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:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td>45</td>
</tr>
<tr>
<td>Electives</td>
<td>7-8</td>
</tr>
<tr>
<td>Requirements for the Major</td>
<td>85-92</td>
</tr>
</tbody>
</table>

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.

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.)
- 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

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 this 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>
<tr>
<td>CMPSC 121</td>
<td>Introduction to Programming Techniques</td>
<td>3</td>
</tr>
<tr>
<td>CMPSC 122</td>
<td>Intermediate Programming</td>
<td>3</td>
</tr>
<tr>
<td>MATH 140</td>
<td>Calculus With Analytic Geometry I</td>
<td>4</td>
</tr>
</tbody>
</table>
Mathematics, B.S. (Behrend)

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  Statistical Analysis I  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  Biology: Basic Concepts and Biodiversity
& BIOL 220W  and Biology: Populations and Communities

CHEM 110  Chemical Principles I
& CHEM 111  and Experimental Chemistry I
& CHEM 112  and Chemical Principles II
& CHEM 113  and Experimental Chemistry II

PHYS 211  General Physics: Mechanics
& PHYS 212  and General Physics: Electricity and Magnetism

PHYS 250  Introductory Physics I
& PHYS 251  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

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

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

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)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prescribed Courses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMPSC 455</td>
<td>Introduction to Numerical Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>CMPSC 465</td>
<td>Data Structures and Algorithms</td>
<td>3</td>
</tr>
<tr>
<td><strong>Additional Courses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMPSC 221</td>
<td>Object Oriented Programming with Web-Based Applications</td>
<td>3</td>
</tr>
<tr>
<td>or SWENG 311</td>
<td>Object-Oriented Software Design and Construction</td>
<td></td>
</tr>
<tr>
<td>CMPSC 312</td>
<td>Computer Organization and Architecture</td>
<td>3</td>
</tr>
<tr>
<td>or CMPEN 351</td>
<td>Microprocessors</td>
<td></td>
</tr>
<tr>
<td>Select 12 credits from CMPSC courses at the 300- and 400-level</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

### Supporting Courses and Related Areas

| **Supporting Courses and Related Areas**               |                                                  |         |
| Select 12 credits from a school-approved list           |                                                  | 12      |

### Pure Mathematics Option (36 credits)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Additional Courses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select six of the following:</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>MATH 310</td>
<td>Elementary Combinatorics</td>
<td></td>
</tr>
<tr>
<td>MATH 412</td>
<td>Fourier Series and Partial Differential Equations</td>
<td></td>
</tr>
<tr>
<td>MATH 421</td>
<td>Complex Analysis</td>
<td></td>
</tr>
<tr>
<td>MATH 426</td>
<td>Introduction to Modern Geometry</td>
<td></td>
</tr>
<tr>
<td>MATH 427</td>
<td>Foundations of Geometry</td>
<td></td>
</tr>
<tr>
<td>MATH 429</td>
<td>Introduction to Topology</td>
<td></td>
</tr>
<tr>
<td>MATH 435</td>
<td>Basic Abstract Algebra</td>
<td></td>
</tr>
<tr>
<td>MATH 436</td>
<td>Linear Algebra</td>
<td></td>
</tr>
<tr>
<td>MATH 455</td>
<td>Introduction to Numerical Analysis I</td>
<td></td>
</tr>
<tr>
<td>MATH 456</td>
<td>Introduction to Numerical Analysis II</td>
<td></td>
</tr>
<tr>
<td>MATH 465</td>
<td>Number Theory</td>
<td></td>
</tr>
<tr>
<td>MATH 482</td>
<td>Mathematical Methods of Operations Research</td>
<td></td>
</tr>
<tr>
<td>STAT 414</td>
<td>Introduction to Probability Theory</td>
<td></td>
</tr>
<tr>
<td>STAT 461</td>
<td>Analysis of Variance</td>
<td></td>
</tr>
<tr>
<td>STAT 462</td>
<td>Applied Regression Analysis</td>
<td></td>
</tr>
<tr>
<td>STAT 464</td>
<td>Applied Nonparametric Statistics</td>
<td></td>
</tr>
<tr>
<td>STAT 466</td>
<td>Survey Sampling</td>
<td></td>
</tr>
<tr>
<td>Select three of the following:</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>MATH 403</td>
<td>Classical Analysis I</td>
<td></td>
</tr>
<tr>
<td>MATH 421</td>
<td>Complex Analysis</td>
<td></td>
</tr>
<tr>
<td>MATH 429</td>
<td>Introduction to Topology</td>
<td></td>
</tr>
<tr>
<td>MATH 435</td>
<td>Basic Abstract Algebra</td>
<td></td>
</tr>
</tbody>
</table>

### Supporting Courses and Related Areas

| **Supporting Courses and Related Areas**               |                                                  |         |
| Select 9 credits from a school-approved list           |                                                  | 9       |