MAT: MATHEMATICS

Courses

MAT Q30. Fundamentals of Algebra. 3 Credits.
This course is designed to strengthen basic algebraic skills. Credits earned in Q00-level courses do not count toward the 120 hours of credit needed for graduation.
MAT Q30 Prerequisite: An appropriate score on the Mathematics Placement Examination.
Distance education offering may be available.

MAT 100. Mathematics for Teachers of Children I with Support. 4 Credits.
This course is designed to deepen prospective teachers' mathematical content knowledge by taking an in-depth exploration of elementary mathematics content including development of whole numbers, integers, and rational numbers (including fractions, ratios, proportions, and percents), and number sense through problem solving. This class integrates additional support to strengthen arithmetic and basic algebraic skills. For students seeking Certification in Grades PK-4 or 4-8 only.
MAT 100 Prerequisite: An appropriate score on the Mathematics Placement Examination.
Equivalent courses: MAT 101

MAT 101. Mathematics for Teachers of Children I. 3 Credits.
This course is designed to deepen prospective teachers' mathematical content knowledge by taking an in-depth exploration of elementary mathematics content including development of whole numbers, integers, and rational numbers (including fractions, ratios, proportions, and percents), and number sense through problem solving. For students seeking Certification in Grades PK-4 or 4-8 only.
MAT 101 Prerequisite: An appropriate score on the Mathematics Placement Examination.
Equivalent courses: MAT 100

MAT 102. Mathematics for Teachers of Children II. 3 Credits.
This course is designed to deepen prospective teachers' mathematical content knowledge by taking an in-depth exploration of elementary mathematics content including the development of algebraic reasoning, functions, geometry, measurement, and probability and statistics through problem solving. For students seeking Certification in Grades PK-4 or 4-8 only.
MAT 102 Prerequisite: Successful completion of MAT 100 or MAT 101.

MAT 103. Introduction to Mathematics. 3 Credits.
This course is a liberal arts introduction to the nature of mathematics. Topics are chosen from among logic, graph theory, number theory, symmetry (group theory), probability, statistics, infinite sets, geometry, game theory, and linear programming. These topics are independent of each other and have as prerequisite the ability to read, reason, and follow a logical argument.
Distance education offering may be available.

MAT 104. Math for Everyday Life. 3 Credits.
The course is designed to help prepare students to understand almost any quantitative issues they will encounter in contemporary society. Topics are selected from the following: principles of reasoning, problem-solving tools, financial management, exponential growth and decay, probability, putting statistics to work, mathematics and the arts, discrete mathematics in business and society and the power of numbers.
Equivalent courses: MAT 106

MAT 106. Math for Everyday Life with Support. 3 Credits.
The course is designed to help prepare students to understand almost any quantitative issues they will encounter in contemporary society. Topics are selected from the following: principles of reasoning, problem-solving tools, financial management, exponential growth and decay, probability, putting statistics to work, mathematics and the arts, discrete mathematics in business and society and the power of numbers. It integrates additional support to strengthen arithmetic, technological, and basic problem-solving skills.
Equivalent courses: MAT 104

MAT 112. Algebra and Functions with Support. 4 Credits.
This course covers basic algebra skills, followed by a thorough treatment of polynomial, rational, exponential, and logarithmic functions. Successful completion of the course prepares students for MAT 143.
MAT 112 Prerequisite: An appropriate score on the Mathematics Placement Examination; or successful completion of MAT 103, MAT 104, or MAT 121.
Equivalent courses: MAT 113

MAT 113. Algebra and Functions. 3 Credits.
A review of basic algebra, followed by a thorough treatment of polynomial, rational, exponential, and logarithmic functions. Successful completion of this course prepares students for MAT 143.
MAT 113 Prerequisite: An appropriate score on the Mathematics Placement Examination.
Distance education offering may be available.
Equivalent courses: MAT 112

MAT 115. Algebra, Functions, and Trigonometry. 3 Credits.
Topics include polynomial, rational, exponential, logarithmic, and trigonometric functions. An emphasis is placed on using technology to understand topics of importance in the life and earth sciences. Successful completion of this course prepares students for MAT 143 or MAT 145.
MAT 115 Prerequisite: Successful completion of MAT 112 with a minimum grade of C-; or an appropriate score on the Mathematics Placement Examination.

MAT 121. Introduction to Statistics I. 3 Credits.
Introduction to statistics and statistical inference. Concepts include: descriptive statistics, sampling distributions, confidence intervals, hypothesis testing, along with a formal introduction to linear regression and categorical data analysis. Statistical software including, but not limited to SPSS and Excel, will be used to facilitate the understanding of important statistical ideas and for the implementation of data analysis in many areas of application.
Distance education offering may be available.

MAT 125. Introduction to Statistics and Probability. 3 Credits.
Introduction to probability, statistics, and statistical inference. Concepts include: descriptive statistics, probability, probability distributions, sampling distributions, confidence intervals, hypothesis testing, along with a formal introduction to linear regression and categorical data analysis. Statistical software, including but not limited to SPSS and Excel, will be used to facilitate the understanding of important statistical ideas and for the implementation of data analysis in many areas of application.
MAT 125 Prerequisite: Successful completion of MAT 112 with a minimum grade of C-; or an appropriate score on the Mathematics Placement Examination.

MAT 131. Precalculus. 3 Credits.
Topics include polynomial, rational, exponential, logarithmic, and trigonometric functions. An emphasis is placed on understanding function properties and graphs without the use of technology. Successful completion of this course prepares students for MAT 161.
MAT 131 Prerequisite: Successful completion of MAT 112 or MAT 113 or MAT 115, with a minimum grade of C-; or an appropriate score on the Mathematics Placement Examination.

MAT 143. Brief Calculus. 3 Credits.
An intuitive approach to calculus with emphasis on conceptual understanding and applications to business. Topics include differentiation, curve-sketching, optimization, integration, and partial derivatives.
MAT 143 Prerequisite: Successful completion of MAT 113, MAT 115, or MAT 131, with minimum grade of C-; or an appropriate score on the Mathematics Placement Examination.
Distance education offering may be available.

MAT 145. Calculus for the Life Sciences. 3 Credits.
An overview of differential and integral calculus, motivated through biological problems. Topics include mathematical modeling with functions, limits, continuity, differentiation, optimization, and integration. Graphing calculators are used as an aid in the application of calculus concepts and methods to realistic biological problems.
MAT 145 Prerequisite: Successful completion of MAT 112, MAT 113, MAT 115, or MAT 131, with a minimum grade of C-; or an appropriate score on the Mathematics Placement Examination.

MAT 151. Introduction to Discrete Mathematics. 3 Credits.
Set theory, Boolean logic, elementary combinatorics, proofs, simple graph theory, and simple probability.
MAT 151 Prerequisite: Successful completion of MAT 112 or MAT 113, with a minimum grade of C-; or an appropriate score on the Mathematics Placement Examination.

MAT 161. Calculus I. 4 Credits.
Differential and integral calculus of real-valued functions of a single real variable with applications.
MAT 161 Prerequisite: Successful completion of MAT 131, with a minimum grade of C, or an appropriate score on the Mathematics Placement Examination.

MAT 162. Calculus II. 4 Credits.
Continuation of MAT 161 including the study of series, methods of integration, transcendental functions, and applications to the sciences.
MAT 162 Prerequisite: Successful completion of MAT 161, with a minimum grade of C.

MAT 190. Topics in Mathematics. 3 Credits.
Topics announced at time of offering.

MAT 199. Mathematics Transfer Credits. 1-10 Credits.
Transfer Credits
Repeatable for credit.

MAT 200. The Nature of Mathematics. 3 Credits.
Topics include the role of mathematics in contemporary society, career opportunities, mathematical notation and argument, structure of proofs, basic facts about logic, mathematical proofs, problem-solving techniques, and introductions to mathematical software packages.
MAT 200 Prerequisite: Successful completion of MAT 161, with a minimum grade of C.

MAT 225. Computer Software for Mathematics. 3 Credits.
This course provides a hands-on introduction to practical computing in mathematics. Students develop tested, reusable programs to solve applied problems, with topics including numerical methods for root-finding, matrix computations, data visualization, and program debugging. Emphasis is placed on accurate and effective scientific programming for solving mathematical models.
MAT 225 Prerequisite: Successful completion of CSC 141 or MAT 125; and MAT 161, MAT 143, or MAT 145; all with a minimum grade of C.

MAT 243. Calculus and Linear Algebra for Applied Statistics. 4 Credits.
This course is designed to survey concepts from calculus and linear algebra that are relevant to the study of applied statistics. Topics include a review of differentiation and the Fundamental Theorem of Calculus, techniques and applications of integration, infinite series, partial derivatives, multiple integrals, matrix operations, linear transformations, and eigenvectors.
MAT 243 Prerequisite: Successful completion of MAT 143 or MAT 161, with minimum grades of C.
Distance education offering may be available.

MAT 261. Calculus III. 4 Credits.
The calculus of several variables. Topics include polar coordinates, vectors and three-dimensional analytic geometry, differentiation of functions of several variables, multiple integrals, and line and surface integrals.
MAT 261 Prerequisite: Successful completion of MAT 162, with minimum grades of C.

MAT 302. Mathematics and Social Justice. 3 Credits.
In this course we will explore several social issues and we will discuss methods which can quantitatively illustrate that are taking place. By doing so, the hope is that each student will learn mathematical skills and techniques. This tool kit of basic mathematical skills is often referred to as Quantitative Literacy (QL). Moreover as attainment of QL is itself a social justice issue, we will explore ways to carry these skills to historically marginalized groups through service learning projects.

MAT 311. Linear Algebra. 3 Credits.
An introduction to linear algebra. Topics covered include matrices, systems of linear equations, vector spaces, linear transformation, determinants, eigenvalues, spectral theorem, and triangulation.
MAT 311 Prerequisite or Corequisite: MAT 162.

MAT 312. Algebra for Teachers in Grades 4-8. 3 Credits.
Formal structure of groups, rings, and fields with examples from the elementary curriculum. Topics from linear algebra including matrices, determinants, and linear programming.
MAT 312 Prerequisite: Successful completion of MAT 102.

MAT 313. Geometry for Teachers in Grades 4-8. 3 Credits.
Modern informal approach to two- and three-dimensional geometric figures, measurement, similarity, congruence, coordinate geometry, and the postulational method.
MAT 313 Prerequisite: Successful completion of MAT 102.

MAT 315. Differential Equations and Linear Algebra. 3 Credits.
An introduction to linear algebra and differential equations. Topics include matrices, vector spaces, linear dependence, determinant, eigenvalues and eigenvectors, ordinary differential equations, initial value problems, and systems of linear ordinary differential equations. Applications to physics and engineering will be emphasized.
MAT 315 Prerequisite: Successful completion of MAT 162, with a minimum grade of C.

MAT 321. Combinatorics and Graph Theory. 3 Credits.
Introduction to set theory, graph theory, and combinatorial analysis. Includes relations, cardinality, elementary combinatorics, principles of inclusion and exclusion, recurrence relations, zero-one matrices, partitions, and Polya's Theorem.
MAT 321 Prerequisite: Successful completion of MAT 162 and MAT 200, with minimum grades of C.

MAT 325. Numerical Analysis I. 3 Credits.
A basic introduction to numerical analysis and scientific computing. Topics which will be studied include: Computer arithmetic, approximation and interpolation of functions, numerical quadratures, solutions of linear systems by direct methods, numerical solutions of nonlinear scalar equations, numerical differentiation, introduction to one step methods for the numerical solution of ordinary differential equations.
MAT 325 Prerequisite: Successful completion of MAT 162, with a minimum grade of C.

MAT 331. Foundations of Geometry. 3 Credits.
Geometric foundations from an advanced viewpoint. Topics are chosen from euclidean and noneuclidean geometrics.
MAT 331 Prerequisite: Successful completion of MAT 162, with a minimum grade of C.

MAT 343. Differential Equations. 3 Credits.
The general theory of nth order, and linear differential equations including existence and uniqueness criteria and linearity of the solution space. General solution techniques for variable coefficient equations, series solutions for variable coefficient equations, and study of systems of linear equations.
MAT 343 Prerequisite: Successful completion of MAT 162 and MAT 311, with minimum grades of C.

MAT 351. Methods for Teaching Children Math. 3 Credits.
In-depth treatment of current pedagogical strategies and materials for teaching concepts, including: early number sense; place value; addition, subtraction, multiplication, and division of whole numbers; and fractions in an elementary classroom.
MAT 351 Prerequisite: Successful completion of MAT 100 or MAT 101; and MAT 102.
Gen Ed Attribute: Writing Emphasis

MAT 352. Methods for Teaching Children Mathematics II. 3 Credits.
A continuation of the pedagogical strategies and methods for teaching the topics covered in MAT 351 extended to topics such as real numbers, geometry, percent, proportional reasoning, measurement, and algebra.
MAT 352 Prerequisite: Successful completion of MAT 351. Teacher Candidacy and Field Clearances.

MAT 353. Methods for Teaching Middle School Mathematics. 3 Credits.
Techniques for teaching children mathematical concepts in the middle school standards. Topics covered include number, algebra, geometry, and probability and statistics.
MAT 353 Prerequisite: Successful completion of MAT 121 and MAT 351. Teacher Candidacy and field clearances. Prerequisite or Corequisite: MAT 312 and MAT 313.

MAT 361. Field Experiences in Elementary School Mathematics. 2 Credits.
Teacher candidates enrolled in this course will develop and apply the knowledge, skills and dispositions needed to be an effective teacher of mathematics at the elementary level. This course will provide supportive and authentic learning experiences in local classrooms with practicing teachers. Teacher candidates will integrate content and pedagogical knowledge to develop instructional and assessment techniques that support all learners in mathematics.
MAT 361 Prerequisite: Successful completion of MAT 100 or MAT 101; and MAT 102.
Prerequisite or Corequisite: MAT 351.

MAT 371. Mathematics of Finance. 3 Credits.
The purpose of this course is to introduce the mathematical theory behind the concepts of: measurement of interest, annuities, yield rates, amortization of loans, sinking funds, and yield rates. Understanding the fundamental concepts of financial mathematics, and how these concepts can be applied to calculate present and future values of various financial instruments, is the prevailing theme of the course.
MAT 371 Prerequisite: Successful completion of MAT 162, with a minimum grade of C.

MAT 390. Seminar in Mathematics Education. 3 Credits.
This course is the capstone course for grades 4-8 certification students completing the 30-credit mathematics certification option. Topics selected from mathematics, statistics, the history of mathematics, and mathematics education for their significance and interest. Field experience may be required.
MAT 390 Prerequisite: Teacher Candidacy
Repeatable for credit.

MAT 400. History of Mathematics for Elementary Teachers. 3 Credits.
History and development of elementary mathematics from primitive times to the discovery of calculus. Problems of the period are considered.
MAT 400 Prerequisite: Successful completion of MAT 312 and MAT 313.

MAT 401. History of Mathematics. 3 Credits.
This course will cover selected topics from the history of mathematics. Many great mathematicians will be studied including Hippocrates, Euclid, Archimedes, Heron, Cardano, Newton, the Bernoulli Brothers, Euler, Gauss, and others. Mathematics problems will be approached using the methods and knowledge of the era studied. A solid background in undergraduate mathematics is required.
MAT 401 Prerequisite: Successful completion of MAT 261, with a minimum grade of C.
Gen Ed Attribute: Speaking Emphasis, Writing Emphasis

MAT 405. Special Topics in Mathematics. 3 Credits.
Topics announced at the time of offering.
MAT 405 Prerequisite: Successful completion of MAT 162 with minimum grade of C, or permission of instructor.
Repeatable for credit.

MAT 411. Algebra I. 3 Credits.
Abstract algebra. Algebraic systems, groups, rings, integral domains, and fields.
MAT 411 Prerequisite: Successful completion of MAT 200, MAT 261, and MAT 311, with minimum grades of C.

MAT 412. Algebra II. 3 Credits.
Abstract algebra. Algebraic systems, groups, rings, integral domains, and fields.
MAT 412 Prerequisite: Successful completion of MAT 411, with a minimum grade of C.

MAT 413. Computer Algebra. 3 Credits.
The focus of this course is to introduce students to computer algebra packages and review important topics in algebra, calculus and linear algebra.
MAT 413 Prerequisite: Successful completion of MAT 162 and MAT 311, with minimum grades of C.

MAT 414. Theory of Numbers. 3 Credits.
Properties of integers; primes, factorization, congruences, and quadratic reciprocity.
MAT 414 Prerequisite: Successful completion of MAT 200 and MAT 261, with minimum grades of C.

MAT 415. Introduction to Cryptography. 3 Credits.
An introduction to the mathematics behind various aspects of modern cryptography, including matrix cryptosystems, quadratic ciphers such as the Rabin cipher, exponential ciphers such as the Diffie-Hellman Key Exchange, the RSA algorithm and DES encryption.
MAT 415 Prerequisite: Successful completion of MAT 161; and MAT 151 or MAT 200.

MAT 421. Mathematical Statistics I. 3 Credits.
Probability; discrete distributions; continuous distributions; mathematical expectation; moment generating functions; bivariate distributions; distributions of functions of random variables. Use of appropriate technology.
MAT 421 Prerequisite or Corequisite: MAT 261. Prerequisite requires a minimum grade of C.

MAT 422. Mathematical Statistics II. 3 Credits.
Order statistics; point estimation; interval estimation; tests of statistical hypotheses; statistics power; least squares regression. Use of appropriate technology.
MAT 422 Prerequisite: Successful completion of MAT 421; and MAT 121 or MAT 125, all with minimum grades of C.

MAT 423. Applied Probability. 3 Credits.
Standard Concepts and methods of stochastic modeling and applications of stochastic processes.
MAT 423 Prerequisite: Successful completion of MAT 261, MAT 311, and MAT 421, with minimum grades of C.

MAT 425. Numerical Analysis II. 3 Credits.
An examination of advanced topics in numerical analysis and scientific computing. Topics include: Approximation and interpolation of functions, numerical quadratures, matrix norms, iterative methods of numerical linear algebra, numerical solution of nonlinear systems of equations, and methods for the numerical solution of ordinary differential equations.
MAT 425 Prerequisite: Successful completion of MAT 325, with a minimum grade of C.

MAT 427. Introduction to Optimization Techniques. 3 Credits.
Nature of optimization problems: deterministic and stochastic, and discrete and continuous. Computer methods of solution, systematic and random search, linear quadratic, dynamic programming, and others.
MAT 427 Prerequisite: Successful completion of MAT 261 and MAT 311, with minimum grades of C.

MAT 432. Topology. 3 Credits.
Elements of point set topology. Separation axioms. Connectedness, compactness, and metrizability.
MAT 432 Prerequisite: Successful completion of MAT 200 and MAT 261, with minimum grades of C.

MAT 433. Mathematical Modeling. 3 Credits.
The idea of a mathematical model of a real situation. Techniques and rationales of model building. Examples from the life, physical, and social sciences.
MAT 433 Prerequisite: Successful completion of MAT 261 and MAT 343, with minimum grades of C.

MAT 441. Real Analysis I. 3 Credits.
Introduces the real line, limits of sequences, Cauchy sequences, limits of real functions, continuous functions, intermediate value theorem, the derivative, mean value theorems and Riemann integral.
MAT 441 Prerequisite: Successful completion of MAT 200 and MAT 261, with minimum grades of C.

MAT 442. Real Analysis II. 3 Credits.
A continuation of MAT 441. Introduces infinite series, sequences and series of functions, Taylor's Theorem with applications and topics from integration theory.
MAT 442 Prerequisite: Successful completion of MAT 441, with a minimum grade of C.

MAT 443. Applied Analysis I. 3 Credits.
The techniques of analysis applied to problems in the physical sciences. Topics include partial differential equations, orthogonal functions, complex integration, and conformal mapping.
MAT 443 Prerequisite: Successful completion of MAT 261, MAT 311, and MAT 343, with minimum grades of C.

MAT 444. Applied Analysis II. 3 Credits.
The techniques of analysis applied to problems in the physical sciences. Topics include partial differential equations, orthogonal functions, complex integration, and conformal mapping.
MAT 444 Prerequisite: Successful completion of MAT 443, with a minimum grade of C.

MAT 445. Complex Variables. 3 Credits.
Introduction to functions of a complex variable. Analytic functions, mappings, differentiation and integration, power series, and conformal mappings.
MAT 445 Prerequisite: Successful completion of MAT 261, with a minimum grade of C.

MAT 455. Industrial Mathematics Practicum. 3 Credits.
This is a case study, team problem-solving based course focused on solving real-world problems that can be modeled using discrete or continuous mathematics techniques and which emanate from industry. Ideally, the problems would be obtained from partnerships with local industry. Until these relationships develop, extant problems or problems arising in WCU faculty research (in math, physics, biology, geology, finance, etc.) will be used.
MAT 455 Prerequisite: Successful completion of STA 319, MAT 413, MAT 425; and MAT 427 or MAT 433.
Gen Ed Attribute: Speaking Emphasis, Writing Emphasis

MAT 478. Fundamentals of Actuarial Science. 3 Credits.
Students completing this course will have a better understanding of actuarial models of life contingencies, more specifically, students will understand that life insurance payments, life annuity payments, pension payments, etc. are determined by financial random variables dependent on human life.
MAT 478 Prerequisite: Successful completion of MAT 371 and MAT 421, with minimum grades of C.
Gen Ed Attribute: Speaking Emphasis, Writing Emphasis

MAT 479. Financial Calculus. 3 Credits.
This course aims to provide the undergraduate mathematics major with an introduction to the mathematics behind derivative pricing and portfolio management. Pricing theory is first developed through the typical binomial model and then is extended to continuous time via the Black-Scholes model. In addition, the student will be exposed to how arbitrage can be used to aid in the pricing more complicated derivatives, such as call options on dividend-paying securities and exotic options.
MAT 479 Prerequisite: Successful completion of MAT 371 and MAT 421, with minimum grades of C.
Gen Ed Attribute: Speaking Emphasis, Writing Emphasis

MAT 480. Capstone in Mathematics. 3 Credits.
This capstone experience surveys important concepts from the pure mathematics curriculum and prepares students to investigate problems that reach beyond the standard course material. The course emphasizes techniques of mathematical writing and speaking on topics selected from calculus, linear algebra, real and complex analysis, abstract algebra, and topology.
Gen Ed Attribute: Speaking Emphasis, Writing Emphasis

MAT 491. Internship in Applied Mathematics. 2-4 Credits.
In cooperation with regional businesses and industrial companies, student will perform an internship in applied mathematics.
Repeatable for credit.

MAT 499. Independent Study in Mathematics. 1-3 Credits.
Independent investigation of an area of mathematics not covered in the department's course offerings.
Repeatable for credit.