COURSES FOR MATHEMATICS

Mathematics Courses

MATH005 Introductory Algebra
Hours 3
Brief review of arithmetic operations and basic algebraic concepts: factoring, operations with polynomials and rational expressions, linear equations and word problems, graphing linear equations, simplification of expressions involving radicals or negative exponents, and elementary work with quadratic equations. Grades are reported as pass/fail.

MATH100 Intermediate Algebra
Hours 3
Prerequisites: Placement and two units of college-preparatory mathematics; if a student has previously been placed in MATH 005, a grade of "C-" or higher in MATH 005 is required. Intermediate-level course including work on functions, graphs, linear equations and inequalities, quadratic equations, systems of equations, and operations with exponents and radicals. The solution of word problems is stressed. NOT APPLICABLE to UA Core Curriculum mathematics requirement. Grades are reported as A, B, C or NC (No Credit).

Prerequisite(s): UA Math Placement Test Score of 190 or higher or ACT Math Subscore of 18 or SAT Math Subscore of 440 or MATH 005

MATH110 Finite Mathematics
Hours 3
This course is intended to give an overview of topics in finite mathematics with applications. This course covers mathematics of finance, logic, set theory, elementary probability and statistics. This course does not provide sufficient background for students who will need to take Precalculus Algebra or Calculus.

Prerequisite(s): UA Math Placement Test Score of 190 or higher or ACT Math Subscore of 18 or SAT Math Subscore of 440 or MATH 005

MATH112 Precalculus Algebra
Hours 3
Prerequisites: Placement and three units of college-preparatory mathematics; if a student has previously been placed in MATH 100, a grade of "C-" or higher in MATH 100 is required. A higher-level course emphasizing functions including polynomial functions, rational functions, and the exponential and logarithmic functions. Graphs of these functions are stressed. The course also includes work on equations, inequalities, systems of equations, the binomial theorem, and the complex and rational roots of polynomials. Applications are stressed. Grades are reported as A, B, C or NC (No Credit).

Prerequisite(s): UA Math Placement Test Score of 310 or higher or ACT Math Subscore of 24 or SAT Math Subscore of 560 or MATH 100

MATH113 Precalculus Trigonometry
Hours 3
Prerequisite: If a student has previously been placed into MATH 112, a grade of "C-" or higher in MATH 112 is required. Continuation of MATH 112. The course includes study of trigonometric functions, inverse trigonometric functions, trigonometric identities and trigonometric equations. Complex numbers, De Moivre's Theorem, polar coordinates, vectors and other topics in algebra are also addressed, including conic sections, sequences and series. Grades are reported as A, B, C or NC (No Credit).

Prerequisite(s): MATH 112

MATH115 Precalculus Algebra & Trig
Hours 3
Prerequisite: Placement and a strong background in college-preparatory mathematics, including one-half unit in trigonometry. Properties and graphs of exponential, logarithmic, and trigonometric functions are emphasized. Also includes trigonometric identities, polynomial and rational functions, inequalities, systems of equations, vectors, and polar coordinates. Grades are reported as A, B, C, or NC (No credit).

Degree credit will not be granted for both MATH 115 and MATH 112 or MATH 113.

Prerequisite(s): UA Math Placement Test Score of 380 or higher or ACT Math Subscore of 29 or SAT Math Subscore of 650

MATH121 Calculus & Applications
Hours 3
Prerequisite: MATH 112 or equivalent. If a student has previously been placed in MATH 112, a grade of "C-" or higher in MATH 112 is required. A brief overview of calculus primarily for students in the Culverhouse College of Commerce and Business Administration. This course does not provide sufficient background for students who will need higher levels of Calculus. Note: This course does not satisfy the requirement for MATH 125 or 126. Degree credit will not be granted for both MATH 121 and MATH 125 or MATH 145.

Prerequisite(s): (MATH 112 AND MATH 113)OR MATH 115

MATH125 Calculus I
Hours 4
This is the first of three courses in the basic calculus sequence. Topics include the limit of a function; the derivative of algebraic, trigonometric, exponential, and logarithmic functions; and the definite integral. Applications of the derivative are covered in detail, including approximations of error using differentials, maxima and minima problems, and curve sketching using calculus. There is also a brief review of selected precalculus topics at the beginning of the course. Degree credit will not be granted for both MATH 121 and MATH 125 or MATH 145.

Prerequisite(s): MATH 113 and MATH 112; or MATH 115
MATH126 Calculus II  
Hours 4  
This is the second of three courses in the basic calculus sequence. Topics include vectors and the geometry of space, applications of integration, integration techniques, L'Hôpital's Rule, improper integrals, parametric equations, polar coordinates, conic sections and infinite series.  
Prerequisite(s): MATH 125 or MATH 131 or MATH 145

MATH145 Honors Calculus I  
Hours 4  
Honors sections of MATH 125.  
MATH146 Honors Calculus II  
Hours 4  
Honors sections of MATH 126.  
Prerequisite(s): MATH 125 or MATH 145

MATH208 Number And Operations  
Hours 3  
Arithmetic of whole numbers and integers, fractions, proportion and ratio, and place value. Class activities initiate investigations underlying mathematical structure in arithmetic processes and include hands-on manipulatives for modeling solutions. Emphasis is on the explanation of the mathematical thought process. Students are required to verbalize explanations and thought processes and to write reflections on assigned readings on the teaching and learning of mathematics.  
Prerequisite(s): MATH 100 or MATH 110 or MATH 112 or MATH 113 or MATH 125

MATH209 Geometry & Measurement  
Hours 3  
Properties of two- and three-dimensional shapes, rigid motion transformations, similarity, spatial reasoning, and the process and techniques of measurement. Class activities initiate investigations of underlying mathematical structure in the exploration of shape and space. Emphasis is on the explanation of the mathematical thought process. Technology specifically designed to facilitate geometric explorations is integrated throughout the course.  
Prerequisite(s): MATH 208

MATH210 Data Analysis Probabil Stats  
Hours 3  
Data analysis, statistics, and probability, including collecting, displaying/representing, exploring, and interpreting data, probability models, and applications. Focus is on statistics for problem solving and decision making, rather than calculation. Class activities deepen the understanding of fundamental issues in learning to work with data Technology specifically designed for data-driven investigations and statistical analysis is integrated throughout the course.  
Prerequisite(s): MATH 208

MATH227 Calculus III  
Hours 4  
This is the third of three courses in the basic calculus sequence. Topics include: vector functions and motion in space; functions of two or more variables and their partial derivatives; and applications of partial derivatives (including Lagrange multipliers), quadric surfaces, multiple integration (including Jacobian), line integrals, Green's Theorem, vector analysis, surface integrals and Stokes' Theorem.  
Prerequisite(s): MATH 146 or MATH 126 or MATH 132

MATH237 Introduction to Linear Algebra  
Hours 3  
Fundamentals of linear algebra and matrix theory are covered. Topics include vectors in Euclidean spaces, solving systems of linear equations, matrix algebra, inverses, determinants, eigenvalues, and eigenvectors. Also, vector spaces and the basic notions of span, subspace, linear independence, basis, dimension, linear transformation, kernel and range are considered. Use of linear algebra software is introduced. Theory plays a significant role in this course - both in lectures and tests.  
Prerequisite(s): MATH 126 or MATH 146

MATH238 Appld Diff Equations I  
Hours 3  
Introduction to analytic and numerical methods for solving differential equations. Topics include numerical methods and qualitative behavior of first order equations, analytic techniques for separable and linear equations, applications to population models and motion problems; techniques for solving higher order linear differential equations with constant coefficients (including undetermined coefficients, reduction of order, and variation of parameters), applications to physical models; the Laplace transform (including initial value problems with discontinuous forcing functions). Use of mathematics software is an integral part of the course.  
Prerequisite(s): MATH 126 or MATH 146  
Prerequisite(s) with concurrency: MATH 227 or MATH 247

MATH247 Honors Calculus III  
Hours 4  
Honors sections of MATH 227.  
Prerequisite(s): MATH 126 or MATH 132 or MATH 146

MATH300 Intro Numerical Analysis  
Hours 3  
Credit will not be granted for both MATH 300 and MATH 411. A beginning course in numerical analysis. Topics include number representation in various bases, error analysis, location of roots of equations, numerical integration, interpolation and numerical differentiation, systems of linear equations, approximations by spline functions, and approximation methods for first-order ordinary differential equations and for systems of such equations.  
Prerequisite(s): MATH 227 or MATH 247; and CS 100 or CS 104 or CS 150 or AEM 249 or ECE 285 or CBH 101
Courses for Mathematics

MATH301 Discrete Mathematics
Hours 3
An introductory course that primarily covers logic, recursion, induction, modeling, algorithmic thinking, counting techniques, combinatorics, and graph theory. Writing proficiency within this discipline is required for a passing grade in this course.
Prerequisite(s): MATH 125 or MATH 145

MATH302 Topics in Discrete Mathematics
Hours 1
A supplemental course in discrete mathematics covering select topics of interest in computer science. Topics include graphs and trees, finite state automata and regular expressions, efficiency of algorithms.
Prerequisite(s): MATH 301

MATH343 Appl Diff Equations II
Hours 3
Continuation of MATH 238. Topics include series solutions of differential equations, the method of Frobenius, Fourier series, method of separation of variables for partial differential equations, elementary boundary value problems for the Laplace, heat and wave equations, an introduction to Sturm-Liouville boundary value problems, and stability of autonomous systems. Usually offered in the spring semester.
Prerequisite(s): MATH 238

MATH355 Theory Of Probability
Hours 3
The foundations of the theory of probability, laws governing random phenomena and their practical applications in other fields. Topics include: probability spaces; properties of probability set functions; conditional probability; and an introduction to combinatorics, discrete random variables, expectation of discrete random variables, Chebyshev's Inequality, continuous variables and their distribution functions, and special densities.
Prerequisite(s): MATH 227 or MATH 247

MATH371 Advanced Linear Algebra
Hours 3
Topics include inner product spaces, norms, self adjoint and normal operators, orthogonal and unitary operators, orthogonal projections and the spectral theorem, bilinear and quadratic forms, generalized eigenvectors, and Jordan canonical form.
Prerequisite(s): MATH 237

MATH382 Advanced Calculus
Hours 3
Further study of calculus with emphasis on theory. Topics include limits and continuity of functions of several variables; partial derivatives; transformations and mappings; vector functions and fields; vector differential operators; the derivative of a function of several variables as a linear transformation; Jacobians; change of variables in multiple integrals; line and surface integrals; and Green's, Stokes', and Divergence Theorems.
Prerequisite(s): MATH 227 or MATH 247; and MATH 237.

MATH402 History Of Mathematics
Hours 3
Survey of the development of some of the central ideas of modern mathematics, with emphasis on the cultural context. Writing proficiency within this discipline is required for a passing grade in this course.

MATH403 Adv Math Connections & Devlpnm
Hours 3
Explore the interconnections between the algebraic, analytic, and geometric areas of mathematics with a focus on properties of various number systems, importance of functions, and the relationship of algebraic structures to solving analytic equations. This exploration will also include the development and sequential nature of each of these branches of mathematics and how it relates to the various levels within the algebra mathematics curriculum.
Prerequisite(s): MATH 237 and MATH 301
Prerequisite(s) with concurrency: MATH 470 or MATH 486

MATH404 Topics Math Secondary Teachers
Hours 1
This is a seminar style course focusing on various mathematical topics related to the high school curriculum. Topics will vary depending upon instructor.
Prerequisite(s): MATH 301

MATH405 Geometry For Teachers
Hours 3
This course will give an overview of geometry from a modern point of view. Both axiomatic and analytic approaches to geometry will be used. The construction of geometric proofs will play an important role.
Prerequisite(s): MATH 125 MATH 403 or department's permission

MATH409 Advanced Data Analysis
Hours 3
Concepts and techniques of posing questions and collecting, analyzing, and interpreting data. Topics include: univariate and bivariate statistics, probability, simulation, confidence intervals and hypothesis testing.
Prerequisite(s): MATH 125 and ST 260

MATH410 Numerical Linear Algebra
Hours 3
Further study of matrix theory, emphasizing computational aspects. Topics include direct solution of linear systems, analysis of errors in numerical methods for solving linear systems, least-squares problems, orthogonal and unitary transformations, eigenvalues and eigenvectors, and singular value decomposition.
Prerequisite(s): MATH 237 or MATH 257

MATH411 Numerical Analysis I
Hours 3
Credit will not be granted for both MATH 411 and MATH 300. A rigorous introduction to numerical methods, formal definition of algorithms, and error analysis and their implementation on a digital computer. Topics include interpolation, roots, linear equations, integration and differential equations, and orthogonal function approximation.
Prerequisite(s): MATH 237 or MATH 257; and MATH 238; and CS 150 or GES 126
MATH420 Linear Optimization Theory
Hours 3
In-depth theoretical development and analysis of linear programming. Topics include formulation of linear programs, various simplex methods, duality, sensitivity analysis, transportation and networks and various geometric concepts.
Prerequisite(s): MATH 237

MATH421 Non-Linear Optimization Theory
Hours 3
In-depth theoretical development and analysis of non linear programming with emphasis on traditional constrained and unconstrained non linear programming methods and an introduction to modern search algorithms.
Prerequisite(s): MATH 237 or MATH 257

MATH422 Mathematics For Finance I
Hours 3
Topics include the basic no-arbitrage principle, binomial model, time value of money, money market, risky assets such as stocks, portfolio management, forward and future contracts, and interest rates.
Prerequisite(s): MATH 227 or MATH 247 and MATH 355

MATH432 Graph Theory & Applictns
Hours 3
Survey of several of the main ideas of general theory with applications to network theory. Topics include oriented and nonoriented linear graphs, spanning trees, branching and connectivity, accessibility, planar graphs, networks and flows, matching, and applications.
Prerequisite(s): MATH 237 or MATH 257

MATH441 Boundary Value Problems
Hours 3
Methods of solving the classical second-order linear partial differential equations: Laplace's equation, the heat equation, and the wave equation, together with appropriate boundary or initial conditions. Usually offered in the fall semester. Prerequisite: MATH 343, or consent of the department.
Prerequisite(s): MATH 343

MATH442 Integral Transf & Asympt
Hours 3
Complex variable methods, integral transforms, asymptotic expansions, WKB method, Airy's equation, matched asymptotics, and boundary layers.
Prerequisite(s): C- or higher in MATH 441

MATH451 Math Stats W/Applictn I
Hours 3
Introduction to mathematical statistics. Topics include bivariate and multivariate probability distributions, functions of random variables, sampling distributions and the central limit theorem, concepts and properties of point estimators, various methods of point estimation, interval estimation, tests of hypotheses and Neyman-Pearson lemma with some applications.
Prerequisite(s): MATH 237 and MATH 355

MATH452 Math Stats W/Applictn II
Hours 3
Further applications of the Neyman-Pearson Lemma, Likelihood Ratio tests, Chi-square test for goodness of fit, estimation and test of hypotheses for linear statistical models, analysis of variance, analysis of enumerative data, and some topics in nonparametric statistics.
Prerequisite(s): MATH 451

MATH457 Stochastic Processes I
Hours 3
Introduction to the fundamental concepts and applications of stochastic processes: Markov chains, continuous-time Markov chains, Poisson and renewal processes, and Brownian motion. Applications include queueing theory, communication networks, and finance.
Prerequisite(s): MATH 451

MATH460 Intro Differential Geom
Hours 3
Introduction to basic classical notions in differential geometry: curvature, torsion, geodesic curves, geodesic parallelism, differential manifold, tangent space, vector field, Lie derivative, Lie algebra, Lie group, exponential map, and representation of a Lie group. Usually offered in the spring semester.
Prerequisite(s): MATH 486

MATH465 Intro General Topology
Hours 3
Basic notions in topology that can be used in other disciplines in mathematics. Topics include topological spaces, open sets, basis for a topology, continuous functions, separation axioms, compactness, connectedness, product spaces, quotient spaces.
Prerequisite(s): MATH 486

MATH466 Intro Algebraic Topology
Hours 3
Homotopy, fundamental groups, covering spaces, covering maps, and basic homology theory, including the Eilenberg Steenrod axioms.
Prerequisite(s): MATH 465

MATH470 Prin Modern Algebra I
Hours 3
A first course in abstract algebra. Topics include: groups, permutation groups, Cayley's theorem, finite abelian groups, isomorphism theorems, rings, polynomial rings, ideals, integral domains and unique factorization domains. Usually offered in the spring semester.
Prerequisite(s): MATH 237

MATH471 Prin Modern Algebra II
Hours 3
Introduction to the basic principles of Galois Theory. Topics include rings, polynomial rings, fields, algebraic extensions, normal extensions, and the fundamental theorem of Galois Theory. Usually offered in the fall semester.
Prerequisite(s): MATH 470
MATH474 Cryptography
Hours 3
Introduction to rapidly growing area of cryptography, an application of algebra, especially number theory. Usually offered in the Fall semester.
Prerequisite(s): MATH 470

MATH485 Intro Complex Variables
Hours 3
Some basic notions in complex analysis. Topics include analytic functions, complex integration, infinite series, contour integration, and conformal mappings.

MATH486 Introduction to Real Analysis I
Hours 3
Rigorous development of the calculus of real variables. Topics include topology of the real line, sequences, limits, continuity, and differentiation.
Prerequisite(s): MATH 237

MATH487 Introduction to Real Analysis II
Hours 3
Riemann integration, introduction to Reimann-Stieltjes integration, series of constants and convergence tests, sequences and series of functions, uniform convergence, power series, Taylor series, and the Weierstrass Approximation Theorem.
Prerequisite(s): MATH 486

MATH495 Seminar Directed Reading
Hours 1-3
Offered as needed.

MATH499 Undergraduate Research Experience
Hours 1-3
Independent or collaborative research experience in mathematics.