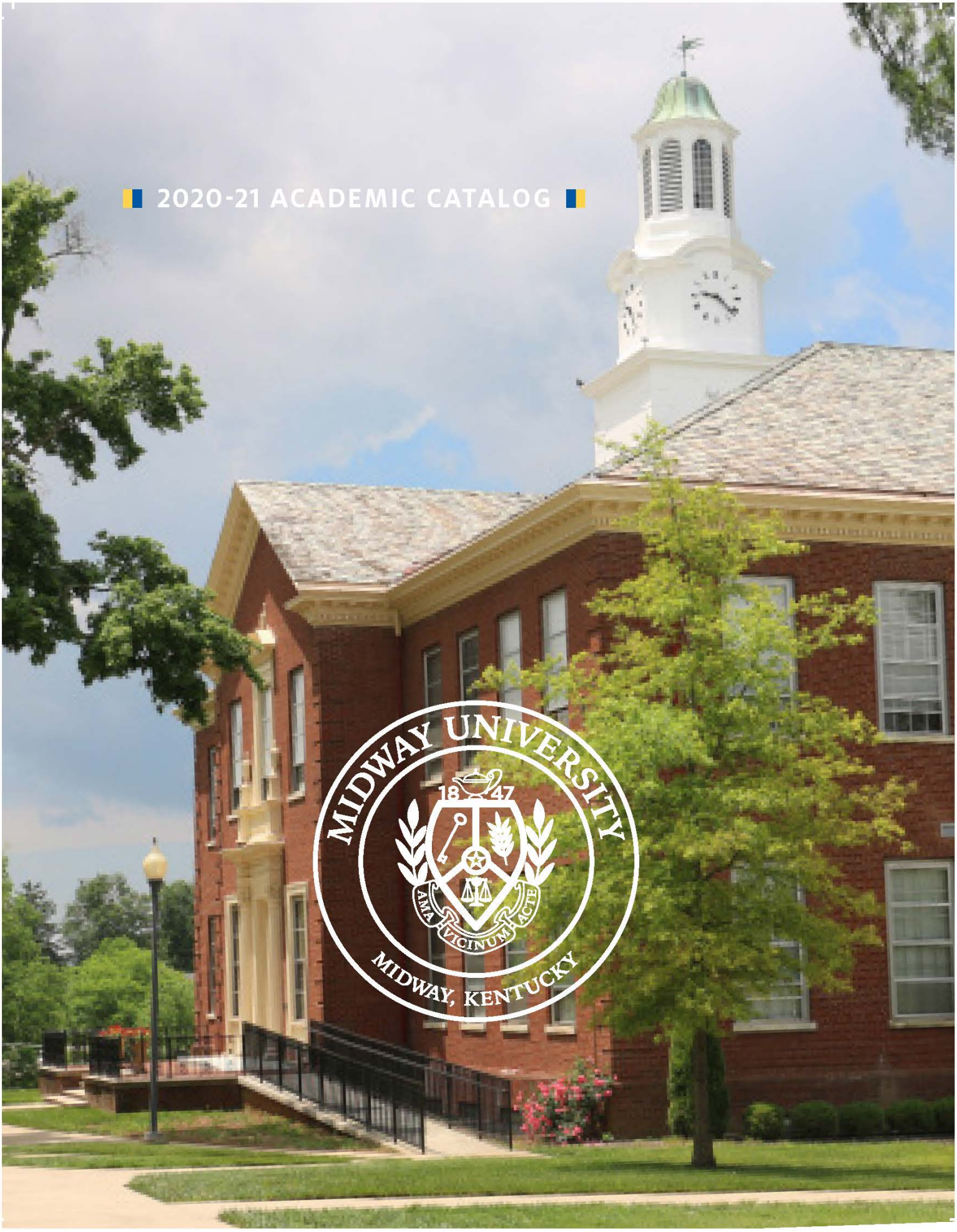
# 2020-21 ACADEMIC CATALOG



# Midway University Course Catalog - Mathematics

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# Mathematics

## Bachelor of Arts in Mathematics - Bachelor of Arts in Mathematics

**Type:**Major

The Bachelor of Arts in Mathematics provides an opportunity for students to fulfill their potential and become contributing members of society in fields that are becoming increasingly important and in which there is growing demand. Students who complete this program will have the skills in logic, problem-solving and data analysis and the familiarity with mathematical concepts necessary for success in such fields as actuarial science, engineering, operations research, data processing, computer science, and Education. In addition, a broad-based background in mathematics has applicability for study or employment in fields outside of mathematics and science, e.g., banking, law, and economics.

### Student Learning Outcomes of Program

- Students will be able to effectively apply critical thinking skills to mathematically model and solve problems.
- Students will be able to critically interpret numerical and graphical data.
- Students will be able to read and construct mathematical arguments and proofs.
- Students will be able to effectively use computer technology to solve problems and create models.
- Students will be able to demonstrate effective oral and written communication of mathematical concepts and applications.
- Students will be able to demonstrate applications of mathematical knowledge to a mathematically-related career or post-baccalaureate studies.

Students who are non-majors in Mathematics will be able to:

- Effectively apply appropriate quantitative tools and logic to analyze and synthesize information for problem solving in specific career fields as well as common life experiences.

## Requirements

### Major Course Requirements

Calculus I - 4 hours

Calculus II - 4 hours

Calculus III - 4 hours

Probability and Statistics - 3 hours

Differential Equations - 3 hours

Mathematical Reasoning and Proofs - 3 hours

Linear Algebra - 3 hours

Discrete Mathematics - 3 hours

Senior Seminar - 3 hours

**Choose two of the following:**

Mathematical Statistics I - 3 hours

Abstract Algebra II - 3 hours

Real Analysis II - 3 hours

**Select either series of PSC courses below:**

Physics I - 3 hours

Physics Laboratory I - 1 hour

Physics for Engineers I - 4 hours

Physics for Engineers I Lab - 1 hour

General Education Hours - 34-40

Elective Hours - 31-37

Total Hours to Complete - 120

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## Mathematics Minor - Mathematics Minor

**Type:**Minor

The minor in mathematics requires a minimum of 18 semester hours. At least 6 semester hours must be selected from courses numbered 300 or higher.

## Requirements

### Minor Requirements

Calculus I - 4 hours

Calculus II - 4 hours

Calculus III - 4 hours

### Any two of the following

Differential Equations - 3 hours

Mathematical Reasoning and Proofs - 3 hours

Linear Algebra - 3 hours

Mathematical Statistics I - 3 hours

Mathematical Statistics II - 3 hours

Discrete Mathematics - 3 hours

Abstract Algebra I - 3 hours

Abstract Algebra II - 3 hours

Real Analysis I - 3 hours

Real Analysis II - 3 hours

Number Theory - 3 hours

Senior Seminar - 3 hours

Elective Hours - 0

Total Hours to Complete - 21

${majorMinorDetails}

# Courses

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## MTH 106 - Math for Meds

Math for Meds is designed to provide practical application of math skills to real-life situations such as calculating medication dosages. Students will develop critical thinking skills to apply to medication Math for Meds is designed to provide practical application of math skills to real-life situations such as calculating medication dosages. Students will develop critical thinking skills to apply to medication

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Prerequisites:**

- MTH 135 - Intermediate Algebra

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## MTH 120 - Basic Mathematics

Basic Mathematics is designed to prepare the student for MTH 135, MTH 139, and MTH 145. Topics include: various classes of numbers (rational, real, etc.); the PEMDAS rule; solving linear equations; percentages; ratios; conversions between the metric and U.S. Customary systems; elementary geometry; simple and compound interest. Minimum grade of C required for successful completion. This course counts as an elective for graduation but may not be used to meet specific program requirements.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

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# MTH 135 - Intermediate Algebra

Intermediate Algebra is designed to prepare the student for MTH 140 and MTH 143. Topics include: solving linear equations in one variable; equations of straight lines in the two-dimensional Cartesian plane; solving systems of linear equations in two or three variables; laws of exponents; factorization of polynomials; manipulating rational and radical expressions. Minimum grade of C required for successful completion. Prerequisite: MTH 120 with a minimum grade of C or a suitable test score. ACT Math score of 18 (minimum) or a SAT Math score of 430. The course counts as an elective for graduation but may not be used to meet specific program requirements.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Prerequisites:**

- MTH 120 - Basic Mathematics

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# MTH 139 - Introduction to Statistics

Introduction to using statistical techniques to model and solve real-world business problems. Topics include: Data-based techniques of graphical display, grouping of data, measures of central tendency and dispersion, probability of concepts and distributions, sampling statistical estimation, hypothesis testing, and time series analysis. Minimum grade of C required for successful completion. Prerequisites: MTH 120 with a minimum grade of C or a suitable test score. ACT Math score of 18 (minimum) or equivalent SAT Math score.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Prerequisites:**

- MTH 120 - Basic Mathematics

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# MTH 140 - College Algebra

This is a standard university Algebra course. Topics include: linear equations and inequalities; complex numbers; quadratic equations; equations of a straight line; finding the implicit domains of functions; the algebra and composition of functions; inverse functions; quadratic functions and their graphs; exponential and logarithmic functions; solving systems of linear equations in several variables. Minimum grade of C required for successful completion. Prerequisites: MTH 135 with a minimum grade of C or a suitable test score. ACT Math score of 22 (minimum) or equivalent SAT Math score.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Prerequisites:**

- MTH 135 - Intermediate Algebra

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# MTH 143 - Trigonometry

This is a one-credit course in the fundamentals of trigonometry intended to prepare the student for physics and calculus. Minimum grade of C required for successful completion. Prerequisite: MTH 135 or a suitable test score. ACT Math score of 22 (minimum) or equivalent SAT Math score.

**Grade Basis:** L
**Credit hours:** 1.0
**Lecture hours:** 1.0

**Prerequisites:**

- MTH 135 - Intermediate Algebra

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# MTH 145 - Finite Mathematics

Finite Mathematics is a course in non-calculus mathematical techniques and their applications in problem- solving. Topics include: set theory and Venn diagrams, combinatorics, probability, linear modeling, matrices, linear programming, and the mathematics of finance. Prerequisites: MTH 120 with a minimum grade of C or a suitable test score. ACT Math score of 18 (minimum) or equivalent SAT Math score. The course counts as an elective for graduation but may not be used to meet specific program requirements.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Prerequisites:**

- MTH 120 - Basic Mathematics

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# MTH 220 - Calculus I

Calculus I is a standard introductory calculus course. Limits and continuity; differentiation; applications of derivatives in a variety of situations; definite and indefinite integration; applications of integrals in a variety of situations; derivatives and integrals of certain transcendental functions. Prerequisites: MTH 140 and MTH 143 with a minimum grade of C or a suitable test score. ACT Math score of 27 (minimum) or equivalent SAT Math score.

**Grade Basis:** L
**Credit hours:** 4.0
**Lecture hours:** 4.0

**Prerequisites:**

- MTH 140 - College Algebra
- MTH 143 - Trigonometry

## MTH 222 - Calculus II

Calculus II covers techniques and applications of integration and the calculus of transcendental functions. Prerequisite: MTH 220.

**Grade Basis:** L
**Credit hours:** 4.0
**Lecture hours:** 4.0

**Prerequisites:**

- MTH 220 - Calculus I

## MTH 223 - Calculus III

Calculus III covers topics in polar coordinates, vector calculus, partial differentiation and multiple integrals. Prerequisite: MTH 222.

**Grade Basis:** L
**Credit hours:** 4.0
**Lecture hours:** 4.0

**Prerequisites:**

- MTH 222 - Calculus II

## MTH 230 - College Geometry

College Geometry is a study of the concepts of geometry in two and three dimensions. Topics include geometric constructions, congruency and similarity, coordinate geometry, tessellations and an introduction to non-Euclidean geometries. The deductive methods and logic of geometric proofs are emphasized. Prerequisite: MTH 140 and MTH 143.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Prerequisites:**

- MTH 140 - College Algebra
- MTH 143 - Trigonometry

## MTH 245 - Probability and Statistics

This is a standard introductory course in probability and statistics. Topics include: working with random samples; organizing data into frequency distributions and histograms; computing various measures of central tendency and variation; elementary probability theory including compound events and conditional probability; working with random variables; the normal distribution; the sampling

distribution of the mean; testing hypotheses using the sampling distribution of the mean. Prerequisite: MTH 140.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Prerequisites:**

- MTH 140 - College Algebra

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# MTH 301 - Differential Equations

An investigation into the solution of ordinary equations including, but not limited to, the following: equations of order one via separation of variables, homogeneous coefficients, integrating factors, and substitution; linear equations via matrix methods and differential operators; transform methods; and series solutions. Both analytic and numerical solutions will be considered. Application of methods to the fields of science and mathematics will be an important part of this course. Prerequisite: MTH 222.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Prerequisites:**

- MTH 222 - Calculus II

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# MTH 305 - Mathematical Reasoning and Proofs

Transition to advanced mathematics is designed to help students learn the principles of mathematical reasoning and the writing of proofs. It is designed for students planning to take advanced mathematics courses. Topics include active reading of mathematics, problem-solving, logical reasoning and communication of mathematics, direct and indirect proofs, and proof by induction. Corequisite or prerequisite: MTH 222.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Prerequisites:**

- MTH 222 - Calculus II

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# MTH 310 - Linear Algebra

This first course in abstract mathematics also covers topics which have powerful practical applications. Linear algebra is a study of linear equations and systems of linear equations. A variety of types of examples of equations and systems is considered for the development of concepts, theory and computation skills (solving systems of linear equations), matrices and vector spaces as

abstract expressions of equations. Systems are studied in depth as they relate to linear equations. Prerequisite: MTH 220 with a minimum grade of C.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Prerequisites:**

- MTH 220 - Calculus I

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# MTH 315 - Mathematical Statistics I

Mathematical Statistics is a calculus-based treatment of probability, random variables, discrete and continuous distributions, conditional probability, independence, moment generating functions, limit theorems, and estimation. Prerequisite: MTH 223.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Prerequisites:**

- MTH 223 - Calculus III

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# MTH 316 - Mathematical Statistics II

Transformations, order statistics, point estimation, sufficient statistics, Rao-Blackwell Theorem, delta method, confidence intervals, likelihood ratio tests, applications. Prerequisite: MTH 315.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Prerequisites:**

- MTH 315 - Mathematical Statistics I

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# MTH 320 - Discrete Mathematics

This course studies the mathematical elements of computer science including propositional logic, predicate logic, sets, functions and relations, combinatorics, mathematical induction, recursion, relations, algorithms, matrices, graphs, trees, Boolean logic, and algebraic structure, with applications. As a beginning course in abstract thinking, this course will lay a basic foundation for mathematical proofs. During the course of the semester, students will learn to recognize and express mathematical ideas graphically, numerically, symbolically, and in writing. Prerequisite: MTH 220 with a minimum grade of C.

**Grade Basis:** L
**Credit hours:** 3.0

**Lecture hours:** 3.0

**Prerequisites:**

- MTH 220 - Calculus I

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# MTH 401 - Abstract Algebra I

This course offers a study algebraic structures, beginning with groups. Group theory topics include permutation groups, cyclic groups, subgroups, normal subgroups, co-sets, quotient groups, group homomorphisms, Cayley's and Sylow's Theorems. The course includes an introduction to the algebraic structure of rings, including the topics of subrings, ideals, ring homomorphisms, and polynomial rings. This course emphasizes proof and connecting the abstract back to the concrete. Prerequisite: MTH 305 with a minimum grade of C.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Prerequisites:**

- MTH 305 - Mathematical Reasoning and Proofs

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# MTH 402 - Abstract Algebra II

This course is a continuation of MTH 401 focusing on internal domains and fields. Topics include integral domains, ordered integral domains, vector spaces, quotient fields, finite fields, real and complex numbers, field extensions, constructability, and roots of polynomials. Prerequisite: MTH 401.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Prerequisites:**

- MTH 401 - Abstract Algebra I

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# MTH 405 - Real Analysis I

This course introduces the student to a rigorous development of the real number system and theory of calculus. Topics include the real number system, sequences and series, limits and continuity, the derivative, properties of continuous functions and some theorems of calculus. Prerequisites: MTH 223 and MTH 305 with a minimum grade of C.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Prerequisites:**

- MTH 223 - Calculus III
- MTH 305 - Mathematical Reasoning and Proofs

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## MTH 406 - Real Analysis II

This course is a continuation of MTH 405. Topics include infinite series, sequences and series of functions, uniform convergence, and the theory of integration. Prerequisites: MTH 405.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Prerequisites:**

- MTH 405 - Real Analysis I

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## MTH 408 - Number Theory

Classical number theory which includes divisibility, prime numbers, congruencies, primitive roots, Diophantine equations, theorems of Fermat, and quadratic reciprocity, along with historical background for various problems are studied. Prerequisite: MTH 305 with a minimum grade of C.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Prerequisites:**

- MTH 305 - Mathematical Reasoning and Proofs

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## MTH 498 - Senior Seminar

A capstone experience for mathematics majors in which students develop an individual research project. Each student in conversation with the seminar leader and other faculty members will present the research project to the campus community. Prerequisite: senior standing.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Restrictions:**

- Senior standing

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## MTH-BIO 487 - Senior Research Data Collection

Under the supervision of a scientist, students will conduct research to gather data for research papers to be completed in BIO 488. Prerequisite: Senior standing and satisfactory completion of BIO 405. Can be repeated for up to 4 credits.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Prerequisites:**

- BIO 405 - Introduction to Biological Research

**Restrictions:**

- Senior standing

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# MTH 490 - Special Topics in Mathematics

Topics courses are designed to allow for study of well-defined areas within a discipline that are not treated in regular coursework. Since prerequisites will vary among courses, students should refer to each semester's Schedule of Academic Offerings before registering for a topics course. Cross-listed with MTH 590. Course completion requirements will differ for undergraduate and graduate students.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Restrictions:**

- Refer to each semester's Schedule of Academic Offerings

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# MTH 590 - Special Topics in Mathematics

Topics courses are designed to allow for study of well-defined areas within a discipline that are not treated in regular coursework. Since prerequisites will vary among courses, students should refer to each semester's Schedule of Academic Offerings before registering for a topics course. Cross-listed with MTH 490. Course completion requirements will differ for undergraduate and graduate students.

**Grade Basis:** L
**Credit hours:** 3.0
**Lecture hours:** 3.0

**Restrictions:**

- refer to each semester's Schedule of Academic Offerings

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**Midway University**
512 E. Stephens Street, Midway, KY 40347
1.800.952.4122