

MATHEMATICS

BS/MS Program in Applied Mathematics

This is an accelerated five-year BS/MS program. By completing this program successfully, a student will receive their baccalaureate degree after four years and their Master's degree after five 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, the 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. Up to 9 credits of approved coursework will count towards both the baccalaureate and the Master's degrees. A student will be eligible for a graduate assistantship only in the last year 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:

Fall	Spring	Summer
School	School	Vacation/School
School	School	Vacation/School/Work
School	Work	School
Work	School	Work
School	School	

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 BCAS: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/engineering-polymer-science/mathematics/applied-mathematics-bs/>)
- Applied Mathematics, Minor (<https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/mathematics/applied-mathematics-minor/>)
- Mathematics, Minor (<https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/mathematics/mathematics-minor/>)
- Technical Mathematics, Certificate (<https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/mathematics/technical-mathematics-certificate/>)

Mathematics (MATH)

MATH:135 Mathematics for Everyday Life (3 Credits)

Prerequisite: DEVP 50 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. (Formerly 3450:135)

Ohio Transfer 36: Yes

Gen Ed: - Mathematics, Statistic, Logic

MATH:140 Mathematics for Early/Middle Teachers 1 (3 Credits)

Prerequisite: [MATH:143, MATH:144, MATH:152, STAT:250, or STAT:260] with a grade of C- or better, or placement test. Pre/Corequisite: EDFN:200. A problem-solving and inquiry-based approach to number systems; bases; operations, properties, relationships, algorithms of Real Numbers; patterns and algebra. (Formerly 3450:140)

Gen Ed: - Mathematics, Statistic, Logic

MATH:143 Technical Algebra and Trigonometry 1 - Expanded (5 Credits)

Prerequisite: DEVP 52 with a grade of C or better, or placement test. Functions; measurement systems; methods of factoring; graphs of polynomial, exponential and trigonometric functions; equations and inequalities; systems of equations; solving triangles using trigonometric and inverse trigonometric functions; vectors; complex numbers. This course also provides just-in-time review to help students achieve the same learning outcomes as MATH 144.

Gen Ed: - Mathematics, Statistic, Logic

MATH:144 Technical Algebra and Trigonometry 1 (4 Credits)

Prerequisite: Placement. Functions; measurement systems; graphs of polynomial, exponential and trigonometric functions; equations and inequalities; systems of equations; solving triangles using trigonometric and inverse trigonometric functions; vectors; complex numbers.

Gen Ed: - Mathematics, Statistic, Logic

MATH:145 Algebra for Calculus (4 Credits)

Prerequisite: DEVP 85 with a grade of C- or better or MATH 152 with a grade of C- or placement test. Real numbers, equations and inequalities, linear and quadratic functions. Exponential and logarithmic functions. Systems of equations, matrices, determinants. Permutations and combinations. (Formerly 3450:145)

Ohio Transfer 36: Yes

Gen Ed: - Mathematics, Statistic, Logic

MATH:149 Precalculus Mathematics (4 Credits)

Prerequisite: [MATH 145 or MATH 153] with a grade of C- or better or placement test. Functions, polynomial functions, complex numbers, exponential and logarithmic functions, systems of equations, trigonometric functions, mathematical inductions, sequences, and binomial theorem. (Formerly 3450:149)

Ohio Transfer 36: Yes

Gen Ed: - Mathematics, Statistic, Logic

MATH:151 Technical Mathematics I (2 Credits)

Prerequisite: placement test, DEVP 52, DEVP 54, DEVP 57, or DEVP 84 with a grade of C or better. Fundamental concepts and operations, functions, graphs, factoring and algebraic fractions, and quadratic equations. (Formerly 2030:151)

MATH:152 Technical Mathematics II (2 Credits)

Prerequisite: MATH 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. (Formerly 2030:152)

Ohio Transfer 36: Yes

MATH:153 Technical Mathematics III (2 Credits)

Prerequisite: MATH 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. (Formerly 2030:153)

Ohio Transfer 36: Yes

Gen Ed: - Mathematics, Statistic, Logic

MATH:154 Technical Algebra and Trigonometry 2 (3 Credits)

Prerequisite: [MATH 143, MATH 144, or MATH 145] with a grade of C- or better or placement test. Functions and their graphs; polynomial, rational, trigonometric, exponential and logarithmic functions; polynomial equations; graphs of trigonometric functions; trigonometric identities and equations; analytic geometry; rates and rates of change. (Formerly 2030:154)

Gen Ed: - Mathematics, Statistic, Logic

MATH:200 Introduction to Data Science (3 Credits)

Prerequisite: MATH 145 with a grade of C- or better or placement test. This course provides students a practical introduction to the field of Data Science and familiarizes them with the essential facets of the data scientist profession. This includes a grounding on data-based reasoning, problem formulation, data collection, data pre-processing, data analytics, visualization, and use of data analysis for decision-making.

MATH:208 Introduction to Discrete Mathematics (4 Credits)

Prerequisite: [MATH 145 or MATH 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. (Formerly 3450:208)

Gen Ed: - Mathematics, Statistic, Logic

MATH:209 Discrete Mathematics for Educators (4 Credits)

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

MATH:210 Calculus with Business Applications (3 Credits)

Prerequisite: Placement test or [MATH 145 or MATH 153] 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. (Formerly 3450:210)

Ohio Transfer 36: Yes

Gen Ed: - Mathematics, Statistic, Logic

MATH:215 Concepts of Calculus (4 Credits)

Prerequisite: MATH 145 or MATH 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. (Formerly 3450:215)

Ohio Transfer 36: Yes

Gen Ed: - Mathematics, Statistic, Logic

MATH:221 Analytic Geometry-Calculus I (4 Credits)

Prerequisite: [MATH 154 or MATH 255 or MATH 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. (Formerly 3450:221)

Ohio Transfer 36: Yes

Gen Ed: - Mathematics, Statistic, Logic

MATH:222 Analytic Geometry-Calculus II (4 Credits)

Prerequisite: MATH 221 with a grade of C- or better or MATH 356 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. (Formerly 3450:222)

Ohio Transfer 36: Yes

Gen Ed: - Mathematics, Statistic, Logic

MATH:223 Analytic Geometry-Calculus III (4 Credits)

Prerequisite: MATH 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. (Formerly 3450:223)

Ohio Transfer 36: Yes

Gen Ed: - Mathematics, Statistic, Logic

MATH:231 Modeling with Algebraic and Transcendental Functions (4 Credits)

Prerequisites: MATH 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. (Formerly 3450:231)

MATH:240 Mathematics for Early/Middle Teachers 2 (3 Credits)

Prerequisite: MATH 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. (Formerly 3450:240)

Gen Ed: - Mathematics, Statistic, Logic

MATH:255 Technical Calculus I (3 Credits)

Prerequisite: MATH 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. (Formerly 2030:255)

Gen Ed: - Mathematics, Statistic, Logic

MATH:260 Advanced Trigonometry (2 Credits)

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

MATH:261 Applied Finite Mathematics (3 Credits)

Prerequisite: [MATH 143, MATH 144, MATH 145, or MATH 153] with a C- or higher, or placement test. Number systems, integer rings, finite fields, number theory algorithms, prime numbers and primality tests, factoring, and random numbers. (Formerly 2030:216)

Gen Ed: - Mathematics, Statistic, Logic

MATH:289 Selected Topics in Mathematics (1-3 Credits)

Prerequisite: Permission. Selected topics of interest in mathematics. (Formerly 3450:289)

MATH: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. (Formerly 2030:290)

MATH:300 Tools for Data Science (3 Credits)

Prerequisites: MATH 200 and [CPSC 209 or CPSC 200] with a grade of C- or better. This course offers students a practical introduction to the field of "Data Science," and common methods for quantitative and computational analytics, through which they can have an overview of key concepts, skills, and technologies used by data scientists. While the course covers several programming languages and tools, the focus is on solving problems. The students will be introduced to several real-life problems that involve collecting and analyzing data.

MATH:307 Fundamentals of Advanced Mathematics (3 Credits)

Prerequisite: MATH 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. (Formerly 3450:307)

MATH:312 Linear Algebra (3 Credits)

Prerequisite: MATH 222 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. (Formerly 3450:312)

Ohio Transfer 36: Yes

Gen Ed: - Mathematics, Statistic, Logic

MATH:331 Modeling with Calculus (4 Credits)

Prerequisite: MATH 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. (Formerly 3450:331)

MATH:335 Introduction to Ordinary Differential Equations (3 Credits)

Prerequisite: MATH 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. (Formerly 3450:335)

Ohio Transfer 36: Yes

MATH:341 Geometry and Measurement (3 Credits)

Prerequisites: MATH 209 with a grade of C- or better, or MATH 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. (Formerly 3450:341)

MATH:345 Technical Data Analysis (2 Credits)

Prerequisite: [MATH 154 or MATH 261] with a grade of C- or better. Data summarization including graphic representation, numerical measures, introduction to probability, confidence intervals and hypothesis testing. (Formerly 2030:345)

MATH:356 Technical Calculus II (3 Credits)

Prerequisite: MATH 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. (Formerly 2030:356)

Gen Ed: - Mathematics, Statistic, Logic

MATH:360 Advanced Mathematics for Surveyors (2 Credits)

Pre/Corequisite: MATH 255 or MATH 221. This course is designed to prepare surveying majors for the math portion of their professional exam. Topics include matrices, introduction to series, partial derivatives, least squares adjustments, topics in astronomy, and coordinate systems. (Formerly 2030:480)

MATH:361 Applied Cryptography (3 Credits)

Prerequisite: A grade of C or better in MATH 261. Symmetric cryptography, modular arithmetic, stream and block ciphers, random numbers, Advanced Encryption Standard, public-key cryptography, key exchange, digital signatures, hash functions, message authentication. (Formerly 2030:361)

MATH:401 History of Mathematics (3 Credits)

Prerequisite: [MATH 307 or MATH 208] with a grade of C- or better. Origin and development of mathematical ideas. (Formerly 3450:401)

MATH:410 Advanced Linear Algebra (3 Credits)

Prerequisite: MATH 312 with a grade of C- or better. Study of vector spaces, linear transformation, canonical and quadratic forms, inner product spaces. (Formerly 3450:410)

MATH:411 Abstract Algebra I (3 Credits)

Prerequisite: MATH 307 with a grade of C- or better or permission of instructor. Study of groups, rings, fields, integral domains. (Formerly 3450:411)

MATH:412 Abstract Algebra II (3 Credits)

Prerequisite: MATH 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. (Formerly 3450:412)

MATH:413 Theory of Numbers (3 Credits)

Prerequisite: MATH 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. (Formerly 3450:413)

MATH:415 Combinatorics & Graph Theory (3 Credits)

Prerequisite: MATH 222 with a grade of C- or better or permission. Introduction to basic ideas and techniques of mathematical counting; properties of structure of systems. (Formerly 3450:415)

MATH:420 Mathematical Technology and Communication (3 Credits)

Prerequisites: MATH 222 and MATH 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. (Formerly 3450:420)

MATH:421 Advanced Calculus I (3 Credits)

Sequential. Prerequisites: MATH 223 with a grade of C- or better and [MATH 307 or MATH 208 with a grade of C- or better]. 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. (Formerly 3450:421)

MATH:422 Advanced Calculus II (3 Credits)

Sequential. Prerequisite: MATH 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. (Formerly 3450:422)

MATH:425 Complex Variables (3 Credits)

Prerequisite: MATH 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. (Formerly 3450:425)

MATH:427 Applied Numerical Methods I (3 Credits)

Prerequisites: MATH 222 and CPSC 209 with grades of C- or better or permission. Numerical methods in polynomial interpolation, rootfinding, numerical integration, and numerical linear algebra. (Formerly 3450:427)

MATH:428 Applied Numerical Methods II (3 Credits)

Prerequisites: MATH 335 and MATH 427 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. (Formerly 3450:428)

MATH:430 Numerical Solutions for Partial Differential Equations (3 Credits)

Prerequisite: MATH 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. (Formerly 3450:430)

MATH:432 Partial Differential Equations (3 Credits)

Prerequisite: MATH 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. (Formerly 3450:432)

MATH:435 Systems of Ordinary Differential Equations (3 Credits)

Prerequisites: MATH 335 and [MATH 312 or MATH 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. (Formerly 3450:435)

MATH:436 Mathematical Models (3 Credits)

Prerequisite: MATH 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. (Formerly 3450:436)

MATH:438 Advanced Engineering Mathematics (3 Credits)

Prerequisites: MATH 335 and MATH 312 with grades of C- or better or permission. Matrices, eigenvalue problems, systems of ODEs, vector analysis, complex variables. (Formerly 3450:438)

MATH:439 Applied Analysis and PDEs (3 Credits)

Prerequisites: MATH 335 and MATH 312 with grades of C- or better or permission. Special functions, Fourier series and transforms, PDEs. (Formerly 3450:439)

MATH:441 Concepts in Geometry (4 Credits)

Prerequisite: [MATH 208 or MATH 209 or MATH 307] with a grade of C- or better, or permission of instructor. This course includes the study of axiomatic, modern, and transformational geometry. In particular: the foundations of geometry (points, lines, segments, angles, polygons, and circles), Euclidean and non-Euclidean geometry. (Formerly 3450:441)

MATH:445 Introduction to Topology (3 Credits)

Prerequisite: MATH 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. (Formerly 3450:445)

MATH:450 Optimization (3 Credits)

Prerequisites: [MATH 223, MATH 312, and STAT 461] with grades of C- or better. Topics include convexity, convex optimization problems, Lagrangian duality, optimality conditions and optimization in machine learning. Algorithmic topics will include the gradient descent and its variants, Newton's and quasi-Newton methods. Applications will emphasize topics in data science.

MATH:455 Deep Learning (3 Credits)

Prerequisites: MATH 223 and MATH 312 with grades of C- or better. Introduction to the basic concepts, theories, and practices of traditional and modern neural networks in the area of deep learning. Materials are grouped in the following categories (i) machine learning basics, (ii) multilayer perceptrons and modern neural networks, (iii) applications and advanced techniques. Students will gain experiences in implementing the concepts and methods for applications.

MATH:461 Applied Cryptanalysis (3 Credits)

Prerequisite: MATH 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. (Formerly 2030:461)

MATH: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. (Formerly 3450:489)

MATH: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. (Formerly 3450:491)

MATH: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. (Formerly 3450:497)

MATH:498 Senior Honors Project: Mathematics (1-3 Credits)

Prerequisite: Senior standing or higher in the Honors program and 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. (Formerly 3450:498)