

MATH 1105 (3)

Intermediate Algebra

An intermediate algebra course connecting the real world to mathematics. Topics include: factoring polynomials and solving equations by factoring, rational expressions and equations, graphing functions, systems of equations, absolute value equations, inequalities, radical expressions and functions, quadratic equations and their graphs, and quadratic formula. Students may enroll concurrently in MATH 1106.

Prerequisite: An ACT Math score of at least 18, an SAT Quantitative score of at least 450, a grade of C- or better in MATH 1101, or an appropriate score on the math placement test.

MATH 1116 (3)

Problem Solving

This course is designed to improve students' problem-solving skills by investigating both traditional and non-traditional mathematics problems. Reasoning, reflection upon the problem-solving process, and the elements of effective thinking will be emphasized. Students will write and present their ideas both orally and visually. There will also be real-world applications of mathematical problem solving to games and puzzles, the infinite, and the arts. This course will be taught in the style of inquiry-based learning. *Prerequisite: An ACT Math score of at least 21, an SAT Quantitative score of at least 510, a grade of C- or better in MATH 1105, or an appropriate score on the math placement test.*

MATH 1123 (3)

Statistics

This course provides an introduction to descriptive and inferential statistics. Topics include describing, summarizing, and displaying data; using sample statistics to estimate population parameters; evaluating hypothesis using confidence levels with application to the physical and social sciences; logically drawing conclusions based on statistical procedures; and quantifying the possibility of error and bias.

Prerequisite: An ACT Math score of at least 21, an SAT Quantitative score of at least 510, a grade of C- or better in MATH 1105, or an appropriate score on the math placement test.

MATH 1130 (3)

Pre-Calculus I

This course covers mathematical topics that prepare students for higher-level mathematics courses. Topics include: functions and their properties, polynomial and rational functions and their graphs, transformation method of graphing functions, exponential and logarithmic functions and equations, right-triangle trigonometry, an introduction to trigonometric functions and their graphs, solving systems of inequalities, and solving systems of equations. Optional topics: matrices, determinants and Cramer's rule, linear programming, fundamental counting principle, permutations and combinations, and an introduction to probability. *Prerequisite: An ACT Math score of at least 21, an SAT Quantitative score of at least 510, a grade of C- or better in MATH 1105, or an appropriate score on the math placement test.*

MATH 1140 (3)**Pre-Calculus II**

This course is a continuation of MATH 1130 and covers further mathematical topics that prepare students for higher level mathematics courses. Course topics include: a complete development of trigonometry including trigonometric functions and their identities; solving trigonometric equations, applications of trigonometry to vectors; polar coordinates, and polar form of complex numbers; rectangular form and polar form of conic sections; matrices and matrix formulation of solution of systems of equations; determinants and Cramer's rule; introduction to sequences and series; and the binomial theorem.

Prerequisite: A grade of C- or better in MATH 1130 or advisor approval.

MATH 1150 (3)**Pre-Calculus I and II Accelerated**

A course for well-qualified students who are prepared to complete the pre-calculus sequence in one term. The course includes all the topics covered in Pre-Calculus I, MATH 1130, and Pre-Calculus II, MATH 1140, but is presented in one term.

Prerequisite: A grade of A in MATH 1105, a grade of C or better in MATH 1130, an ACT Math score of at least 24, an SAT Quantitative score of at least 570, or an appropriate score on a placement test.

MATH 1234 (3)**Introduction to Cryptology**

This course gives an historical introduction to cryptology, the science of making and breaking secret codes. It begins with the oldest recorded codes, taken from hieroglyphic engravings, and ends with the encryption schemes used to maintain privacy during internet credit card transactions. Since secret codes are based on mathematical ideas, each new encryption method discussed in this course leads to the study of new mathematical ideas and results. Topics covered include basic modular arithmetic, primes and divisors, permutations, and elementary statistics. This course will also cover the social and historical aspects associated to cryptology.

Prerequisite: An ACT Math score of at least 21, an SAT Quantitative score of at least 510, a grade of C- or better in MATH 1105, or an appropriate score on the math placement test.

MATH 2007 (3)**Mathematics Across the Ages**

A survey of the historical development of mathematical thought from ancient times to the present. Possible topics include: Babylonian, Egyptian, Greek, Chinese, Hindu, and Arabian mathematics; European mathematics in the middle- ages and the Renaissance; and the development of calculus, number theory, abstract algebra, non-Euclidean geometry, set theory, and information theory.

Prerequisite: An ACT Math score of at least 24, an SAT Quantitative score of at least 570, a grade of C- or better in MATH 1130, or an appropriate score on the math placement test.

MATH 2214 (3)**Calculus I**

A course in single variable calculus which emphasizes limit, continuity, derivative, and integral. Primary focus is on the derivative with an introduction to the integral and elementary applications of the integral. Differentiation topics include: chain rule, implicit differentiation, curve sketching, and maxima and minima problems. Integration topics include: fundamental theorem of calculus, method of substitution, area between curves, and volumes of revolution. *Prerequisite: An ACT Math score of at least 26, an SAT Quantitative score of at least 620, a grade of C- or better in MATH 1140 or 1150, or an appropriate score on the math placement test.*

MATH 2215 (3)**Calculus II**

A continuation of Calculus I, completing the development of the integral. Integration topics include: integration by parts, trigonometric substitution, method of partial fractions, length of curves, surfaces, and volumes of revolutions. Other topics include: infinite series, tests of convergence; power series, radius of convergence, and Taylor's series. Other topics may include calculus of conic sections, vector algebra, and scalar and vector product. *Prerequisite: MATH 2214 or advisor approval.*

MATH 2216 (3)**Calculus III**

A course in calculus of several variables. The course begins with vector algebra, scalar and vector product, and elementary applications of vectors. Emphasis is placed on differentiation and integration of functions of several variables with peripheral focus on limits and continuity. Differentiation topics include: partial derivative, directional derivative, chain rule formula, gradient, maxima and minima problems, Lagrange multipliers, divergence, and curl. Integration topics include: iterated integrals in rectangular, polar, and spherical coordinates; line integrals; Green's theorem; divergence theorem; and Stoke's theorem. *Prerequisite: MATH 2215.*

MATH 2220 (3)**Proof Writing**

An introduction to proof writing and mathematical logic covering sentential and first order logic, introduction to sets, introduction to formal proofs, and practical proof writing for a working mathematician.

Prerequisite: An ACT Math score of at least 24, an SAT Quantitative score of at least 570, a grade of C- or better in MATH 1130, or an appropriate score on the math placement test.

MATH 2326 (3)**Mathematics for Decision-Making**

A course developing the quantitative skills necessary for the effective formulation and solution of problems in business, management, economics, and the social and life sciences. Topics include: probability and probability distributions, functions and their graphs, differentiation and its application to max-min problems, linear programming, network models, project management with PERT-CPM, and simulation. *Prerequisite: MATH 1123; MATH 1130 or higher.*

MATH 3110 (3)**Foundations of Mathematical Logic and Applications**

A course in mathematical logic covers proof theory, model theory, and the theory of decidability. Topics include sentential logic, First order logic, deductive calculus, completeness and soundness theorems, model theory, isomorphisms, compactness theorem, and Godel's incompleteness theorem, applications to theoretical computer science, and complexity theory. *Prerequisite: CSCI 1301, MATH 2220, 3301*, or consent of instructor. (*May be taken concurrently).*

MATH 3220 (3)**College Geometry**

This course provides geometry content and process for those planning to become secondary math teachers. The course is also appropriate for other mathematics majors. Included are activities and discussions in inductive and deductive reasoning in Euclidean geometry, classical geometry with constructions, transformations, dynamical geometry software, non-Euclidean geometries, three-dimensional geometry, spatial reasoning, and miscellaneous topics. *Prerequisite: MATH 2215.*

MATH 3234 (3)**Mathematical Cryptology**

This course gives a mathematical introduction to cryptology, the art and science of making and breaking secret codes. It begins with the oldest recorded codes and ends with the encryption schemes used to maintain privacy during internet credit card transactions. Topics covered include the classical monoalphabetic ciphers and their cryptanalysis; polyalphabetic ciphers and their cryptanalysis; perfect cipher systems; and public-key cryptology, including Diffie-Hellman key exchange, RSA, Knapsack codes, and anonymity. The mathematical subjects include permutations, modular arithmetic, statistics, recurrence relations, and elementary number theoretic results.

Prerequisite: MATH 2214 (Calculus I) or higher or consent of instructor.

MATH 3240 (3)**Math Concepts for Elementary Teachers**

A review of the central concepts, tools of inquiry, and structures of the discipline of mathematics so that elementary teachers can create learning experiences that make aspects of the subject matter meaningful for students.

Prerequisite: MATH 1115.

MATH 3301 (3)**Discrete Mathematics**

This course focuses on the theory and application of mathematical principles critical to the computing sciences. Students study and apply key concepts in topics such as set theory, combinatorics, language and grammars, propositional and quantifier logic, Boolean functions and circuit design, growth of functions and big-O notation, time complexity of algorithms, mathematical induction and program correctness, recursive definitions and recursive algorithms, and solving recurrence relations.

Prerequisite: MATH 1130, 2220, or consent of instructor.

MATH 3302 (3)**Elementary Number Theory**

Topics covered include prime and composite integers; factorization; divisibility; number theoretic functions; Diophantine equations; congruence of integers; quadratic reciprocity; mathematical inductions; cryptography; Pythagorean triples; and real, complex and p-adic numbers. *Prerequisite: MATH 2215; or MATH 2214 and 3301. Undergraduate standing.*

MATH 3305 (3)**Linear Algebra**

Elementary linear algebra with applications in the sciences and to computers and economics. Topics include: systems of linear equations; matrix theory, determinants and eigenvalues; geometry of Euclidean n-space; abstract vector spaces, bases, linear independence, and spanning sets; linear transformations, null space, and range; diagonalization of matrices; eigenvalues and eigenvectors of symmetric matrices; quadratic forms, inner products; and orthonormalization. *Prerequisite: MATH 2214 or higher except MATH 2326 or consent of instructor .*

MATH 3307 (3)**Differential Equations**

A course in ordinary differential equations utilizing concepts and techniques from Calculus I and II and linear algebra. Emphasis is on solution to higher-order linear equations. First order topics include: separation of variables, exact equations, integrating factors, and homogenous and non-homogenous systems with applications to networks. Higher order topics include: a detailed study of solutions to second order linear equations by reduction of order, variation of parameters, and series solutions; linear independence of solutions, the Wronskian, general solution to linear homogenous and non-homogenous equations, and linear equations with constant coefficients and the Laplace transform method. *Prerequisite: MATH 2214 or higher except MATH 2326/3301. Recommended: MATH 3305.*

MATH 3316 (3)**Problem Solving for Mathematics Teaching**

This course is designed to improve students' problem-solving skills for solving both traditional and non-traditional mathematics problems. Reasoning, communicating mathematics, mathematical representations, and connections between various mathematical topics will be emphasized. *Prerequisite: MATH 2214.*

MATH 3320 (3)**Set Theory**

To provide students with a solid background in set theory and to develop mathematical sophistication in general, this is a course in which covers ZF (Zermelo Frankel axioms) and ZFC (ZF + the axiom of choice), DeMorgan's laws, Power SetS, Set Algebra, Zorn's lemma and other equivalent versions of AC, equivalence relations, well orderings and partial orderings, bijections, Russell's paradox, con-final maps, mathematical induction, transfinite induction, ordinals and cardinals, ordinal and cardinal arithmetic, the continuum hypothesis, and the constructible universe.

Prerequisite: MATH 2220, 3110, 3301, or consent of instructor.

MATH 3330 (3)**Abstract Algebra**

An introduction to algebra as a deductive system. Topics include: complex numbers, well ordering, groups, cyclic groups, permutation groups, rings, equivalence relations, polynomial rings, division algorithm, unique factorization, zeros of polynomials.

Prerequisite: MATH 3305 or consent of instructor. MATH 2220 is strongly suggested but not required.

MATH 3450 (3)**Real Analysis**

An introduction to the theory of real analysis. Topics include: completeness of the real numbers, basic topology of the real numbers, continuous functions and compactness, sequences and series, limits, derivatives, mean value theorems, the Riemann integral, Taylor's formula, power series, uniform convergence.

Prerequisite: MATH 2215 or consent of instructor. MATH 2220 is strongly suggested but not required.

MATH 3460 (3)**Probability**

Discrete and continuous probability with applications. Topics include: finite sample spaces, combinations and permutations, conditional probability, independent events, discrete random variables, continuous random variables, functions of random variables, higher-dimensional random variables, expectation, variance, correlation coefficient, generating function, reproductive properties, sequences of random variables, law of large numbers, central limit theorem.

Prerequisite: MATH 2215 or consent of instructor.

MATH 3470 (3)**Applied Statistics**

This course is an introduction to the mathematical theory of statistics. Topics covered include discrete and continuous distributions, tests of hypotheses, estimation, analysis of variance, regression and correlation, sequential analysis, and rank order statistics.

Prerequisite: MATH 2214 or higher except MATH 2326/3301, or consent of instructor. MATH 1123 is strongly suggested but not required.

MATH 3500 (3)**Numerical Methods**

The purpose of numerical analysis is two-fold: (1) to find acceptable approximate solutions when exact solutions are either impossible or impractical, and (2) to devise alternate methods of solution better suited to the capabilities of computers. Topics for this course include: elements of error analysis, real roots of an equation, polynomial approximation by finite difference and least square methods, interpolation, quadrature, numerical solution of ordinary differential equations, and numerical solutions of systems of linear equations. Students should expect to program a computer and use a graphing calculator.

Prerequisite: CHEM 2050; CSCI 2911; MATH 3305 and 3307; PHYS 2052. (*May be taken concurrently.)*

MATH 4301 (3)**Combinatorics and Graph Theory**

This course explains how to reason and model using enumerative combinatorics and applied graph theory. It also stresses the systematic analysis of different possibilities, exploration of the logical structure of a problem, and ingenuity. Combinatorial reasoning underlies all analysis of computer systems. It plays a similar role in discrete operations research problems and infinite probability. Topics covered include generating functions, set partitions, recurrence relations, inclusion-exclusion, trees, graph connectivity, independence, and graph colorings. Additional topics will be chosen from Ramsey theory, planarity, matchings, Polya's enumeration formula, and Hamiltonian and Eulerian graphs.

Prerequisite: MATH 3301.

MATH 4450 (3)**Complex Analysis**

Complex Analysis is the theory and applications of analytic functions of a single complex variable. Topics include: Taylor and Laurent series representation, Cauchy's integral theorem and formula, residue calculus, harmonic functions, zeros and poles, counting theorem, conformal mappings, linear functional transformations, Schwartz-Christoffel transformation, Laplace's equation, Poisson's equation, Neumann problems, and the Fourier representation theorem.

Prerequisite: MATH 2216, or consent of instructor.

MATH 4470 (3)**Methods of Applied Mathematics I**

Applied Mathematics I is the first course in a course sequence exploring analytical methods of solution in various mathematical and scientific areas. The course may review a variety of topics: solution of ordinary differential equations, solution of systems of ordinary differential equations, Laplace transform method, methods of applied linear algebra, and vector calculus. New topics presented in this class include: complex variables, Fourier transform, partial differential equations, Laplace's equation, and equations of motion and fluids.

Prerequisite: MATH 3307, PHYS 2052, or consent of instructor. (*may be taken concurrently). MATH 3216 is recommended.*

MATH 4471 (3)**Methods of Applied Mathematics II**

Applied Mathematics II is the second course in a course sequence exploring numerical solutions in various mathematical and scientific areas. Topics for this course include: elements of error analysis, real roots of an equation, polynomial approximation by finite difference and least square methods, interpolation, quadrature, numerical solution of ordinary differential equations, and numerical solutions of systems of linear equations. Additional topics explore partial differential equations and finite-element analysis.

Prerequisite: CSCI 2911; MATH 3305, 4470; or consent of instructor.

MATH 4475 (3)**Modeling and Simulation**

Material includes the advanced study of mathematical techniques, algorithms, and applications applicable to assist and improve decision-making in the management and behavioral sciences. The course focuses on both the techniques and the use of the computer in facilitating application of these techniques.

Prerequisite: CSCI 2912; MATH 1123 and 2214.

MATH 4920 (3)**Math Education Practicum**

This course combines the study of mathematics problem-solving with practical classroom experience. Students will investigate the issues of teaching mathematics while gaining practical experience as tutors. Students will follow the progress of their own students in mathematics labs.

Prerequisite: MATH 3316, or any other MATH 3000-level class, or consent of instructor.

MATH 3990 Nonpaid Internship See Internship Section.

MATH 4210 (3)**Topology**

An introduction to the basic concepts of topology in the setting of metric spaces and more general topological spaces. Topics include completeness, compactness, connectedness, continuous functions and continuity in terms of nets, Hausdorff spaces, product spaces, metric spaces, Tychonoff theorem, Bolzano-Weierstrass theorem, Stone-Weierstrass theorem, and the Baire category theorem.

Prerequisite: MATH 2215; and MATH 3310 or higher; or consent of instructor.

This course combines the study of mathematics problem-solving with practical classroom experience. Students will investigate the issues of teaching mathematics while gaining practical experience as tutors. Students will follow the progress of their own students in mathematics labs.

Prerequisite: MATH 3316, or any other MATH 3000-level class, or consent of instructor.

Math 4940 (3)**Research in Logic or Pure Mathematics**

Math 4940 is a class where seniors who have excelled in mathematics can be mentored by individual faculty members. Exceptional students will work closely with a faculty member who will guide them in advanced topics and mathematical research. The class utilizes the best aspects of Mentoring, namely individual attention and guidance, catering to the student's interest and strength. Math 4940 has one to three hours of instruction per week and extra office hours. The class is flexible to meet student needs and help prepare them for independent research in advanced logic or pure mathematics.

MATH 4950 (3)**Research in Applied Mathematics**

MATH 4950 Research in Applied Mathematics is an upper- division course for senior students from any major in CNCS. Students work closely with a faculty member in the Department of Mathematics who will guide them in learning advanced topics and doing research in applied mathematics. The topics broadly encompass mathematical modeling, data analysis, numerical implementation, etc. in interdisciplinary studies, depending on students' majors and needs. There is no prerequisite but MATH 3307 Differential Equation is highly recommended.