2024-2025
Department of Mathematics
HANDBOOK
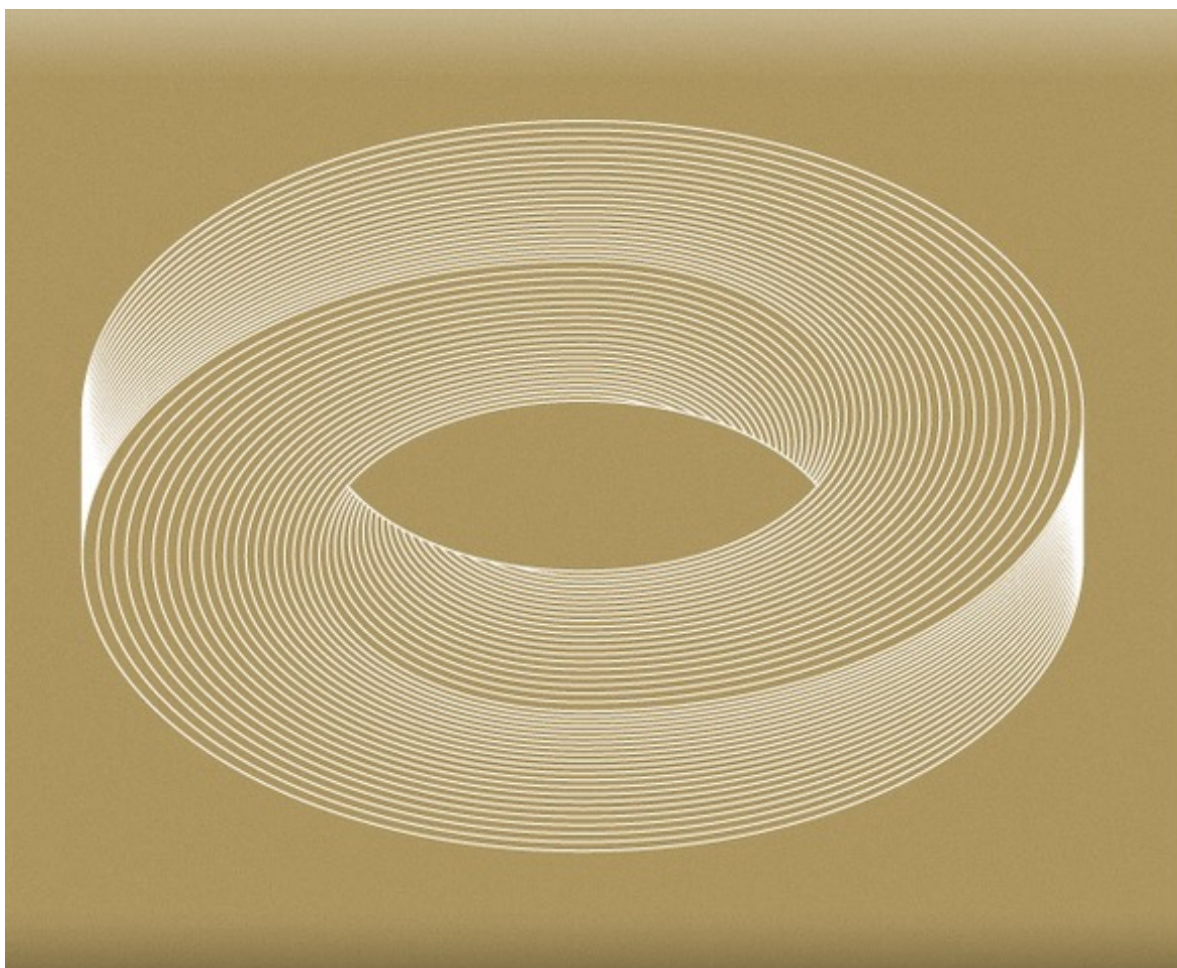
Mathematics and Actuarial Science
MAJORS AND MINORS

RIDER
UNIVERSITY
1865

The mathematics major in the College of Liberal Arts and Sciences of Rider University will study pure mathematics, applied mathematics, and statistics. Graduating students have been prepared rigorously for a career in mathematics, its allied fields, teaching, or graduate study.

The mathematics program offers small classes, all taught by faculty. Students enjoy unusual accessibility to their teachers that is possible only in a program of our size.

Graduates from the program have attended graduate school in mathematics, engineering, and mathematics education. Others have entered industry as systems analysts, researchers, actuaries, and managers, or are employed by state or federal agencies working in areas related to mathematics. Many of our students enter the teaching profession, in elementary, middle, or secondary schools.

The mathematics faculty consists of four mathematicians, all of whom are actively engaged in research. Advanced students are urged to get involved with research, and are offered opportunities to take individualized courses with faculty members.

The members of the faculty are:

Anthony Bahri   D.Phil., Oxford University   (609)895-5431
Toufik Khyat   Ph.D., University of Rhode Island (609)895-5432
Ruowen Liu   Ph.D., Arizona State University   (609)896-5091
Ahmad Mojiri, Chairperson Ph.D., University of Ottawa   (609)895-5419

For further information, please contact Dr. Mojiri at (609) 895-5419, or at amojiri@rider.edu.

Requirements for the Mathematics Major

The mathematics major is required to take the following courses. Furthermore, the mathematics major must attain a "B" average in Calculus I (MTH-210) and Calculus II (MTH-211).

Course Number	Course Name	Credits
MTH-210	Calculus I	4
MTH-211	Calculus II	4
MTH-212	Calculus III	4
MTH-240	Linear Algebra	3
MTH-250	Differential Equations	3
MTH-308	Advanced Calculus	3
MTH-315	Modern Geometry	3
MTH-340	Probability and Statistical Analysis I	3
MTH-401	Modern Algebra	3
MTH-410	Complex Analysis	3
	Three upper level mathematics electives	9
PHY-200	General Physics I	3
PHY-200L	General Physics I Lab	1
PHY-201	General Physics II	3
PHY-201L	General Physics II Lab	1
	Total Credits	50

Mathematics Electives

The following upper level electives are offered:

MTH-402	Topics in Advanced Mathematics	3
MTH-420	Number Theory	3
MTH-430	Introduction to Topology	3
MTH-440	Real Analysis	3

In addition, MTH-402, *Topics in Advanced Mathematics*, may, with permission of the department, be taken more than once for credit and to satisfy the upper level mathematics elective requirement. A student may also use MTH-490, *Independent Study and Research* credits, or *Supervised Study* credits, to satisfy the upper level math elective requirement.

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Requirements for the Mathematics Minor

Course Number	Course Name	Credits
MTH-210	Calculus I	4
MTH-211	Calculus II	4
MTH-212	Calculus III	4
	Any four mathematics courses above the 212 level	12
	Total credits	24

Actuarial Science B.S. Major Requirements

(60 credits)

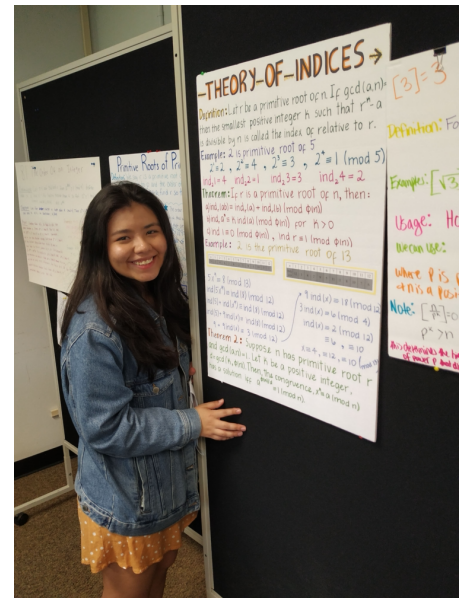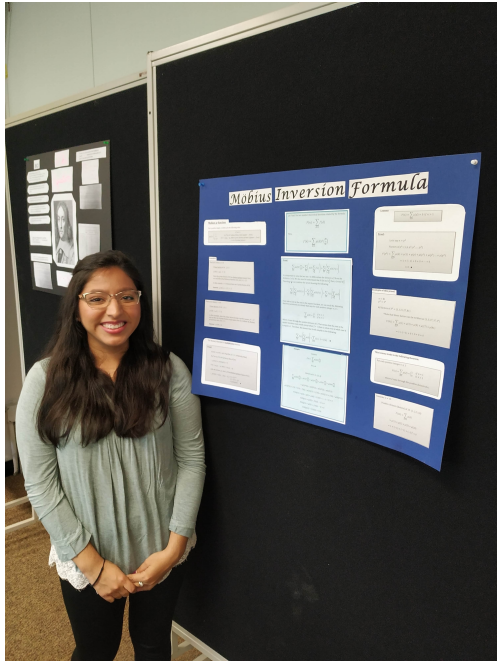| Code	Title	Credits
CLAS General Education Curriculum		
See CLAS General Education Curriculum Page		
Required Mathematics Courses		30
MTH 210	Calculus I	
MTH 211	Calculus II	
MTH 212	Calculus III	
MTH 240	Linear Algebra	
MTH 250	Differential Equations	
MTH 308	Advanced Calculus	
MTH 340	Probability & Statistical Analysis I	
MTH 341	Probability & Statistical Analysis II	
Math Elective	Math Elective (at 300 level or above)	
Math Elective	Math Elective (at 300 level or above)	
Required Accounting Course		6
ACC 210	Introduction to Accounting	
ACC 220	Managerial Uses of Accounting	
Required Finance Course		6
FIN 220	Introduction to Finance	
FIN 309	Intermediate Corporate Finance	
Required Economics Courses		6
ECO 200	Principles of Macroeconomics	
ECO 201	Principles of Microeconomics	
Required Management Science Courses		6
MSD 330	Predictive Modeling and Applications	
MSD 350	Financial Mathematics	
Required Computer Science Courses		3
Select one of the following courses:		
CSC 105	Fundamentals of Computer Science	
CSC 110	Computer Science I	
Total Credits		**60**
Course List		

Recommended Free Electives

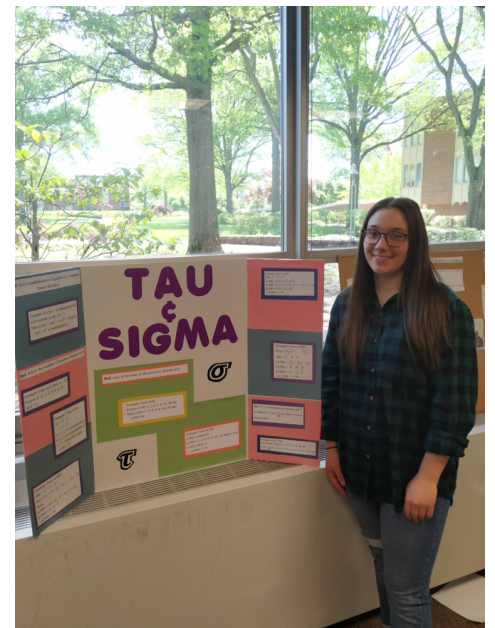|		
FIN 307	Financial Markets & Institut	
FIN 308	International Finance	
FIN 312	Investments	
FIN 340	Risk Management	
FIN 360	Fixed Income and Derivatives	
HTH 336	Economics of Health Care System	

- Students are required an average of "B" or above in Calculus I and II.
- Recommended free electives are not required for completion of the major.

Student Research

Opportunities to do independent research with a faculty member is a valuable experience for undergraduates, especially those seeking admission to graduate schools.

Senior students are encouraged to get involved with research, and are offered opportunities to take individualized courses with faculty members. In addition, students have the opportunity to gain teaching experience as tutors at the campus' Academic Success Center.

Rider's Math Club

Whether you are a math major or just curious about mathematics, Math Club welcomes you to join us!

About the Math Club

Math Club meetings are open to all Rider students and meetings are twice a month. Everyone is welcome to attend!

The purpose of the Math Club is:

1. to promote the appreciation of mathematics throughout the Rider community.
2. to provide a social and intellectual environment to all students interested in mathematics.

3. to organize extracurricular mathematics related activities.
4. to invite guests to speak to the club on mathematics topics and career options in mathematics.

The 2024-2025 Math Club Officers

- **President:** Sophia Tauer
- **Vice President:** Maria De Oliveira Lima
- **Treasurer:** Reese Mauriello
- **Secretary:** Adrienne Steinruck
- **Faculty Advisors:** Dr. Toufik Khyat

What can I do with a degree in mathematics?

A mathematics major at Rider University prepares you for graduate school as well as a wide range of careers in industry, finance, insurance, government, and teaching.

Graduates from the program have attended graduate school in mathematics, engineering, and mathematics education. Others have entered industry as systems analysts, researchers, actuaries, and managers, or are employed by state or federal agencies working in areas related to mathematics. Many of our graduates enter the teaching profession, in elementary or secondary schools.

Many Career Paths

Mathematics is the foundation of many careers. Program graduates go on to careers in the following fields:

- Scientific and medical research
- Elementary, secondary, and university teaching
- Actuarial science
- Statistics
- Data Science
- Engineering
- Computer science
- Pharmaceutical research
- Finance

Where do Rider mathematics majors attend graduate school?	Where do Rider mathematics alumni work and what they do?
- Rutgers University - Johns Hopkins University - Drexel University - University of Delaware - Lehigh University - New Jersey Institute of Technology - Kean University - Nova Southeastern University	- West Chester University of Pennsylvania – Professor - Various schools – Math Teacher - George Mason University - Professor - University of Southern Mississippi – Professor - The Academy of Notre Dame de Namur – Math Teacher - University of Pennsylvania - Professor - Jaeb Center for Health Research - Biostatistician - Federal Aviation Administration - Mathematician - JP Morgan Chase - Defined Benefit Senior Analyst - Ardent Software - Principle Software Developer - First Fidelity Bank - Programmer Analyst

	- Consulting Actuaries – Actuary - New York Life Insurance - Actuarial Services Consultant - Washington Township Board of Education – Principal - Milliman – Actuary - Advanced Magnetics, Inc. - Biostatistician - Corning Incorporated – Statistician - IBM Global Services - Administration Manager - Merrill Lynch - 'Wealth Management Client Services - Human Services Data Center – Computer Programmer - Software Application Systems - Software Consultant - Sanofi Aventis U.S. - Senior IS Specialist - Geisinger Health Plan - Actuarial Analyst - Old Bridge Board of Education – Principal - Bank of America Merrill Lynch - Assistant Vice President - GAF Materials Corporation – Network Engineer - Innovated Software Solutions, Inc. - Client Service Representative - Everest National Insurance Co. – Director - Prudential Financial - Process Management Specialist - NJ State Department of Banking & Insurance - Insurance Analyst - Bigitos Health - Financial Analyst - Educational Testing Service - Computer Programmer/Analyst - ATI Technologies, Inc. – Manager - Fisher Investments - Systems Engineer - AT&T Communications - Computer Programmer - Marsh & McLennan Companies – Analyst - US Army – Statistician

Companies Where Our Recent Students Have Completed Internships:

- Buck, A Gallagher Company
- Aon
- Pennsylvania Compensation Rating Bureau
- Liberty Mutual
- Retirement Actuarial Consulting

Description of Required Mathematics Courses

MTH-105 Algebra and Trigonometry *(4 credits)*
Algebraic functions, trigonometric functions, identities and conditional equations, inequalities, progressions, exponential and logarithmic functions, mathematical induction and the binomial theorem. Students who take MTH-105 may not take Quantitative Methods for Business I for credit. Placement is by examination. FALL AND SPRING.

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: MTH-105 or placement by examination. FALL AND SPRING.

MTH-211 Calculus II *(4 credits)*
The definite integral, differentiation of transcendental functions, methods of integration and approximation of integrals. Determination of area, volume, and surface area are covered. Prerequisite: MTH-210. FALL AND SPRING.

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: MTH-211. SPRING.

MTH-240 Linear Algebra *(3 credits)*
Systems of linear equations, vector spaces, linear independence, determinants, orthogonality, linear maps, eigenvectors. Prerequisite: MTH-210; sophomore standing or permission of instructor. Co-requisite: MTH-211. FALL.

MTH-250 Differential Equations *(3 credits)*
First order differential equations, separable and exact equations, integrating factors, second order linear differential equations, series solutions of second order equations, higher order equations, existence and uniqueness theorems, systems of linear differential equations. Prerequisites: MTH-211 and MTH-240. Pre- or Co-requisite: MTH-212. Spring of even years.

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, Stoke's theorem. Prerequisites: MTH-212, MTH-240. Fall of odd years.

MTH-315 Modern Geometry *(3 credits)*
Covers geometry with an emphasis on non-Euclidean geometry, particularly projective geometry. Prerequisite: MTH-211.

MTH-340 Probability and Statistical Analysis I *(3 credits)*
Emphasis on statistics with the use of calculus. Basic probability distributions, estimation and confidence intervals. Prerequisite: MTH-212. FALL.

MTH-401 Modern Algebra *(3 credits)*
An introduction to modern abstract algebra. It emphasizes the axiomatic method to analyze the major algebraic systems. The instructor will choose the topics from among algebraic structures such as integral domains, fields, complete ordered fields, groups, polynomial rings, ideals, and modules. Prerequisite: MTH-240. Fall of even years.

MTH-402 Topics in Advanced Mathematics *(3 credits)*
Chosen from topics in pure or applied mathematics. Prerequisites vary depending on the topic.

Recent Offerings for MTH-402 have included:

Introduction to Algebraic Geometry
Among the topics covered were: projective space, transformations, homogeneous polynomials, and projective varieties. Lines, conics and cubics in projective space, affine varieties, and the Nullstellenstaz were also discussed.

The Geometry of Curves and Surfaces
This course studies the curves in the plane and in space, and surfaces in space, mostly from the point of view of differential geometry. The method of moving frame is used for curves, and the concept of curvature is introduced and explored for surfaces. A working knowledge of calculus in several variables is assumed.

Rings and Fields
Among topics covered were: rings, ideals, principal ideal domain, unique factorization domains and fields.

MTH-410 Complex Analysis *(3 credits)*
Analytic functions, conformal mappings, power series, Cauchy's theorem, calculus of residues. Prerequisite: MTH-308. Spring of even years.

MTH-420 Number Theory *(3 credits)*
This course 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. May be run as a seminar. Prerequisite: MTH 240 or POI.

MTH-430 Introduction to Topology *(3 credits)*
This course is 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: MTH 212.

MTH-440 Real Analysis *(3 credits)*
This course 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, introduction to the Lebesque theory of integration. Pre- or co-requisite: MTH 212.

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.

Sample Four-Year Schedule for <u>Mathematics</u> Major

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The following represents a suggested four-year schedule for the *typical* mathematics major. It should be pointed out that, only very rarely, can any individual mathematics major be considered *typical*.

While there is a certain amount of flexibility built into this schedule, it is important for the student to complete Calculus I, II, and III, Linear Algebra, and Differential Equations before the end of the sophomore year, since these courses are prerequisite to the junior/senior year courses. It is also recommended that the physics courses be completed during the sophomore year.

	<u>Fall 2023</u>	<u>Spring 2024</u>
Freshman Year	Calculus I (core classes) (core classes)	Calculus II
Sophomore Year	Linear Algebra General Physics I and Lab	Calculus III General Physics II and Lab Modern Geometry
Junior Year	Advanced Calculus Probability and Statistics I *Math elective	Differential Equations Complex Analysis
Senior Year	Modern Algebra *Math elective	*Math elective

* Math electives – take 3

Sample Four-Year Schedule for
Mathematics/Education Major

	Fall	Spring
Freshman Year	Calculus I (core classes) (core classes)	Calculus II
Sophomore Year	Calculus III Linear Algebra General Physics I and Lab	Differential Equations General Physics II and Lab
Junior Year	Advanced Calculus Probability and Statistics I *Math elective*Math elective	Complex Analysis Modern Geometry
Senior Year	Modern Algebra *Math elective	Student Teaching

*Math electives – take 3

Sample Four-Year Schedule for <u>Actuarial Science</u> Major

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	<u>Fall 2023</u>	<u>Spring 2024</u>
Freshman Year	Calculus I (core classes) (core classes) ECO 200	Calculus II ECO 201
Sophomore Year	Linear Algebra ACC 210 CSC 105 or 110	Calculus III ACC 220 FIN 220
Junior Year	Advanced Calculus Probability and Statistics I FIN 309	Differential Equations Probability & Statistics II
Senior Year	Math elective MSD 325 MSD 320 MSD 350	

* Math electives – take 3

Mathematics Course Rotations

Course Number	Course Title	Fall Even Years	Spring Odd Years	Fall Odd Years	Spring Even Years
MTH 210	Calculus I	X	X	X	X
MTH 211	Calculus II	X	X	X	X
MTH 212	Calculus III		X		X
MTH 240	Linear Algebra	X		X	
MTH 250	Differential Equation				X
MTH 308	Advanced Calculus			X	
MTH 315	Modern Geometry		X		
MTH 340	Prob & Stat I	X		X	
MTH 341	Prob & Stat II		X		X
MTH 401	Modern Algebra	X			
MTH 410	Complex Analysis				X
MTH 4XX	Math Elective	X	X	X	X

Note: Course offerings are subject to change.