Algorithms	3
<b>Additional Courses</b>		
<i>Additional Courses: Require a grade of C or better</i>		
CMPSC 221	Object Oriented Programming with Web-Based Applications	3
or SWENG 311	Object-Oriented Software Design and Construction	
CMPSC 312	Computer Organization and Architecture	3
or CMPEN 351	Microprocessors	
Select 12 credits from CMPSC courses at the 300- and 400-level		12
<b>Supporting Courses and Related Areas</b>		

**Prescribed Courses**

*Prescribed Courses: Require a grade of C or better*

CMPSC 455 Introduction to Numerical Analysis I 3

CMPSC 465 Data Structures and Algorithms 3

**Additional Courses**

*Additional Courses: Require a grade of C or better*

CMPSC 221 Object Oriented Programming with Web-Based Applications 3

or SWENG 311 Object-Oriented Software Design and Construction

CMPSC 312 Computer Organization and Architecture 3

or CMPEN 351 Microprocessors

Select 12 credits from CMPSC courses at the 300- and 400-level 12

**Supporting Courses and Related Areas**

*Supporting Courses and Related Areas: Require a grade of C or better*

Select 12 credits from a school-approved list 12

**Pure Mathematics Option (36 credits)**

Code	Title	Credits
<b>Additional Courses</b>		
<i>Additional Courses: Require a grade of C or better</i>		
Select six of the following:		18
MATH 310	Elementary Combinatorics	
MATH 412	Fourier Series and Partial Differential Equations	
MATH 421	Complex Analysis	
MATH 426	Introduction to Modern Geometry	
MATH 427	Foundations of Geometry	
MATH 429	Introduction to Topology	
MATH 435	Basic Abstract Algebra	
MATH 436	Linear Algebra	
MATH 455	Introduction to Numerical Analysis I	
MATH 456	Introduction to Numerical Analysis II	
MATH 465	Number Theory	
MATH 482	Mathematical Methods of Operations Research	
STAT 414	Introduction to Probability Theory	
STAT 461	Analysis of Variance	
STAT 462	Applied Regression Analysis	
STAT 464	Applied Nonparametric Statistics	
STAT 466	Survey Sampling	
Select three of the following:		9
MATH 403	Classical Analysis I	
MATH 421	Complex Analysis	
MATH 429	Introduction to Topology	
MATH 435	Basic Abstract Algebra	
<b>Supporting Courses and Related Areas</b>		
<i>Supporting Courses and Related Areas: Require a grade of C or better</i>		
Select 9 credits from a school-approved list		9

**Additional Courses**

*Additional Courses: Require a grade of C or better*

Select six of the following: 18

MATH 310 Elementary Combinatorics

MATH 412 Fourier Series and Partial Differential Equations

MATH 421 Complex Analysis

MATH 426 Introduction to Modern Geometry

MATH 427 Foundations of Geometry

MATH 429 Introduction to Topology

MATH 435 Basic Abstract Algebra

MATH 436 Linear Algebra

MATH 455 Introduction to Numerical Analysis I

MATH 456 Introduction to Numerical Analysis II

MATH 465 Number Theory

MATH 482 Mathematical Methods of Operations Research

STAT 414 Introduction to Probability Theory

STAT 461 Analysis of Variance

STAT 462 Applied Regression Analysis

STAT 464 Applied Nonparametric Statistics

STAT 466 Survey Sampling

Select three of the following: 9

MATH 403 Classical Analysis I

MATH 421 Complex Analysis

MATH 429 Introduction to Topology

MATH 435 Basic Abstract Algebra

**Supporting Courses and Related Areas**

*Supporting Courses and Related Areas: Require a grade of C or better*

Select 9 credits from a school-approved list 9

**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.