

MATHEMATICS (MATH)

Vertically-related courses in this subject field are: MATH 170–MATH 175–MATH 275–MATH 471–MATH 472.

Credit Limitations: MATH 108 carries no credit after MATH 143; MATH 143 carries no credit after MATH 160 or MATH 170; MATH 170 carries 2 credits after MATH 160; MATH 160 carries no credit after MATH 170, MATH 215 carries no credit after MATH 461 or MATH 471.

MATH 108 Intermediate Algebra (3 credits)

Carries no credit after MATH 143. Review of algebra including factoring, rational expressions, exponents, radicals, quadratic equations, equations of lines. Taught using the Polya Math Center, a studio environment featuring group study, one-to-one interaction with instructors, computer-mediated modules, and lectures. Does not satisfy general education requirement.

MATH 123 Math in Modern Society (3 credits)

General Education: Mathematical Ways of Knowing
Discussion of some aspects of mathematical thought through the study of problems taken from areas such as logic, political science, management science, geometry, probability, and combinatorics; discussion of historical development and topics discovered in the past 100 years. Typically Offered: Fall, Spring and Summer.

MATH 143 Precalculus I: Algebra (3 credits)

General Education: Mathematical Ways of Knowing
Carries no credit after MATH 160 or MATH 170. Algebraic, exponential, logarithmic functions; graphs of conics; zeros of polynomials; systems of equations, induction. Taught using the Polya Math Center, a studio environment featuring group study, one-to-one interaction with instructors, computer-mediated modules, and lectures. Typically Offered: Fall, Spring and Summer.

Prereqs: Sufficient score on SAT, ACT, or math placement test; or MATH 108 with grade of C or better. It is recommended that MATH 143 be taken within two years of passing MATH 108 or its equivalent. Required test scores can be found here: <http://www.uidaho.edu/registrar/registration/placement>

MATH 144 Precalculus II: Trigonometry (1 credit)

Trigonometric functions, inverse functions, applications. Taught using the Polya Math Center, a studio environment featuring group study, one-to-one interaction with instructors, computer-mediated modules, and lectures. Typically Offered: Fall, Spring and Summer. **Prereqs:** MATH 143 or MATH 170

MATH 153 Introduction to Statistical Reasoning (3 credits)

General Education: Mathematical Ways of Knowing
Cross-listed with STAT 153
A course in statistical literacy, an introduction with emphasis on examples and case studies. Topics include data sources and the distinction between experiments, observational studies, and surveys; graphical and numerical description of data; understanding randomness; central tendency; correlation versus causation; line of best fit; estimation of proportions; and statistical testing.

MATH 160 Survey of Calculus (4 credits)

General Education: Mathematical Ways of Knowing
Carries no credit after MATH 170. Overview of functions, and graphs, derivatives, integrals, exponential and logarithmic functions, functions of several variables, and differential equations. Primarily for students who need only one semester of calculus, such as students in business or architecture. Typically Offered: Fall, Spring and Summer.
Prereqs: Sufficient score on SAT, ACT, or math placement test, or MATH 143 with a C or better. Required test scores can be found here: <http://www.uidaho.edu/registrar/registration/placement>.

MATH 170 Calculus I (4 credits)

General Education: Mathematical Ways of Knowing
Carries 2 credits after MATH 160. Functions, limits, continuity, differentiation, integration, applications, differentiation and integration of transcendental functions. Primarily for students in engineering, mathematics, science or computer science. Typically Offered: Fall, Spring and Summer.
Prereqs: MATH 143 (with a grade of C or better) and MATH 144 (concurrent enrollment in MATH 144 is allowed although it is recommended that students complete MATH 144 before enrolling in MATH 170); or demonstrated proficiency through a sufficiently high score on the ACT, SAT, or math placement test. Required test scores can be found here: <http://www.uidaho.edu/registrar/registration/placement>.

MATH 175 Calculus II (4 credits)

General Education: Mathematical Ways of Knowing
Differentiation and integration of transcendental functions, integration techniques, general mean value theorem, numerical techniques, and series. Typically Offered: Fall, Spring and Summer.
Prereqs: MATH 170 with a grade of C or better

MATH 176 Discrete Mathematics (3 credits)

Induction, set theory, graph theory, number systems, Boolean algebra, and elementary counting.
Prereqs: MATH 143 or sufficiently high score on SAT, ACT, or math placement test. Required test scores can be found here: <http://www.uidaho.edu/registrar/registration/placement>.

MATH 183 Introduction to Data Science in Python (3 credits)

The purpose of this course is to introduce fundamental skills in data science such as data manipulation, data visualization, and tabular data analysis, as well as the basic usage of Python and Python techniques to perform such skills. Relevant mathematical topics such as basic linear algebra and basic statistics will also be introduced as required.
Prereqs: MATH 160 or MATH 170

MATH 204 (s) Special Topics (1-16 credits)

Credit arranged

MATH 215 Proof via Number Theory (3 credits)

An introduction to mathematical thinking and proof through the development of the basic results of elementary number theory. Emphasis on techniques of mathematical proofs, reading and writing proofs, and fundamental mathematical structures.
Prereqs: MATH 175 and MATH 176

MATH 275 Calculus III (3 credits)

General Education: Mathematical Ways of Knowing
Vectors, functions of several variables, and multiple integration. Typically Offered: Fall, Spring and Summer.
Prereqs: MATH 175

MATH 299 (s) Directed Study (1-16 credits)

Credit arranged

MATH 310 Ordinary Differential Equations (3 credits)

Classification, initial and boundary value problems of one variable, exact equations, methods of solving higher-order linear equations, second-order equations with constant coefficient, series solutions, systems of linear equations, Laplace transforms, and existence theorems. Recommended preparation: MATH 275.

Prereqs: MATH 175

MATH 315 HON:Topics in Pure Mathematics (3 credits)

A topic selected each year that develops skill and appreciation for theoretical nature of mathematics.

Prereqs: Permission of director of University Honors Program

MATH 330 Linear Algebra (3 credits)

Linear equations, matrices, linear transformations, eigenvalues, diagonalization; applications. Recommended Preparation: MATH 175.

Prereqs: MATH 160 or MATH 170

MATH 371 Mathematical Physics (3 credits)

Cross-listed with PHYS 371

Mathematical techniques needed in upper-division physics courses, including vector analysis, matrices, Sturm-Liouville problems, special functions, partial differential equations, complex variables. Typically Offered: Fall (Even Years).

Prereqs: PHYS 212 and MATH 275

MATH 376 Discrete Mathematics II (3 credits)

Selected topics from discrete mathematics such as graph theory, modeling, and optimization. Recommended for Computer Science majors.

Prereqs: MATH 176 or Permission

MATH 385 Theory of Computation (3 credits)

Cross-listed with CS 385

Mathematical models of computation, including finite automata and Turing machines. Typically Offered: Fall.

MATH 386 Theory of Numbers (3 credits)

Second course on number theory, including a historical treatment of efforts to answer basic questions on the density and possible forms of prime numbers. Topics may include: quadratic reciprocity, cubic reciprocity, quadratic forms, genus theory, higher reciprocity laws, Hilbert class field, the prime number theorem, Dirichlet's theorem on primes in an arithmetic progression, elliptic curves, and modular forms.

Prereqs: MATH 215

MATH 388 History of Mathematics (3 credits)

History of the development of mathematical ideas from ancient cultures to the present, including the relationship of those ideas to the cultures that produced them as well as an understanding of the mathematics involved. Cooperative: open to WSU degree-seeking students.

Prereqs: MATH 175 or Permission

MATH 390 Axiomatic Geometry (3 credits)

Development of Euclidean and hyperbolic geometry using the axiomatic approach. Recommended Preparation: MATH 215.

Prereqs: High school geometry and MATH 176, or Instructor Permission

MATH 391 Modern Geometry (3 credits)

Euclidean and non-Euclidean geometries, plus topics chosen from projective, transformational, and computational geometry. Recommended Preparation: MATH 215.

Prereqs: High School Geometry and MATH 176, or Instructor Permission

MATH 395 Analysis of Algorithms (3 credits)

Cross-listed with CS 395

Measures of efficiency; standard methods and examples in the design, implementation, and analysis of algorithms. (Spring only)

Prereqs: MATH 175 and CS 121

MATH 400 (s) Seminar (1-16 credits)

Credit arranged

MATH 404 (s) Special Topics (1-16 credits)

Credit arranged

MATH 415 Cryptography (3 credits)

General Education: Senior Experience

Congruences, modular arithmetic, private-key cryptosystems, public-key cryptosystems, and applications. The role of modern mathematics in information age society.

Prereqs: MATH 330

MATH 420 Complex Variables (3 credits)

Complex numbers, elementary functions, derivatives, the residue theorem, conformal mappings, contour integration, infinite series, applications.

Prereqs: MATH 275

MATH 426 Discrete Optimization (3 credits)

Optimization on graphs, networks and flows, and related topics.

Recommended Preparation: MATH 175.

MATH 427 Transformational Geometry (3 credits)

Geometry concepts of congruence, parallelism, and similarity using rigid motions; the group structure of the collection of isometries and their matrix representations. The course is of particular interest to secondary mathematics teaching majors.

Prereqs: MATH 330 or equivalent

MATH 428 Numerical Methods (3 credits)

Cross-listed with ENGR 428, PHYS 428

Joint-listed with MATH 529, PHYS 528

Systems of equations, eigenvalues and eigenvectors, root finding, error analysis, numerical solution to differential equations, interpolation and data fitting, numerical integration, related topics and applications, such as fast Fourier transforms, as time and interest permits. Typically Offered: Spring.

Prereqs: Math 310; and CS 120 or Math 183 or ENGR 212 or Permission

MATH 430 Advanced Linear Algebra (3 credits)

Vector spaces, linear transformations, characteristic polynomial, eigenvectors, Hermitian and unitary operators, inner products, quadratic forms, Jordan canonical form, applications.

Prereqs: MATH 215 and MATH 330 or Instructor Permission

MATH 432 Numerical Linear Algebra (3 credits)

Analysis of efficiency and accuracy of large linear algebra problems; special emphasis on solving linear equations and finding eigenvalues.

Prereqs: MATH 275, MATH 330, and knowledge of a computer language

MATH 437 Mathematical Biology (3 credits)

General Education: Senior Experience

Modeling biological phenomena, mostly through differential equations; mathematical topics include stability analysis and limit cycles for nonlinear ODE's, spatial diffusion and traveling waves for PDE's; biological topics include models of predator-prey systems, infectious diseases, and competition.

Prereqs: MATH 310 or Permission Cooperative: open to WSU degree-seeking students.

MATH 438 Mathematical Modeling (3 credits)

Topics in the use of mathematics to model phenomena from science, business, economics, and engineering.

Prereqs: CS 120, MATH 310 and MATH 330, or Instructor Permission

MATH 451 Probability Theory (3 credits)

Cross-listed with STAT 451

Random variables, expectation, special distributions (normal, binomial, exponential, etc.), moment generating functions, law of large numbers, central limit theorem. Cooperative: open to WSU degree-seeking students. (Fall only)

Prereqs or Coreqs: MATH 275 or Permission

MATH 452 Mathematical Statistics (3 credits)

Cross-listed with STAT 452

Estimation of parameters, confidence intervals, hypothesis testing, likelihood ratio test, sufficient statistics. Cooperative: open to WSU degree-seeking students. (Spring only)

Prereqs: MATH 451 or Permission

MATH 453 Stochastic Models (3 credits)

Cross-listed with STAT 453

Joint-listed with MATH 538

Markov chains, stochastic processes, and other stochastic models; applications. Additional projects/assignments required for graduate credit. Cooperative: open to WSU degree-seeking students.

Prereqs: MATH 451 or Permission.

MATH 455 Applied Actuarial Science (1 credit)

Risk problems on the actuarial exam. Graded P/F.

Prereqs: MATH 451

MATH 461 Abstract Algebra I (3 credits)

Groups, rings, and fields. (Fall only)

Prereqs: MATH 215 and MATH 330; or Permission

MATH 462 Abstract Algebra II (3 credits)

Groups, rings, and fields. (Spring only)

Prereqs: MATH 461

MATH 471 Introduction to Analysis I (3 credits)

Topology of Euclidean n -space, limit and continuity, differentiation, integration. (Fall only)

Prereqs: MATH 275 and MATH 215; or Permission

MATH 472 Introduction to Analysis II (3 credits)

Topology of Euclidean n -space, limit and continuity, differentiation, integration. (Spring only)

Prereqs: MATH 471 or Permission

MATH 476 Combinatorics (3 credits)

Elementary counting methods, generating functions, recurrence relations, Polya's enumeration, enumeration of graphs, trees, searching, combinatorial algorithms. Recommended Preparation: MATH 176, or MATH 215, or MATH 376.

Prereqs: MATH 175 and MATH 330

MATH 480 Partial Differential Equations (3 credits)

Intro to Fourier analysis, application to solution of partial differential equations; classical partial differential equations of engineering and physics.

Prereqs: MATH 310 or Permission

MATH 483 Foundations of Machine Learning (3 credits)

This course covers mathematical foundations as well as basic algorithms for machine learning. Topics include algorithms for classification, regression, and clustering such as support vector machines, decision tree learning, and K-means; dimensionality reduction for data compression; and deep learning. The implementation of the algorithms will be in Python. Typically Offered: Varies.

Prereqs: MATH 183, MATH 275, and MATH 330; or by permission

MATH 499 (s) Directed Study (1-16 credits)

Credit arranged

MATH 500 Master's Research and Thesis (1-16 credits)

Credit arranged

MATH 501 (s) Seminar (1-16 credits)

Credit arranged

MATH 502 (s) Directed Study (1-16 credits)

Credit arranged

MATH 504 (s) Special Topics (1-16 credits)

Credit arranged

MATH 505 (s) Professional Development (1-16 credits)

Credit arranged. Credit earned in this course will not be accepted toward graduate degree programs.

MATH 510 Seminar on College Teaching of Mathematics (1 credit, max arranged)

Development of skills in the teaching of college mathematics; includes structure of class time, test construction, and various methods of teaching mathematics; supervision of teaching assistants in their beginning teaching assignments. Graded P/F.

Prereqs: Permission

MATH 521 Topology I (3 credits)

Basic concepts of point set and algebraic topology. Cooperative: open to WSU degree-seeking students.

MATH 523 Algebraic Topology I (3 credits)

Basic homotopy theory, covering spaces, homology theory, and applications.

MATH 528 Differentiable Manifolds (3 credits)

Fundamentals of smooth manifolds, tangent spaces, vector fields, Lie groups, integration on manifolds, and applications. Cooperative: open to WSU degree-seeking students.

Prereqs: MATH 521 and MATH 472

MATH 529 Numerical Methods (3 credits)

Cross-listed with PHYS 528

Joint-listed with ENGR 428, MATH 428, and PHYS 428

Systems of equations, root finding, error analysis, numerical solution to differential equations, interpolation and data fitting, numerical integration, related topics and applications. Additional projects and/or assignments required for graduate credit in PHYS 528.

Prereqs: MATH 310.

MATH 531 Complex Variables (3 credits)

Theory of functions of a complex variable. Cooperative: open to WSU degree-seeking students.

MATH 535 Real Variables (3 credits)

Measure and integration theory for functions of one or several variables.

MATH 536 Probability Theory (3 credits)

Random variables, characteristic functions, convergence theorems, central limit theorem, conditional probability, and stochastic processes as developed from a measure theoretic basis.

Prereqs: MATH 535 or Permission

MATH 537 Fourier Analysis (3 credits)

Basic properties of Fourier series, convergence of Fourier series, Fourier transforms, finite Fourier analysis, and applications to signal processing such as frames and wavelets. Recommended preparation: MATH 471 and 472; or Permission. Typically Offered: Varies. Cooperative: open to WSU degree-seeking students.

MATH 538 Stochastic Models (3 credits)

Joint-listed with MATH 453 and STAT 453

Markov chains, stochastic processes, and other stochastic models; applications. Additional projects/assignments required for graduate credit. Cooperative: open to WSU degree-seeking students.

Prereqs: MATH 451 or Permission.

MATH 539 Theory of Ordinary Differential Equations (3 credits)

Existence, uniqueness, and stability of solutions of first-order systems; other topics. Cooperative: open to WSU degree-seeking students.

MATH 540 Partial Differential Equations (3 credits, max 3)

Existence and uniqueness theorems for the wave, heat, and Laplace's equations of physics; additional topics such as nonlinear models in mathematical biology, perturbation methods, etc. Cooperative: open to WSU degree-seeking students.

Prereqs: MATH 539 or Permission

MATH 555 Groups and Fields I (3 credits)

Groups, fields, polynomials, Galois theory, representation theory. Cooperative: open to WSU degree-seeking students.

Prereqs: MATH 461 and MATH 462; or equivalent

MATH 556 Groups and Fields II (3 credits)

Groups, fields, polynomials, Galois theory, representation theory. Cooperative: open to WSU degree-seeking students.

Prereqs: MATH 555 or Permission

MATH 557 Ring Theory (3 credits)

Rings, ideals, modules, commutative algebra. Cooperative: open to WSU degree-seeking students.

Prereqs: MATH 461 and MATH 462; or equivalent

MATH 558 Introduction to Algebraic Geometry (3 credits)

Affine and projective varieties, morphisms, functions on varieties, birational maps, applications. Cooperative: open to WSU degree-seeking students.

Prereqs: MATH 557 or Permission

MATH 559 Algebraic Number Theory (3 credits)

Dedekind rings, algebraic integers, prime ideals and their splittings, decomposition group, inertia group, ideal class group, quadratic extensions and cyclotomic extensions. Some class field theory, including Frobenius automorphism, Artin automorphism, Hilbert class field, adeles and ideles.

Prereqs: MATH 557 or permission.

MATH 561 (s) Seminar in Algebra (1-3 credits, max arranged)

Current literature.

MATH 563 Mathematical Genetics (3 credits)

Cross-listed with BIOL 563

Investigation of aspects of evolutionary biology with an emphasis on stochastic models and statistical methods; topics include: diffusion methods in molecular evolution, gene genealogies and the coalescent, inferring coalescent times from DNA sequences, population subdivision and F statistics, likelihood methods for phylogenetic inference, statistical hypothesis testing, the parametric bootstrap. Cooperative: open to WSU degree-seeking students.

Prereqs: MATH 160 or MATH 170 and STAT 251 or STAT 301

MATH 571 Functional Analysis I (3 credits)

Linear topological spaces and linear operators.

Prereqs: MATH 535

MATH 572 Functional Analysis II (3 credits)

Linear topological spaces and linear operators.

Prereqs: MATH 571

MATH 575 Graph Theory I (3 credits)

Basic concepts and theorems; topics include trees and connectivity, eulerian and hamiltonian graphs, graph colorings, matchings, graph decomposition, and extremal graph theory.

MATH 576 Graph Theory II (3 credits)

Basic concepts and theorems; topics include trees and connectivity, eulerian and hamiltonian graphs, graph colorings, matchings, graph decomposition, and extremal graph theory.

Prereqs: Instructor Permission

MATH 579 Combinatorics (3 credits)

Topics from enumerative combinatorics, design theory, extremal combinatorics and algebraic combinatorics.

MATH 596 MAT Comp Exam (1 credit)

Supervised preparation for the Master of Arts in Teaching comprehensive exam. Graded P/F.

MATH 598 (s) Internship (1-16 credits)

Credit arranged

MATH 599 (s) Non-thesis Master's Research (1-16 credits)

Credit arranged. Research not directly related to a thesis or dissertation.

Prereqs: Permission

MATH 600 Doctoral Research and Dissertation (1-45 credits)

Credit arranged