

Mathematics

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

Credit Limitations: Math 108 carries no credit after Math 137 or 143; Math 137 carries no credit after 143; Math 143 carries no credit after 160 or 170; Math 170 carries 2 credits after 160; Math 160 carries no credit after 170, Math 215 carries no credit after 411 or 471.

Math 108 Intermediate Algebra (3 cr)

Carries no credit after Math 137 or 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 core requirement.

Math 123 Mathematics Applied To The Modern World (3 cr)

May be used as core credit in J-3-c. Discussion of some aspects of mathematical thought through the study of problems taken from areas such as logic, number theory, geometry, probability, and combinatorics; discussion of historical development.

Math 130 Finite Mathematics (3 cr)

May be used as core credit in J-3-c. Systems of linear equations and inequalities, matrices, linear programming, and probability.

Prereq: 1 yr high school algebra, 1 yr plane geometry, and sufficient score on SAT, ACT, or COMPASS Math Test

Math 137 Algebra with Applications (3 cr)

May be used as core credit in J-3-c. Carries no credit after Math 143. Algebraic, exponential, logarithmic functions, systems of equations, applications.

Prereq: 1-1/2 years high school algebra, 1 yr high school plane geometry, and sufficient score on SAT, ACT, or COMPASS Math Test; or Math 108 with grade of C or better. It is recommended that Math 137 be taken within two years of passing Math 108 or its equivalent.

Math 143 Pre-calculus Algebra and Analytic Geometry (3 cr)

May be used as core credit in J-3-c. Carries no credit after Math 160 or 170; carries 2 credits after Math 137. 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.

Prereq: 1-1/2 yrs high school algebra, 1 yr high school plane geometry, and sufficient score on SAT, ACT, or COMPASS Math 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.

Math 144 Analytic Trigonometry (1 cr)

Not open for cr to students who have previous high school or college cr in trigonometry. 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.

Prereq: 2 yrs high school algebra (or Math 143) and 1 yr plane geometry, and/or **Coreq:** Math 143 or 170. Concurrent enrollment in Math 143 or 170 permitted.

Math 160 Survey of Calculus (4 cr)

May be used as core credit in J-3-c. Carries no credit after Math 170. Functions, graphing, derivative, integral, exponential and logarithmic functions, functions of several variables. Primarily for students in business, life sciences or architecture who need only one semester of calculus.

Prereq: One yr of high school geometry and one of the following: (1) 1-1/2 yrs high school algebra and sufficiently high score on SAT, ACT, or COMPASS Math Test, or (2) Math 137, or (3) Math 143.

Math 170 Analytic Geometry and Calculus I (4 cr)

May be used as core credit in J-3-c. 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.

Prereq: One of the following: a) Math 143 and Math 144, b) Math 143 and sufficiently high score on COMPASS Trig Test, or c) 2 yrs high school algebra and 1 yr plane geometry and ½ yr analytic trigonometry and sufficiently high score on SAT, ACT, or COMPASS Math Tests (College Algebra and Trigonometry). (Concurrent enrollment in 170 and 144 is permitted with permission of the department).

Math 175 Analytic Geometry and Calculus II (4 cr)

Differentiation and integration of transcendental functions, integration techniques, general mean value theorem, numerical techniques, and series.

Prereq: Math 170

Math 176 Discrete Mathematics (3 cr)

Induction, set theory, graph theory, number systems, Boolean algebra, and elementary counting.

Prereq: Two yrs high school algebra and sufficiently high score on SAT, ACT, or COMPASS Math Test; or Math 143

Math 204 (s) Special Topics (cr arr)

Math 215 Introduction to Higher Mathematics (3 cr)

Carries no credit after Math 461 or Math 471. The primary goal of this course is to teach students how to read and write mathematical proofs. Topics include logic and proof techniques, as well as fundamental mathematical structures such as sets, relations, functions, and number systems.

Prereq: Math 175 and permission

Math 235 Mathematics for Elementary Teachers I (3 cr)

Mathematical development of arithmetic and problem solving as those subjects are currently taught in elementary schools. Three lec and one 1-hr lab a wk.

Prereq: 1 year of plane geometry, and Math 143 or 137 (or sufficient score on SAT, ACT, or COMPASS Math Test)

Math 236 Mathematics for Elementary Teachers II (3 cr)

Mathematical development of informal geometry, problem solving, and probability and statistics as those subjects are currently taught in elementary schools. Three lec and one 1-hr lab a wk.

Prereq: Math 235

Math 275 Analytic Geometry and Calculus III (3 cr)

Vectors, functions of several variables, and multiple integration.

Prereq: Math 175

Math 299 (s) Directed Study (cr arr)**Math 301 Early Childhood Mathematics (4 cr)**

Focus on the mathematics for early childhood: numbers and operations, algebraic thinking, geometry, measurement, probability and statistics. Emphasis will be placed on reasoning, representation, connections and communication. This course is restricted to students from either the School of Family and Consumer Sciences or the College of Education. This course will not count as a 300 – level mathematics course in any major or minor in the College of Science. Recommended preparation: Stat 150. (Fall Only)

Prereq: One core math course

Math 310 Ordinary Differential Equations (3 cr)

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.

Prereq: Math 175

Math H315 Topics in Pure Mathematics (3 cr)

A topic selected each yr that develops skill and appreciation for theoretical nature of mathematics. (Fall only)

Prereq: Permission of director of University Honors Program

Math 326 Linear Optimization (3 cr)

Geometric solutions, simplex method, duality and revised simplex method, sensitivity, integer programming, applications. Recommended Preparation: Math 175. (Spring, Alt/yr)

Prereq: Math 160 or 170

Math 330 Linear Algebra (3 cr)

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

Prereq: Math 160 or 170

Math 371 Mathematical Physics (3 cr)

See Phys 371.

Math 376 Discrete Mathematics II (3 cr)

Selected topics from discrete mathematics such as graph theory, modeling, and optimization. Recommended for computer science majors. (Spring, Alt/yr)

Prereq: Math 176 or Permission

Math 385 Theory of Computation (3 cr)

Same as CS 385. Mathematical models of computation, including finite automata and Turing machines. (Fall only)

Prereq: Permission

Math 386 Theory of Numbers (3 cr)

Elementary number theory, including divisibility properties, congruences, and Diophantine equations. (Spring only)

Prereq: Math 175 or Permission

Math 388 History of Mathematics (3 cr)

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.

Prereq: Math 175 and 330; or Permission

Math 390 Axiomatic Geometry (3 cr)

Development of Euclidean and hyperbolic geometry using the axiomatic approach. Recommended Preparation: Math 215. (Spring, Alt/yrs)

Prereq: High school geometry and Math 330, or Permission

Math 391 Modern Geometry (3 cr)

Euclidean and non-Euclidean geometries, plus topics chosen from projective, transformational, and computational geometry. Recommended Preparation: Math 215. Spring, Alt/yrs)

Prereq: High School Geometry and Math 330, or Permission

Math 395 Analysis of Algorithms (3 cr)

Same as CS 395. Measures of efficiency; standard methods and examples in the design and analysis of algorithms. (Spring only)

Prereq: Math 175

Math 400 (s) Seminar (cr arr)

Math 404 (s) Special Topics (cr arr)

Math 415 Cryptography (3 cr)

Congruences, Modular Arithmetic, Private-key cryptosystems, Public-key cryptosystems, Applications.

Prereq: Math 330

Math 420 Complex Variables (3 cr)

Complex numbers, elementary functions, derivatives, the residue theorem, conformal mappings, contour integration, infinite series, applications. (Alt/yrs, Spring only)

Prereq: Math 275

Math 426 Discrete Optimization (3 cr)

Optimization on graphs, networks and flows, and related topics. Recommended Preparation: Math 175. (Fall, Alt/yrs)

Math 430 Advanced Linear Algebra (3 cr)

Vector spaces, linear transformations, characteristic polynomial, eigenvectors, Hermitian and unitary operators, inner products, quadratic forms, Jordan canonical form, applications. Recommended Preparation: Math 215.

Prereq: Math 330 or Permission

Math 432 Numerical Linear Algebra (3 cr)

Analysis of efficiency and accuracy of large linear algebra problems; special emphasis on solving linear equations and finding eigenvalues. (Fall, Alt/yrs)

Prereq: Math 275, 330, and knowledge of a computer language

Math 433 Numerical Analysis (3 cr)

Analysis of numerical methods useful in solving applied problems; solution of nonlinear equations, interpolation, numerical differentiation and integration, numerical solution of differential equations. (Spring only)

Prereq: Math 275, 330, and knowledge of a computer language

Math 435 (s) Topics in Applied Mathematics (cr arr)

Topics chosen from fields of current interest in applied mathematics; inquire at the Department of Mathematics for a description of topics for future semesters.

Prereq: Permission

Math 437 Mathematical Biology (3 cr)

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. (Spring, Alt/yrs)

Prereq: Math 310 or Permission

Math ID&WS451 Probability Theory (3 cr) WSU Math 443

Same as Stat 451. Random variables, expectation, special distributions (normal, binomial, exponential, etc.), moment generating functions, law of large numbers, central limit theorem. (Fall only)

Prereq or Coreq: Math 275, Graduate standing, or Permission

Math ID&WS452 Mathematical Statistics (3 cr) WSU Math and Stat 456

Same as Stat 452. Estimation of parameters, confidence intervals, hypothesis testing, likelihood ratio test, sufficient statistics. (Spring only)

Prereq: Math 451 or Permission

Math ID&WS-J453/ID&WS-J538 Stochastic Models (3 cr) WSU Stat 544

Same as Stat J453/J544. Markov chains, stochastic processes, and other stochastic models; applications. Additional projects/assignments reqd for grad cr. (Spring, Alt/yrs)

Prereq: Math 451 or Permission

Math 455 Applied Actuarial Science (1 cr)

Risk problems on the actuarial exam. Graded P/F. (Spring only)

Prereq: Math 451

Math 461 Abstract Algebra (3 cr)

Groups, rings, and fields. (Fall only)

Prereq: Math 215 and Math 330; or Permission

Math 462 Abstract Algebra (3 cr)

Groups, rings, and fields. (Spring only)

Prereq: Math 461

Math 471 Introduction to Analysis 1 (3 cr)

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

Prereq: Math 275, Math 215, or Permission

Math 472 Introduction to Analysis 2 (3 cr)

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

Prereq: Math 471 or Permission

Math 476 Combinatorics (3 cr)

Elementary counting methods, generating functions, recurrence relations, Polya's enumeration, enumeration of graphs, trees, searching, combinatorial algorithms. Recommended Preparation: Math 176, or 215, or 376. (Fall, Alt/yrs)

Prereq: Math 175 and 330

Math 480 Partial Differential Equations (3 cr)

Intro to Fourier analysis, application to solution of partial differential equations; classical partial differential equations of engineering and physics. (Spring, Alt/yrs)

Prereq: Math 310 or Permission

Math 497 (s) Practicum in Tutoring (1 cr, max 2)

Tutorial services performed by advanced students under faculty supervision. Graded P/F.

Prereq: Permission of department

Math 499 (s) Directed Study (cr arr)**Math 500 Master's Research and Thesis (cr arr)****Math 501 (s) Seminar (cr arr)****Math 502 (s) Directed Study (cr arr)****Math 504 (s) Special Topics (cr arr)****Math 505 (s) Professional Development (cr arr)**

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

Prereq: Permission

Math 510 Seminar on College Teaching of Mathematics (1 cr)

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.

Prereq: Permission

Math 513 Problem Solving Through History (3 cr)

Historical study of approaches to solving problems in geometry, number theory, and set theory. This course is specifically designed for the MAT program, and will not satisfy the requirements of other mathematics degree programs.

Math 514 Foundations of Calculus (3 cr)

Real numbers, sequences, topology of the real numbers, continuous functions, differentiation, and integration; emphasis on developing the conceptual understanding needed to teach calculus in secondary school. This course is specifically designed for the MAT program, and will not satisfy the requirements of other mathematics degree programs.

Math 515 Problems in Geometry (3 cr)

Exploration of topics in geometry with emphasis on developing geometric reasoning and problem solving. This course is specifically designed for the MAT program, and will not satisfy the requirements of other mathematics degree programs.

Math 516 Groups and Symmetry (3 cr)

Exploration of groups, symmetry, and permutations. This course is specifically designed for the MAT program, and will not satisfy the requirements of other mathematics degree programs.

Math 519 (s) Special Topics (cr arr)

Special topics of interest to mathematics teachers. This course is specifically designed for the MAT program, and will not satisfy the requirements of other mathematics degree programs.

Prereq: Permission

Math ID&WS521 Topology (3 cr) WSU Math 525

Basic concepts of point set and algebraic topology. (Fall, Alt/yrs)

Math 522 Topology (3 cr)

Basic concepts of point set and algebraic topology. (Spring, Alt/yrs)

Math 523 Algebraic Topology (3 cr)

Basic homotopy theory, covering spaces, homology theory, and applications. (Alt/yrs)

Math 524 Algebraic Topology (3 cr)

Basic homotopy theory, covering spaces, homology theory, and applications. (Alt/yrs)

Math 525 (s) Seminar in Topology (1-3 cr, max arr)

Current literature.

Math 526 (s) Topics in Topology (1-3 cr, max 12)**Math 528 Differentiable Manifolds (3 cr)**

Fundamentals of smooth manifolds, tangent spaces, vector fields, Lie groups, integration on manifolds, and applications.

Prereq: Math 521, and 471

Math ID&WS531 Complex Variables (3 cr) WSU Math 503

Theory of functions of a complex variable. (Spring, Alt/yrs)

Math 535 Real Variables (3 cr)

Measure and integration theory for functions of one or several variables. (Alt/yrs, fall only)

Math 536 Probability Theory (3 cr)

Random variables, characteristic functions, convergence theorems, central limit theorem, conditional probability, and stochastic processes as developed from a measure theoretic basis. (Spring, Alt/yrs)

Prereq: Math 535 or Permission

Math ID&WS538 Stochastic Models (3 cr)

See Math J453/J538.

Math ID&WS539 Theory of Ordinary Differential Equations (3 cr) WSU Math 512

Existence, uniqueness, and stability of solutions of first-order systems; other topics. (Fall, Alt/yrs)

Math 540 Partial Differential Equations (3 cr)

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.

Prereq: Math 539 or Permission

Math ID&WS541 (s) Seminar in Analysis (1-3 cr, max arr) WSU Math 581

Current literature.

Math WS543 Approximation Theory (3 cr) WSU Math 543**Math WS544 Advanced Matrix Computations (3 cr) WSU Math 544****Math WS547 Numerical Analysis of Elliptic PDE's (3 cr) WSU Math 546****Math 554 Advanced Topics in Geometry (3 cr)**

(Alt/yrs)

Math 555 Groups and Fields I (3 cr)

Groups, fields, polynomials, Galois theory, representation theory. (Fall, alt/yrs)

Prereq: Math 461 and Math 462; or equivalent

Math 556 Groups and Fields II (3 cr)

Groups, fields, polynomials, Galois theory, representation theory. (Spring, alt/yrs)

Prereq: Math 555 or Permission

Math 557 Ring Theory (3 cr)

Rings, ideals, modules, commutative algebra. (Fall, alt/yrs)

Prereq: Math 461 and Math 462; or equivalent

Math 558 Introduction to Algebraic Geometry (3 cr)

Affine and projective varieties, morphisms, functions on varieties, birational maps, applications. (Spring, alt/yrs)

Prereq: Math 557 or Permission

Math ID&WS561 (s) Seminar in Algebra (1-3 cr, max arr) WSU Math 582

Current literature.

Math ID&WS563 Mathematical Genetics (3 cr) WSU Math 563 and Biol 563

Same as 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. (Fall, Alt/yrs)

Prereq: Math 160 or Math 170 and Stat 251 or Stat 301

Math 571 Functional Analysis (3 cr)

Linear topological spaces and linear operators. (Fall, Alt/yrs)

Prereq: Math 536

Math 572 Functional Analysis (3 cr)

Linear topological spaces and linear operators. (Spring, Alt/yrs)

Prereq: Math 536

Math 575 Graph Theory (3 cr)

Basic concepts and theorems; topics include trees and connectivity, eulerian and hamiltonian graphs, graph colorings, matchings, graph decomposition, and extremal graph theory. (Fall, Alt/yrs)

Math 576 Graph Theory (3 cr)

Basic concepts and theorems; topics include trees and connectivity, eulerian and hamiltonian graphs, graph colorings, matchings, graph decomposition, and extremal graph theory. (Spring, Alt/yrs)

Math 578 Combinatorial Optimization (3 cr)

Optimization problems on graphs, network flow problems, complexity analysis of algorithmic solutions, and related topics. (Fall, Alt/yrs)

Math 581 (s) Seminar in Combinatorics (1-3 cr, max arr)

Math WS583 Seminar in Applied Mathematics (3 cr, max arr) WSU Math 583

Math 599 (s) Non-thesis Master's Research (cr arr)

Research not directly related to a thesis or dissertation.

Prereq: Permission

Math 600 Doctoral Research and Dissertation (cr arr)