

# Mathematics (MATH)

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## **MATH 0996. Support for Elementary Statistics. 2 Hours.**

Prerequisite: Placement into course by University guidelines. Co-requisite: MATH 1401. Corequisite support to provide essential quantitative skills needed to be successful in MATH 1401.

## **MATH 0997. Support for Quantitative Reasoning. 2 Hours.**

Prerequisite: Placement into course by University guidelines. Co-requisite: MATH 1001. Corequisite support to provide essential quantitative skills needed to be successful in MATH 1001.

## **MATH 0998. Support For Mathematical Modeling. 2 Hours.**

Prerequisite: Placement into course by University guidelines. Corequisite: MATH 1101. Corequisite support to provide essential quantitative skills needed to be successful in MATH 1101.

## **MATH 0999. Support for College Algebra. 2 Hours.**

Prerequisites: Placement into course by University guidelines. Corequisite: MATH 1111. Corequisite support to provide essential quantitative skills needed to be successful in MATH 1111.

## **MATH 1001. Quantitative Reasoning. 3 Hours.**

A study of quantitative reasoning skills needed for informed citizens to understand the world around them. Topics include logic, proportional reasoning, basic probability, data analysis, and modeling form data with the appropriate use of technology. NOTE: Not intended for STEM majors.

## **MATH 1101. Introduction to Mathematical Modeling. 3 Hours.**

A study of algebraic topics from a modeling perspective. Introduction to different types of models including linear, quadratic, polynomial, exponential, and logarithmic. Emphasis on gathering, presentation, and interpretation of data by using real-world examples as models.

## **MATH 1111. College Algebra. 3 Hours.**

Algebraic topics including polynomials, rational expressions, equations, inequalities, graphing, exponents and radicals, relations and functions through exponential and logarithmic functions.

## **MATH 1112. Trigonometry. 3 Hours.**

Prerequisite: MATH 1111, 1261, or 1113 with a grade of "C" or higher, or by mathematics placement policy. Circular, trigonometric, and inverse functions, mathematical induction, the binomial theorem, and complex numbers.

## **MATH 1113. Precalculus. 3 Hours.**

Prerequisite: MATH 1112 with a grade of "C" or higher, or by mathematics placement policy. Study of polynomial, rational, and transcendental functions and applications, conic sections, polar coordinates, parametric equations, and mathematical induction.

## **MATH 1113H. Honors Precalculus. 3 Hours.**

Prerequisite: MATH 1112 with a grade of "C" or higher, or by mathematics placement policy. Study of polynomial, rational, and transcendental functions and applications, conic sections, polar coordinates, parametric equations, and mathematical induction. Focus on concepts and real-world applications.

## **MATH 1261. Survey of Calculus I. 3 Hours.**

Prerequisite: MATH 1101, 1111, 1112, 1113, or 1113H, with a grade of "C" or higher, or by mathematics placement policy. Topics include limits, continuity, differentiation of functions of one variable, and applications.

## **MATH 1401. Elementary Statistics. 3 Hours.**

An introductory course in statistics. Topics include descriptive statistics; basic notions of probability, random variables, probability distributions, simple random sampling, and sampling distributions; confidence intervals and hypothesis tests; and regression. The application of statistical methodology and the use of computer software are emphasized.

## **MATH 1501. Calculus I. 4 Hours.**

Topics to include functions, limits, continuity, the derivative, antidifferentiation, the definite integral, and applications. Prerequisites: Math 1113 - Precalculus or its equivalent. For more information on this institution's eCore courses, please see <http://www.valdosta.edu/ecore/>.

## **MATH 2008. Foundations of Numbers and Operations. 3 Hours.**

Prerequisite: MATH 1001, 1101, MATH 1111, MATH 1112, MATH 1113, 1401 with a grade of "C" or higher. An introductory mathematics course for early childhood education majors. This course will emphasize the understanding and use of the major concepts of number and operations. As a general theme, strategies of problem solving will be used and discussed in the context of various topics.

## **MATH 2150. Introduction to Linear Algebra. 3 Hours.**

Prerequisite: MATH 2261 with a grade of "C" or higher. Systems of linear equations, matrices, determinants, and their properties; vectors and inner products; vector spaces; linear transformations; eigenvalues and eigenvectors. Special emphasis is placed on applications.

## **MATH 2261. Analytic Geometry and Calculus I. 4 Hours.**

Prerequisite: MATH 1112 or MATH 1113 with a grade of "C" or higher, or by university placement policy. Introduction to limits, derivatives, integration, fundamental theorem of calculus, and applications.

**MATH 2262. Analytic Geometry and Calculus II. 4 Hours.**

Prerequisite: MATH 2261 with a grade of "C" or higher. Integrals; exponential, logarithmic, and inverse functions; applications of calculus; parametric equations; polar coordinates; sequences and series.

**MATH 2263. Analytic Geometry and Calculus III. 4 Hours.**

Prerequisite: MATH 2262 with a grade of "C" or higher. Three-dimensional analytic geometry; functions of several variables; partial derivatives; multiple integrals, line and surface integrals.

**MATH 2900. Mathematics Sophomore Seminar – Discrete Mathematics. 2 Hours.**

Prerequisites: MATH 2262 or MATH 2150 with a grade of "C" or better. An introduction to discrete mathematics with an emphasis on written and oral communication of the basic ideas of combinatorics and graph theory. Weekly presentation by students will be required as well as substantial final project that models standard research methods in mathematics.

**MATH 3010. History of Mathematics. 3 Hours.**

Prerequisite: MATH 2262 with a grade of "C" or higher. A study of the development of mathematics from primitive times to the twentieth century; including numeral systems, arithmetical methods, origins of algebra, geometry, trigonometry, analytic geometry, calculus; and selected topics from modern mathematics.

**MATH 3040. Set Theory. 3 Hours.**

Prerequisite: MATH 2262 with a grade of "C" or higher. Propositional and predicate logic; mathematical induction. Logic and structure of sets as related to mathematical proof. Relations and cardinality.

**MATH 3161. Mathematics for Early Childhood Teachers I. 3 Hours.**

Prerequisite: ECSE 2999 or DEAF 2999 and a grade of "C" or higher in MATH 2008. An in-depth study of the concepts and processes underlying the P-5 school mathematics curriculum, with special emphasis on numeration, number systems, estimation, algebraic thinking, and computational algorithms. Problem solving and historical context serve as unifying strands.

**MATH 3162. Mathematics for Early Childhood Teachers II. 3 Hours.**

Prerequisite: C or better in MATH 3161. An in-depth study of concepts and processes underlying the P-5 school mathematics curriculum with special emphasis on measurement, geometry, and the fundamentals of probability and statistics. Problem solving and historical context serve as unifying strands.

**MATH 3180. Mathematics for Middle School Teachers. 3 Hours.**

Prerequisite: Grade of "C" or higher in either MATH 1101, MATH 1111, MATH 1112, MATH 1113, MATH 1261, or MATH 2261. Concepts and processes that provide the foundation for the middle-grades mathematics curriculum (5-8). Includes an in-depth study of the real number system with emphasis on the rational number system and axiomatic differences among number systems. Other topics include relations and functions, geometry (including coordinate geometry and graphing), measurement, and elementary probability and statistics.

**MATH 3190. Algebra and Geometry for Teachers. 3 Hours.**

Prerequisite: Grade of "C" or higher in MATH 3180 or MATH 2261. An in-depth study of concepts and processes underlying the middle and secondary school mathematics curriculum with special emphasis placed upon the integrated development of algebra, geometry, and analytical geometry. Problem solving and historical context serve as unifying strands.

**MATH 3340. Ordinary Differential Equations. 3 Hours.**

Prerequisite: MATH 2262 with a grade of "C" or higher. Differential equations of first and second order, linear equations of higher order, and applications.

**MATH 3510. Foundations of Geometry. 3 Hours.**

Prerequisite: MATH 3040 with a grade of "C" or higher. A study of the Euclidean and non-Euclidean plane geometry from both synthetic and metric approaches. Topics include concepts related to incidence, betweenness, plane separation and convexity, congruence, and parallelism, with some attention given to geometric transformations.

**MATH 3600. Probability and Statistics. 3 Hours.**

Prerequisite: Either MATH 2262 with a "C" or higher. Descriptive statistics, probability distributions for discrete and continuous random variables, statistical inference, one way analysis of variance, and regression analysis.

**MATH 3700. Statistical Computing. 3 Hours.**

Prerequisite: MATH 3600 or permission of instructor. A study of the basic tools for statistical computing. Topics include generating random variates; Monte Carlo integration; Monte Carlo methods for estimation and hypothesis tests; Bootstrap confidence interval; numerical methods for root-finding, integration, optimization; regression; and other modern topics.

**MATH 3900. Mathematical Theory of Interest. 3 Hours.**

Prerequisite: MATH 2262. A treatment of the mathematical theory and the practical applications of the various measures of interest. Included in the topics to be covered are simple and compound interest, continuous annuities, varying annuities, amortization, sinking funds, bonds, valuation of securities.

**MATH 4081. Modern Algebra I. 3 Hours.**

Prerequisite: MATH 3040 with a grade of "C" or higher. Topics from groups, rings, and fields. Subgroups, cyclic groups, permutation groups, normal subgroups, homomorphisms, Cayley's and Lagrange's Theorems, factor groups, abelian groups, direct products. Introduction to rings and fields.

**MATH 4082. Modern Algebra II. 3 Hours.**

Prerequisite: MATH 4081 with a grade of "C" or higher. Continuation of MATH 4081 with emphasis on rings and fields. Rings, integral domains, and fields. Vector spaces, extension fields, finite fields.

**MATH 4085. Applied Modern Algebra. 3 Hours.**

Prerequisite: MATH 4081 with a grade of "C" or higher. Lattices, Boolean algebras, semi-groups, binary group codes, binary relations, and graphs. Special emphasis is placed on applications.

**MATH 4110. Number Theory. 3 Hours.**

Prerequisite: MATH 3040 with a grade of "C" or higher. Elementary properties of integers including divisibility, unique factorization, progressions and prime numbers. Linear congruences and residue classes, complete and reduced residue systems, Chinese Remainder Theorem, quadratic residues, law of quadratic reciprocity, Theorems of Fermat and Wilson, Fibonacci and perfect numbers, sums of squares, elementary theory of continued fractions.

**MATH 4150. Linear Algebra. 3 Hours.**

Prerequisites: MATH 2150 and MATH 3040 with a grade of "C" or higher. Introduction to the theory of vector spaces, with emphasis on finite-dimensional vector spaces, linear systems, matrices, linear transformations, eigenvalues, and related subjects.

**MATH 4155. Computational Linear Algebra. 3 Hours.**

A study of mathematical and computational models for compartmental modeling in epidemiology, ecology, population genetics, and physiology.

**MATH 4161. Mathematical Reasoning. 3 Hours.**

Prerequisites: MATH 3162 or MATH 3180 with a grade of "C" or better. An in-depth study of concepts and processes underlying the P-8 school mathematics curriculum, with special emphasis on informal and formal mathematical reasoning. Problem solving and historical context serve as unifying strands. The analysis and remediation of student errors manifested in the application of conceptual and procedural mathematical knowledge will also be addressed.

**MATH 4260. Mathematical Analysis. 3 Hours.**

Prerequisites: MATH 3040 with a grade of "C" or higher. A study of the principles of mathematical analysis; point set topology in Euclidean and metric spaces, numerical sequences and series, continuity, differentiation, integration, sequences and series of functions.

**MATH 4300. Functions of a Complex Variable. 3 Hours.**

Prerequisite: MATH 2263 with a grade of "C" or higher. Introductory study of the algebraic and geometric properties of the complex number system and functions of a complex variable. Limits, continuity, and differentiation of complex functions. Analytic functions and the Cauchy-Riemann conditions. Integration of complex functions; Cauchy-Goursat theorem; Cauchy integral formula; the theorems of Morera and Liouville. Taylor and Laurent series expansions. Residues and poles with applications to integration. Conformal mappings.

**MATH 4540. Topology. 3 Hours.**

Prerequisite: MATH 3040 with a grade of "C" or higher. The study of point set topology in metric and topological spaces. Open and closed sets, compactness, connectedness, topological mappings, separation, product and function spaces.

**MATH 4621. Mathematical Statistics I. 3 Hours.**

Prerequisites: MATH 2263 and MATH 3600 with a grade of "C" or higher in both. Distributions of random variables, conditional probability and stochastic independence, multivariate and some special distributions, and distributions of functions of random variables.

**MATH 4622. Mathematical Statistics II. 3 Hours.**

Prerequisite: MATH 4621 with a grade of "C" or higher. Introduction to statistical inference, sufficient statistic, estimation theory, theory of statistical tests, and inferences about normal models.

**MATH 4651. Numerical Analysis I. 3 Hours.**

Prerequisites: MATH 2150, 2262 and CS 1301 with a grade of "C" or higher in all three. Development and implementation of efficient numerical methods; locating roots of nonlinear equations; solving systems of linear equations; numerical differentiation and integration; interpolation; approximation of functions.

**MATH 4652. Numerical Analysis II. 3 Hours.**

Prerequisites: MATH 4651 and MATH 3340 with a grade of "C" or higher in both. Continuation of MATH 4651. Determination of eigenvalues and eigenvectors of matrices; method of least squares, and curve fitting; numerical solutions of ordinary and partial differential equations.

**MATH 4801. Mathematical Biology 1. 3 Hours.**

A study of analytical and computational tools for modeling biological processes including single species and interacting population dynamics, population genetics, and infectious and dynamic diseases.

**MATH 4802. Mathematical Biology 2. 3 Hours.**

A study of mathematical and computational models for compartmental modeling in epidemiology, ecology, population genetics, and physiology.

**MATH 4901. Operations Research I. 3 Hours.**

Prerequisite: MATH 2150 or MATH 4150 with a grade of "C" or higher, or by permission of instructor. Mathematical aspects and applications of Operations Research. Topics are selected from linear programming (mainly), integer programming, and dynamic programming.

**MATH 4902. Operations Research II. 3 Hours.**

Prerequisite: MATH 3600 or MATH 4621 with a grade of "C" or higher. (Note that MATH 4901 is not a prerequisite). An introduction to stochastic operations research. Topics are selected from stochastic modeling and optimization, probability models, queueing theory and Monte Carlo simulation.

**MATH 4905. Topics in Data Science. 3 Hours.**

Prerequisite: MATH 3700 or 4901 or permission of instructor. Capstone project class for the Basic Data Science Certificate program. Students will apply the knowledge and skills of R data analysis to complete course projects that will test essential skills in data visualization, probability, statistical inference, modeling, data organization, regression, Monte Carlo simulation and machine learning. Students will create data products that can be used to showcase their skills to potential employers. All project will come from real world problems. May repeated up to twice for credit.

**MATH 4910. Mathematical Models. 3 Hours.**

Prerequisite: MATH 2263 and 3600 each with a "C" or higher or permission of instructor. An introduction to basic principles and applications of classical mathematical models, optimization models and probabilistic models.

**MATH 4980. Senior Seminar. 3 Hours.**

Prerequisite: MATH 2263, and one of MATH 4081, 4150, 4260, or 4540. A capstone experience in pure mathematics. Topics in an area of algebra, analysis, or topology will be covered and presented in a written and/or oral form.

**MATH 4990. Special Topics in Mathematics. 1-3 Hours.**

Prerequisites: Consent of instructor and Head of the Department of Mathematics. Topics and credits to be assigned. May be taken more than once if topics are different.

**MATH 4990H. Honors Special Topics in Mathematics. 1-3 Hours.**

Prerequisites: Consent of instructor and Head of the Department of Mathematics. Topics and credits to be assigned. Student presentations will be required. May be taken more than once if topics are different.