

# MATHEMATICS

## Program Overview

Students majoring in mathematics at Rider are met with rigorous and insightful instruction. Courses progress from foundational topics to advanced theories and techniques. Faculty members are active in research and will invite, stimulate and support students' curiosity and understanding.

Graduates of Rider's mathematics program go on to careers in such fields as education, scientific and medical research, engineering, computer science, architecture, pharmaceutical research, actuarial science, and urban planning and development.

## Curriculum Overview

Requirements for the mathematics major total 50 semester hours and include calculus I, II and III, linear algebra, differential equations, advanced calculus, modern geometry, probability and statistical analysis I, modern algebra, complex analysis, and mathematics electives. Also required are general physics I and II.

## Student Learning Outcomes

Graduates of the Mathematics major will be able to:

1. Apply analytical skills and logical thinking to solve problems in a broad range of mathematics.
2. Explain and write mathematical arguments
3. Communicate mathematical ideas clearly and with proper notation and terminology.

## Honors Program in Mathematics

Superior students majoring in mathematics may participate in a program leading to graduation with honors in mathematics. A candidate must submit a written application by March 1 of their junior year to the departmental honors committee. Admission to the program will be based on a 3.25 cumulative average in mathematics courses taken in the first five semesters and sponsorship by a member of the departmental faculty. During their senior year, the student will be enrolled in MTH 490 Independent Study: Research and Creative Expression. Honors in mathematics is based upon earning a 3.4 average in seven mathematics courses at the 300 and 400 levels (excluding MTH 490) and an acceptable senior thesis. Further information on the program can be obtained from the department.

## Degrees Offered

- B.A. in Mathematics

## Contact

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**Program Website:** M (<http://www.rider.edu/academics/colleges-schools/college-liberal-arts-education-science/science-programs/mathematics/>)athematics (<http://www.rider.edu/academics/colleges-schools/college-liberal-arts-education-science/science-programs/mathematics/>)

[schools/college-liberal-arts-education-science/science-programs/mathematics/](http://www.rider.edu/academics/colleges-schools/college-liberal-arts-education-science/science-programs/mathematics/))

**Associated Department:** Mathematics (<https://www.rider.edu/academics/colleges-schools/college-arts-sciences/science-technology-math/faculty-departments/mathematics/>)

## Related Programs

- Biochemistry (<http://catalog.rider.edu/undergraduate/colleges-schools/arts-sciences/majors-minors-certificates/biochemistry/>)
- Biology (<http://catalog.rider.edu/undergraduate/colleges-schools/arts-sciences/majors-minors-certificates/biology/>)
- Chemistry (<http://catalog.rider.edu/undergraduate/colleges-schools/arts-sciences/majors-minors-certificates/chemistry/>)
- Computer Science (<http://catalog.rider.edu/undergraduate/colleges-schools/arts-sciences/majors-minors-certificates/computer-science/>)
- Education (<http://catalog.rider.edu/undergraduate/colleges-schools/education/>)
- Philosophy (<http://catalog.rider.edu/undergraduate/colleges-schools/arts-sciences/majors-minors-certificates/philosophy-minor/>)
- Physics (<http://catalog.rider.edu/undergraduate/colleges-schools/arts-sciences/majors-minors-certificates/physics/>)

## Requirements for the Major

(50 credits)

Code	Title	Credits
<b>Major Requirements:</b>		
MTH 210 & MTH 211 & MTH 212	Calculus I and Calculus II and Calculus III	12
MTH 240	Linear Algebra	3
MTH 250	Differential Equations	3
MTH 308	Advanced Calculus	3
MTH 315	Modern Geometry	3
MTH 340	Probability & Statistical Analysis I	3
MTH 401	Modern Algebra	3
MTH 410	Complex Analysis	3
Three 400-level mathematics electives (excluding MTH 490) or one 300-level and two 400-level mathematics electives (excluding MTH 490)		9
<b>Physics</b>		
PHY 200	General Physics I	4
PHY 201	General Physics II	4
<b>Total Credits</b>		<b>50</b>

Note:

1. Mathematics majors must attain a "B" average in Calculus I and II in order to take advanced mathematics courses.

## Requirements for the Minor

(24-25 credits)

Code	Title	Credits
MTH 210	Calculus I	4
MTH 211	Calculus II	4

MTH 212	Calculus III	4
<b>Select four (4) mathematics courses above the MTH 212 level</b>		<b>12-13</b>
MTH 230	Discrete Mathematics	
MTH 240	Linear Algebra	
MTH 250	Differential Equations	
MTH 308	Advanced Calculus	
MTH 315	Modern Geometry	
MTH 340	Probability & Statistical Analysis I	
MTH 341	Probability & Statistical Analysis II	
MTH 401	Modern Algebra	
MTH 402	Topics in Advanced Mathematics	
MTH 410	Complex Analysis	
MTH 420	Number Theory	
MTH 430	Introduction to Topology	
MTH 440	Real Analysis	
MTH 490	Independent Study: Research and Creative Expression	
<b>Total Credits</b>		<b>24-25</b>

## Academic Plan of Study

The following educational plan is provided as a sample only. Rider students who do not declare a major during their freshman year; who are in a Continuing Education Program; who change their major; or who transfer to Rider may follow a different plan to ensure a timely graduation. Each student, with guidance from their academic advisor, will develop a personalized educational plan.

Course	Title	Credits
<b>Year 1</b>		
<b>Fall Semester</b>		
CMP 120	Seminar in Writing and Rhetoric	3
MTH 210	Calculus I <sup>1</sup>	4
HIS 150	Pre-Modern World: Evolution to Revolution	3
Social Perspectives (1 of 2)		3
Foreign Language <sup>1</sup>		3
<b>Semester Credit Hours</b>		<b>16</b>
<b>Spring Semester</b>		
CMP 125	Seminar in Writing and Research	3
MTH 211	Calculus II	4
HIS 151	World in the Modern Era: Exploration to	3
or HIS 152	Globalization	
or HIS 153	or Contemporary World: Historical Perspectives	
	or Cold War: A Global History	
Foreign Language		3
Social Perspectives (2 of 2)		3
<b>Semester Credit Hours</b>		<b>16</b>
<b>Year 2</b>		
<b>Fall Semester</b>		
MTH 212	Calculus III	4
MTH 240	Linear Algebra	3
PHY 200 & 200L	General Physics I and General Physics I Lab	4

Aesthetic Perspectives: Fine Arts		3
<b>Semester Credit Hours</b>		<b>14</b>
<b>Spring Semester</b>		
MTH 250	Differential Equations	3
MTH 315	Modern Geometry	3
PHY 201 & 201L	General Physics II and General Physics II Lab	4
Aesthetic Perspectives: Literature		3
Elective Course Credits <sup>2</sup>		3
<b>Semester Credit Hours</b>		<b>16</b>
<b>Year 3</b>		
<b>Fall Semester</b>		
MTH 308	Advanced Calculus	3
MTH 340	Probability & Statistical Analysis I	3
Philosophical Perspectives		3
Elective Course Credits <sup>2</sup>		6
<b>Semester Credit Hours</b>		<b>15</b>
<b>Spring Semester</b>		
MTH 410	Complex Analysis	3
Math Elective		3
Elective Course Credits <sup>2</sup>		9
<b>Semester Credit Hours</b>		<b>15</b>
<b>Year 4</b>		
<b>Fall Semester</b>		
MTH 401	Modern Algebra	3
Math Elective		3
Elective Course Credits <sup>2</sup>		9
<b>Semester Credit Hours</b>		<b>15</b>
<b>Spring Semester</b>		
Math Elective		3
Elective Course Credits <sup>2</sup>		10
<b>Semester Credit Hours</b>		<b>13</b>
<b>Total Credit Hours for Graduation</b>		<b>120</b>

<sup>1</sup> For course placement information see <https://www.rider.edu/student-life/first-year-experience/orientation/placement-testing> (<https://www.rider.edu/student-life/first-year-experience/orientation/placement-testing/>)

<sup>2</sup> Please note that elective credits may be used to complete requirements in a second major or minor.

## Courses and Descriptions

### MTH 102 Finite Mathematics 3 Credits

This mathematically rigorous course begins with a review of the rational numbers, repeating decimals, irrational numbers and non-repeating decimals. The elementary theory of sets is discussed with applications to surveys and data mining. This is followed by a discussion of the cardinality of infinite sets. An introduction to elementary number theory includes various applications. The Cartesian plane and the idea of a function and its graph are introduced with applications. Counting theory then precedes an elementary discussion of probability.

**MTH 105 Algebra and Trigonometry 4 Credits**

The course is an in depth and rigorous study of functions and graphs, equations and inequalities, polynomial and rational functions, exponential, and logarithmic functions, basic trigonometric functions and their inverses, trigonometric identities.

**Prerequisite(s):** A mathematics SAT score of 570, departmental placement or MTH 100 with a grade of C or higher.

**MTH 210 Calculus I 4 Credits**

Introduces analytic geometry, functions, limits, and derivatives; differentiation of algebraic and trigonometric functions, curve sketching, maxima and minima, and higher derivatives.

**Prerequisite(s):** Math SAT 650 or higher or Math ACT score of 28 or higher or MTH 105 or MTH 106 with a grade of C or higher.

**MTH 211 Calculus II 4 Credits**

The definite integral, differentiation of transcendental functions, methods of integration and approximate integration, determination of area, volume, and surface area.

**Prerequisite(s):** MTH 210 with a grade of C or higher.

**MTH 212 Calculus III 4 Credits**

Infinite series; functions of two and three variables, vectors and tangent planes, partial derivatives, multiple integrals, determination of volume and density.

**Prerequisite(s):** MTH 211 with a grade of C or higher.

**MTH 230 Discrete Mathematics 4 Credits**

An introduction to topics in Discrete Mathematics. This course covers methods of proof, induction and recursion, and other topics in discrete mathematics. Topics may include graph theory, trees, and symmetry groups.

**Prerequisite(s):** MTH 102, MTH 105 or MTH 210.

**MTH 240 Linear Algebra 3 Credits**

Systems of linear equations; vector spaces; linear independence; determinants; orthogonality; linear maps; eigenvectors.

**Prerequisite(s):** MTH 210 or as corequisite; sophomore standing; or permission of instructor.

**MTH 250 Differential Equations 3 Credits**

First order differential equations, separable and exact; integrating factors; second order linear differential equations; series solutions of second order linear differential equations; higher order equations; existence and uniqueness theorems; systems of linear differential equations.

**Prerequisite(s):** MTH 240, MTH 211.

**Corequisite(s):** MTH 212 or as prerequisite.

**MTH 308 Advanced Calculus 3 Credits**

Vectors, gradients, and directional derivatives, Lagrange multipliers, Taylor's theorem, multiple integrals, change of variables, line and surface integrals, Stokes' theorem.

**Prerequisite(s):** "B" average in MTH 210 and MTH 211; MTH 212, MTH 240.

**MTH 315 Modern Geometry 3 Credits**

Covers geometry from a modern point of view, with emphasis on non-Euclidean geometry, particularly projective geometry.

**Prerequisite(s):** MTH 211, MTH 240.

**MTH 340 Probability & Statistical Analysis I 3 Credits**

Theory of sets and probability; discrete and continuous random variables and probability distributions. Emphasizes foundations and utilizes the techniques of the calculus.

**Prerequisite(s):** MTH 212 or MSD 111.

**MTH 341 Probability & Statistical Analysis II 3 Credits**

Continuation of MTH 340. Foundations of mathematical statistics: normal distributions, estimation, confidence intervals and hypothesis testing; topics chosen from student's t-test, chi-square tests, analysis of variance and regression analysis. Emphasizes foundations and utilizes the techniques of the calculus.

**Prerequisite:** MTH 340. Spring.

**MTH 401 Modern Algebra 3 Credits**

Provides an introduction to modern abstract algebra. It emphasizes the axiomatic method to analyze the major algebraic systems. The instructor will choose the topics to be studied from among the following algebraic structures: integral domains, fields, complete ordered fields, groups, polynomials, rings, ideals and modules.

**Prerequisite(s):** MTH 240.

**MTH 402 Topics in Advanced Mathematics 3 Credits**

Chosen from advanced pure or applied mathematics. Topics vary, depending on instructor.

**Prerequisite(s):** MTH 212 and MTH 240.

**MTH 410 Complex Analysis 3 Credits**

Analytic functions, conformal mapping, power series, Cauchy's theorem, calculus of residues.

**Prerequisite(s):** MTH 212 and MTH 240.

**MTH 420 Number Theory 3 Credits**

Covers topics including divisibility theory, the prime numbers, the theories of congruences and of quadratic reciprocity, and Fermat's Last Theorem. Other topics may also include applications to cryptography, Pell's equations, continued fractions, and the theory of partitions.

**Prerequisite(s):** MTH 240 or permission of instructor.

**MTH 430 Introduction to Topology 3 Credits**

A comprehensive introduction to elementary topology. The concepts of topological spaces and metric spaces will be introduced. Connectedness, compactness and properties of subsets of the real numbers rooted in topology will also be considered. The quotient topology will be used to construct surfaces as identification spaces, and tools will be developed to distinguish one surface from another.

**Prerequisite(s):** MTH 212.

**MTH 440 Real Analysis 3 Credits**

Covers the theory of sets, the real number system and its properties, convergence of sequences and series of numbers and functions, and the theory of integration, including: measure theory, the Riemann integral, and introduction to the Lebesgue theory of integration.

**Prerequisite(s):** MTH 212 and MTH 240.

**MTH 490 Independent Study: Research and Creative Expression 1-4 Credits**

Immerses the student in research and mathematical literature. If possible, the student will publish the results or present them at a scientific meeting.

**PHY 200 General Physics I 4 Credits**

Introductory classical physics; Newtonian mechanics, including the conservation laws, wave motion, gravity, thermodynamics. Three hours of lecture and one three-hour lab per week. Prerequisite(s): MTH 210 or concurrent enrollment

**Corequisite(s):** PHY 200L.

**PHY 201 General Physics II 4 Credits**

A continuation of the concepts developed in Physics 200. Electricity, electrical circuits, magnetism, Maxwell's equations. Light and optics, including lenses, interference, and diffraction. Three hours of lecture and one three-hour lab per week. Prerequisite(s): PHY 200, MTH 211 or concurrent enrollment.

**Corequisite(s):** PHY 201L.