MATHEMATICS

BS/MS Program in Applied Mathematics
This is an accelerated five-year BS/MS program. After successfully completing this program, a student will receive a bachelor's degree in either mathematics or applied mathematics, as well as a master's degree in applied mathematics. Under the supervision of a faculty adviser, a student in the program will finish the core course requirements and most of the electives for the bachelor's degree in the first three years. During the third year of the baccalaureate degree, a student will formally apply to the program through the Graduate School (https://www.uakron.edu/gradsch/). Upon acceptance, a student will be cleared to complete the remaining electives of the bachelor's degree and 30 credits of graduate work for the master's degree in the last two years. A student will be eligible for a graduate assistantship only in these last two years and must be registered for at least nine credits in each of those semesters.

Cooperative Education Program: Mathematics or Applied Mathematics
The work-study schedule for a student participating in the Cooperative Education Program is as follows:

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Admission
Arrangements for student entry into the program are on an individual basis, and must be initiated by the student during the second year of undergraduate study. The Cooperative Education Program is an optional program available only to all full-time mathematics or applied mathematics students at The University of Akron who have satisfactorily met the following requirements:

- Sixty credits with a grade-point average of at least 2.00 out of a possible 4.00 in the program curriculum and be on schedule in the curriculum
- Acceptance by a cooperative education coordinator or director following interviews
- A transfer student must complete 16 credits of academic work at The University of Akron with a grade-point average of at least 2.00 out of a possible 4.00 and be on schedule in the program curriculum

A student who desires to participate in the program will fill out a Personal Data form and submit it to the department chair. The student will then meet with a member of the cooperative education staff to discuss the availability of prospective employers. During this interview, the student will be asked to sign a Cooperative Educational Agreement and a grade release form which will become effective upon employment. Employment must be coordinated or have approval of the department and the cooperative education director. The University does not guarantee employment for the student. The student will be expected to remain with the employer for all cooperative work periods in order to provide a progression of experience and responsibility.

Registration
While no academic credits are assigned, each student must register for 3000:301 Cooperative Education in the same manner that a student registers for any other University course. See department adviser before enrolling for this course.

A cooperative program fee for each work period is charged. Upon completion of a work period, a statement will appear on each student's official transcript listing the course number, title and name of the employer. In the place of a grade "credit" or "no credit" will be given, depending upon the student's satisfactory or unsatisfactory completion of the following:

- Work performance as evaluated by the employer
- Written work report as approved by department chair and cooperative education staff
- Cooperative Work Period Summary form

Usually, work progresses satisfactorily on the job and a grade of "credit" is assigned at the end of the semester. If all the above conditions are not met, a grade of "no credit" will be submitted.

- Applied Mathematics, BS (https://bulletin.uakron.edu/undergraduate/colleges-programs/arts-sciences/mathematics/applied-mathematics-bs/)
- Applied Mathematics, Minor (https://bulletin.uakron.edu/undergraduate/colleges-programs/arts-sciences/mathematics/applied-mathematics-minor/)
- Mathematics, Minor (https://bulletin.uakron.edu/undergraduate/colleges-programs/arts-sciences/mathematics/mathematics-minor/)

Mathematics (2030)

2030:130 Mathematics for Allied Health (3 Credits)
Prerequisite: placement test, 2010:52, 2010:54, 2010:57, or 2010:84 with a grade of C or better. The real number system, systems of measurement, conversions, linear equations, factoring, quadratic equations, graphing, linear systems, organizing data, averages, standard deviation, the normal distribution.

2030:151 Technical Mathematics I (2 Credits)

2030:152 Technical Mathematics II (2 Credits)
Prerequisite: 2030:151 with a grade of C- or better or placement test. Variation, equations of lines, Cramer’s rule, right triangle trigonometry, oblique triangles, radian measure, and complex numbers. Gen Ed: Tier 1 - Quantitative Reasoning

2030:153 Technical Mathematics III (2 Credits)
Prerequisite: 2030:152 with a grade of C- or better or placement test. Factoring, algebraic fractions, exponents and radicals, equations with radicals, equations in quadratic form, functions, their properties and graphs, exponential and logarithmic functions. Gen Ed: Tier 1 - Quantitative Reasoning
2030:154 Technical Mathematics IV (3 Credits)
Prerequisite: 2030:153 with a grade of C- or better or placement test. Functions and their graphs, polynomial and rational functions, polynomial equations, graphs of trigonometric functions, trigonometric identities and equations, analytic geometry, complex numbers in polar form.
Gen Ed: Tier 1 - Quantitative Reasoning

2030:161 Mathematics for Modern Technology (4 Credits)
Prerequisite: Placement test or completion of 2010:052, 2010:054, 2010:057, or 2010:084 with a grade of C or better. Lines, linear regression, sets, counting, basic probability, basic statistics, binomial and normal distributions, mathematics of finance, symbolic logic, arguments, logic circuits.
Gen Ed: Tier 1 - Quantitative Reasoning

2030:216 Applied Finite Mathematics (3 Credits)
Prerequisite: 2030:153 with a grade of C- or better, or placement test. Number systems, integer rings, finite fields, number theory algorithms, prime numbers and primality tests, factoring, and random number.

2030:255 Technical Calculus I (3 Credits)
Prerequisite: 2030:154 with a grade of C- or better or placement test. The derivative, applications of the derivative, derivatives of the trigonometric, logarithmic and exponential functions. Integration by antidifferentiation. Gen Ed: Tier 1 - Quantitative Reasoning, Tier 3 - Critical Thinking

2030:260 Advanced Trigonometry (2 Credits)
Prerequisite: 2030:153 or equivalent with a grade of C- or better, or placement test. Horizontal circular curves, vertical curves, and spherical triangles.

2030:290 Special Topics: Associate Studies Mathematics (1-4 Credits)
(May be repeated with a change in topic) Prerequisite: Permission. Selected topics on subject areas of interest in associate studies.

2030:345 Technical Data Analysis (2 Credits)
Prerequisite: [2030:154 or 2030:216] with a grade of C- or better. Data summarization including graphic representation, numerical measures, introduction to probability, confidence intervals and hypothesis testing.

2030:356 Technical Calculus II (3 Credits)
Prerequisite: 2030:255 or equivalent with a grade of C- or better, or placement test. Methods and applications of integration, first and second order differential equations and applications, series expansion, Laplace transform, partial derivatives, and double integrals.
Gen Ed: Tier 1 - Quantitative Reasoning

2030:361 Applied Cryptography (3 Credits)
Prerequisite: A grade of C or better in 2030:216. Symmetric cryptography, modular arithmetic, stream and block ciphers, random numbers, Advanced Encryption Standard, public-key cryptography, key exchange, digital signatures, hash functions, message authentication.

2030:461 Applied Cryptanalysis (3 Credits)
Prerequisite: 2030:361 with a grade of C or better. Cryptanalysis concepts; cryptanalysis of symmetric and public key cryptosystems, key exchange systems, and digital signatures; hash function collision resistance; cryptanalysis with quantum computer.

2030:480 Advanced Topics in Technical Mathematics (2 Credits)
Prerequisite: 2030:255 or equivalent with a grade of C- or better, or placement test. Matrices, introduction to series, partial derivatives, least squares adjustments, topics in astronomy, and coordinate systems.

Mathematics (3450)

3450:135 Mathematics for Everyday Life (3 Credits)
Prerequisite: 2010:52, 2010:57, or 2010:84 with a grade of C- or better or placement test. Contemporary applications of mathematics for the non-science major to develop skills in logical thinking and reading technical material. Topics include voting, apportionment, scheduling, patterns, networks.
Gen Ed: Tier 1 - Quantitative Reasoning

3450:140 Fundamentals of Mathematics for Primary Educators (3 Credits)
Prerequisite: placement test or 3470:250 with a grade of C- or better. Corequisite: 5100:200. A problem-solving and inquiry-based approach to number systems; bases; operations, properties, relationships, algorithms of Real Numbers; patterns and algebra.

3450:145 Algebra for Calculus (4 Credits)
Prerequisite: 2010:85 with a grade of C or better or placement test. Real numbers, equations and inequalities, linear and quadratic functions. Exponential and logarithmic functions. Systems of equations, matrices, determinants. Permutations and combinations.
Gen Ed: Tier 1 - Quantitative Reasoning

3450:149 Precalculus Mathematics (4 Credits)
Prerequisite: 3450:145 with a grade of C- or better or placement. Functions, polynomial functions, complex numbers, exponential and logarithmic functions, systems of equations, trigonometric functions, mathematical inductions, sequences, and binomial theorem.
Gen Ed: Tier 1 - Quantitative Reasoning

3450:208 Introduction to Discrete Mathematics (4 Credits)
Prerequisite: Completion of 3450:145 or 3450:149 with a grade of C- or better or placement. A foundation course in discrete mathematics with applications. Topics include sets, number systems, Boolean Algebra, logic, relations, functions, recursion, matrices, induction, graphs, and trees.
Gen Ed: Tier 1 - Quantitative Reasoning

3450:209 Discrete Mathematics for Educators (4 Credits)
Prerequisite: Completion of 3450:140 with a grade of C- or better or placement. Corequisite: 3450:231. Introduction to discrete mathematics topics for middle school instruction: sets, counting, probability, recurrence relations, graph theory, logic and elementary proof techniques.

3450:210 Calculus with Business Applications (3 Credits)
Prerequisite: Mathematics Placement Test or completion of 3450:145 with a grade of C- or better. Review of functions, derivatives of functions, extrema and concavity, optimization, logarithmic and exponential functions, extrema for multivariate functions. Graphing calculator required. For business or economics majors only.
Gen Ed: Tier 1 - Quantitative Reasoning

3450:215 Concepts of Calculus (4 Credits)
Prerequisite: Completion of 145 or 149 with a grade of C- or better or placement. Functions; limits and continuity; differentiation and applications of differentiation; logarithmic and exponential functions; integration and applications of integration; partial differentiation.
Gen Ed: Tier 1 - Quantitative Reasoning

3450:221 Analytic Geometry-Calculus I (4 Credits)
Prerequisite: 3450:149 with a grade of C- or better or placement test. Limits; continuity; rates of change; derivatives and applications algebraic, trigonometric, transcendental functions; curve sketching, antiderivatives and integration, areas.
Gen Ed: Tier 1 - Quantitative Reasoning
3450:222 Analytic Geometry-Calculus II (4 Credits)
Prerequisite: Completion of 3450:221 with a grade of C- or better. Methods and applications of integration; sequences, series and power series; Taylor polynomials and Taylor series; parametric and polar coordinates.
Gen Ed: Tier 1 - Quantitative Reasoning

3450:223 Analytic Geometry-Calculus III (4 Credits)
Prerequisite: Completion of 3450:222 with a grade of C- or better. Vector algebra, cylindrical, spherical coordinates, vector-valued functions, curvature; functions of several variables, limit, continuity, partial derivatives, differentials, directional derivatives, maxima and minima, multiple integrals, Divergence Theorem.
Gen Ed: Tier 1 - Quantitative Reasoning

3450:231 Modeling with Algebraic and Transcendental Functions (4 Credits)
Prerequisites: Completion of 3450:140 with a grade of C- or better or placement test or permission. Modeling and regression with algebraic, exponential, logarithmic, and trigonometric functions; systems of equations and matrices. These topics will be enhanced by the use of CAS.

3450:240 Mathematical Foundations for Early Childhood Educators (3 Credits)
Prerequisite: Completion of 3450:140 with a grade of C- or better. A problem-solving and inquiry-based approach to functions and algebra, coordinate and Euclidean geometry, and elementary data analysis.
Gen Ed: Tier 1 - Quantitative Reasoning

3450:289 Selected Topics in Mathematics (1-3 Credits)
Prerequisite: Permission. Selected topics of interest in mathematics.

3450:307 Fundamentals of Advanced Mathematics (3 Credits)
Prerequisite: Completion of 3450:222 with a grade of C- or better. Logic, solving problems, and doing proofs in mathematics. Sets, extended set operations, and indexed family sets, induction. Binary relations. Functions, cardinality. Introductory concepts of algebra and analysis.

3450:312 Linear Algebra (3 Credits)
Prerequisite: Completion of 3450:223 with a grade of C- or better. Study of vector spaces, linear transformations, matrices, determinants, inner products, the eigenvalue problem, quadratic forms and canonical forms.
Gen Ed: Tier 1 - Quantitative Reasoning

3450:331 Modeling with Calculus (4 Credits)
Prerequisite: Completion of 3450:231 with a grade of C- or better. Introduction to limits, continuity, differentiation with applications, integration with applications, sequences and series. These topics will be enhanced by the use of CAS.

3450:333 Introduction to Ordinary Differential Equations (3 Credits)
Prerequisite: Completion of 3450:223 with a grade of C- or better or permission of instructor. Basic techniques for solving ODEs and systems of ODEs. Analysis of models involving differential equations of first order and simple equations of second order.
Gen Ed: Tier 1 - Quantitative Reasoning

3450:341 Geometry and Measurement (3 Credits)
Prerequisites: Completion of 3450:209 with a grade of C- or better, or 3450:307 with a grade of C- or better and be admitted to the College of Education. Basic Constructions, Polygons, Similarity, Pythagorean Theorem, Circles, Congruence, Perimeters and Areas of Plane Figures, Surface and Volume of Solids, Rigid Motions and Symmetry, Coordinate geometry.

3450:401 History of Mathematics (3 Credits)
Prerequisite: Completion of 3450:307 with a grade of "C-" or better. Origin and development of mathematical ideas.

3450:410 Advanced Linear Algebra (3 Credits)
Prerequisite: Completion of 3450:312 with a grade of C- or better. Study of vector spaces, linear transformation, canonical and quadratic forms, inner product spaces.

3450:411 Abstract Algebra I (3 Credits)
Prerequisite: Completion of 3450:307 with a grade of C- or better or permission of instructor. Study of groups, rings, fields, integral domains.

3450:412 Abstract Algebra II (3 Credits)
Prerequisite: Completion of 3450:411 with a grade of C- or better or permission of instructor. Study of groups, rings, fields, integral domains, vector spaces, field extensions, Galois theory.

3450:413 Theory of Numbers (3 Credits)
Prerequisite: Completion of 3450:222 with a grade of C- or better or permission. Euclidean algorithm, unique factorization theorem, congruences, primitive roots, indices, quadratic residues, number-theoretic functions, Gaussian integers and continued fractions.

3450:415 Combinatorics & Graph Theory (3 Credits)
Prerequisite: Completion of 3450:222 with a grade of C- or better or permission. Introduction to basic ideas and techniques of mathematical counting; properties of structure of systems.

3450:420 Mathematical Technology and Communication (3 Credits)
Prerequisites: Completion of 3450:222 and 3450:312 with grades of C- or better, or permission. Graphical, numerical, and algebraic computation with applications using a variety of mathematical hardware and software: symbolic manipulators, dynamic geometry software, programs, scripts and web-browsers.

3450:421 Advanced Calculus I (3 Credits)
Sequential. Prerequisite: Completion of 3450:223 with a grade of C- or better; 3450:307 is highly recommended. Real number system, sequences, series, set theory, continuity, differentiation, integration, partial derivatives, multiple integration, maxima and minima, convergence and uniform convergence, power series, improper integrals, transformations, line and surface integrals.

3450:422 Advanced Calculus II (3 Credits)
Sequential. Prerequisite: Completion of 3450:421 with a grade of C- or better or permission of instructor. Real number system, sequences, series, set theory, continuity, differentiation, integration, partial derivatives, multiple integration, maxima and minima, convergence and uniform convergence, power series, improper integrals, transformations, line and surface integrals.

3450:425 Complex Variables (3 Credits)
Prerequisite: Completion of 3450:223 with a grade of C- or better. Complex variables; elementary functions, differentiation and analytic functions; integration and Cauchy’s theorem; power series and Laurent series; residue theorem; applications such as conformal mappings, inversion of integral transform.

3450:427 Applied Numerical Methods I (3 Credits)
Prerequisites: Completion of 3450:222 and 3460:209 with grades of C- or better or permission. Numerical methods in the solution of ordinary and partial differential equations. Numerical differentiation, Runge-Kutta methods, and iterative methods for ODEs, finite differences for PDEs.
3450:430 Numerical Solutions for Partial Differential Equations (3 Credits)
Prerequisite: Completion of 3450:428 with a grade of C- or better or equivalent. For advanced undergraduate and graduate students. The study of finite difference and finite element methods for partial differential equations consistency, stability, convergence and computer implementation.

3450:432 Partial Differential Equations (3 Credits)
Prerequisite: Completion of 3450:335 with a grade of C- or better. The classical initial value and boundary value problems of mathematical physics developed and solved using Fourier series and integral transforms.

3450:435 Systems of Ordinary Differential Equations (3 Credits)
Prerequisites: Completion of 3450:335 and either 3450:312 or 3450:428 with grades of C- or better or permission. Analysis, solution of systems of equations, linear, nonlinear. Topics: stability theory, perturbation methods, asymptotic methods, applications from physical, social sciences.

3450:436 Mathematical Models (3 Credits)
Prerequisite: Completion of 3450:335 with a grade of C- or better, and a six-hour sequence in an approved applied area, or permission. Formulation and analysis of mathematical models in social and physical sciences. Analysis of deterministic and stochastic models. Topics may include stochastic processes, linear programming, graph theory, theory of measurement.

3450:438 Advanced Engineering Mathematics I (3 Credits)
Prerequisites: Completion of 3450:335 and 3450:312 with grades of C- or better or permission. Matrices, eigenvalue problems, systems of ODEs, vector analysis, complex variables.

3450:439 Advanced Engineering Mathematics II (3 Credits)
Prerequisites: Completion of 3450:335 and 3450:312 with grades of C- or better or permission. Special functions, Fourier series and transforms, PDEs.

3450:441 Concepts in Geometry (4 Credits)
Prerequisite: 3450:307 with a grade of C- or better or permission of instructor. Axiomatic treatment of both Euclidean and non-Euclidean geometries. Other concepts included are finite geometry, transformations, constructions and inversions.

3450:445 Introduction to Topology (3 Credits)
Prerequisite: Completion of 3450:307 with a grade of C- or better or permission of instructor. Introduction to topological spaces and topologies, mappings, cardinality, homeomorphisms, connected spaces, metric spaces.

3450:489 Topics in Mathematics (1-4 Credits)
(May be repeated for a total of 12 credits) Prerequisite: Permission of instructor. Selected topics in mathematics and applied mathematics at an advanced level.

3450:491 Workshop in Mathematics (1-4 Credits)
(May be repeated) Group studies of special topics in mathematics and applied mathematics. May not be used to meet undergraduate or graduate major requirements. May be used for elective credit.

3450:497 Individual Reading: Mathematics (1-2 Credits)
Prerequisites: senior standing and permission. Mathematics or applied mathematics majors only. Directed studies designed as an introduction to research problems, under guidance of selected faculty member.

3450:498 Senior Honors Project: Mathematics (1-3 Credits)
Prerequisite: Permission of Instructor. Directed study for senior student in the Honors Program. An introduction to research problems in mathematics and applied mathematics under the guidance of selected faculty. May be repeated for up to six credits.