# MATHEMATICS (BS)

**CIP:** 27.0101

## Program Description

Mathematics is the cornerstone of science. It provides both the language and framework for scientific thought, incorporating logical rigor and the power of abstraction. These attributes allow human ingenuity to extract deep scientific understanding from relatively simple experiments and physical observations. Mathematics plays a double role: On the one hand, it is a scientific field of its own that has yielded powerful and surprisingly beautiful theroretical constructions. On the other hand, mathematics provides the toolbox needed to solve problems and to model phenomena observed in nature or of interest in industry and technology. As such, mathematics allows humans to model the physical universe, to build efficient algorithms in computing, to develop powerful artificial intelligence methods, to analyze financial markets, to produce predictions for climate science, to map and study the human genome, to analyze the structure of the human brain, and a long list of etcetera's.

NYU Shanghai offers two tracks for a degree in Mathematics: Mathematics and Honors Mathematics. Both tracks develop the pure and applied aspects of the discipline. Math majors acquire a solid grasp of the main areas of mathematics while being invited, through a number of electives courses, to apply this knowledge in a wide range of areas, including computer science, physics, chemistry, engineering, data science, operations research, finance, etc. Graduates are qualified either to continue with further graduate education, or to start a career in industry, financial institutions, logistics, statistical consulting, or any activity requiring abstraction capability, mathematical modeling skills or relying on intensive computational or quantitative techniques.

The Honors Math track requires students to take the Honors version of the mandatory Math courses and to keep both a general and a Math Cumulative GPA higher or equal to 3.65. Honors courses have a broader scope and breadth than the regular courses, exposing students to general definitions and complete proofs. The Honors program is very demanding, as the combination of distinguished professors and a homogeneous selected audience results in fast moving courses that often become undistinguishable from graduate courses.

## Admissions

New York University's Office of Undergraduate Admissions supports the application process for all undergraduate programs at NYU. For additional information about undergraduate admissions, including application requirements, see How to Apply (https://www.nyu.edu/admissions/undergraduate-admissions/how-to-apply.html).

## Program Requirements

| Course | Title | Credits |
|---|---|---|
| **Core Curriculum** | | |
| Social and Cultural Foundations | | |
| CCSF-SHU 101L | Global Perspectives on Society | 4 |
| Interdisciplinary Perspectives on China (Two Courses) | | 8 |
| *Writing* | | |
| WRIT-SHU 102 | Writing as Inquiry | 4 |
| WRIT-SHU 201 | Perspectives on the Humanities | 4 |
| *Language* [1] | | |
| Language Courses | | 8-16 |
| *Mathematics* | | |
| Mathematics Requirement Fulfilled by Major Coursework | | |
| *Algorithmic Thinking* | | |
| Algorithmic Thinking Course | | 4 |
| *Science* | | |
| Experimental Discovery in the Natural World Course | | 4 |
| Science, Technology and Society Course | | 4 |
| **Major Requirements** | | |
| *Required Mathematics Courses* | | |
| MATH-SHU 140 | Linear Algebra [2] | 4 |
| MATH-SHU 143 | Foundations of Mathematical Methods | 4 |
| or MATH-SHU 201 | Honors Calculus | |
| MATH-SHU 151 | Multivariable Calculus | 4 |
| MATH-SHU 235 | Probability and Statistics | 4 |
| or MATH-SHU 238 | Honors Theory of Probability | |
| MATH-SHU 262 | Ordinary Differential Equations | 4 |
| or MATH-SHU 362 | Honors Ordinary Differential Equations | |
| *Constrained Electives* [3] | | |
| Select at least two of the following: | | 8 |
| MATH-SHU 141 | Honors Linear Algebra I | |
| MATH-SHU 142 | Honors Linear Algebra II | |
| MATH-SHU 226 | Functional Analysis | |
| MATH-SHU 282 | Functions of a Complex Variable | |
| MATH-SHU 328 | Honors Analysis I | |
| MATH-SHU 329 | Honors Analysis II | |
| MATH-SHU 339 | Real Variables | |
| MATH-SHU 348 | Honors Algebra I | |
| MATH-SHU 349 | Abstract Algebra I | |
| MATH-SHU 350 | Probability Limit Theorems | |
| MATH-SHU 375 | Topology | |
| MATH-SHU 377 | Differential Geometry | |
| *Additional Mathematics Electives* [3, 4] | | |
| Select six of the following: | | 24 |
| CSCI-SHU 2314 | Discrete Mathematics | |
| MATH-SHU 160 | Networks and Dynamics | |
| MATH-SHU 234 | Mathematical Statistics | |

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|---|---|
| MATH-SHU 250 | Mathematics of Finance |
| MATH-SHU 251 | Introduction to Math Modeling |
| MATH-SHU 252 | Numerical Analysis |
| MATH-SHU 263 | Partial Differential Equations |
| MATH-SHU 345 | Introduction to Stochastic Processes |
| MATH-SHU 997 | Independent Study: Mathematics |
| *Senior Thesis* [5] | |
| **Other Elective Credits** | **28-36** |
| **Total Credits** | **128** |

1 Students who did not attend a Chinese-medium high school fulfill the Core language requirement by demonstrating proficiency of the Chinese language through the Intermediate level. Chinese speakers who did not attend an English-medium high school fulfill the Core language requirement through completion of EAP-SHU 100 English for Academic Purposes I and EAP-SHU 101 English for Academic Purposes II . Additional information can be found on the NYU Shanghai Core Curriculum page (https://bulletins.nyu.edu/undergraduate/shanghai/core-curriculum/#text).

2 Students wishing to major in Mathematics are strongly advised to take the course MATH-SHU 140 Linear Algebra in their first year, as it is a prerequisite for most advanced math courses. This course can be taken at the same time as MATH-SHU 131 Calculus.

3 Please note that many elective courses have a prerequisite of either MATH-SHU 143 Foundations of Mathematical Methods and/or MATH-SHU 201 Honors Calculus.

4 Students may elect to take more than two courses from the Constrained Math Electives area and apply it toward the Additional Electives requirement.

5 In their senior year, each Honors Mathematics student is additionally required to complete a capstone project, ending with a written report and an oral presentation. This thesis can be completed as part of any of the following senior courses: MATH-SHU 142 Honors Linear Algebra II, MATH-SHU 226 Functional Analysis, MATH-SHU 250 Mathematics of Finance, MATH-SHU 251 Introduction to Math Modeling, MATH-SHU 329 Honors Analysis II, MATH-SHU 345 Introduction to Stochastic Processes, MATH-SHU 348 Honors Algebra I, MATH-SHU 349 Abstract Algebra I, MATH-SHU 350 Probability Limit Theorems, MATH-SHU 263 Partial Differential Equations, MATH-SHU 997 Independent Study: Mathematics.

# Sample Plan of Study

| Course | Title | Credits |
|---|---|---|
| **1st Semester/Term** | | |
| CCSF-SHU 101L | Global Perspectives on Society | 4 |
| MATH-SHU 131 | Calculus | 4 |
| MATH-SHU 140 | Linear Algebra | 4 |
| Chinese or EAP | | 4 |
| | **Credits** | **16** |
| **2nd Semester/Term** | | |
| WRIT-SHU 102 | Writing as Inquiry | 4 |
| MATH-SHU 151 | Multivariable Calculus | 4 |
| MATH-SHU 143 | Foundations of Mathematical Methods | 4 |
| Chinese or EAP | | 4 |
| | **Credits** | **16** |
| **3rd Semester/Term** | | |
| WRIT-SHU 201 | Perspectives on the Humanities | 4 |
| MATH-SHU 235 | Probability and Statistics | 4 |
| Math Elective or General Elective | | 4 |
| Chinese or Core Course | | 4 |
| | **Credits** | **16** |
| **4th Semester/Term** | | |
| Core Class | | 4 |
| MATH-SHU 262 | Ordinary Differential Equations | 4 |
| Math Elective or General Elective | | 4 |
| Chinese or Core Course | | 4 |
| | **Credits** | **16** |
| **5th Semester/Term** | | |
| Core Course or General Elective | | 4 |
| Math Elective | | 4 |
| Math Elective | | 4 |
| General Elective | | 4 |
| | **Credits** | **16** |
| **6th Semester/Term** | | |
| Math or General Elective | | 4 |
| Math Elective | | 4 |
| Math Elective | | 4 |
| General Elective | | 4 |
| | **Credits** | **16** |
| **7th Semester/Term** | | |
| Math Elective | | 4 |
| Math or General Elective | | 4 |
| General Elective | | 4 |
| General Elective | | 4 |
| | **Credits** | **16** |
| **8th Semester/Term** | | |
| Math Elective | | 4 |
| Math or General Elective | | 4 |
| General Elective | | 4 |
| General Elective | | 4 |
| | **Credits** | **16** |
| | **Total Credits** | **128** |

# Learning Outcomes

Upon successful completion of this program, students will:

1. Understand the fundamental theorems of calculus and analysis and be able to use them to solve problems.
2. Understand the fundamental theorems of algebra, geometry and probability and be able to use them to solve problems.
3. Understand the fundamental principles and skills in computational mathematics.

# Policies

## Prerequisite Courses for Declaring a Major

Final grade of C/ current semester midterm grade of B or higher in Multivariable Calculus.

## Math and Data Science Double Major Guidelines

Students who are interested in pursuing a Data Science major along with a Mathematics major can have more than two courses that may be double-counted between the majors. Students would need to complete

course requirements for both majors. The following courses are allowed to double counted toward both majors:

### Math and Data Science (Concentration in Finance)

- MATH-SHU 140 Linear Algebra
- MATH-SHU 151 Multivariable Calculus
- MATH-SHU 235 Probability and Statistics ***or*** MATH-SHU 238 Honors Theory of Probability

### Math and Data Science (Concentration in Mathematics)

- MATH-SHU 140 Linear Algebra
- MATH-SHU 201 Honors Calculus
- MATH-SHU 151 Multivariable Calculus
- MATH-SHU 235 Probability and Statistics **or** MATH-SHU 238 Honors Theory of Probability
- MATH-SHU 329 Honors Analysis II **or** MATH-SHU 142 Honors Linear Algebra II

## NYU Policies

University-wide policies can be found on the New York University Policy pages (https://bulletins.nyu.edu/nyu/policies/).

## NYU Shanghai Policies

Additional academic policies can be found on the NYU Shanghai Academic Policies page (https://bulletins.nyu.edu/undergraduate/shanghai/academic-policies/).