Mathematics (MAT)

NOTE: All prerequisites for Mathematics (MAT) courses must be completed with a grade of "C-" or better.

Mathematics (MAT) Courses

MAT 0203. Basic Mathematics. (3-0) 3 Credit Hours.
A course intended for students with minimal mathematical skills who need a comprehensive review before they can successfully complete an algebra course. Topics include the Fundamental Mathematics and Geometry objectives of the Texas Success Initiative (TSI), with an introduction to algebra. Intensive review and maintenance of computational skills with integers, fractions, decimals, percentages, ratios, and proportions; reading and interpreting information presented in graphs, tables, and charts; solving word problems, elementary algebraic equations, problems with two- and three-dimensional geometric figures; and inductive and deductive reasoning skills. Course does not count toward any degree at UTSA. This course may be repeated. (Formerly MTC 0103.)

MAT 0213. Intermediate Algebra. (3-0) 3 Credit Hours.
Introductory algebra course that includes the Texas Success Initiative (TSI) Algebra and Problem Solving objectives. Operations with algebraic expressions; solving one- and two-variable equations; solving word problems involving one and two variables; graphing number relationships; and solving problems involving quadratic equations. Course does not count toward any degree at UTSA. This course may be repeated. (Formerly MTC 0113.)

MAT 1023. College Algebra with Applications. (3-0) 3 Credit Hours. (TCCN = MATH 1314)
Prerequisite: Satisfactory performance on a placement examination. Topics include algebraic expressions; equations; inequalities over the real numbers; relations, functions and graphs; polynomial and rational functions; systems of linear equations and inequalities; complex numbers; and matrices and determinants. A wide range of applications will be included in this course. Students majoring in areas that require MAT 1214 Calculus I are encouraged to take MAT 1073 instead of MAT 1023. (Formerly MTC 1023. Credit can be earned for only one of the following: MAT 1023, MTC 1023, MAT 1063, MTC 1073, or MAT 1073.) This course is designed for majors outside sciences and engineering. May apply toward the Core Curriculum requirement in Mathematics. Generally offered: Fall, Spring, Summer.

MAT 1033. Algebra with Calculus for Business. (3-0) 3 Credit Hours. (TCCN = MATH 1325)
Prerequisite: Satisfactory performance on a placement examination. An introduction to business calculus with an emphasis on the algebra of functions. Concentration is on the algebraic manipulations of functions and includes volume and profit functions, both linear and quadratic; root finding and graphical analysis; matrices; and differentiation and integration. (Formerly MTC 1033. Credit cannot be earned for both MAT 1033 and MTC 1033.) May apply toward the Core Curriculum requirement in Mathematics. Generally offered: Fall, Spring, Summer.

MAT 1043 and MTC 1043.) May apply toward the Core Curriculum requirement in Mathematics. Generally offered: Fall, Spring, Summer.

MAT 1073. Algebra for Scientists and Engineers. (3-0) 3 Credit Hours. (TCCN = MATH 1314)
Prerequisite: Satisfactory performance on a placement examination. This course is designed to prepare the student for MAT 1093 Precalculus and MAT 1214 Calculus I. Topics may include algebraic expressions; equations; inequalities over the real numbers; relations; functions; polynomial and rational functions; logarithmic and exponential functions; systems of linear equations and inequalities; matrices and determinants; complex numbers; sequences; series binomial expansion; mathematical induction; permutations, and combinations. (Formerly MTC 1073. Credit can be earned for only one of the following: MAT 1073, MTC 1073, MAT 1063, MTC 1023, or MAT 1023.) May apply toward the Core Curriculum requirement in Mathematics. Generally offered: Fall, Spring, Summer.

MAT 1093. Precalculus. (3-0) 3 Credit Hours. (TCCN = MATH 2312)
Prerequisite: MAT 1073 or the equivalent course or satisfactory performance on a placement examination. Exponential functions, logarithmic functions, trigonometric functions, complex numbers, DeMoivre's theorem, and polar coordinates. May apply toward the Core Curriculum requirement in Mathematics. Generally offered: Fall, Spring, Summer.

MAT 1153. Essential Elements in Mathematics I. (3-0) 3 Credit Hours. (TCCN = MATH 1350)
Prerequisite: MAT 1023 or MAT 1073. Numeration systems; properties of the systems of whole numbers, integers, rational numbers, and real numbers; problem solving; logic. May not be applied toward a major in mathematics. (Credit cannot be earned for both MAT 1153 and MAT 1143.) Generally offered: Fall, Spring, Summer.

MAT 1163. Essential Elements in Mathematics II. (3-0) 3 Credit Hours. (TCCN = MATH 1351)
Prerequisite: MAT 1153. Algebra, statistics and probability; geometric shapes; measurement; coordinate and transformational geometry. May not be applied toward a major in mathematics. Generally offered: Fall, Spring, Summer.

MAT 1193. Calculus for the Biosciences. (3-0) 3 Credit Hours. (TCCN = MATH 2313)
Prerequisite: MAT 1093 or an equivalent course or satisfactory performance on a placement examination. An introduction to calculus is presented using discrete-time dynamical systems and differential equations to model fundamental processes important in biological and biomedical applications. Specific topics to be covered are limits, continuity, differentiation, antiderivatives, definite and indefinite integrals, the fundamental theorem of calculus, differential equations, and the phase-plane. (Formerly MAT 1194. Credit can be earned for only one of the following: MAT 1193, MAT 1194, or MAT 1214.) May apply toward the Core Curriculum requirement in Mathematics. Generally offered: Fall, Spring, Summer.
MAT 1214. Calculus I. (4-0) 4 Credit Hours. (TCCN = MATH 2413) Prerequisite: MAT 1093 or an equivalent course or satisfactory performance on a placement examination. An introduction to the concepts of limit, continuity and derivative, mean value theorem, and applications of derivatives such as velocity, acceleration, maximization, and curve sketching; introduction to the Riemann integral and the fundamental theorem of calculus. (Credit can be earned for only one of the following: MAT 1214, MAT 1193, or MAT 1194.) May apply toward the Core Curriculum requirement in Mathematics. Generally offered: Fall, Spring, Summer.

MAT 1224. Calculus II. (4-0) 4 Credit Hours. (TCCN = MATH 2414) Prerequisite: MAT 1193 or MAT 1214. Methods of integration, applications of the integral, sequences, series, and Taylor expansions. (Formerly MAT 1223. Credit cannot be earned for both MAT 1224 and MAT 1223.) Generally offered: Fall, Spring, Summer.

MAT 2214. Calculus III. (4-0) 4 Credit Hours. (TCCN = MATH 2415) Prerequisite: MAT 1224. Vectors, functions of several variables, partial derivatives, line, surface and volume integrals, Green’s, Stokes’ and the Divergence theorems. (Formerly MAT 2213. Credit cannot be earned for both MAT 2214 and MAT 2213.) Generally offered: Fall, Spring, Summer.

MAT 2233. Linear Algebra. (3-0) 3 Credit Hours. (TCCN = MATH 2318) Prerequisite: MAT 1224 or EGR 2323. Vector spaces and matrix algebra, matrices and determinants, characteristic values of matrices, and reduction to canonical forms. Emphasis on applications. Generally offered: Fall, Spring, Summer.

MAT 3013. Foundations of Mathematics. (3-0) 3 Credit Hours. Prerequisite: MAT 1214. Development of theoretical tools for rigorous mathematics. Topics may include mathematical logic, propositional and predicate calculus, set theory, functions and relations, cardinal and ordinal numbers, Boolean algebras, and construction of the natural numbers, integers, and rational numbers. Emphasis on theorem proving. (Formerly MAT 2243. Credit cannot be earned for MAT 3013 and MAT 2243.) Generally offered: Fall, Spring, Summer.

MAT 3103. Data Analysis and Interpretation. (3-0) 3 Credit Hours. Prerequisite: MAT 1093 or consent of instructor. Measurement, sampling, summarizing and displaying data, types of data, inferential methods, nonparametric methods, qualitative research designs and methods, interpreting research results, and research design. Applications to research techniques in school-based settings will be emphasized. May not be applied toward the Mathematics Concentration of the B.S. degree in Mathematics. Generally offered: Fall, Spring, Summer.

MAT 3123. Fundamentals of Geometry. (3-0) 3 Credit Hours. Prerequisite: MAT 1093 or consent of instructor. A survey of geometric concepts, including axiomatic development of advanced Euclidean geometry, coordinate geometry, non-Euclidean geometry, three-dimensional geometry, and topology. May not be applied toward the Mathematics Concentration of the B.S. degree in Mathematics. Generally offered: Fall, Spring, Summer.

MAT 3213. Foundations of Analysis. (3-0) 3 Credit Hours. Prerequisites: MAT 1224 and MAT 3013. Axiomatic definition of real numbers, including order properties and completeness; infinite sequences and their convergence; basic notions related to series and their convergence; functions and function limits. Introduction to topology of the real line. Emphasis on theorem proving. Generally offered: Fall, Spring, Summer.

MAT 3223. Complex Variables. (3-0) 3 Credit Hours. Prerequisites: MAT 2214 and MAT 3213. An introduction to complex variables, including elementary functions, line integrals, power series, residues and poles, and conformal mappings. Generally offered: Spring.

MAT 3233. Modern Algebra. (3-0) 3 Credit Hours. Prerequisite: MAT 3013. Topics will include the development of groups, integral domains, fields, and number systems, including the complex numbers. Divisibility, congruences, primes, perfect numbers, and some other problems of number theory will be considered. Generally offered: Fall, Spring, Summer.

MAT 3273. Applied Mathematics for Sciences and Engineering. (3-0) 3 Credit Hours. Prerequisite: MAT 2214 or MAT 3613 or consent of instructor. Mathematical applications in biology, physics, engineering or other scientific disciplines. Topics may employ techniques of complex analysis, harmonic analysis, Fourier series, Fourier transforms, and partial differential equations.

MAT 3613. Differential Equations I. (3-0) 3 Credit Hours. Prerequisite: Completion of or concurrent enrollment in MAT 2233. Basic notions of differential equations, solution of first-order equations and linear equations with constant coefficients, nth-order initial value problems, Laplace transforms, and may include additional topics such as power series solutions of differential equations, linear systems, and stability. Generally offered: Fall, Spring, Summer.

MAT 3623. Differential Equations II. (3-0) 3 Credit Hours. Prerequisite: MAT 3613. Continuation of MAT 3613. May include topics in stability, linear systems, power series solutions, partial differential equations, and boundary value problems. Generally offered: Spring.

MAT 3633. Numerical Analysis. (3-0) 3 Credit Hours. Prerequisites: MAT 2233, MAT 3213, and one of the following: CS 1063, CS 1713, or CS 2073. Solution of linear and nonlinear equations, curve-fitting, and eigenvalue problems. Generally offered: Fall, Spring.

MAT 3653. Stochastic Calculus. (3-0) 3 Credit Hours. Prerequisite: STA 3513. Probability, random walk, Brownian motion, stationary and evolutionary processes and stochastic differential equations.

MAT 4013. Graphing Calculator Topics. (3-0) 3 Credit Hours. Prerequisite: MAT 1214 or consent of instructor. Mathematical topics from algebra, trigonometry, calculus, modeling, and probability and statistics will be investigated using the graphing calculator. Assessment and evaluation techniques using technology will also be included. May not be applied toward the Mathematics Concentration of the B.S. degree in Mathematics. Generally offered: Fall, Spring.

MAT 4113. Computer Mathematical Topics. (3-0) 3 Credit Hours. Prerequisite: MAT 1214. Mathematical topics from algebra, Euclidean and non-Euclidean geometry, number theory, and probability and statistics will be investigated using Geometer’s Sketchpad and a variety of Web-based mathematics resources. Course will also include the application of software to the solution of a variety of geometric and algebraic problems. May not be applied toward the Mathematics Concentration of the B.S. degree in Mathematics. Generally offered: Spring, Summer.

MAT 4123. History of Mathematics. (3-0) 3 Credit Hours. Prerequisites: MAT 3233 or MAT 4233, and either MAT 3123 or MAT 4263. Selected subjects in mathematics developed through historical perspectives and biographies. May not be applied toward the Mathematics Concentration of the B.S. degree in Mathematics. Generally offered: Spring, Summer.
MAT 4213. Real Analysis I. (3-0) 3 Credit Hours.  
Prerequisite: MAT 3213. Continuous functions, uniform continuity; theory of differentiation; applications of the derivative to properties of functions; antiderivatives; Riemann integral; connection between differentiation and integration. Generally offered: Fall, Spring, Summer.

MAT 4223. Real Analysis II. (3-0) 3 Credit Hours.  
Prerequisite: MAT 4213. Lebesgue integral on the real line; n-dimensional spaces; vectors; calculus of functions of several variables; multidimensional integration. Generally offered: Fall, Spring.

MAT 4233. Modern Abstract Algebra. (3-0) 3 Credit Hours.  
Prerequisites: MAT 2233 and MAT 3013. Basic properties and examples of semigroups, monoids, and groups, detailed study of permutation, dihedral, and congruence groups, cyclic groups, normal subgroups, quotient groups, homomorphism, isomorphism theorems, direct products of groups. The Sylow Theorems, rings and fields and their basic properties, ideals, polynomial rings. Generally offered: Spring.

MAT 4253. Number Theory. (3-0) 3 Credit Hours.  
Prerequisite: MAT 3233 or MAT 4233. The theory of primes, congruences, and related subjects.

MAT 4263. Geometry. (3-0) 3 Credit Hours.  
Prerequisite: MAT 3013. A study of non-Euclidean geometries, including spherical geometry, hyperbolic geometry and others. Generally offered: Spring.

MAT 4273. Topology. (3-0) 3 Credit Hours.  
Prerequisite: MAT 3213. Set theory, including cardinal and ordinal numbers. Topological properties of the real-line and metric spaces. Generally offered: Fall.

MAT 4303. Capstone Course for Mathematics. (3-0) 3 Credit Hours.  
Prerequisites: Consent of instructor or one each from MAT 3123 or MAT 4263, MAT 3233 or MAT 4233, and MAT 4013 or MAT 4113. This course is for any interested mathematics major, particularly for those students who intend to pursue secondary certification in Mathematics. The goals of the course are to enable students to build connections among the mathematical areas they have studied and between undergraduate mathematics and high school mathematics, to develop their understanding of mathematics as an integrated discipline, and to strengthen their oral and written communication skills in mathematics. May not be applied toward the Mathematics Concentration of the B.S. degree in Mathematics. Generally offered: Fall, Spring.

MAT 4313. Applied Combinatorics. (3-0) 3 Credit Hours.  
Prerequisite: MAT 1224. Permutations, combinations, arrangements, selections, distributions, generating functions, inclusion-exclusion principle.

MAT 4323. Applied Graph Theory. (3-0) 3 Credit Hours.  
Prerequisite: MAT 1224. Isomorphism, planarity, computer representation of graphs, covering circuits and graph colorings, Euler and Hamiltonian graphs, trees and searching network algorithms (shortest paths, connectivity, traveling salesman, network flow, matching, sorting, etc.).

MAT 4353. Mathematical Foundations of Cryptography. (3-0) 3 Credit Hours.  
Prerequisite: MAT 3233 or MAT 4233 or consent of instructor. Congruences and residue class rings, Fermat’s Little Theorem, the Euler phi-function, the Chinese Remainder Theorem; complexity; symmetric-key cryptosystems; cyclic groups, primitive roots, discrete logarithms, one-way functions; public-key cryptosystems (Diffie-Hellman key exchange, RSA, Rabin, El Gamal); digital signatures; and other groups (finite fields, elliptic curves). Generally offered: Spring.

MAT 4803. Statistical Quality Control. (3-0) 3 Credit Hours.  
Prerequisites: MAT 1224 and STA 3003 or STA 3513. Statistical methods are introduced in terms of problems that arise in manufacturing and their applications to the control of manufacturing processes. Topics include control charts and acceptance sampling plans. (Same as STA 4803. Credit cannot be earned for both MAT 4803 and STA 4803.).

MAT 4913. Independent Study. (0-0) 3 Credit Hours.  
Prerequisites: Permission in writing (form available) of the instructor, the student’s advisor, the Department Chair, and the Dean of the College in which the course is offered. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor’s degree.

MAT 4953. Special Studies in Mathematics. (3-0) 3 Credit Hours.  
Prerequisite: Consent of instructor. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. May be repeated for credit when the topics vary, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor’s degree. Generally offered: Fall, Spring, Summer.

MAT 4993. Honors Research. (0-0) 3 Credit Hours.  
Prerequisites: Enrollment limited to candidates for College Honors during their last two semesters; approval by the College Honors Committee. Supervised research and preparation of an honors thesis. May be repeated once with approval.