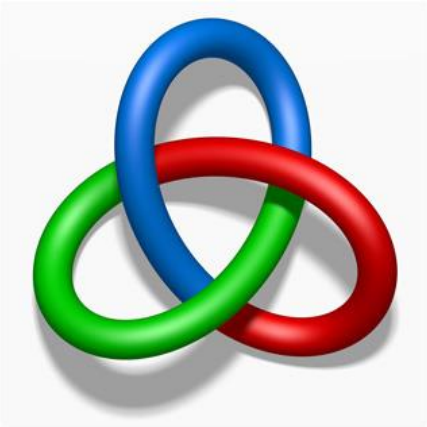
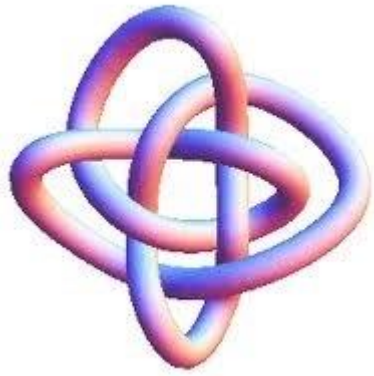
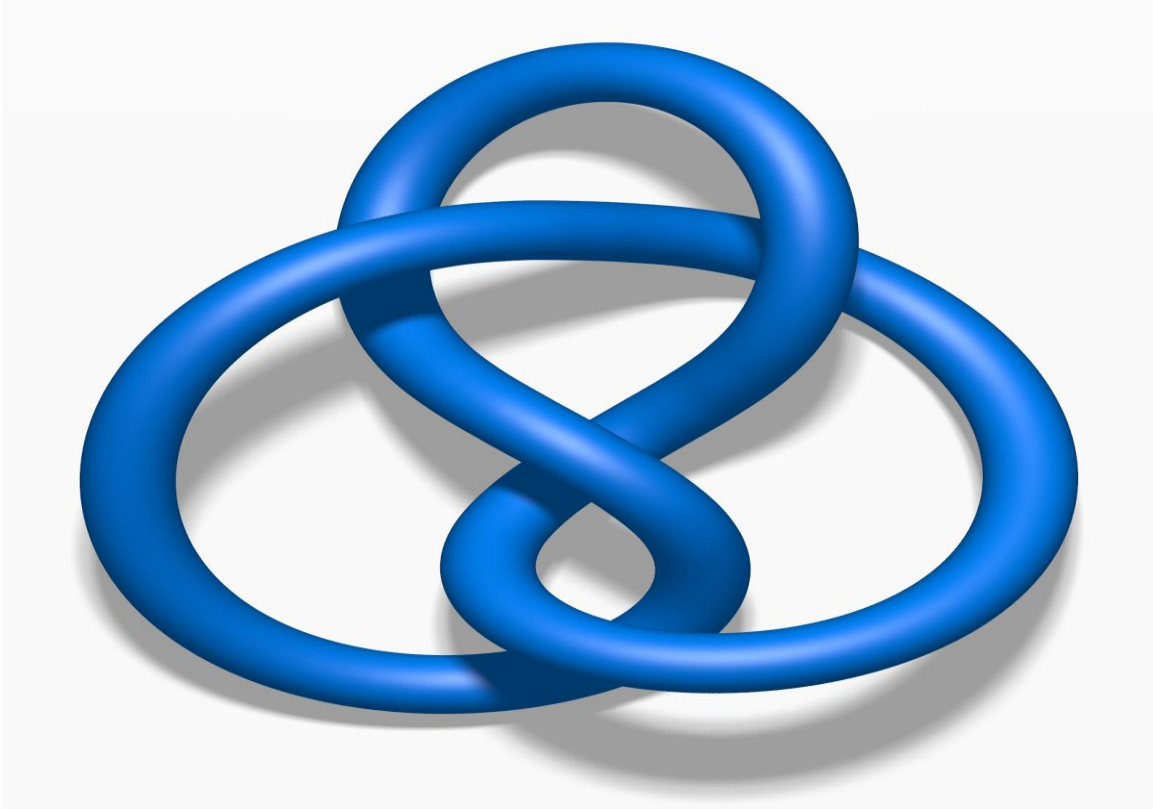
Mathematics Student Handbook
2013-2014







Mathematics Department
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

- Pure 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 630-637-5232 or djschmitz@noctrl.edu.

David J. Schmitz
Math Department Chair

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: Professor in the Honor's Program, College Scholars Program, E^2 Math Circle, Math Club/Pi Mu Epsilon Advisor, Girls in Math Workshop

Marco V. Martinez, Assistant Professor of Mathematics. 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, Girls in Math Workshop

Jaclyn M. Murawska, Adjunct Instructor of Mathematics. 2008. BS., University of Illinois at Urbana-Champaign, 1991; M.S.T., University of Illinois at Chicago, 1996; Ed.D., Northern Illinois University, 2013.

Interests: constructivism, place value, inductive reasoning, rational numbers, STEM, and pedagogical content knowledge

Additional Responsibilities: Math and Art Workshop, KenKen Competition Organizer

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: Professor in the First Year Experience and LEV Programs, E^2 Math Circle, SIFE/Enactus Advisor, NCC Cycling & Multisport Club Advisor, Co-coordinator of Undergraduate Math Competitions

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: Coordinator of Math Resource Center, Professor in the First Year Experience and Honor's Programs, OUTreach Advisor

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: Chair of the Mathematics Department, Math Club/Pi Mu Epsilon Advisor, SquareRoots Advisor, Co-coordinator of Undergraduate Math Competitions

Richard J. Wilders, Marie and Bernice Gantzert Professor in the Liberal Arts and Sciences and Professor of Mathematics. 1975. B.S., Carnegie-Mellon University, 1967; M.S., 1969, Ph.D., 1975, The Ohio State University.

Interests:

Additional Responsibilities: Chair of the Science Division, Director of Lederman Scholars and Community Scholars Program, Professor in the Honor's Program, Highschool Math Contest Host, Math and Art Workshop, American Mathematics Competition 8 Workshop

Richard J. Wyllie, Adjunct Associate Professor of Mathematics. 1995. B.A., North Central College, 1963; M.A., Northwestern University, 1967; Ed.D., Northern Illinois University, 1996.

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.

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 problem solving seminar, MTH 375, 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.

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; location varies by term.

Students interested in a tutoring position should contact the MRC Coordinator.

Math Circles

The math department is currently hosting the E^2 (Expository Engagement) Math Circle funded by a grant from the Mathematical Association of America. Our goal is to engage mathematically minded and talented students from area high schools in mathematics they don't typically see in their classrooms. Every two weeks, students will learn a new topic during a 45-minute expository talk followed by a 45-minute breakout, problem solving session where participants, in small groups led by an undergraduate mentor, will work on challenging problems related to the expository talk.

Summer Camps

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

- **Girls in 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 Workshop**
  This fast-paced week will introduce students to the mathematics behind the art of M.C. Escher. They will learn hot 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. Rich Wilders.

The Curriculum

Mathematics Major

B.A. Requirements:

At least 40 credit hours in mathematics, including:

I. Required core courses:

Calculus: MTH 141 or MTH 151, MTH 152, MTH 153, and MTH 254
Mathematical Proofs: MTH 280
Algebra: MTH 300 and MTH 421
Real Analysis: MTH 461
Seminar: MTH 490
Problem Solving: MTH 375 (at least 1 credit hour)

II. Electives (select one group):

Group 1: At least four of the following courses: MTH 305, MTH 315, MTH 323, MTH 341, MTH 342, MTH 355, MTH 422, MTH 462, MTH 473

Group 2: (required for secondary education supplementary major) MTH 305, MTH 310, MTH 341, MTH 342, and completion of the secondary education supplementary major

B.S. Requirements:

At least 44 credit hours in mathematics, including:

I. Required core courses:
Calculus: MTH 141 or MTH 151, MTH 152, MTH 153, and MTH 254
Complex Variables: MTH 323
Mathematical Proofs: MTH 280
Algebra: MTH 300 and MTH 421
Real Analysis: MTH 461
Seminar: MTH 490
Problem Solving: MTH 375 (at least 2 credit hours)

II. Electives:

Choose at least two of: MTH 422, MTH 462, and MTH 473
Choose at least one pair: MTH 341 and MTH 342, or MTH 315 and MTH 355

III. Required Support Courses:
CSC 161, and at least one course in Computer Science at the 200-level or above of at least 3.00 credit hours; a minor in biology, chemistry, computer science, economics, or physics, or the completion of the secondary education supplementary major.

Mathematics Minor

At least 18 credit hours in mathematics, with at least nine credit hours numbered 200 or higher, including MTH 256, and no more than three credit hours numbered below MTH 141. ECN 440 or ECN 445 may be included in the 18 credit hours required for the minor.

Applied Mathematics Major

B.A. Requirements:

I. Required core courses:

Calculus: MTH 141 or MTH 151, MTH 152, MTH 153, and MTH 254
Mathematical Proofs: MTH 280
Statistics: MTH 341 and MTH 342
Differential Equations: MTH 315 and MTH 355
Real Analysis: MTH 461

II. A minor or major outside the math department

III. A three-credit-hour capstone experience in

• a 400 level course with topics involving significant applications of mathematics in the other major/minor field **-or-**

• a 400 level independent study project involving significant applications of mathematics in the other major/minor.

B.S. Requirements:

I. Required core courses:

Calculus: MTH 141 or MTH 151, MTH 152, MTH 153, and MTH 254
Mathematical Proofs: MTH 280
Statistics: MTH 341 and MTH 342
Differential Equations: MTH 315 and MTH 355
Real Analysis: MTH 461 and MTH 462

II. CSC 161, and at least one course in Computer Science at the 200-level or above of at least 3.00 credit hours

III. A minor or major outside the math department

IV. A three-credit-hour capstone experience in

• a 400 level course with topics involving significant applications of mathematics in the other major/minor field **-or-**

• a 400 level independent study project involving significant applications of mathematics in the other major/minor

Actuarial Science Major

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

At least 45 credit hours from Mathematics, Economics and Finance, including:

I. Required core courses:

Calculus: MTH 141 or MTH 151, MTH 152, MTH 153, and MTH 254
Linear Algebra: MTH 300
Statistics: MTH 341 and MTH 342
Differential Equations: MTH 315 and MTH 355
Theory of Interest: MTH/FIN 365
Accounting: ACC 201 and ACC 202
Economics: ECN 250, ECN 252, ECN 360, and ECN 445
Finance: FIN 30, FIN 400, and FIN 425

II. CSC 161, and at least one course in Computer Science at the 200-level or above of at least 3.00 credit hours

III. Recommended Electives: SPC 214, SPC 230 and CSC 230

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

As you begin to think about a four year plan, it is a good idea to consult your academic advisor. The checklists, planning sheets, and course availability list on the next few pages will help you organize this process.

Mathematics B.A.

Required for Major

Within Major Department

Course	Term-Year
___ MTH 141 or 151	3 ____ ____
___ MTH 152	3 ____ ____
___ MTH 153	3 ____ ____
___ MTH 254	3 ____ ____
___ MTH 280	3 ____ ____
___ MTH 300	3 ____ ____
___ MTH 375	1 ____ ____
___ MTH 421	3 ____ ____
___ MTH 461	3 ____ ____
___ MTH 490	3 ____ ____

Choose one of the following options:

___ **Option 1:** Complete four of the following:

MTH 305, MTH 315, MTH 323, MTH 341, MTH 342, MTH 355, MTH 422, MTH 462, MTH 473.

_____	3 ____ ____
_____	3 ____ ____
_____	3 ____ ____
_____	3 ____ ____

OR

___ **Option 2:** Complete the following:

___ MTH 305	3 ____ ____
___ MTH 310	3 ____ ____
___ MTH 341	3 ____ ____
___ MTH 342	3 ____ ____

___ Secondary Education Supplementary Major (see next column)

Secondary Education Supplementary Major to accompany the mathematics major

Course	Term-Year
___ EDN 101	3 ____ ____
___ PSY 100	3 ____ ____
___ PSY 205	3 ____ ____
___ PSY 220	3 ____ ____
___ EDN 200	3 ____ ____
___ EDN 201	1 ____ ____
___ EDN 276	1.5 ____ ____
___ EDN 322	3 ____ ____
___ EDN 330	3 ____ ____
___ EDN 344	3 ____ ____
___ EDN 360	3 ____ ____
___ EDN 361	.5 ____ ____
___ EDN 371	1 ____ ____
___ EDN 403	3 ____ ____
___ EDN 411	3 ____ ____
___ EDN 436	1.5 ____ ____
___ EDN 470	1 ____ ____
___ EDN 480	5 ____ ____
___ EDN 481	2 ____ ____
___ EDN 490	5 ____ ____
___ EDN 491	2 ____ ____

For more information on the secondary education supplementary major, see the Department of Education Student Handbook.

Mathematics B.S.

Required for Major

Within Major Department

Course	Term-Year
___ MTH 141 or 151	3 ____ ____
___ MTH 152	3 ____ ____
___ MTH 153	3 ____ ____
___ MTH 254	3 ____ ____
___ MTH 280	3 ____ ____
___ MTH 300	3 ____ ____
___ MTH 323	3 ____ ____
___ MTH 375	2 ____ ____
___ MTH 421	3 ____ ____
___ MTH 461	3 ____ ____
___ MTH 490	3 ____ ____

___ Must include two of the following: MTH 422, MTH 462, MTH 473.

_____ 3 ____ ____

_____ 3 ____ ____

___ Must include at least one pair: MTH 341 and MTH 342, or MTH 315 and MTH 355.

_____ 3 ____ ____

_____ 3 ____ ____

Required Outside of Major Department

___ CSC 161 3 ____ ____

___ 200-level or above Computer Science

_____ 3 ____ ____

___ Must complete a minor in one of the following departments: biology, chemistry, computer science, physics, or economics, or the secondary education supplementary major.

Applied Mathematics B.A.

Required for Major

Within Major Department

Course	Term-Year
___ MTH 141 or 151	3 ____ ____
___ MTH 152	3 ____ ____
___ MTH 153	3 ____ ____
___ MTH 254	3 ____ ____
___ MTH 280	3 ____ ____
___ MTH 300	3 ____ ____
___ MTH 315	3 ____ ____
___ MTH 341	3 ____ ____
___ MTH 342	3 ____ ____
___ MTH 355	3 ____ ____
___ MTH 461	3 ____ ____

Required Outside of Major Department

___ Must complete a major or minor outside of the math department.

___ Must complete a 3-credit hour capstone experience* in

• a 400-level course with topics involving significant applications of mathematics in the other major/minor field

OR

• a 400-level independent study project involving significant applications of mathematics in the other major/minor

_____ 3 ____ ____

*Approved by department chair by end of junior year

Applied Mathematics B.S.

Required for Major

Within Major Department

Course	Term-Year
___ MTH 141 or 151	3 ____ ____
___ MTH 152	3 ____ ____
___ MTH 153	3 ____ ____
___ MTH 254	3 ____ ____
___ MTH 280	3 ____ ____
___ MTH 300	3 ____ ____
___ MTH 315	3 ____ ____
___ MTH 341	3 ____ ____
___ MTH 342	3 ____ ____
___ MTH 355	3 ____ ____
___ MTH 461	3 ____ ____
___ MTH 462	3 ____ ____

Required Outside of Major Department

___ CSC 161 3 ____ ____

___ 200-level or above Computer Science

_____ 3 ____ ____

___ Must complete a major or minor outside of the math department.

___ Must complete a 3-credit hour capstone experience* in

• a 400-level course with topics involving significant applications of mathematics in the other major/minor field

OR

• a 400-level independent study project involving significant applications of mathematics in the other major/minor

_____ 3 ____ ____

Actuarial Science B.S.

Required for Major

Within Major Department

Course	Term-Year
___ MTH 141 or 151	3 ____ ____
___ MTH 152	3 ____ ____
___ MTH 153	3 ____ ____
___ MTH 254	3 ____ ____
___ MTH 300	3 ____ ____
___ MTH 341	3 ____ ____
___ MTH 342	3 ____ ____
___ MTH 365	3 ____ ____

Required Outside of Major Department

Course	Term-Year
___ ECN 250	3 ____ ____
___ ECN 252	3 ____ ____
___ ECN 360	3 ____ ____
___ ECN 445	3 ____ ____
___ FIN 350	3 ____ ____
___ FIN 400	3 ____ ____
___ FIN 425	3 ____ ____

___ CSC 161 3 ____ ____

___ 200-level or above Computer Science

_____ 3 ____ ____

__ ACC 201 3 ____ ____

__ ACC 202 3 ____ ____

Recommended Electives

SPC 214, SPC 230, CSC 230

*Approved by department chair by end of junior year

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.

MTH095	Intermediate Algebra	F
MTH107	Elementary Mathematics I	FW
MTH108	Elementary Mathematics II	WS
MTH111	Quantitative Reasoning	FWS
MTH118	Finite Mathematics	FWS
MTH121	College Algebra	FWS
MTH122	College Trigonometry	W
MTH130	Calculus for Business and Social Sciences	F
MTH140	Integrated Calculus I: Calculus of Limits	F
MTH141	Integrated Calculus II: Calculus of Derivatives	W
MTH151	Calculus I	FWS
MTH152	Calculus II	FWS
MTH153	Calculus III	FWS
MTH230	Discrete Structures I	S
MTH231	Discrete Structures II	W Odd
MTH254	Calculus IV	FW
MTH256	Introduction to Differential Equations and Linear Algebra	W
MTH280	The Nature of Proof in Mathematics	F
MTH300	Linear Algebra	W
MTH305	College Geometry	S Even
MTH310	History of Mathematics	S Odd
MTH315	Ordinary Differential Equations with Applications	W Odd
MTH323	Complex Variables	S Even
MTH341	Probability & Statistics I	W
MTH342	Probability & Statistics II	S
MTH355	Applied Mathematical Techniques	S Odd
MTH365	Theory of Interest	S Even
MTH375	Problem Solving Seminar	FW
MTH421	Abstract Algebra I	F Odd, W Odd
MTH422	Abstract Algebra II	W Even
MTH461	Real Analysis I	F Even, W Even
MTH462	Real Analysis II	W Odd
MTH473	Topology	S Odd
MTH490	Seminar	S

Mathematics B.A.

Year	Fall	Winter	Spring
1	MTH 151 3	MTH 152 3	MTH 153 3
	ENG 115 3	IDS 125 3	
	FYE 100 1		
2	MTH 254 3	MTH 300 3	MTH Elective 3
	MTH 280 3		
3	MTH 421 3	MTH Elective 3	MTH Elective 3
	ENG 315 3	MTH 375 1	
4	MTH 461 3	MTH Elective 3	MTH 490 3

Mathematics B.A with Secondary Education

Year	Fall	Winter	Spring
1	MTH 151 3	MTH 152 3	MTH 153 3
	ENG 115 3	IDS 125 3	PSY 205 3
	PSY 100 3	EDN 101 3	
	FYE 100 1		
2	MTH 254 3	MTH 300 3	MTH 342 3
	MTH 280 3	MTH 341 3	EDN 200/1 4
	PSY 220 3		EDN 201 1
3	MTH 421 3	EDN 344 3	MTH 305 3
	EDN 360/1 3.5	EDN 371 1	ENG 315 3
	EDN 276 1.5	EDN 403 3	EDN 330 3
	EDN 322 3	MTH 375 1	EDN 436 1.5
4	EDN 470 1	MTH 461 3	MTH 310 3
	EDN 480/1 7	EDN 411 3	MTH 490 3
	EDN 490/1 7		

Mathematics B.S.

Year	Fall	Winter	Spring
1	MTH 151 3	MTH 152 3	MTH 153 3
	ENG 115 3	IDS 125 3	
	FYE 100 1		
2	MTH 254 3	MTH 300 3	MTH 342 3
	MTH 280 3	MTH 341 3	CSC Elective 3
	CSC 160 3.5	CSC 161 3.5	
3	MTH 421 3	MTH 422 3	MTH 323 3
	ENG 315 3	MTH 375 1	
4	MTH 461 3	MTH 462 3	MTH 490 3

Applied Mathematics B.S.

Year	Fall	Winter	Spring
1	MTH 151 3	MTH 152 3	MTH 153 3
	ENG 115 3	IDS 125 3	
	FYE 100 1		
2	MTH 254 3	MTH 300 3	MTH 342 3
	MTH 280 3	MTH 341 3	CSC Elective 3
	CSC 160 3	CSC 161 3	
3	ENG 315 3	MTH 315 3	MTH 355 3
4	MTH 461 3	MTH 462 3	Capstone 3

Actuarial Science B.S.

Year	Fall	Winter	Spring
1	MTH 151 3	MTH 152 3	MTH 153 3
	ENG 115 3	IDS 125 3	ECN 252 3
	FYE 100 1	ECN 250 3	
2	MTH 254 3	MTH 300 3	MTH 342 3
	ACC 201 3	MTH 341 3	
	ECN 360 3	ACC 202 3	
3	CSC 160 3	CSC 161 3	MTH 365 3
	FIN 350 3	ENG 315 3	CSC 230 3
4			

Course Offerings

095 Intermediate Algebra (3.00)
A standard course in intermediate algebra (high school Algebra II) covering equations, exponents and radicals, rational expressions, graphing, and logarithms. It is designed to prepare students for MTH 111 or 121. This course does not count toward a major or minor in mathematics. It does not count toward graduation. It does count toward full-time status. Prerequisite: One year high school algebra or placement test.

107 Elementary Mathematics I (3.00)
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, percents, proportions, and number theory. Emphasis on problem solving techniques. Prerequisites: Intermediate Algebra, high school geometry, Elementary Education major.

108 Elementary Mathematics II (3.00)
Continuation of MTH 107 to include Euclidean and transformational geometry, measurement and the metric system, basic algebra, probability, and applied statistics. Emphasis on problem solving. Prerequisites: MTH 107, high school geometry, Elementary Education major. Core: Mathematics.

111 Quantitative Reasoning (3.00)
This course is designed to fulfill the general education core requirement in mathematics for students whose majors do not require specific skills in mathematics. The course focuses on mathematical reasoning. A maximum of four of the following topics are covered in-depth: graph theory, logic, game theory, linear programming, and statistics. Use of the computer or an algebraic calculator is a part of this course. Prerequisite: Two years high school algebra. Core: Mathematics.

118 Finite Mathematics (3.00)
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: MTH 095 or 2 years of high school algebra. Core: Mathematics.

121 College Algebra (3.00)
This course covers the algebra skills needed for the study of calculus. Topics include linear, quadratic, and absolute value equations and inequalities; graphs of linear, quadratic, and rational functions; graphs, properties, and applications of exponential and logarithmic functions. Students may not receive credit for both MTH 121 and MTH 140. Prerequisite: MTH 095 or two years high school algebra.

122 College Trigonometry (3.00)
This course covers the topics in trigonometry and the theory of equations needed for the study of calculus. Topics include definitions and graphs of the trigonometric functions, solutions of triangles, conic sections, systems of equations, DeMoivre's theorem, and theory of equations. Students may not receive credit for both MTH 122 and MTH 140. Prerequisite: MTH 121 or 2 ½ years high school algebra.

130 Calculus for Business and Social Sciences (3.00)
An introductory course in the elements of the differential and integral calculus, including applications in business and social sciences. To include: limits and continuity, differentiation and integration of algebraic functions, max/min theory, exponential functions and their calculus. Students may not receive credit for MTH 130 and either MTH 141 or MTH 151. This course does not prepare students for MTH 152. Prerequisite: One of MTH 121, MTH 140, or three years high school algebra. Core: Mathematics.

140 Integrated Calculus I: Calculus of Limits (3.00)
An integrated calculus course which combines the study of algebraic and trigonometric functions with a formal development of the limit. Students may not receive credit for MTH 140 and any of MTH 121, MTH 122, or MTH 151. Prerequisites: Four years of high school mathematics, including trigonometry and geometry.

141 Integrated Calculus II: Calculus of Derivatives (3.00)
An integrated calculus course which combines the study of exponential, logarithmic and inverse trigonometric functions with a formal development of the derivative. Students may not receive credit for MTH 141 and any of the following: MTH 122, MTH 130, or MTH 151. Prerequisite: MTH 140 or consent of the instructor. Core: Mathematics.

151 Calculus I (3.00)
Fundamental concepts of calculus including limits, continuity, and differentiation with applications. The Calculus I, II, and III sequence is recommended for students in the Division of Science as well as for students in other divisions desiring a strong preparation in mathematics. Students may not receive credit for MTH 151 and any of the following: MTH 130, MTH 140, or MTH 141. Prerequisites: MTH 121 and MTH 122; or four years high school math including algebra, geometry, and trigonometry. Core: Mathematics.

152 Calculus II (3.00)
Continuation of Calculus I with emphasis on integration and its applications. Required for the B.S. degree in any department. Prerequisite: MTH 141 or MTH 151. Core: Mathematics.

153 Calculus III (3.00)
Continuation of Calculus II with an emphasis on infinite series. Prerequisite: MTH 152. Core: Mathematics.

230 Discrete Structures I (3.00)
(Same as: CSC 230.) Fundamental topics in mathematics and computer science including formal logic, proof techniques, sets, relations and functions, combinatorics, graphs, logic circuits, and finite state machines. Prerequisites: CSC 160, MTH 121 or higher or appropriate placement. Core: Mathematics.

231 Discrete Structures II (3.00)
(Same as: CSC 231.) A second course in discrete mathematics that introduces more advanced topics as well as covering some of the material introduced in CSC/MTH 230 in more depth. Topics include growth of functions and complexity of algorithms; number theory; recursive definition and algorithms; proof techniques; program verification; discrete probability; finite state automata; and formal grammars and language recognizers. Hands-on labs allow students to apply one or more course topics to build practical working systems. Prerequisite: CSC/MTH 230.

254 Calculus IV (3.00)
Functions of two or more variables, partial derivatives, multiple integrals, and line integrals. Vector analysis, divergence and Stokes's theorems. Prerequisite: MTH 153. Core: Mathematics.

256 Introduction to Differential Equations and Linear Algebra (3.00)
First and second order differential equations, complex numbers, matrix and vector algebra, systems of linear equations, vectors, eigenvalues and eigenvectors. Students may not receive credit for both MTH 256 and MTH 315. Prerequisite: MTH 152.

280 The Nature of Proof in Mathematics (3.00)
The study of the nature of proof in mathematics. Students learn to find examples and counterexamples of abstractly defined objects and to generalize from those examples to conjecture theorems of their own. Specific proof techniques are taught within the context of subject matter chosen by the instructor. Prerequisite: MTH 152.

300 Linear Algebra (3.00)
Vector spaces, linear transformations, inner products, eigenvalues and eigenvectors, Gram-Schmidt process, and orthogonal transformations. Prerequisite: MTH 153. MTH 280 recommended.

305 College Geometry (3.00)
Euclidean and non-Euclidean geometry in two and three dimensions. Axiomatics and the nature of proof. Required for secondary education majors in mathematics. Prerequisite: MTH 153. MTH 280 recommended.

310 History of Mathematics (3.00)
An examination of the historical origins and genesis of important mathematical concepts from the ancient Greeks to modern times. Emphasis on the methodologies and philosophies of those involved in the creative process. Required for secondary education majors in mathematics. Prerequisite: MTH 153.

315 Ordinary Differential Equations with Applications (3.00)
First and second order differential equations; algebraic, numerical and graphical solutions; series solutions; applications. Students may not receive credit for both MTH 315 and MTH 256. Prerequisite: MTH 254 and MTH 300.

323 Complex Variables (3.00)
Algebra, geometry, and calculus with complex numbers. Transformations of the complex plane, analytic functions, Cauchy theory of integration, power series, and residue theory. Prerequisite: MTH 254.

341 Probability & Statistics I (3.00)
Basic laws of probability, discrete distributions, random variables, mathematical expectation, moment generating functions, Chebyshev's inequality, and Markov chains. Prerequisite: MTH 254.

342 Probability & Statistics II (3.00)
A continuation of MTH 341 to include continuous distributions, central limit theorem, estimations, hypothesis testing, and applications. Prerequisite: MTH 341.

355 Applied Mathematical Techniques (3.00)
(Same as: PHY 355.) Topics in applied mathematics, including series solutions, systems of linear and nonlinear differential equations, integral transforms with emphasis on the Laplace transform, Fourier series, partial differential equations, and survey of some advanced topics. Prerequisites: MTH 254, MTH 256 or MTH 315.

365 Theory of Interest (3.00)
(Same as: FIN 365.) The study of compound interest and annuities; applications to problems in finance and actuarial science. Required for the major in actuarial science. Prerequisites: MTH 152; MTH 153 and FIN 350 are recommended.

375 Problem Solving Seminar (1.00-3.00)
An intensive seminar in problem solving. Intended to provide participants with the ability to solve non-routine problems. Useful preparation for mathematics competitions. Prerequisite: Junior or senior mathematics major, or instructor consent.

421 Abstract Algebra I (3.00)
Elementary theory of rings, fields, and groups, including modular arithmetic, polynomial rings, factorization, ideals and quotient rings, homomorphisms, and subgroups. Prerequisites: MTH 280 and at least one 300-level mathematics course.

422 Abstract Algebra II (3.00)
Advanced theory of rings, fields, and groups, including symmetric and alternating groups, structure theorems for finite abelian groups, principal ideal domains, unique factorization domains, the field of quotients of an integral domain, vector spaces, extension fields, finite fields, and the Galois Theory. Prerequisite: MTH 421.

461 Real Analysis I (3.00)
Sets, functions, properties and elementary topology of the real number system. Rigorous analysis of limits, sequences, series, continuity, differentiation, and integration theory. Prerequisites: MTH 280 and at least one 300-level mathematics course.

462 Real Analysis II (3.00)
A continuation of the topics from MTH 461. Prerequisites: MTH 300, MTH 461.

473 Topology (3.00)
Set theory, metric spaces, general topological spaces, continuous functions, connectedness, compactness, separation axioms, and metrization. Prerequisites: MTH 254, MTH 280, MTH 300.

490 Seminar (3.00)
Exploration of topics not included in other mathematics courses. Specific topics are determined by the interest of the students and faculty. Repeatable with different topic. Prerequisite: MTH 421 or MTH 461 or consent of instructor.

Interdisciplinary Studies

IDS 125 – Science in Context (3.00)

Science is seen by many as being independent of cultural or societal influences. Through the study of the histories of physics and the theory of evolution we will investigate the interactions of science with society and with religion. We will also study how science is portrayed in the media; including film, newspapers, and magazines.

IDS 125 – The Ethics of Statistical Manipulation (3.00)

"There are three kinds of lies. Lies, damn lies, and statistics." Numbers are misunderstood, misrepresented, misused, and abused. Yet in our society, decisions are oftentimes influenced and determined by them. Numbers carry weight and influence, and those that understand them oftentimes wield a certain power. What constitutes proper use of statistics, or is there even such a thing? What is statistical manipulation and why does it "work?" Is it good or bad? What ethical standards dictate how numbers are used, and do those in power have an obligation to provide unbiased facts? We will investigate these questions and others from the multiple perspectives: leadership, marketing, ethics, psychology, and mathematics.

IDS 360 – Math, Music, and Art (3.00)

This course is based on Douglas Hofstadter's magical book Godel, Escher, Bach and focuses the approaches of Reductionism and Holism. Reductionism argues that all complicated phenomena can be reduced to underlying, simple components. Holism, by contrast, argues that some (perhaps) all phenomena can only be understood properly as complete, organic wholes. Mathematics, Music, and Art can each be viewed holistically or reductionistically – each approach yields important insights, yet neither seems to provide the whole picture.

IDS 360 – Math for Social Justice (3.00)

The power of mathematics is an essential analytic tool in understanding justice issues in our community and in the world. In this course, mathematics is used to explore issues of social, political and economic justice, and in turn this understanding is used to change the world, and make it a more fair and just place.

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 Wisconsin-Madison;
- University of Wisconsin-Milwaukee;
- 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.