

# Mathematics

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Mathematics Web Site (<http://www.tamuc.edu/academics/colleges/scienceEngineeringAgriculture/departments/mathematics/>)

America desperately needs more students to major in mathematics. There are plenty of good jobs for math graduates. The Department of Mathematics offers the Bachelor of Science degree with a major in Mathematics. This major prepares graduates for careers in industry, government, business, and employment in scientific and technological fields, computing and information science, actuarial work, and education. A graduate with a major in mathematics should possess the following competencies: calculus, discrete mathematics, and abstract algebra, as well as advanced electives.

The Bachelor of Science degree with a major in Mathematics with teacher certification also is offered by the department. A student may select a broadfield major or select a field outside mathematics as a minor. This major prepares graduates for careers in teaching at the secondary level. A graduate with a major in mathematics should possess the following competencies: calculus, discrete mathematics, geometry, abstract and linear algebra, history of mathematics, and number theory.

The Department of Mathematics also offers a BS Degree in Mathematics with Emphasis in Data Science and an accelerated BS/MS program. For the Emphasis in Data Science, a graduate can work as a data scientist, or continue to graduate school. In addition, the Department of Mathematics collaborates with the Department of Health and Human Performance and the Department of Marketing and Business Analytics to offer an interdisciplinary BS Degree in Applied Sports Analytics (ASA). Students who are interested in business or sport management are encouraged to pursue the major in ASA. Graduates with BS in ASA can work in the fields of business, sport management and mathematics. A current undergraduate student can join the accelerated BS/MS program by taking graduate courses during their senior year so that they can obtain a MS degree in Math sooner.

*Students seeking a bachelor's degree in this major must complete:*

1. degree requirements for a Bachelor Science degree, and
2. Core Curriculum Requirements (<https://coursecatalog.tamuc.edu/undergrad/core-curriculum-requirements/>) (refer to those sections of this catalog).

In addition, courses in the major must be completed as shown below.

## Teacher Education Programs

Students seeking a bachelor's degree in a teacher education program must complete:

1. degree requirements for a Bachelor of Science degree (refer to the bachelor's degree requirements section of this catalog),
2. Core Curriculum Requirements (<https://coursecatalog.tamuc.edu/undergrad/core-curriculum-requirements/>) (refer to that section of this catalog),
3. requirements for admission to and retention in the Teacher Education Program (refer to the Center for Educator Certification and Academic Services section of this catalog), and
4. professional development courses (refer to the appropriate departmental section in this catalog, i.e. Department Curriculum & Instruction).

In addition, courses in the major must be completed as shown below.

## Guide for Initial Enrollment in Mathematics

The Texas Higher Education Coordinating Board has ruled that a mathematics course taught in a college or university may count toward the baccalaureate degree requirements only if it has a prerequisite of high school Algebra II. Generally, students not taking Algebra II in high school will need remediation in college. A diagnostic test will be given to each entering student for initial placement in mathematics courses. (See "Basic Skills Policy")

Fast-Track Bachelors + Masters Mathematics (<https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/mathematics/bs-ms-math/>)

Mathematics B.S. (<https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/mathematics/mathematics-ba-bs/>)

Mathematics Minor (<https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/mathematics/mathematics-minor/>)

Mathematics Second Major (<https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/mathematics/mathematics-second-major/>)

Mathematics, 7-12 Teacher Certification B.S. (<https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/mathematics/mathematics-8-12-teacher-certification-ba-bs/>)

**MATH 1314 - College Algebra**

Hours: 3

This course covers an in-depth study and applications of quadratics, polynomial, rational, exponential and logarithmic functions, and systems of equations. Additional topics such as arithmetic and geometric progressions; sequences and series; and matrices and determinants are included. In order to take this course, students must meet or exceed the benchmark determined by the state for the TSI assessment, or have one of various TSI exemptions, or be concurrently enrolled in MATH 131 in the co-requisite model.

**MATH 1324 - Math for Business Applications I**

Hours: 3

Linear equations, quadratic equations, functions, inequalities, mathematics of finance, linear programming, matrices and determinants, systems of linear equations, probability. Applications to management, economics, and business. In order to take this course, students must meet or exceed the benchmark determined by the state for the TSI assessment, or have one of various TSI exemptions, or be concurrently enrolled in MATH 131 in the co-requisite model.

**MATH 1325 - Mathematics for Business Applications II**

Hours: 3

This course is the basic study of limits and continuity, differentiation, optimization and graphing, and integration of elementary functions, with emphasis on applications in business, economics, and social sciences. This course is not a substitute for MATH 2413, Calculus I. Prerequisites: MATH 1314 with a minimum grade of C or MATH 1324 with a minimum grade of C.

**MATH 1332 - Contemporary Mathematics**

Hours: 3

Intended for Non STEM (Science, Technology, Engineering, and Mathematics) majors. Topics include introductory treatments of sets and logic, financial mathematics, probability and statistics with appropriate applications. Number sense, proportional reasoning, estimation, technology, and communication should be embedded throughout the course. Additional topics may be covered. In order to take this course, students must meet or exceed the benchmark determined by the state for the TSI assessment, or have one of various TSI exemptions, or be concurrently enrolled in MATH 120 in the co-requisite model.

**MATH 1342 - Elementary Statistical Methods**

Hours: 3

Collection, analysis, presentation and interpretation of data, and probability. Analysis includes descriptive statistics, correlation and regression, confidence intervals and hypothesis testing. Appropriate technology will be used. In order to take this course, students must meet or exceed the benchmark determined by the state for the TSI assessment, or have one of various TSI exemptions, or be concurrently enrolled in MATH 120 in the co-requisite model.

**MATH 1350 - Mathematics for Teachers I**

Hours: 3

This course is intended to build or reinforce a foundation in fundamental mathematics concepts and skills. It includes the conceptual development of the following: sets, functions, numeration systems, number theory, and properties of the various number systems with an emphasis on problem solving and critical thinking. Prerequisites: MATH 1314 with a minimum grade of C.

**MATH 1351 - Mathematics for Teachers II**

Hours: 3

This course is intended to build or reinforce a foundation in fundamental mathematics concepts and skills. It includes the concepts of geometry, measurement, probability, and statistics with an emphasis on problem solving and critical thinking. Prerequisites: MATH 1350 with a minimum grade of C and MATH 1314 with a minimum grade of C.

**MATH 2305 - Discrete Mathematics**

Hours: 3

A course designed to prepare math, computer science, and engineering majors for a background in abstraction, notation, and critical thinking for the mathematics most directly related to computer science. Topics include: logic, relations, functions, basic set theory, countability and counting arguments, proof techniques, mathematical induction, combinatorics, discrete probability, recursion, sequence and recurrence, elementary number theory, graph theory, and mathematical proof techniques Prerequisites: MATH 2413 Calculus I with a minimum grade of C.

**MATH 2312 - Pre-Calculus**

Hours: 3

In-depth combined study of algebra, trigonometry, and other topics for calculus readiness. Prerequisites: MATH 1314 with a minimum grade of C.

**MATH 2318 - Linear Algebra**

Hours: 3

Introduces and provides models for application of the concepts of vector algebra. Topics include finite dimensional vector spaces and their geometric significance; representing and solving systems of linear equations using multiple methods, including Gaussian elimination and matrix inversion; matrices; determinants; linear transformations; quadratic forms; eigenvalues and eigenvector; and applications in science and engineering. Prerequisites: MATH 2414 with a minimum grade of C.

**MATH 2320 - Differential Equations**

Hours: 3

Ordinary differential equations, including linear equations, systems of equations, equations with variable coefficients, existence and uniqueness of solutions, series solutions, singular points, transform methods, and boundary value problems; application of differential equations to real-world problems. Prerequisites: MATH 2414 with a minimum grade of C.

**MATH 2413 - Calculus I**

Hours: 4

Limits and continuity; the Fundamental Theorem of Calculus; definition of the derivative of a function and techniques of differentiation; applications of the derivative to maximizing or minimizing a function; the chain rule, mean value theorem, and rate of change problems; curve sketching; definite and indefinite integration of algebraic, trigonometric, and transcendental functions, with an application to calculation of areas. Prerequisites: MATH 2312 with a minimum grade of C.

**MATH 2414 - Calculus II**

Hours: 4

Differentiation and integration of transcendental functions; parametric equations and polar coordinates; techniques of integration; sequences and series; improper integrals. Prerequisites: MATH 2413 with a minimum grade of C.

**MATH 2415 - Calculus III**

Hours: 4

Advanced topics in calculus, including vectors and vector-valued functions, partial differentiation, Lagrange multipliers, multiple integrals, and Jacobians; application of the line integral, including Green's Theorem, the Divergence Theorem, and Stokes' Theorem. Prerequisites: MATH 2414 with a minimum grade of C.

**MATH 100 - TSI**

Hours: 0

**MATH 120 - Foundations of Mathematics for Non-STEM Non-Algebra Majors**

Hours: 3

Intended for Non STEM (Science, Technology, Engineering, and Mathematics) majors. In particular, students who are majoring in fields considered to be in the "liberal arts" (students who will not be continuing in an Algebra-intensive math pathway), and who are not TSI complete, will take this course. Course topics include: sets, Venn diagrams, basic arithmetic/algebra operations, rational expressions, exponents and radicals, evaluating formulas, Fundamental Counting Principles, Summation and subscript notation, dimensional analysis, graphing, and the beauty of mathematics. The course helps prepare students for further study in first year college level non-STEM math courses. This course is considered developmental and may not be used to satisfy any mathematics or degree requirements.

**MATH 131 - Intermediate Algebra**

Hours: 3

May not be used to satisfy any mathematics or degree requirements. Basic algebraic operations, equations and inequalities, polynomials, functions, rational expressions, exponents and radicals, quadratic equations, graphing and geometry in the plane, sequences and series. This course is to prepare students for further study at the level of college mathematics. In particular, this course is considered a "STEM" course, preparing students for further study in the STEM fields. Successfully passing this course meets the TSI standard for college-readiness.

**MATH 177 - Business Applications in Mathematics II**

Hours: 3

This course includes an intense Algebra review, followed by an extensive look at derivatives in Calculus, as applied to future courses in Business. This course is intended for Business majors. Topics include an in-depth Algebra review (solving equations and systems of equations), finding derivatives, matrices, and in-depth applications problems. Prerequisites: MATH 1314 or MATH 1324 with a grade of C or better.

**MATH 189 - Independent Study**

Hours: 0-4

Independent Study. One to four semester hours. Individualized instruction/research at an advanced level in a specialized content area under the direction of a faculty member. May be repeated when the topic varies. Prerequisite: consent of department head.

**MATH 289 - Independent Study**

Hours: 0-4

**MATH 297 - Special Topics**

Hours: 0-4

**MATH 301 - Introductory Geometry**

Hours: 3

Topics will include plane and solid Euclidean geometry, including the properties of parallels, perpendiculars, triangles, and circles along with perimeter and formulas for area of plane regions and for the surface area and volume of solids. Prerequisites: MATH 1351 with a minimum grade of C or MATH 2414 with a minimum grade of C.

**MATH 303 - Introduction to Data Science**

Hours: 3

An introductory course in data science with an application in statistical software R. Students will learn about the fundamental concepts, tools and techniques to solve data driven problems. Students will also develop skills in data analysis such as preparing, cleaning, manipulating, visualization and reporting techniques along with basic statistical methods. Emphasis will be given on hands-on experience with real-world datasets and practical applications. Prerequisites: MATH 1342 - Elementary Statistical Methods or MATH 1314 - College Algebra or similar courses with grade of "C" or better.

**MATH 316 - Mathematical Methods in Physics & Engineering**

Hours: 3

Mathematical techniques from the following areas: infinite series; integral transforming; applications of complex variables; vectors, matrices, and tensors; special functions; partial differential equations; Green's functions; perturbation theory; integral equations; calculus of variations; and groups and group representatives. Prerequisites: MATH 2415 Calculus III or Math 314 with "C" or higher, or consent of instructor.

**MATH 317 - Numerical Analysis**

Hours: 3

(Same as CSCI 317) Computer algebra systems will be introduced. Topics include methods for approximate solutions of equations in one variable, polynomial approximation methods, numerical calculus, numerical solutions to ordinary differential equations, linear systems of equations, and difference equations. Prerequisites: MATH 2414 with a minimum grade of C and COSC 1436 with a minimum grade of C.

**MATH 321 - College Geometry**

Hours: 3

Advanced treatment of standard topics in Euclidean geometry for teachers and others using informal and axiomatic approaches. Includes proofmaking techniques, traditional and transformational geometry, finite geometries, and a brief introduction to other geometries. Prerequisites: MATH 2305 with a minimum grade of C.

**MATH 325 - Partial Differential Equations**

Hours: 3

This course studies the general theory of partial differential equations with emphasis on linear equations and the basic techniques for solving initial boundary value problems involving one unknown function and one independent variable. In addition, this course will help student understand how to model the world in terms of partial differential equations, and how to solve those equations and interpret the solutions. Topics may include transport equation, Laplace's equation, heat equation, wave equation, application of Sturm-Liouville's theory, Fourier series/transforms, Green's functions, method of characteristics, Duhamel's principle, and maximum principle. Prerequisites: MATH 2320 with a minimum grade of C.

**MATH 326 - Mathematical Modeling and Simulation**

Hours: 3

An introduction to developing, solving, and validating mathematical models of real-life problems. Topics may include unconstrained and constrained growth models, epidemiological models, equilibrium analysis, stability, force and motion, predator-prey model, enzyme kinetics, data-driven models, probability distributions, and high-performance computing. Case-study approach will be implemented. Prerequisites: MATH 2415 with a minimum grade of C and MATH 2320 with a minimum grade of C.

**MATH 332 - Methods of Mathematical Proofs**

Hours: 3

This course trains students on mathematical proof to deepen and broaden the knowledge of various aspects of discrete mathematics that will lay a foundation for further study of many fields in mathematics including topology, analysis, number theory, abstract algebra, probability, and computer science. Topics may include: functions and relations on sets, equivalence relations and partitions of sets, mathematical theorems and proofs, Peano Axiom and natural numbers, Cardinality and Cantor's theorem, the barber's Paradox and the Axiom of Choice, Countably infinite sets and Hilbert's infinite hotel paradox, algebraic, metric and topological structures on a set. Prerequisites: MATH 2414 with a minimum grade of C.

**MATH 333 - Advanced Linear Algebra**

Hours: 3

Covers real and complex vector spaces, subspaces, linear operators, eigenvalues and eigenvectors, inner product spaces, operators on inner product spaces, singular value decomposition and pseudo-inverse, canonical forms. Prerequisites: MATH 2414 with a minimum grade of C and MATH 2305 with a minimum grade of C or MATH 2318 with a minimum grade of C or MATH 332 with a minimum grade of C. Crosslisted with: MATH 531.

**MATH 334 - Abstract Algebra**

Hours: 3

Properties of the integers, permutations, groups, rings, integral domains and fields. Prerequisites: MATH 2305 with a minimum grade of C. Crosslisted with: MATH 550.

**MATH 341 - Linear Regression Models**

Hours: 3

A calculus-based course in statistical regression models with an application in R. Topics covered include: Introduction to statistical models, simple linear regression, multiple linear regression, parameter estimation, inference in linear regression models, regression diagnostics, model selection, and multicollinearity. Prerequisites: MATH 2414 with a grade of "C" or higher.

**MATH 342 - Mathematics for Machine Learning**

Hours: 3

This course will introduce mathematical concepts from calculus, linear algebra and optimization required for Machine Learning. Basic Machine Learning concepts including, activation functions, loss function, weights, and popular learning methods such as gradient descend and the stochastic gradient descend methods will be introduced. Prerequisites: Linear Algebra-MATH 2318 and MATH 2413-Calculus I with Min Grade of C.

**MATH 361 - Mathematical Modeling of Science for Middle School I**

Hours: 3

Mathematics will serve as the basis of the course and the following topics will be covered: Mathematical modeling, transformation of functions, data analysis skills, linear models, exponential growth and decay, logarithmic functions, logistic models, power and polynomial models, inverse and direct variation, periodic models and trigonometric functions. Prerequisites: MATH 1350 with a minimum grade of C.

**MATH 362 - Mathematical Modeling of Science for Middle School II**

Hours: 3

Mathematics will serve as the basis of the course and the following topics will be covered: Trigonometric functions and relationships, rate of change, derivative concepts, extrema and points of inflection, accumulating change, concepts of the definite integral, finite difference equations. Technology will be a vital part of the course. Prerequisites: MATH 361 with a minimum grade of C.

**MATH 371 - Science and Math Education Theory and Practice**

Hours: 1

Learning theory and teaching practices for science learning assistants. Topics include questioning strategies, conceptual development, formative assessment, argumentation, metacognition, and nature of science. Prerequisites: Instructor permission. Crosslisted with: PHYS 371, CHEM 371, BSC 371.

**MATH 372 - Mathematics Structures and Applications**

Hours: 3

A study of the algebraic processes, polynomials, equations, inequalities, functions, graphs, and mathematics of finance. Prerequisites: MATH 1351 with a minimum grade of C or MATH 2414 with a minimum grade of C.

**MATH 380 - Mathematics History**

Hours: 3

A survey of the history of mathematics; attention will be given to the origin, development and importance of mathematical ideas. Prerequisite: MATH 301.

**MATH 389 - Independent Study**

Hours: 1-4

Independent Study. One to four semester hours. Individualized instruction/research at an advanced level in a specialized content area under the direction of a faculty member. May be repeated when the topic varies. Prerequisite: consent of department head.

**MATH 397 - Special Topic**

Hours: 1-4

Special Topics. One to four semester hours. Organized class. May be repeated when topics vary

**MATH 402 - Mathematical Statistics I**

Hours: 3

A calculus-based course in statistics. Topics covered include probability and its properties; discrete random variables and their probability distributions; continuous random variables and their probability distributions; joint probability distributions; sampling distributions and central limit theorem; one- and two-sample point and interval estimation problems; test of hypotheses; and other topics as time allows. Prerequisites: MATH 2414 with a minimum grade of C.

**MATH 403 - Mathematical Statistics II**

Hours: 3

A calculus-based course in statistical inference. Topics covered include functions of random variables - moment generating functions; methods of point estimation; correlation; simple and multiple linear regression; ANOVA; Bayesian statistics; and other topics as time allows. Prerequisites: MATH 402 (Mathematical Statistics I) or similar statistics courses with a minimum grade of C.

**MATH 426 - History of Mathematics**

Hours: 3

Selected topics in the history of mathematics; the growth of algebra, trigonometry, geometry, and the calculus; the contribution of different cultures; selected biographies of mathematicians. Prerequisites: MATH 2414 with a minimum grade of C or consent of Instructor.

**MATH 436 - Real Analysis**

Hours: 3

Real number system; sequences and series; limit, continuity and differentiation; sequences and series of functions; uniform convergence; the Riemann integral, proofs in real analysis. Prerequisites: MATH 2414 Min Grade C and MATH 2305 with a minimum grade of C. Crosslisted with: MATH 511.

**MATH 437 - Number Theory**

Hours: 3

Mathematical induction, divisibility, prime numbers, congruences, factorization, arithmetic functions, quadratic reciprocity, primitive roots, diophantine equations. Prerequisites: MATH 2305 with a minimum grade of C.

**MATH 438 - Complex Analysis**

Hours: 3

This course covers one-dimensional complex analysis, including complex numbers, elementary complex functions, analytic functions, Mobius transformations, integration in the complex plane, and infinite series of complex numbers and variables. Prerequisites: MATH 2415 with a minimum grade of C. Crosslisted with: MATH 538.

**MATH 440 - Topology**

Hours: 3

Ordinals and cardinals, topology of the real line, metric spaces, topological spaces, sequences, continuity and homeomorphisms on topological spaces. Prerequisites: MATH 2305 with a minimum grade of C or MATH 2414 with a minimum grade of C. Crosslisted with: MATH 522.

**MATH 453 - Essentials of Statistics**

Hours: 3

Techniques of statistical applications concerning descriptive statistics, tests of hypothesis, regression and analysis of variance. Prerequisite MATH 1314 or above with a minimum grade of C.

**MATH 454 - Introduction to Sports Analytics**

Hours: 3

An introductory course in sports analytics with a focus on using the R programming language. Students will learn fundamental concepts, techniques, and tools used to analyze sports data, evaluate player performance, optimize game strategies, and make data-driven decisions in sports management. Throughout the course, we will conduct exploratory data analysis, correlations, ANOVA, regression models, as well as non-parametric statistical models commonly implemented in pro sports. Prerequisites: MATH 403 - Intro to Mathematical Statistics or MATH 303 - Intro to data science or similar courses with grade of "C" or better.

**MATH 460 - Math for Secondary Teachers**

Hours: 3

Mathematics for Secondary Teachers. Three semester hours. Exploration of problems in algebra, trigonometry, analytic geometry, calculus, Euclidean geometry, probability, statistics and discrete mathematics using technology. The course is intended as a capstone study for prospective secondary teachers of mathematics. Graphing calculators and computers will be employed to illustrate and encourage conjecturing and problem solving with an emphasis on applications. In addition, a brief survey will be made of major documents and resources pertinent to secondary mathematics teachers, such as the NCTM Standards. Prerequisites: MATH 2305 with a minimum grade of C.

**MATH 486 - Image Processing with Applications**

Hours: 3

This course will introduce students to image processing and image enhancement by applying mathematical methods in the spatial domains – first and second derivatives and the gradient; Image Restoration; Transformation, and applications will be introduced. Skills for working with image processing (IP) algorithms and tools including development and coding IP algorithms will be introduced. Prerequisites: MATH 2414-Calculus II with Min Grade of C.

**MATH 489 - Independent Study**

Hours: 1-4

Independent Study. One to four semester hours. Individualized instruction/research at an advanced level in a specialized content area under the direction of a faculty member. May be repeated when the topic varies. Prerequisite: consent of department head.

**MATH 490 - H Honors Thesis**

Hours: 3

H Honors Thesis Hours: 6 Individualized instruction/research at an advanced level in a specialized content area under the direction of a faculty member.

Prerequisite Consent of head. Note May be repeated when the topic varies.

**MATH 491 - H Ind Honors Readings**

Hours: 3

Hours: One to four - Organized class Note May be graded on a satisfactory (S) or unsatisfactory (U) basis. May be repeated when topics vary

**MATH 497 - Special Topics**

Hours: 0-4

Special Topics. One to four semester hours. Organized class. May be repeated when topics vary.