

MATHEMATICS (MATH)

Courses

MATH 001. Elementary College Algebra. 3 Credits.

Fundamental operations and study of high school topics: fractions; exponents; radicals; linear and quadratic equations; proportion; progressions; binomial theorem. No University credit given for this course. Prerequisite: One year of high school algebra.

MATH 009. College Algebra. 3 Credits.

Sets, relations, functions with particular attention to properties of algebraic, exponential, logarithmic functions, their graphs and applications in preparation for MATH 019. May not be taken for credit concurrently with, or following receipt of, credit for any mathematics course numbered MATH 019 or above. Pre/co-requisites: Two years of secondary school algebra; one year of secondary school geometry.

MATH 010. Pre-Calculus Mathematics. 3 Credits.

Skills in working with numerical, algebraic, and trigonometric expressions are developed in preparation for MATH 021. May not be taken for credit concurrently with, or following receipt of, credit for any mathematics course numbered MATH 019 or above. Prerequisite: Two years of secondary school algebra; one year of secondary school geometry.

MATH 015. Elementary School Math. 3 Credits.

Operations with real numbers: decimals, fractions, percents, integers. Set operations, Venn diagrams, algebra, and problem solving provide background for future instruction in elementary/middle school mathematics. Prerequisite: Three years of secondary school math.

MATH 016. Fund Concepts Elem School Math. 3 Credits.

Topics include geometry, measurement, probability, statistics, algebra, number theory, and problem solving to provide background for future instruction in elementary and middle school mathematics. Prerequisite: Three years of secondary school math.

MATH 017. Applications of Finite Math. 3 Credits.

Introduction to mathematics of finite systems with applications, such as probability, statistics, graph theory, fair division and apportionment problems, voting systems. Prerequisites: Two years of secondary school algebra or MATH 009 or MATH 010.

MATH 018. Basic Mathematics. 3 Credits.

Data, statistics, modeling, algebra, word problems, calculus. Students who do well in the algebra section may continue with MATH 019 or MATH 021. Prerequisite: three years of high school math. No credit for CEMS students.

MATH 019. Fundamentals of Calculus I. 3 Credits.

Introduction to limits and differential calculus with a wide variety of applications. Students interested in intensive use of mathematics should take MATH 021. Credit not given for more than one of the courses MATH 019, MATH 021 unless followed by MATH 022. See MATH 023. Prerequisite: MATH 009 or MATH 010, or sufficiently strong background in secondary school algebra and geometry.

MATH 020. Fundamentals of Calculus II. 3 Credits.

Introduction to integral calculus with a wide variety of applications. A student who completes MATH 020 may be admitted to MATH 022; however, MATH 019, MATH 023 is preferable to MATH 019, MATH 021, MATH 022 or MATH 019, MATH 020, MATH 022. Prerequisite: MATH 019.

MATH 021. Calculus I. 4 Credits.

Introduction to calculus of functions of one variable including: limits, continuity, techniques and applications of differentiation and integration. Prerequisites: MATH 010, or strong background in secondary school algebra and trigonometry. Credit not given for more than one course in the pair MATH 019, MATH 021 unless followed by MATH 022 or MATH 023.

MATH 022. Calculus II. 4 Credits.

Techniques and applications of integration. Polar coordinates, Taylor polynomials, sequences and series, power series. Prerequisite: MATH 021. Credit will not be given for both MATH 022 and MATH 023.

MATH 023. Transitional Calculus. 5 Credits.

Intended to make the transition from a B or better in MATH 019 to MATH 121. Topics are similar to MATH 022 but recognizing different backgrounds of students in MATH 019 versus MATH 021. Prerequisite: B or better in MATH 019. Credit will not be given for both MATH 022 and MATH 023.

MATH 052. Fundamentals of Mathematics. 3 Credits.

Emphasizing proofs, fundamental mathematical concepts and techniques are investigated within the context of number theory and other topics. Prerequisite: MATH 021 or MATH 023. Credit not given for both MATH 052 and MATH 054.

MATH 054. Fund of Math of Computation. 3 Credits.

Introduction to mathematical theory and techniques underlying computer science. Co-requisite: MATH 019 or MATH 021.

MATH 090. Internship. 1-3 Credits.

An on-site supervised work experience combined with a structured academic learning plan directed by a faculty member or a faculty-staff team in which a faculty member is the instructor of record, for which academic credit is awarded. Offered at department discretion.

MATH 095. Special Topics. 1-18 Credits.

Introductory courses or seminars on topics beyond the scope of existing departmental offerings. See Schedule of Courses for specific titles. Prerequisite: Instructor permission.

MATH 121. Calculus III. 4 Credits.

Vectors, vector-valued functions. Calculus of functions of several variables: partial derivatives, gradient, divergence, curl, multiple integrals, line integrals, Stokes' and Green's theorems. Prerequisite: MATH 022 or MATH 023.

MATH 122. Applied Linear Algebra. 3 Credits.

Vectors, matrices, linear independence, vector spaces (with focus on real n -space), determinants, linear transformations, eigenvalues and eigenvectors. Applications from engineering and the sciences incorporated through required computer assignments. Credit not given for both MATH 122 and MATH 124. Prerequisite: MATH 022 or MATH 023.

MATH 124. Linear Algebra. 3 Credits.

Matrices, linear dependence, vector spaces, linear transformations, characteristic equations and applications. Credit not given for both MATH 122 and MATH 124. Co-requisite: MATH 121.

MATH 141. Real Analysis in One Variable. 3 Credits.

Principles of analysis in one variable. Heine-Borel and Bolzano-Weierstrass theorems; rigorous development of differential and integral calculus; infinite sequences and series of functions. May not be taken concurrently with or after MATH 241. Pre/co-requisite: MATH 052.

MATH 151. Groups and Rings. 3 Credits.

An introduction to the basic concepts of abstract algebra emphasizing examples, including modular arithmetic, symmetric groups, cyclic groups, polynomial rings, homomorphisms, and isomorphisms. May not be taken concurrently with or after MATH 251. Prerequisite: MATH 052.

MATH 161. Development of Mathematics. 3 Credits.

Historical development of mathematical sciences emphasizing interrelations among them. Individual assignments correspond to background and interests of students. Prerequisite: Nine hours of college mathematics.

MATH 167. Physical Chemistry Preparation. 1 Credit.

Review of relevant mathematical and physical concepts as applied to physical chemistry. Credit cannot be obtained for both MATH 167 and MATH 121. Not available for credit for E&M students. Prerequisite: MATH 022; CHEM 032 or CHEM 036. Cross-listed with: CHEM 167.

MATH 168. Mathematics of Biology. 0 or 3 Credits.

Discrete biological processes: nonlinear difference equations. Continuous processes: ordinary differential equations, phase plane methods, quantitative solutions. Applications: population dynamics, epidemiology, Michaelis-Menten kinetics, autocatalysis, muscle contraction. Includes a lab. May not be taken concurrently with or after MATH 268. Pre/co-requisites: MATH 022 or MATH 023; MATH 122 or MATH 124. Cross-listed with: BIOL 168.

MATH 173. Basic Combinatorial Theory. 3 Credits.

Introduction to basic combinatorial principles emphasizing problem-solving techniques. Enumeration, generating functions, Fibonacci numbers, pigeonhole principle, inclusion-exclusion, and graph theory. Prerequisites: MATH 052 or MATH 054 or CS 064.

MATH 183. Fundamentals of Financial Math. 3 Credits.

Students will be introduced to the basic ideas and algebraic structures of interest theory, time-value of money, annuities, loans, bonds, cash-flows and portfolios. Prerequisites: MATH 020, MATH 022 or MATH 023.

MATH 190. Internship. 1-18 Credits.

An on-site supervised work experience combined with a structured academic learning plan directed by a faculty member or a faculty-staff team in which a faculty member is the instructor of record, for which academic credit is awarded. Offered at department discretion.

MATH 192. Independent Study. 1-18 Credits.

A course which is tailored to fit the interests of a specific student, which occurs outside the traditional classroom/laboratory setting? under the supervision of a faculty member, for which credit is awarded. Offered at department discretion. Prerequisite: Junior/Senior standing; approval of Department Chair.

MATH 193. College Honors. 1-3 Credits.**MATH 194. College Honors. 1-3 Credits.****MATH 195. Special Topics. 1-18 Credits.**

See Schedule of Courses for specific titles.

MATH 197. Teaching Assistantship. 1-3 Credits.

Undergraduate student service as a teaching assistant, usually in an introductory level course in the discipline, for which credit is awarded. Offered at department discretion.

MATH 198. Undergraduate Research. 1-18 Credits.

Undergraduate student work on individual or small team research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

MATH 207. Probability Theory. 3 Credits.

Distributions of random variables and functions of random variables. Expectations, stochastic independence, sampling and limiting distributions (central limit theorems). Concepts of random number generation. Prerequisites: MATH 121; STAT 151 or STAT 153 recommended. Cross-listed with: STAT 251, BIOS 251.

MATH 221. Deterministic Models in Operations Research. 3 Credits.

The linear programming problem. Simplex algorithm, dual problem, sensitivity analysis, goal programming. Dynamic programming and network problems. Prerequisites: MATH 122 or MATH 124; MATH 121 desirable. Cross-listed with: CSYS 221.

MATH 222. Stochastic Models in Operations Research. 3 Credits.

Development and solution of some typical stochastic models. Markov chains, queueing problems, inventory models, and dynamic programming under uncertainty. Prerequisite: MATH 207, STAT 151.

MATH 230. Ordinary Differential Equation. 3 Credits.

Solutions of linear ordinary differential equations, the Laplace transformation, and series solutions of differential equations. Prerequisite: MATH 121. Corequisite: MATH 122 or MATH 124. Credit not granted for more than one of the courses MATH 230 or MATH 271.

MATH 235. Mathematical Models & Analysis. 3 Credits.

Techniques of Undergraduate calculus and linear algebra are applied for mathematical analysis of models of natural and human-created phenomena. Students are coached to give presentations. Prerequisites: MATH 121; MATH 122 or MATH 124 or MATH 230 or MATH 271.

MATH 236. Calculus of Variations. 3 Credits.

Necessary conditions of Euler, Legendre, Weierstrass, and Jacobi for minimizing integrals. Sufficiency proofs. Variation and eigenvalue problems. Hamilton-Jacobi equations. Prerequisite: MATH 230.

MATH 237. Intro to Numerical Analysis. 3 Credits.

Error analysis, root-finding, interpolation, least squares, quadrature, linear equations, numerical solution of ordinary differential equations. Prerequisites: MATH 121; MATH 122, MATH 124 or MATH 271; knowledge of computer programming.

MATH 238. Applied Computational Methods. 3 Credits.

Direct and iterative methods for solving linear systems; numerical solution of ordinary and partial differential equations. Focus will be on application of numerical methods. Prerequisites: MATH 121; MATH 122 or MATH 124 or MATH 271.

MATH 240. Fourier Series & Integral Trans. 3 Credits.

Fourier series, orthogonal functions, integral transforms and boundary value problems. Prerequisite: MATH 230 or MATH 271.

MATH 241. Anyl in Several Real Vars I. 3 Credits.

Properties of the real numbers, basic topology of metric spaces, infinite sequences and series, continuity. Prerequisites: MATH 052; MATH 121; MATH 122 or MATH 124.

MATH 242. Anyl Several Real Variables II. 3 Credits.

Differentiation and integration in n -space, uniform convergence of functions, fundamental theorem of calculus, inverse and implicit function theorems. Prerequisite: MATH 241.

MATH 251. Abstract Algebra I. 3 Credits.

Basic theory of groups, rings, fields, homomorphisms, and isomorphisms. Prerequisite: MATH 052; MATH 122 or MATH 124.

MATH 252. Abstract Algebra II. 3 Credits.

Modules, vector spaces, linear transformations, rational and Jordan canonical forms. Finite fields, field extensions, and Galois theory leading to the insolvability of quintic equations. Prerequisite: MATH 251.

MATH 255. Elementary Number Theory. 3 Credits.

Divisibility, prime numbers, Diophantine equations, congruence of numbers, and methods of solving congruences. Prerequisite: MATH 052 or MATH 054.

MATH 257. Topics in Group Theory. 3 Credits.

Topics may include abstract group theory, representation theory, classical groups, Lie groups. Prerequisite: MATH 251.

MATH 260. Foundations of Geometry. 3 Credits.

Geometry as an axiomatic science; various non-Euclidean geometries; relationships existing between Euclidean plane geometry and other geometries; invariant properties. Prerequisite: MATH 022 and either MATH 052 or MATH 054.

MATH 264. Vector Analysis. 3 Credits.

Gradient, curl and divergence, Green, Gauss, and Stokes Theorems, applications to physics, tensor analysis. PrerequisiteS: MATH 121; MATH 122 or MATH 124 or MATH 271.

MATH 266. Chaos, Fractals & Dynamical Syst. 3 Credits.

Discrete and continuous dynamical systems, Julia sets, the Mandelbrot set, period doubling, renormalization, Henon map, phase plane analysis and Lorenz equations. Co-requisite: MATH 271 or MATH 230. Cross-listed with: CSYS 266.

MATH 268. Mathematical Biology & Ecology. 3 Credits.

Mathematical modeling in the life sciences. Topics include population modeling, dynamics of infectious diseases, reaction kinetics, wave phenomena in biology, and biological pattern formation. Prerequisite: MATH 122 or MATH 124; MATH 230; or Instructor permission. Cross-listed with: CSYS 268.

MATH 271. Adv Engineering Mathematics. 3 Credits.

Differential equations and linear algebra, including linear ordinary differential equations, Laplace transforms, matrix theory, and systems of differential equations. Examples from engineering and physical sciences. Prerequisite: MATH 121. Credit not granted for both MATH 230 and MATH 271. No credit for Mathematics majors.

MATH 272. Applied Analysis. 3 Credits.

Basics of Fourier series, partial differential equations of mathematical physics, functions of a complex variable, Cauchy's theorem, integral formula. Prerequisites: MATH 230 or MATH 271.

MATH 273. Combinatorial Graph Theory. 3 Credits.

Paths and trees, connectivity, Eulerian and Hamiltonian cycles, matchings, edge and vertex colorings, planar graphs, Euler's formula and the Four Color Theorem, networks. Prerequisite: MATH 052 or MATH 054.

MATH 274. Numerical Linear Algebra. 3 Credits.

Direct and iterative methods for solving linear equations, least square factorization methods, eigenvalue computations, ill-conditioning and stability. Prerequisite: MATH 237.

MATH 283. Junior-Senior Seminar. 1 Credit.

Students required to give presentations on selected topics.

MATH 290. Internship. 1-18 Credits.

An on-site supervised work experience combined with a structured academic learning plan directed by a faculty member or a faculty-staff team in which a faculty member is the instructor of record, for which academic credit is awarded. Offered at department discretion.

MATH 292. Independent Study. 1-18 Credits.

A course which is tailored to fit the interests of a specific student, which occurs outside the traditional classroom/laboratory setting under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

MATH 293. Undergraduate Honors Thesis. 3-4 Credits.

Program of reading and research culminating in written thesis and oral presentation. Honors notation appears on transcript and Commencement Program. Contact department chairperson for procedures.

MATH 294. Undergraduate Honors Thesis. 3-4 Credits.

Program of reading and research culminating in written thesis and oral presentation. Honors notation appears on transcript and Commencement Program. Contact department chairperson for procedures.

MATH 295. Special Topics. 1-18 Credits.

For advanced students in the indicated fields. Lectures, reports, and directed readings on advanced topics. Credit as arranged. Offered as occasion warrants.

MATH 297. Teaching Assistantship. 1-3 Credits.

Undergraduate student service as a teaching assistant, usually in an introductory level course in the discipline, for which credit is awarded. Offered at department discretion.

MATH 298. Undergraduate Research. 1-18 Credits.

Undergraduate student work on individual or small team research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.