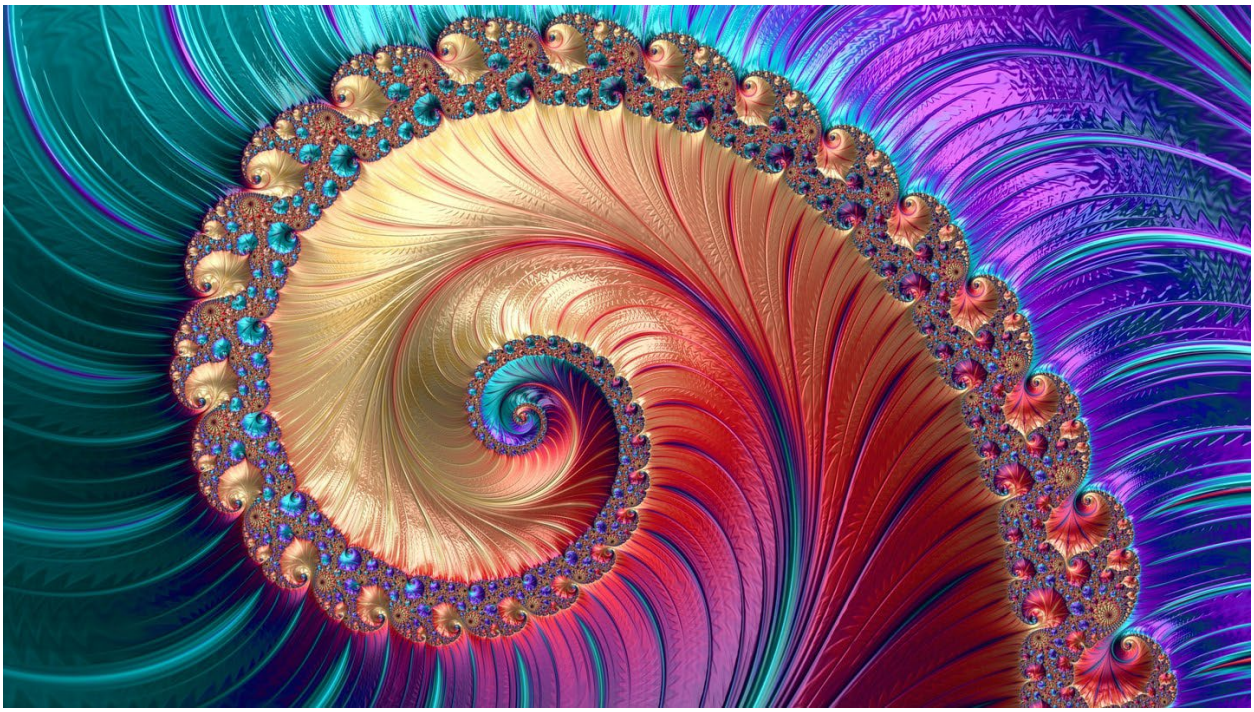
Student Handbook
2021-2022



Department of Mathematics and Actuarial Science
North Central College

Welcome

Originally created to keep track of sheep or compute the taxes due on a tract of land, mathematics has evolved into one of the most beautiful expressions of the human spirit. And while you probably know that mathematics is essential for work in physics, chemistry and computer science, did you know it's also used in business, psychology and sociology? In fact, the North Central College mathematics faculty have wide-ranging interests and offer majors in

- Theoretical mathematics
- Applied mathematics
- Actuarial science

Whatever your interests, we'll help you find the right coursework in mathematics to be sure you have the tools to be successful. We offer a wide range of majors, each designed for a specific audience, while all of them are intended to develop an increasingly sophisticated understanding of both theoretical and applied mathematics. We are also aware that many students will need mathematics to succeed in their chosen profession. We're committed to making sure that all students (not just math majors) in each of our classes are successful in learning the mathematics they need to know for their chosen careers. To achieve this goal, the mission of the department is three-fold:

> I. To support the mission of the institution by providing general education and service courses in mathematics which provide each student with the mathematical experience appropriate to that student's interests and abilities;
>
> II. To provide mathematics majors and minors with a strong grounding in the tools and methods of mathematics so as to enable them to succeed in mathematics or a related field, and to provide as many majors as possible with a significant independent research experience;
>
> III. To provide education majors with the mathematical content knowledge and discipline specific skills to be effective educators as they explore the direction of present day mathematics education.

As a prospective math major, you will design a course of study with your undergraduate advisor. There are several options within the department and typically there is some flexibility within each program of study. This freedom gives each student the opportunity to make the major his/her own. This handbook is designed to you help you plan this program. The planning sheets, checklists, and course availability & offerings sections are present to give you a clear idea of how the program is laid out, and also to provide a side by side comparison of the degrees we offer.

In addition to course work, there are a number of ways to be involved in the department. Several of these opportunities are outlined later in this handbook. If you have an interest in any of these activities, feel free to contact the program coordinator. If you have any questions about the program of study or the department in general, feel free to contact me at 630-637-5231 or mapons@noctrl.edu.

Matthew A. Pons
Chair, Mathematics and Actuarial Science

The Faculty

Katherine C. Heller, Assistant Professor of Mathematics. 2010. B.S., The University of South Carolina, 2004; M.S., 2006, Ph.D., 2010, The University of Virginia.
Interests: Real and complex analysis, functional analysis, operator theory, composition operators
Additional Responsibilities: Math Resource Center Co-coordinator, Math Club/Pi Mu Epsilon Advisor

Marco V. Martinez, Assistant Professor of Mathematics and Actuarial Science Coordinator. 2013. B.S., 2005 (Biology), 2007 (Mathematics), Pontificia Universidad Javeriana; M.S., 2013 (Statistics), Ph.D., 2013 (Mathematics), The University of Tennessee.
Interests: Mathematical and statistical tools in biology

Mary T. McMahon, Associate Professor of Mathematics and Mathematics Education Coordinator. 1986. B.A., St. John's University, 1969; M.S., Queens College of the City University of New York, 1972.
Interests: Mathematics education, mentoring of pre-service and in-service teachers, lesson study
Additional Responsibilities: Coordinator of Math Education

Neil R. Nicholson, Assistant Professor of Mathematics. 2010. B.A., Lake Forest College, 2002; Ph.D., The University of Iowa, 2007.
Interests: Knot theory, lattice point theory, recreational mathematics
Additional Responsibilities: NCAA Faculty Athletic Representative, NCC Cycling & Multisport Club Advisor, Co-coordinator of Undergraduate Math Competitions

Maria Orjuela Garavito, Half-time Instructor of Mathematics. 2018. B.S., Pontificia Universidad Javeriana, 2006; M.S., University of Puerto Rico, Mayaguez Campus, 2009; M.S., Florida International University, 2013.

Matthew A. Pons, Associate Professor of Mathematics. 2007. B.A., The University of North Carolina, 2002; M.S., 2005, Ph.D., 2007, The University of Virginia.
Interests: Real and complex analysis, functional analysis, operator theory, composition operators
Additional Responsibilities: Chair of the Mathematics Department, Co-coordinator of Math Resource Center

David J. Schmitz, Associate Professor of Mathematics. 2001. B.S., The University of Notre Dame, 1990; S.M., 1991, Ph.D., 2001, The University of Chicago.
Interests: Algebraic and analytic number theory, the mathematics of square dancing, recreational mathematics, crosswords
Additional Responsibilities: Math Club/Pi Mu Epsilon Advisor, Co-coordinator of Undergraduate Math Competitions, Coordinator of Actuarial Science, Actuarial Science Club Advisor

The Department

The Mathematics Department at North Central College is a lively and energetic place. We engage with the student body, the campus, and the community in a variety of ways, a few of which are detailed below.

Math Club/Pi Mu Epsilon Illinois Nu Chapter

Math Club creates opportunities for students to engage with new and interesting mathematics, to interact with mathematicians, and to attend relevant colloquiums/conferences. We also provide information on career and graduate school opportunities in the various fields of mathematics and encourage students to join the Pi Mu Epsilon Honorary Society, the key affiliate of Math Club. On the lighter side, the club also sponsors a trivia competition each term.

Actuarial Science Club

The Actuarial Science club aids actuarial science majors to be successful in and after college, provides tutoring for the actuarial exams and also vital information about what employers are looking for in actuarial scientists.

Undergraduate Math Competitions

Throughout the year our majors compete in several math contests, the William Lowell Putnam Mathematical Competition and the ACCA Calculus Competition being the two most popular. Students at all levels are encouraged to attempt these contests, and our research methods seminar, MATH 390, is a good place to start honing your skills. The Putnam is an individual effort while the ACCA contest allows teams of up to three undergraduates.

Mathematics Education Conferences

During the school year, junior and senior mathematics/Secondary Education majors participate in regional conferences/meetings sponsored by the Illinois Council of Teachers of Mathematics, Metropolitan Mathematics Club, DuPage Valley Conference and Mathematics Department Heads of the Western Chicago Suburbs. Mathematics/Secondary Education can also apply for the prestigious Illinois Council of Teachers of Mathematics Scholarship. The award is for $1500 and can be spent on whatever the recipient chooses.

Math Resource Center

Students in any 100-level mathematics course are encouraged to spend some time in our drop-in assistance center. Staffed by faculty members and students, the center offers a place to study with assistance when needed. Our focus is on student problem solving in an effort to empower students to become independent critical thinkers. Operating hours are M-TH from 2:30-4:30 in STEM 313.

Students interested in a tutoring position should contact either of the MRC coordinators.

Summer Camps

Each summer the department hosts several camps. Students interested in assisting with these are encouraged to contact the camp coordinator.

- **Girls and Math**
  This week of mathematics activities is designed to provide middle schools girls enrolled in grades 7 and 8 with a variety of engaging mathematical experiences focused on extending their understanding and knowledge in mathematics. The program allows talented and enthusiastic students under the guidance of an undergraduate mentor to explore several aspects of mathematics not covered by the traditional school curriculum. Potential topics include: modular arithmetic, cryptography, voting theory, fractals, graph theory, and binary code.

- **Math and Art**
  This fast-paced week will introduce students to the mathematics behind the art of M.C. Escher. They will learn how to make Escher-like drawings by hand and use KaleidoMania to explore the connections between math and art. They will use Microsoft Excel to create clock arithmetic tables an color them to make very interesting designs. The week will culminate with a PowerPoint art show for parents and friends. The workshop is intended for those students entering grades 6, 7, and 8.

- **American Mathematics Competition 8**
  The AMC 8 is the premier mathematics contest for students who have not yet completed 8th grade. This camp is designed to prepare students to do well in this competition and each day will feature two hours of instruction and problem solving. After a lunch break, students will return to complete an actual past AMC 8 exam and then discuss the solutions.

High school Mathematics Contests

Each year the department plays host to a variety of math contests for high school students, including the ICTM High School Mathematics Contest, the American Mathematics Competition 8, 10, and 12, and the WSYE Academic Challenge (not exclusively mathematics). If you are interested in assisting with these contests in any way, see Dr. Katherine Heller, Professor Mary McMahon, Dr. Neil Nicholson, or Dr. David Schmitz.

The Curriculum

Mathematics Major

B.A. Requirements:

I. Required core courses:

Calculus: MATH 151, MATH 152, and MATH 253
Mathematical Proofs: MATH 280
Algebra: MATH 300 and MATH 421
History: MATH 310
Research Methods: MATH 390
Real Analysis: MATH 461
Seminar: MATH 490

II. Electives:

Choose at least two of: MATH 260, MATH 305, MATH 315, MATH 320, MATH 340, MATH 422, MATH 462, MATH 470.

*Cannot take both MATH 260 and MATH 340.

Note: Students seeking teaching licensure must also complete the Secondary Education major requirements as well as the following courses: MATH 305 and MATH 260.

B.S. Requirements:

I. Required core courses:
Calculus: MATH 151, MATH 152, and MATH 253
Mathematical Proofs: MATH 280
Algebra: MATH 300 and MATH 421
Complex Variables: MATH 320
Research Methods: MATH 390
Real Analysis: MATH 461
Seminar: MATH 490
Computer Science: CSCE 160 and CSCE 210

II. Electives:

Choose at least two of: MATH 422, MATH 462, and MATH 470
Choose at least one of: MATH 260, MATH 315, or MATH 340

III. Required Support Courses:
Complete either a minor in computer science, PHYS 161 and PHYS 162, or CHEM 121 and CHEM 122.

Note: Students intending to go to graduate school in mathematics are strongly encouraged to take MATH 320, MATH 422, MATH 462 and MATH 470.

Mathematics Minor

At least 24 credit hours in mathematics, including:

I. Required core courses:

Calculus: MATH 151, MATH 152, and MATH 253

IV. Elective Options:

Choose one of the preapproved options listed below. The set of courses should be cohesive with respect to each other and should be based on the student's area of applied study. Other options may be available to students with departmental approval. The Mathematics Department must be consulted in the planning process.

Option A: MATH 265 and MATH 340, and one of the following: MATH 350, MATH 410, ECON 365, or ECON 355.

Option B: MATH 255 and one of the following: MATH 260, MATH 320, MATH 340, or MATH 350, and one of the following: ECON 355, ECON 365, or PHYS 440.

Option C: MATH 300, and one of the following: MATH 260, MATH 320, MATH 340, or MATH 350, and one of the following: ECON 355, ECON 365, or PHYS 440.

Option D: MATH 280 and two four credit hour Mathematics courses at the 300-level or above (excluding MATH 350 and MATH 410).

Applied Mathematics Major

<u>B.S. Requirements:</u>

I. Required core courses:

Calculus: MATH 151, MATH 152, and MATH 253
Statistics: MATH 260
Mathematical Proofs: MATH 280
Algebra: MATH 300
Differential Equations: MTH 315
Data Analytics: MATH 350
Research Methods: MATH 390
Seminar: MATH 490
Computer Science: CSCE 160 and CSCE 210

II. A minor in an applied area (Biology, Biochemistry, Chemistry, Computer Science, Economics, Environmental Studies, Finance, Neuroscience, Physics, Psychology, or other minor approved by the department.)

III. One of the following sequences:

Choose one pair: MATH 421 and MATH 422 **or** MATH 461 and MATH 462.

Actuarial Science Major

B.S. Requirements:

I. Required core courses:

Calculus: MATH 151, MATH 152, and MATH 253
Theory of Interest: MATH 265
Financial Mathematics: MATH 270
Linear Algebra: MATH 300
Probability: MATH 340 and MATH 370
Data Analytics: MATH 350
Models for Financial Economics: MATH 410
Accounting: ACCT 201
Economics: ECON 200, ECON 205, and ECON 365
Finance: FINA 350

II. Computer Science: CSCE 160 and CSCE 210

Note: It is strongly recommended that actuarial science majors pass at least one actuary exam (P or FM/1) and complete an internship prior to graduation.

Undergraduate Research/Independent Study

When you join the North Central College family, you join a community that fosters independent and collaborative research, giving you opportunities to experience problem solving and project development in ways rarely experienced by undergraduates — and to communicate the results of your work in local, national and international conferences and publications. In the math department, the faculty have a variety of interests (see The Faculty) and actively engage with students at various levels of inquiry. These projects take the form of summer research programs, Honor's Theses, and independent study projects (MTH 299/399/499). Though not required for any of the majors we offer, the interested student is encouraged to seek out a potential research advisor early in his/her academic program.

Planning your Academic Course

It is recommended that each student develop a four-year plan in consultation with their academic advisor. The checklists, planning sheets, and course availability list on the next few pages will help you organize this process. The sample four-year plans are included to assist you but keep in mind that these are samples. There is a blank for you plan for you to develop you own academic program. Feel free to consult with a math faculty member if you have any questions.

Mathematics B.A.

Required for Major

Within Major Department

Course	Term-Year
___ MATH 151	4 ____ ____
___ MATH 152	4 ____ ____
___ MATH 253	4 ____ ____
___ MATH 280	4 ____ ____
___ MATH 300	4 ____ ____
___ MATH 310	4 ____ ____
___ MATH 390	2 ____ ____
___ MATH 421	4 ____ ____
___ MATH 461	4 ____ ____
___ MATH 490	2 ____ ____

Choose at least two of the following courses:

___ Complete two of the following:

MATH 260, MATH 305, MATH 315, MATH 320, MATH 340, MATH 422, MATH 462, MATH 470.

_____ 4 ____ ____

_____ 4 ____ ____

___ Supplemental Secondary Education Major (see next column)

Supplemental Secondary Education Major to accompany the mathematics major

Course	Term-Year
___ EDUC 101	4 ____ ____
___ PSYC 100	4 ____ ____
___ EDUC 200	4 ____ ____
___ EDUC 235	2 ____ ____
___ EDUC 290	1 ____ ____
___ EDUC 322	4 ____ ____
___ EDUC 330	4 ____ ____
___ EDUC 360	4 ____ ____
___ EDUC 390	1 ____ ____
___ EDUC 403	4 ____ ____
___ EDUC 411	4 ____ ____
___ EDUC 490	1 ____ ____
___ EDUC 492	1 ____ ____
___ EDUC 494	4 ____ ____
___ EDUC 496	8 ____ ____

One of the following:

___ EDUC 338	4 ____ ____
___ EDUC 340	4 ____ ____
___ EDUC 342	4 ____ ____
___ EDUC 344	4 ____ ____
___ EDUC 346	4 ____ ____
___ EDUC 348	4 ____ ____

Mathematics B.S.

Required for Major

Within Major Department

Course	Term-Year
___ MATH 151	4 ____ ____
___ MATH 152	4 ____ ____
___ MATH 253	4 ____ ____
___ MATH 280	4 ____ ____
___ MATH 300	4 ____ ____
___ MATH 320	4 ____ ____
___ MATH 390	2 ____ ____
___ MATH 421	4 ____ ____
___ MATH 461	4 ____ ____
___ MATH 490	2 ____ ____
___ CSCE 160	4 ____ ____
___ CSCE 210	4 ____ ____

___ Must include two of the following: MATH 422, MATH 462, MATH 470.

_____ 4 ____ ____

_____ 4 ____ ____

___ Must include at least one of the following: MATH 260 or MATH 315 or MATH 340.

_____ 4 ____ ____

Required Outside of Major Department

Complete one of the following:

___ Minor in Computer Science

___ Physics: PHYS 161 (4) and PHYS 162 (4)

___Chemistry: CHEM 121 (4) and CHEM 122 (4)

Applied Mathematics B.S.

Required for Major

Course	Term-Year
___ MATH 151	4 ____ ____
___ MATH 152	4 ____ ____
___ MATH 253	4 ____ ____
___ MATH 260	4 ____ ____
___ MATH 280	4 ____ ____
___ MATH 300	4 ____ ____
___ MATH 315	4 ____ ____
___ MATH 350	4 ____ ____
___ MATH 390	2 ____ ____
___ MATH 490	2 ____ ____

Choose One of the Following Pairs:

___ MATH 421	4 ____ ____
___ MATH 422	4 ____ ____
-or-	
___ MATH 461	4 ____ ____
___ MATH 462	4 ____ ____

Required Outside of Major Department

___ CSCE 160	4 ____ ____
___ CSCE 210	4 ____ ____

___ Complete at least a minor outside of the math department in an applied area.

Actuarial Science B.S.

Required for Major

Within Major Department

Course	Term-Year
___ MATH 151	4 ____ ____
___ MATH 152	4 ____ ____
___ MATH 253	4 ____ ____
___ MATH 265	4 ____ ____
___ MATH 270	2 ____ ____
___ MATH 300	4 ____ ____
___ MATH 340	4 ____ ____
___ MATH 350	4 ____ ____
___ MATH 370	2 ____ ____
___ MATH 410	4 ____ ____

Required Outside of Major Department

Course	Term-Year
___ ACCT 201	4 ____ ____
___ ECON 200	4 ____ ____
___ ECON 205	4 ____ ____
___ ECON 365	4 ____ ____
___ FINA 350	4 ____ ____
___ CSCE 160	4 ____ ____
___ CSCE 210	4 ____ ____

Recommendation

It is strongly recommended that Actuarial Science majors pass at least one actuarial exam (preferable in the summer following their second year) and complete an internship before graduation.

Course Availability

As we are a small department, not every course is offered every term. The following list details course availability for each of our catalog courses.

MATH106	Elementary Mathematics I - College Algebra	F (first half)
MATH107	Elementary Mathematics II	F (second half)
MATH108	Elementary Mathematics III	S
MATH120	Mathematics for the Liberal Arts	FS
MATH130	Finite Mathematics	FS
MATH140	Precalculus	FS
MATH151	Calculus I	FS
MATH152	Calculus II	FS
MATH253	Calculus III	FS
MATH255	Linear Algebra and Differential Equation	S
MATH260	Introduction to Mathematical Statistics*	F or S
MATH265	Theory of Interest	S
MATH270	Financial Mathematics	S
MATH280	The Nature of Proof in Mathematics	F
MATH300	Linear Algebra	FS
MATH305	College Geometry	S Even
MATH310	History of Mathematics	S Odd
MATH315	Ordinary Differential Equations with Applications*	F or S
MATH320	Complex Variables	F Odd
MATH340	Probability	F
MATH350	Data Analytics	S Odd
MATH370	Probability for Risk Management	F
MATH390	Research Methods	F
MATH410	Models for Financial Economics	S Even
MATH421	Abstract Algebra I	F
MATH422	Abstract Algebra II	S Even
MATH461	Real Analysis I	F
MATH462	Real Analysis II	S Odd
MATH470	Topology	S Even
MATH490	Seminar	S

* Runs one of the given semesters but not both.

Mathematics B.A.

Year	Fall	Winter
Year 1	MATH 151 4	MATH 152 4
Year 2	MATH 253 4	MATH 300 4
	MATH 280 4	
Year 3	MATH 421 4	MATH 310 4
	MATH 390 2	MATH Elective 4
Year 4	MATH 461 4	MATH Elective 4
		MATH 490 2

If you are math and secondary education, see the Education Department Student Handbook for scheduling EDUC course and consult your academic advisor.

Mathematics B.S.

Year	Fall	Spring
Year 1	MATH 151 4	MATH 152 4
Year 2	MATH 253 4	MATH 300 4
	MATH 280 4	MATH Elective 4
Year 3	MATH 421 4	MATH Elective 4
	MATH 390 2	
	MATH 320 4	
Year 4	MATH 461 4	MATH Elective 4
		MATH 490 2

Applied Mathematics B.S.

Year	Fall	Spring
Year 1	MATH 151 4	MATH 152 4
Year 2	MTH 253 4	MTH 300 4
	MTH 280 4	MATH 260 4
Year 3	MATH 315 4	MATH 350 4
	MATH 390 2	
Year 4	MATH 461 4	MATH 462 4
		MATH 490 2

Actuarial Science B.S.

Year	Fall		Spring	
Year 1	MATH 151	4	MATH 152	4
	ACCT 201	4	ECON 200	4
Year 2	MATH 253	4	MATH 265	4
	CSCE 160	4	MATH 270	2
	ECON 205	4	CSCE 210	4
			FINA 350	4
Year 3	MATH 340	4	MATH 350	4
	MATH 370	2	ECON 365	4
Year 4	MATH 300	4	MATH 410	4

Blank Four-Year Plan

Year	Fall	Spring
Year 1		
Year 2		
Year 3		
Year 4		

Course Offerings

106 Elementary Mathematics I (2.00)
College algebra for the prospective elementary teaching to include linear, quadratic and absolute value equations and inequalities; graphs and applications of linear, quadratic, rational, exponential and logarithmic functions; conic sections; and use of augmented matrices to solve systems of linear equations. Emphasis on both the procedural and conceptual nature of the material. Prerequisites: Elementary Education major and placement; Three years of math including algebra and geometry recommended

107 Elementary Mathematics II (2.00)
Essentials of mathematics for the prospective elementary teacher to include cognitive reasoning, sets, logic, and structure of arithmetic through the real numbers including numeration systems, fractions, and number theory. Emphasis on problem solving techniques. Prerequisites: Elementary Education major; MATH 106 or placement

108 Elementary Mathematics III (4.00)
Continuation of MTH 107 to include Euclidean and transformational geometry, measurement and the metric system, integers, rational numbers, real numbers, decimals, percent, proportions, probability, and applied statistics. Emphasis on problem solving. Prerequisites: Elementary Education major and MATH 107. Cardinal Directions Designation(s): Quantitative Analysis.

120 Mathematics for the Liberal Arts (4.00)
A course designed for students in the liberal arts disciplines whose major does not require specific mathematical skills. The course focuses on mathematical reasoning and applications by exploring the mathematics inherent in the world around us. Prerequisite: Placement; Two years of math recommended Cardinal Directions Designation(s): Quantitative Analysis.

130 Finite Mathematics (4.00)
An introduction to mathematical and critical thinking skills with applications. Topics include symbolic logic, set theory, elementary combinatorics, probability and statistics, mathematics of finance, applications of linear functions and equations, and may include applications of matrices. Prerequisite: Placement; Two years of algebra recommended. Cardinal Directions Designation(s): Quantitative Analysis.

140 Precalculus (4.00)
A review of the major topics form algebra necessary for the study of calculus (including polynomial, rational, exponential, and logarithmic functions), an investigation of trigonometric functions, and a brief introduction to differentiation and antidifferentiation. Prerequisite: Placement; Three years of math including algebra and geometry recommended.

151 Calculus I (4.00)
An exploration of the fundamental concepts of single-variable calculus including limits, continuity, differentiation and integration with applications. Prerequisites: MATH 140 or placement; Four years of math including algebra, geometry and trigonometry recommended. Cardinal Directions Designation(s): Quantitative Analysis.

152 Calculus II (4.00)
Continuation of single-variable with emphasis on advanced integration techniques and applications, parametric equations, polar coordinates, and infinite series. Prerequisite: MATH 151. Cardinal Directions Designation(s): Quantitative Analysis.

253 Calculus III (4.00)
A continuation of calculus with an emphasis on vectors, vector-values and multiple-variable functions, partial derivatives, line and multiple integrals, vector analysis, Green's, divergence and Stokes' theorems. Prerequisite(s): MATH 152. Cardinal Directions Designation(s): Quantitative Analysis.

255 Linear Algebra and Differential Equation (4.00)
First and second order differential equations, systems of differential equations, matrix and vector algebra, systems of linear equations, eigenvalues and eigenvectors. Students may not receive credit for both MATH 255 and either MATH 300 or MATH 315 Prerequisite(s): MATH 253.

260 Introduction to Mathematical Statistics (4.00)
This course provides a calculus-based introduction to probability and the beginning of statistical inference. Topics included: Descriptive statistics, elements of probability theory, random variables, central limit theorem, confidence intervals, hypothesis testing and simple linear regression. Prerequisite(s): MATH 253.

265 Theory of Interest (4.00)
Topics in the mathematics of finance that are required for the FM (Financial Mathematics) Exam in actuarial science. Includes the study of Microsoft Excel macros. Prerequisites: MATH 152.

270 Financial Mathematics (2.00)
Advanced topics in financial mathematics including discounted cash flow analysis, asset management strategies, swaps, pricing, and amortizing bonds and annuities Prerequisites: MATH 265.

280 The Nature of Proof in Mathematics (4.00)
The study of the nature of proof in mathematics. Specific proof techniques are taught within the context of number theory, set theory, functions, and cardinality. Prerequisite: MATH 152.

297 Internship (0.00-12.00)

299 Independent Study (1.00-12.00)

300 Linear Algebra (4.00)
Vector spaces, linear transformations, inner products, eigenvalues and eigenvectors, Gram-Schmidt process, and orthogonal transformations. Students may not receive credit for MATH 300 and MATH 255 Prerequisite: MATH 253 and MATH 280.

305 College Geometry (4.00)
Euclidean and non-Euclidean geometry in two and three dimensions via axiomatic approach. Other topics include transformations, isometries and symmetries of the plane. Prerequisite: MTH 280.

310 History of Mathematics (4.00)
An examination of the historical origins of important mathematical concepts leading up to calculus. Emphasis on the methodologies and motivations of those involved in the creative process. Students will complete several projects to illustrate key concepts from the course. Prerequisite: MATH 152.

315 Ordinary Differential Equations with Applications (4.00)
First and second order differential equations; algebraic, numerical and graphical solutions; series solutions; Laplace transforms; applications. Prerequisite: MATH 254 and MATH 300.

320 Complex Variables (4.00)
Algebra of the complex numbers, geometry and transformations of the complex plane, analytic functions, Cauchy theory of integration, power series and residue theory. Prerequisite: MATH 253.

340 Probability (4.00)
Basic laws of probability, discrete and continuous distributions of random variables, mathematical expectation, moment generating functions and transformations, random variables and multivariate probability distributions. Prerequisite: MATH 253.

350 Data Analytics (4.00)

An overview of the field of statistical learning. Survey of techniques for predictive analytics including model selection and validation methods, linear and non-linear models and supervised and unsupervised learning. Implementation of all techniques will employ appropriate software. Prerequisite: MATH 260 or MATH 240; CSCE 210.

370 Probability for Risk Management (2.00)
Fundamental probabilistic tools for the quantitative assessment of risk. Prerequisite: MATH 340.

390 Research Methods (2.00)
An intensive seminar intended to introduce research methods in mathematics, develop processes for approaching and solving non-routine problems, and exploring advanced written and oral presentation of solutions. Prerequisite: MATH 253 and MATH 280. Cardinal Directions Designation(s): Writing Intensive.

397 Internship (0.00-12.00)

399 Independent Study (1.00-12.00)

410 Models for Financial Economics (4.00)
Theoretical basis of financial models and the application of those models to insurance and other financial risks. Prerequisite: MATH 265 or MATH 340.

421 Abstract Algebra I (4.00)
Introduction to the theory of rings, fields, and groups. Topics include modular arithmetic, polynomial rings, factorization, and tests for irreducibility, ideals, quotient rings, morphisms, and subgroups. Prerequisites: MATH 280 and MATH 300.

422 Abstract Algebra II (4.00)
Advanced theory of rings, fields, and groups, including symmetric and alternating groups, structure theorems for finite abelian groups, vector spaces, extension fields, finite fields, and the Galois Theory. Prerequisite: MATH 421.

461 Real Analysis I (4.00)
A study of sets, functions, properties and elementary topology of the real number system, sequences, series, continuity, differentiation and integration. Prerequisites: MATH 280 and MATH 300.

462 Real Analysis II (4.00)
A continuation of the topics from MATH 461 including sequences and series of functions, Riemann and Lebesgue integration, elementary measure theory, and an introduction to basic concepts in functional analysis. Prerequisites: MATH 461.

470 Topology (4.00)
Set theory, metric spaces, general topological spaces, continuous functions, connectedness, compactness, separation axioms, and metrization. Prerequisites: MATH 280 and MATH 300.

490 Seminar in Advanced Mathematics (2.00)
A critical evaluation including modern-day and historical applications, of advanced topics not included in other mathematics courses. Emphasis is placed on reflecting upon and further developing each student's philosophical view of mathematics as a discipline. Prerequisite: MATH 421 or MATH 461. Cardinal Directions Designation(s): Writing Intensive.

497 Internship (0.00-12.00)

499 Independent Study (1.00-12.00)

After Graduation

A major in mathematics can lead to any number of exciting career paths. Each year, the department sees graduates begin careers in **industry:**

- Algorithm analyst;
- Software engineer;
- Computer scientist;
- Financial consultant;
- Commercial loan officer;

move on to **graduate study:**

- University of Tennessee;
- University of Missouri
- University of Iowa;
- Purdue University;
- University of Notre Dame;
- University of Illinois-Chicago;

or enter the world of **secondary education:**

- Aurora school districts;
- Chicago Public Schools;
- East Aurora School District 131;
- Naperville School District 203;
- Indian Prairie School District 204;
- Plainfield School District 202.

Whatever your aspirations, the math faculty and Career Development Services are excellent resources available to help you in planning for the next step in your journey.