

MATHEMATICS

Majors:

- Bachelor of Science, Mathematics (p. 1)
- Bachelor of Science, Applied Mathematical Economics (p. 2)
- Bachelor of Arts, Mathematics (p. 4)

Minors:

- Actuarial Science (p. 4)
- Mathematics (p. 5)

The B.S. program in mathematics provides a foundation for students who wish to pursue graduate studies in any area of the mathematical sciences, to enter the actuarial profession, or to enter careers where mathematics is used in an engineering or science setting. The elective courses can be used to complement a chosen career path. Those planning on pursuing an actuarial career should consider completing the actuarial science minor described below.

All students pursuing a bachelor of science in mathematics are required to complete a minor in another subject.

The B.S. program in applied mathematical economics provides a foundation in economics, mathematics and statistics needed for graduate study in economics or applied statistics, or for research and technical careers in business or government service.

The B.A. program in mathematics provides for a breadth of mathematical study within the context of a liberal arts degree. It may be chosen as a preparation for a professional career in business, education, law, or social science. It affords students a significant distribution of courses in the humanities and social sciences so that they can develop a concentration in a field other than mathematics. A student's career goals can suggest desirable upper level mathematics electives. Prospective secondary mathematics teachers should consider pursuing the B.A. in mathematics as a second major.

A minor in mathematics consists of 12 semester hours (300-400 level).

A minor in actuarial science is offered through the Department of Mathematics. This consists of courses in calculus, statistics, theory of interest, economics, and finance, and is designed to prepare the student to take the actuarial examinations in probability and financial mathematics.

The basic courses are offered every term:

MTH 168	Analytic Geometry & Calculus I	4
MTH 169	Analytic Geometry & Calculus II	4
MTH 218	Analytic Geometry & Calculus III	4
MTH 219	Applied Differential Equations	3
MTH 308	Foundations & Discrete Mathematics	3
MTH 310	Linear Algebra & Matrices	3

Most majors should take MTH 218 and MTH 308 in the same term.

The required core courses are offered once a year:

MTH 330	Intermediate Analysis	3
MTH 361	Introduction to Abstract Algebra	3

MTH 411	Probability & Statistics I	3
MTH 412	Probability & Statistics II	3
MTH 430	Real Analysis	3

However, most of the other upper-level electives for the major are offered only once every two years; thus careful planning for a student's upper-level electives should be done in consultation with the advisor.

A minor in mathematics consists of 12 semester hours (300-400 level).

A minor in actuarial science is offered through the Department of Mathematics. This consists of courses in calculus, statistics, theory of interest, economics, and finance, and is designed to prepare the student to take the actuarial examinations in probability and financial mathematics.

Faculty

Wiebke Diestelkamp, Chairperson
 Distinguished Service Professor: Peterson
 Professors Emeriti: Back, Friel, Gantner, Gorton, Kauflin, Mashburn, McCloskey, Mushenheim, Rice, Schleppe, Shaughnessy, R. Steinlage, Strange
 Professors: Abueida, Diestelkamp, Driskell, Elo, Higgins, Islam, Liu, Raffoul, Usman
 Associate Professors: Brown, Busch, Hovey, Krakowski, Kublik, Qumsiyeh, Ren, Veliz-Cuba
 Assistant Professors: Chen, Larrain-Hubach, Li, Shapiro, Todd
 Senior Lecturer: Simon
 Lecturers: Harrison, Wellingshoff

Bachelor of Science, Mathematics (MTH) minimum 120 hours

Common Academic Program (CAP) ¹		
First-Year Humanities Commons ²		12 cr. hrs.
HST 103	The West & the World	
REL 103	Introduction to Religious and Theological Studies	
PHL 103	Introduction to Philosophy	
ENG 100	Writing Seminar I ³	
Second-Year Writing Seminar ⁴		0-3 cr. hrs.
ENG 200	Writing Seminar II	
Oral Communication		3 cr. hrs.
CMM 100	Principles of Oral Communication	
Mathematics		3 cr. hrs.
Social Science		3 cr. hrs.
SSC 200	Social Science Integrated	
Arts		3 cr. hrs.

Natural Sciences ⁵	7 cr. hrs.
Crossing Boundaries	up to 12 cr. hrs.
Faith Traditions	
Practical Ethical Action Inquiry ⁶	
Integrative	
Advanced Study	
Philosophy and/or Religious Studies (6 cr. hrs.)	
Historical Studies (3 cr. hrs.) ⁷	
Diversity and Social Justice ⁸	3 cr. hrs.
Major Capstone ⁹	0-6 cr. hrs.

- ¹ The credit hours listed reflect what is needed to complete each CAP component. However, they should not be viewed as a cumulative addition to a student's degree requirements because many CAP courses are designed to satisfy more than one CAP component (e.g., Crossing Boundaries and Advanced Studies) and may also satisfy requirements in the student's major.
- ² May be completed with ASI 110 and ASI 120 through the Core Program.
- ³ May be completed with ENG 100A and ENG 100B, by placement.
- ⁴ May be completed with ENG 114 or ENG 198 or ASI 120.
- ⁵ Must include two different disciplines and at least one accompanying lab.
- ⁶ U.S. History AP and CLEP credit will not satisfy this requirement.
- ⁷ May be completed with ASI 110 and ASI 120 through the Core Program. U.S. History AP and CLEP credit will not satisfy this requirement.
- ⁸ May not double count with First-Year Humanities Commons, Second-Year Writing, Oral Communication, Social Science, Arts, or Natural Sciences CAP components, but may double count with courses taken to satisfy other CAP components and/or courses taken in the student's major.
- ⁹ The course or experience is designed by faculty in each major; it may, or may not, be assigned credit hours.

Science Breadth Requirements

Computer Science (CPS 150 applies to CAP Natural Sciences)	3-4
CPS 132 Computer Programming for Engineering & Science or CPS 150 Algorithms & Programming I	
Select one natural sciences group from: (Applies to CAP Natural Science)	8
BIO 151 Concepts of Biology I: Cellular & Molecular Biology & 151L and Concepts of Biology Laboratory I: Cellular & Molecular Biology & BIO 152 and Concepts of Biology II: Evolution & Ecology and Concepts of Biology Laboratory II: Evolution & Ecology	

CHM 123 & 123L & CHM 124 & CHM 124L	General Chemistry and General Chemistry Laboratory and General Chemistry and General Chemistry Laboratory	
GEO 115 & 115L & GEO 116 & GEO 116L	Physical Geology and Physical Geology Laboratory and Geological History of the Earth and Geological History of the Earth Laboratory	
PHY 206 & PHY 207 & PHY 210L & PHY 211L	General Physics I - Mechanics and General Physics II - Electricity & Magnetism and General Physics Laboratory I and General Physics Laboratory II	
Select two courses acceptable for science majors		6

Major Requirements

MTH 168	Analytic Geometry & Calculus I (Satisfies CAP Mathematics)	4
MTH 169	Analytic Geometry & Calculus II	4
MTH 218	Analytic Geometry & Calculus III	4
MTH 219	Applied Differential Equations	3
MTH 308	Foundations & Discrete Mathematics	3
MTH 310	Linear Algebra & Matrices	3
MTH 330	Intermediate Analysis	3
MTH 361	Introduction to Abstract Algebra	3
MTH 430	Real Analysis	3
MTH 480	Mathematics Capstone (Satisfies CAP Major Capstone)	1
Select four MTH courses (300/400 level) ¹		12
Academic minor in any subject. ²		

Breadth

ASI 150	Introduction to the University Experience	1
Social and Behavioral Sciences (Includes CAP Social Science)		6
Total Hours to total at least		120

- ¹ Departmental approval required.
- ² All students pursuing a bachelor of science in mathematics are required to complete a minor in another subject. See list of academic minors (<http://catalog.udayton.edu/minorsaz/>).

Bachelor of Science, Applied Mathematical Economics (MTE) minimum 120 hours

Common Academic Program (CAP) ¹

First-Year Humanities Commons ²		12 cr. hrs.
HST 103	The West & the World	
REL 103	Introduction to Religious and Theological Studies	
PHL 103	Introduction to Philosophy	
ENG 100	Writing Seminar I ³	
Second-Year Writing Seminar ⁴		0-3 cr. hrs.
ENG 200	Writing Seminar II	

Oral Communication	3	cr.	hrs.
CMM 100 Principles of Oral Communication	3	cr.	hrs.
Mathematics	3	cr.	hrs.
Social Science	3	cr.	hrs.
SSC 200 Social Science Integrated	3	cr.	hrs.
Arts	3	cr.	hrs.
Natural Sciences ⁵	7	cr.	hrs.
Crossing Boundaries	up to 12	cr.	hrs.
Faith Traditions			
Practical Ethical Action Inquiry ⁶			
Integrative			
Advanced Study			
Philosophy and/or Religious Studies (6 cr. hrs.)			
Historical Studies (3 cr. hrs.) ⁷			
Diversity and Social Justice ⁸	3	cr.	hrs.
Major Capstone ⁹	0-6	cr.	hrs.

¹ The credit hours listed reflect what is needed to complete each CAP component. However, they should not be viewed as a cumulative addition to a student's degree requirements because many CAP courses are designed to satisfy more than one CAP component (e.g., Crossing Boundaries and Advanced Studies) and may also satisfy requirements in the student's major.

² May be completed with ASI 110 and ASI 120 through the Core Program.

³ May be completed with ENG 100A and ENG 100B, by placement.

⁴ May be completed with ENG 114 or ENG 198 or ASI 120.

⁵ Must include two different disciplines and at least one accompanying lab.

⁶ U.S. History AP and CLEP credit will not satisfy this requirement.

⁷ May be completed with ASI 110 and ASI 120 through the Core Program. U.S. History AP and CLEP credit will not satisfy this requirement.

⁸ May not double count with First-Year Humanities Commons, Second-Year Writing, Oral Communication, Social Science, Arts, or Natural Sciences CAP components, but may double count with courses taken to satisfy other CAP components and/or courses taken in the student's major.

⁹ The course or experience is designed by faculty in each major; it may, or may not, be assigned credit hours.

Science Breadth Requirements

Satisfies CAP Natural Science		
CPS 150	Algorithms & Programming I	4
CPS 151	Algorithms & Programming II	4
Select one natural sciences group from:		
BIO 151 & 151L & BIO 152 & BIO 152L	Concepts of Biology I: Cellular & Molecular Biology and Concepts of Biology Laboratory I: Cellular & Molecular Biology and Concepts of Biology II: Evolution & Ecology and Concepts of Biology Laboratory II: Evolution & Ecology	8
CHM 123 & 123L & CHM 124 & CHM 124L	General Chemistry and General Chemistry Laboratory and General Chemistry and General Chemistry Laboratory	
GEO 115 & 115L & GEO 116 & GEO 116L	Physical Geology and Physical Geology Laboratory and Geological History of the Earth and Geological History of the Earth Laboratory	
PHY 206 & PHY 207 & PHY 210L & PHY 211L	General Physics I - Mechanics and General Physics II - Electricity & Magnetism and General Physics Laboratory I and General Physics Laboratory II	

Major Requirements

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Mathematics		
MTH 168	Analytic Geometry & Calculus I (Satisfies CAP Mathematics)	4
MTH 169	Analytic Geometry & Calculus II	4
MTH 218	Analytic Geometry & Calculus III	4
MTH 308	Foundations & Discrete Mathematics	3
MTH 310	Linear Algebra & Matrices	3
MTH 330	Intermediate Analysis	3
MTH 411	Probability & Statistics I	3
MTH 412	Probability & Statistics II	3
MTH 480	Mathematics Capstone (Satisfies CAP Major Capstone)	1

Economics

ECO 203	Principles of Microeconomics (Satisfies CAP Crossing Boundaries: Inquiry)	3
ECO 204	Principles of Macroeconomics (Satisfies CAP Crossing Boundaries: Inquiry)	3
ECO 346	Intermediate Microeconomic Analysis	3
ECO 347	Intermediate Macroeconomic Analysis	3
ECO 441	Econometrics	3
Select one ECO course (300/400 level)		3

Breadth

ASI 150	Introduction to the University Experience	1
Social and Behavioral Sciences (Includes CAP Social Science)		6
Total Hours to total at least		120

Bachelor of Arts, Mathematics (MTH) minimum 124 hours

Common Academic Program (CAP) ¹

First-Year Humanities Commons ²	12 cr. hrs.
HST 103 The West & the World	
REL 103 Introduction to Religious and Theological Studies	
PHL 103 Introduction to Philosophy	
ENG 100 Writing Seminar I ³	
Second-Year Writing Seminar ⁴	0-3 cr. hrs.
ENG 200 Writing Seminar II	
Oral Communication	3 cr. hrs.
CMM 100 Principles of Oral Communication	
Mathematics	3 cr. hrs.
Social Science	3 cr. hrs.
SSC 200 Social Science Integrated	
Arts	3 cr. hrs.
Natural Sciences ⁵	7 cr. hrs.
Crossing Boundaries	up to 12 cr. hrs.
Faith Traditions	
Practical Ethical Action Inquiry ⁶	
Integrative	
Advanced Study	
Philosophy and/or Religious Studies (6 cr. hrs.)	
Historical Studies (3 cr. hrs.) ⁷	
Diversity and Social Justice ⁸	3 cr. hrs.
Major Capstone ⁹	0-6 cr. hrs.

¹ The credit hours listed reflect what is needed to complete each CAP component. However, they should not be viewed as a cumulative addition to a student's degree requirements because many CAP courses are designed to satisfy more than one CAP component (e.g., Crossing Boundaries and Advanced Studies) and may also satisfy requirements in the student's major.

- ² May be completed with ASI 110 and ASI 120 through the Core Program.
- ³ May be completed with ENG 100A and ENG 100B, by placement.
- ⁴ May be completed with ENG 114 or ENG 198 or ASI 120.
- ⁵ Must include two different disciplines and at least one accompanying lab.
- ⁶ U.S. History AP and CLEP credit will not satisfy this requirement.
- ⁷ May be completed with ASI 110 and ASI 120 through the Core Program. U.S. History AP and CLEP credit will not satisfy this requirement.
- ⁸ May not double count with First-Year Humanities Commons, Second-Year Writing, Oral Communication, Social Science, Arts, or Natural Sciences CAP components, but may double count with courses taken to satisfy other CAP components and/or courses taken in the student's major.
- ⁹ The course or experience is designed by faculty in each major; it may, or may not, be assigned credit hours.

Liberal Studies Curriculum

Creative and Performing Arts (May include CAP Arts)	3
L2 Proficiency (Proficiency in a language other than English)	0-11
Literature (May include CAP Components)	3
Natural Sciences (Satisfies CAP Natural Science)	11
Social Sciences (Includes CAP Social Science)	12

Major Requirements

MTH 168 Analytic Geometry & Calculus I (Satisfies CAP Mathematics)	4
MTH 169 Analytic Geometry & Calculus II	4
MTH 218 Analytic Geometry & Calculus III	4
MTH 308 Foundations & Discrete Mathematics	3
MTH 310 Linear Algebra & Matrices	3
MTH 330 Intermediate Analysis	3
MTH 361 Introduction to Abstract Algebra	3
MTH 411 Probability & Statistics I	3
MTH 480 Mathematics Capstone (Satisfies CAP Major Capstone)	1
Select three MTH courses (300/400 level)	9

Breadth

ASI 150 Introduction to the University Experience	1
Total Hours to total at least	124

Minor in Actuarial Science (ACS)

The Minor in Actuarial Science is designed to prepare students to pass the P and FM actuarial tests. It is also designed to supply students with VEE (Validation by Educational Experience) credit in economics, corporate finance, and applied statistics.

The minor contains eight courses in mathematics for a total of 22 semester hours. One of these is a course in the theory of interest and one is a seminar which prepares students to take the P test. Mathematics majors will take all but two of the mathematics requirements for the minor as part of their major requirements.

The minor also contains eight courses in accounting, economics, and finance for a total of twenty-four semester hours. Economics and finance

majors will take all of these courses as part of their major requirements. They will be able to substitute two of the mathematics courses for those that they are required to take for their major.

A total of 46 semester hours are required for the minor.

The Minor in Actuarial Science is designed to prepare students to begin the pathway to becoming an Associate of the Society of Actuaries. The coursework in the minor is selected to satisfy the SOA coursework requirements and teach the material necessary to pass the first set of introductory actuarial exams.

The minor contains seven courses in mathematics for a total of 22 semester hours. All mathematics majors pursuing the minor will take five of these courses as part of their major requirements.

The minor also contains seven courses in accounting, economics, and finance, totaling 21 semester hours. Applied Mathematical Economics majors will take two of these courses as part of their major requirements, and Finance majors will take all of these courses as part of their major. A combined total of 43 semester hours are required for the minor.

Actuarial Science

ACC 207	Introduction to Financial Accounting	3
ECO 203	Principles of Microeconomics	3
ECO 204	Principles of Macroeconomics	3
FIN 300	Survey of Financial Management ¹	3
FIN 360	Investments	3
FIN 470	Fixed Income Securities	3
FIN 480	Options & Futures Markets	3
MTH 168	Analytic Geometry & Calculus I	4
MTH 169	Analytic Geometry & Calculus II	4
MTH 218	Analytic Geometry & Calculus III	4
MTH 229	Theory of Interest	3
MTH 328	Actuarial Probability Seminar	1
MTH 411	Probability & Statistics I	3
MTH 412	Probability & Statistics II	3
Total Hours		43

¹ May substitute FIN 301.

Minor in Mathematics (MTH)

Mathematics

Select four MTH courses (300/400 level)	12
Total Hours	12

- Bachelor of Science, Mathematics
- Bachelor of Science, Applied Mathematical Economics
- Bachelor of Arts, Mathematics

Bachelor of Science, Mathematics

First Year

Fall	Hours	Spring	Hours
ASI 150		1 MTH 169	4
MTH 168 (Satisfies CAP Mathematics)		4 REL 103, PHL 103, or HST 103 (CAP Humanities Commons)	3

ENG 100 (CAP Humanities Commons)		3 REL 103, PHL 103, or HST 103 (CAP Humanities Commons)	3
REL 103, PHL 103, or HST 103 (CAP Humanities Commons)		3 CAP Natural Science w/lab	4
CAP Natural Science w/lab		4 Social Science - elective	3
		15	17

Second Year

Fall	Hours	Spring	Hours
MTH 218		4 MTH 219	3
MTH 308		3 Natural Science	3
ENG 200 (CAP Writing Seminar)		3 MTH 310	3
CMM 100 (CAP Communication)		3 SSC 200 (CAP Social Science)	3
Natural Science		3 CAP Arts	3
		16	15

Third Year

Fall	Hours	Spring	Hours
MTH 330		3 MTH 361	3
MTH elective		3 MTH 430	3
CPS 132 or 150		3-4 CAP Inquiry	3
CAP Adv. Philosophy/Religious Studies (Practical Ethical Action/Faith Traditions)		3 CAP Integrative	3
Minor elective		3 Minor elective	3
		15-16	15

Fourth Year

Fall	Hours	Spring	Hours
MTH elective		3 MTH 480 (Satisfies CAP Major Capstone)	1
MTH elective		3 MTH elective	3
CAP Adv. Philosophy/Religious Studies (Practical Ethical Action/Faith Traditions)		3 CAP Advanced Historical Studies	3
Minor elective		3 CAP Diversity and Social Justice	3
Minor elective		3 Minor elective	3
		15	13

Total credit hours: 121-122

Bachelor of Science, Applied Mathematical Economics

First Year

Fall	Hours	Spring	Hours
ASI 150		1 MTH 169	4
MTH 168 (Satisfies CAP Mathematics)		4 ECO 204	3
ECO 203		3 REL 103, PHL 103, or HST 103 (CAP Humanities Commons)	3

6 Mathematics

ENG 100 (CAP Humanities Commons)	3	REL 103, PHL 103, or HST 103 (CAP Humanities Commons)	3
CAP Natural Science w/lab	4	CAP Natural Science w/lab	4
		15	17
Second Year			
Fall	Hours	Spring	Hours
MTH 218		4 MTH 310	3
MTH 308		3 CMM 100 (CAP Communication)	3
ECO 346		3 SSC 200 (CAP Social Science)	3
ENG 200 (CAP Writing Seminar)		3 CAP Arts	3
REL 103, PHL 103, or HST 103 (CAP Humanities Commons)		3 CAP Faith Traditions	3
		16	15
Third Year			
Fall	Hours	Spring	Hours
MTH 330 or 411		3 CPS 151	4
CPS 150		4 MTH 412 (or ECO Elective)	3
ECO 347		3 CAP Integrative	3
CAP Inquiry		3 CAP Practical Ethical Action	3
CAP Advanced Philosophy/Religious Studies		3 General Elective	3
		16	16
Fourth Year			
Fall	Hours	Spring	Hours
MTH 330 or 411		3 MTH 480 (Satisfies CAP Major Capstone)	1
ECO 441		3 MTH 412 (or ECO elective)	3
CAP Advanced Philosophy/Religious Studies		3 CAP Diversity and Social Justice	3
CAP Advanced Historical Studies		3 General Elective (optional)	3
General Elective		1 General Elective (optional)	3
General Elective		3	
		16	13

Total credit hours: 124

Bachelor of Arts, Mathematics

First Year			
Fall	Hours	Spring	Hours
ASI 150		1 MTH 169	4
MTH 168 (Satisfies CAP Mathematics)		4 CAP Natural Science w/lab	4

CAP Natural Science w/lab	4	REL 103, PHL 103, or HST 103 (CAP Humanities Commons)	3
ENG 100 (CAP Humanities Commons)	3	REL 103, PHL 103, or HST 103 (CAP Humanities Commons)	3
		15	17
Second Year			
Fall	Hours	Spring	Hours
MTH 218		4 MTH 310	3
MTH 308		3 SSC 200 (CAP Social Science)	3
CMM 100 (CAP Communication)		3 CAP Arts / Creative and Performing	3
ENG 200 (CAP Writing Seminar)		3 Literature	3
Natural Science		3 Language 101	4
		16	16
Third Year			
Fall	Hours	Spring	Hours
MTH elective		3 MTH 361	3
MTH 330 or 411		3 MTH elective	3
Social Science - elective		3 CAP Inquiry	3
CAP Faith Traditions		3 CAP Integrative	3
Language 141		4 Language 201 or contextual course	3
		16	15
Fourth Year			
Fall	Hours	Spring	Hours
MTH 330 or 411		3 MTH 480 (Satisfies CAP Major Capstone)	1
Social Science - 300/400 level		3 MTH elective	3
CAP Advanced Philosophy/Religious Studies		3 CAP Advanced Philosophy/Religious Studies	3
CAP Advanced Historical Studies		3 CAP Diversity and Social Justice	3
CAP Practical Ethical Action		3 General Elective	4
		15	14

Total credit hours: 124

Courses

MTH 114. Contemporary Mathematics. 3 Hours

Study of contemporary mathematical topics and their applications. Topics may include management science, statistics, social choice, size and shape, and computer mathematics. Prerequisite(s): Two years of high school algebra.

MTH 116. Precalculus Math. 4 Hours

Review of topics from algebra and trigonometry including polynomials, functions and graphs, exponential and logarithmic functions, trigonometric functions and identities. Prerequisite(s): Two years of high school algebra.

MTH 128. Finite Mathematics. 3 Hours

Topics from mathematics used in business including systems of equations, inequalities, matrix algebra, linear programming and logarithms; applications to compound interest, annuities and other finance problems. Prerequisite(s): MTH 102 or sufficient college preparatory mathematics.

MTH 129. Calculus for Business. 3 Hours

Topics from differential and integral calculus used in business; applications to optimizing financial functions, marginal functions in economics, and consumer or producer surplus. Prerequisite(s): MTH 128 or sufficient college preparatory mathematics.

MTH 148. Introductory Calculus I. 3 Hours

Introduction to the differential and integral calculus; differentiation and integration of algebraic and transcendental functions with applications to the life and social sciences. Prerequisite(s): MTH 116 or equivalent.

MTH 149. Introductory Calculus II. 3 Hours

Continuation of MTH 148. Multivariable calculus, matrices, difference equations, probability, discrete and continuous random variables, and differential equations with applications to the life and social sciences. Prerequisite(s): MTH 138 or MTH 148.

MTH 168. Analytic Geometry & Calculus I. 4 Hours

Introduction to the differential and integral calculus; differentiation and integration of algebraic and transcendental functions with applications to science and engineering. Prerequisite(s): MTH 116 or equivalent.

MTH 169. Analytic Geometry & Calculus II. 4 Hours

Continuation of MTH 168. Conic sections, techniques of integration with applications to science and engineering, infinite series, indeterminate forms, Taylor's theorem. Prerequisite(s): MTH 138 or MTH 168.

MTH 204. Mathematical Concepts I. 3 Hours

First course of a two-semester sequence designed for pre-service teachers. Concepts necessary for an understanding of the structure of arithmetic and its algorithms, number patterns, sets, problem solving, percent, relation and proportion, use of calculators. Prerequisite(s): One year of high school algebra; one year of high school geometry.

MTH 205. Mathematical Concepts II. 3 Hours

Continuation of MTH 204- a two semester sequence designed for pre-service teachers. Topics include probability, representing and interpreting data, the metric system, elementary geometry, geometric patterns, coordinate geometry, algebra and geometry, transformations, computer literacy. Prerequisite(s): MTH 204.

MTH 207. Introduction to Statistics. 3 Hours

Introduction to the concepts of statistical thinking for students whose majors do not require calculus. Methods of presenting data, including graphical methods. Using data to make decisions and draw conclusions. Basic ideas of drawing a sample and interpreting the information that it contains. Prerequisite(s): Two years of high school algebra.

MTH 214. Mathematical Concepts for Middle School Teachers. 3 Hours

Concepts necessary for an understanding of the arithmetic taught in both elementary and middle grades. Includes a study of the structure of arithmetic and its algorithms; problem solving; reasoning and proof; proportional reasoning; use of computers and calculators to solve problems. Prerequisite(s): Two years of high school algebra.

MTH 215. Algebra, Functions & Graphs. 3 Hours

Development of the algebra of various families of functions including polynomial, exponential, logarithmic, and trigonometric functions; factoring and roots; interpretation of graphs; use of calculators and data collection devices to solve problems. Prerequisite(s): MTH 214.

MTH 216. Calculus Concepts & Applications. 3 Hours

Develop conceptual understanding of basic calculus concepts; introduction to the notion of limit; rates of change; slopes and area computations; use of calculators and data collection devices to make predictions, estimations, and solve problems. Prerequisite(s): MTH 215.

MTH 218. Analytic Geometry & Calculus III. 4 Hours

Continuation of MTH 169. Solid analytic geometry, vectors and vector functions, multivariable calculus, partial derivatives, multiple integrals. Prerequisite(s): MTH 169.

MTH 219. Applied Differential Equations. 3 Hours

First order equations, linear equations with constant coefficients, systems of equations, the Laplace transform, numerical methods, applications. Prerequisite(s): MTH 218.

MTH 229. Theory of Interest. 3 Hours

Rigorous, calculus-based treatment of the Theory of Interest. Topics covered include interest, compounding, discounting, annuities, sinking funds, amortization, bonds, yield rates, and applications of these ideas and processes to problems in finance. Prerequisite(s): MTH 169.

MTH 266. Discrete & Finite Mathematics for Middle School Teachers. 3 Hours

Topics in finite and discrete mathematics; linear programming; applications in finance; graph theory; mathematics of social choice; logic; use of computers and calculators to model and solve problems. Prerequisite(s): MTH 214.

MTH 270. Geometry Concepts & Applications. 3 Hours

Introduction to the geometry of two- and three-dimensional space; patterns in geometry; measurement systems; transformations and similarity; coordinate geometry; the algebra of geometry; trigonometry; use of dynamic computer software to explore geometric concepts. Prerequisite(s): MTH 214.

MTH 290. Topics in Mathematics. 1-3 Hours

Exploration of varying topics appropriate for the needs of the pre-service training of teachers of mathematics. May be repeated as topics change. Prerequisite(s): One mathematics course beyond MTH 102; permission of department chairperson and/or instructor.

MTH 295. Historical Roots of Elementary Mathematics. 3 Hours

Fundamental historical development of modern arithmetic, algebra, geometry, and number systems from early Egyptian, Babylonian, and Greek sources. Students may not receive credit for both this course and MTH 395. Prerequisite(s): MTH 214.

MTH 301. Matrix Theory and Applications. 3 Hours

Investigation of systems of linear equations and matrices. Matrix operations, inverse matrix, partitioned matrices, matrix factorizations. Vector space and subspace of R^n . Null and Column spaces of matrices. Eigenvalues and eigenspaces of matrices. Orthogonal vectors, Least-Squares problems, Diagonalization, Quadratic forms, Singular value decompositions. Applications such as Markov chains, computer graphics, electric circuits, and image processing. Mathematics majors should take MTH 310 rather than MTH 301. Students cannot receive credit for both MTH 301 and MTH 310. Prerequisite(s): MTH 218.

MTH 308. Foundations & Discrete Mathematics. 3 Hours

An introduction to proof using topics in foundational and discrete mathematics; propositional logic; number theory; sequences and recursion; set theory; relations; combinatorics; linear programming. Prerequisite(s): MTH 169.

MTH 310. Linear Algebra & Matrices. 3 Hours

Fundamental concepts of vector spaces, determinants, linear transformations, matrices, inner product spaces, and eigen-vectors. Students cannot receive credit for both MTH 301 and MTH 310. Prerequisites: MTH 218, MTH 308.

MTH 328. Actuarial Probability Seminar. 1 Hour

Problem solving seminar to develop and improve skills in applied probability. This seminar will focus on actuarial applications of probability theory. Prerequisite(s): MTH 411.

MTH 329. Actuarial Finance Seminar. 1 Hour

Problem solving seminar to develop and improve skills in applied mathematical finance. This seminar will focus on integrating the mathematical presentation of the Theory of Interest to the field of finance. Prerequisite(s): FIN 470; MTH 229.

MTH 330. Intermediate Analysis. 3 Hours

Theoretical development of the calculus of a real-valued function of a real variable. Topics include the algebraic and topological properties of the real line, limits of sequences and functions, continuity, differentiability, and integration. Prerequisite(s): MTH 310.

MTH 342. Set Theory. 3 Hours

Elementary set theory including relations, functions, indexed families, denumerable and nondenumerable sets, cardinal and ordinal arithmetic, Zorn's Lemma, the well-ordering principle and transfinite induction. Prerequisite(s): MTH 218, MTH 308.

MTH 361. Introduction to Abstract Algebra. 3 Hours

Fundamental concepts of groups, rings, integral domains and fields. Prerequisite(s): MTH 218, MTH 308.

MTH 367. Statistical Methods I. 3 Hours

Probability distributions including binomial, hypergeometric, Poisson, and normal. Estimation of population mean and standard deviation: Confidence intervals and tests of hypotheses using t -, Chi-square, and F -statistics. Mathematics majors enroll in MTH 411 instead of MTH 367. Prerequisite(s): MTH 149 or MTH 169.

MTH 368. Statistical Methods II. 3 Hours

Distribution-free methods including rank tests, sign tests, and Kolmogorov-Smirnov test. Method of least squares, correlation, linear regression, analysis of variance. Design of experiments and computer applications. Mathematics majors enroll in MTH 412 instead of 368. Prerequisite(s): MTH 367.

MTH 370. Introduction to Higher Geometry. 3 Hours

Projective, affine, and hyperbolic geometries using synthetic and/or analytic techniques. Prerequisite(s): MTH 218, MTH 308.

MTH 376. Number Theory. 3 Hours

Topics include Diophantine equations, Chinese Remainder theorem, Mobius inversion formula, quadratic residues and the Law of Quadratic Reciprocity, Gaussian integers, and integral quaternions. Prerequisite(s): MTH 218, MTH 308.

MTH 395. Development of Mathematical Ideas. 3 Hours

The evolution of mathematical ideas and techniques from ancient times to the present with emphasis on the Greek era. Famous people and famous problems. Chronological outline of mathematics in each of its branches along with applications. Prerequisite(s): MTH 218, MTH 308.

MTH 403. Boundary Value Problems. 3 Hours

Introduction to the Sturm-Liouville problem. Fourier trigonometric series, Fourier integrals, Bessel functions, and Legendre polynomials. The heat equation, wave equation, and Laplace's equation with applications. Solutions by the product method. Prerequisite(s): MTH 219, MTH 310.

MTH 404. Complex Variables. 3 Hours

Functions of a complex variable, conformal mapping, integration in the complex plane. Laurent series and residue theory. Prerequisite(s): MTH 219.

MTH 411. Probability & Statistics I. 3 Hours

Mathematical probability, random variables, Bayes' Theorem, Chebyshev's Inequality, Binomial, Poisson, and Normal probability laws, moment generating functions, limit theorems, descriptive statistics, large sample statistical inference. MTH 308 is recommended as preparation for this course. Prerequisite(s): MTH 218.

MTH 412. Probability & Statistics II. 3 Hours

Multivariate distributions, transformations of random variables, sampling distribution theory, estimation of parameters including maximum likelihood, confidence intervals, the Neyman-Pearson lemma, tests of hypotheses, likelihood ratio tests. Prerequisite(s): MTH 411.

MTH 430. Real Analysis. 3 Hours

Continuation of MTH 330. Topics include the theory of convergence of sequences and series of functions in the context of metric spaces, uniform continuity, uniform convergence, and integration. Prerequisite(s): MTH 330.

MTH 435. Advanced Multivariate Calculus. 3 Hours

Topics include directional derivatives, chain rule, Lagrange multipliers, Taylor's formula, the mean value theorem, inverse mapping theorem, implicit function theorem, integration, Fubini's theorem, change of variables, line integrals, Green's theorem and Stoke's theorem. Prerequisite(s): MTH 310.

MTH 445. Special Topics in Mathematics. 1-3 Hours

Lectures in specialized areas such as abstract algebra, applied mathematics, complex variables, differential forms, functional analysis, Galois theory, game theory, general topology, normed linear spaces, probability theory, real variables, topological groups. May be taken more than once. Prerequisite(s): Permission of department chairperson.

MTH 458. Mathematical Models in Finance. 3 Hours

Mathematical models in finance which include discrete and continuous models for stock price, interest rate model, bond pricing model, and option pricing model. Quantitative methods are introduced and employed. The methods include Black-Scholes formula, Monte-Carlo simulation, and binomial tree. Markowitz's optimal portfolio selection method is introduced and employed. Prerequisite(s): MTH 310.

MTH 465. Linear Algebra. 3 Hours

Vector spaces, linear transformations and matrices, determinants, inner product spaces, invariant direct-sum decomposition and the Jordan canonical form. Prerequisite(s): MTH 310.

MTH 466. Graph Theory & Combinatorics. 3 Hours

Graphs as algebraic structures; Eulerian, Hamiltonian, complete, connected and planar graphs. Applications include scheduling and routing problems. Discussion of algorithms for optimal or near-optimal solutions. Combinatorial topics could include generating functions, recurrence relations, Polya's theorem and Ramsey Theory. Prerequisite(s): MTH 308 or MTH 310.

MTH 467. Combinatorial Design Theory. 3 Hours

Topic include discussion of Latin squares, mutually orthogonal Latin squares, orthogonal and perpendicular arrays, Steiner triple systems, block designs, difference sets, and finite geometries. Prerequisite(s): MTH 308.

MTH 471. Topology. 3 Hours

Introduction to topological spaces and continuous functions including a study of separation and countability axioms and elementary properties of metric spaces, connected spaces, and compact spaces. Prerequisite(s): MTH 308.

MTH 477. Honors Thesis Project. 3 Hours

First of two courses leading to the selection, design, investigation, and completion of an independent, original Honors Thesis project under the guidance of a faculty research advisor. Restricted to students in the University Honors Program with permission of the program director and department chairperson. Students pursuing an interdisciplinary thesis topic may register for three semester hours each in two separate disciplines in consultation with the department chairpersons. Prerequisite(s): Approval of University Honors Program.

MTH 478. Honors Thesis Project. 3 Hours

Second of two courses leading to the selection, design, investigation, and completion of an independent, original Honors Thesis project under the guidance of a faculty research advisor. Restricted to students in the University Honors Program with permission of the program director and department chairperson. Students pursuing an interdisciplinary thesis topic may register for three semester hours each in two separate disciplines in consultation with the department chairpersons. Prerequisite(s): Approved 477; approval of University Honors Program.

MTH 480. Mathematics Capstone. 1 Hour

Students will prepare a presentation or a paper appropriate for a general audience on an advanced mathematical topic that builds on the foundation laid by previous mathematics courses. This course fulfills the Major Capstone component of the Common Academic Program for MTA, MTH and MTE majors. Junior or senior standing. Prerequisite(s): MTH 308.

MTH 490. Readings in Mathematics. 1-3 Hours

Individual study in specialized areas carried out under the supervision of a staff member. May be taken more than once. Prerequisite(s): Permission of department chairperson.