

# MATHEMATICS

The Department of Mathematics offers a broadly based curriculum that includes a variety of mathematical areas, both traditional and contemporary. With a strong commitment to quality undergraduate education and research, we seek to develop individuals who can enjoy productive careers in business, government, industry, research and education at all levels.

## Program Requirements

A student may not take a course required for a mathematics major unless a grade of "C" or above has been earned in prerequisite courses.

It is recommended that majors complete MTH 1321 Calculus I, MTH 1322 Calculus II, MTH 2311 Linear Algebra, MTH 2321 Calculus III, and MTH 3300 Foundations of Mathematics within their first two years.

Students planning to go to graduate school in mathematics should include MTH 4326 Advanced Calculus I, MTH 4327 Advanced Calculus II, MTH 4314 Abstract Algebra, and MTH 4316 Linear Algebra and Matrix Theory in their course of study.

## Programs

- Mathematics, B.A. (<https://catalog.baylor.edu/undergraduate/college-arts-sciences/academic-departments/mathematics/mathematics-ba/>)
- Mathematics (Mathematics Education), B.A. (<https://catalog.baylor.edu/undergraduate/college-arts-sciences/academic-departments/mathematics/mathematics-mathematics-education-concentration-ba/>)
- Accelerated Bachelor of Arts in Mathematics/Master of Arts in Teaching (<https://catalog.baylor.edu/undergraduate/college-arts-sciences/academic-departments/mathematics/joint-bachelor-arts-master-arts-teaching/>)
- Mathematics, B.S. (<https://catalog.baylor.edu/undergraduate/college-arts-sciences/academic-departments/mathematics/mathematics-bs/>)
- Mathematics (Mathematics Education), B.S. (<https://catalog.baylor.edu/undergraduate/college-arts-sciences/academic-departments/mathematics/mathematics-mathematics-education-concentration-bs/>)
- Applied Mathematics, B.S. (<https://catalog.baylor.edu/undergraduate/college-arts-sciences/academic-departments/mathematics/applied-mathematics-bs/>)
- Accelerated Bachelor of Science in Applied Mathematics/Master of Arts in Teaching (<https://catalog.baylor.edu/undergraduate/college-arts-sciences/academic-departments/mathematics/joint-bachelor-science-master-arts-teaching/>)
- Mathematics - Secondary Major (<https://catalog.baylor.edu/undergraduate/college-arts-sciences/academic-departments/mathematics/mathematics-secondary-major/>)
- Mathematics Minor (<https://catalog.baylor.edu/undergraduate/college-arts-sciences/academic-departments/mathematics/mathematics-minor/>)

## Mathematics (MTH)

### MTH 1109 Business Calculus Supplement (1)

Pre-requisite(s): Concurrent enrollment in MTH 1309  
 Focused, just-in-time review of the background algebra skills needed to be successful in MTH 1309.

### MTH 1121 Calculus Supplement (1)

Pre-requisite(s): Concurrent enrollment in MTH 1321  
 Focused, just-in-time review of the background algebra and trigonometry skills needed to be successful in MTH 1321.

### MTH 1220 Algebra Review (2)

Algebra review for students who need to take MTH 1320 (pre-calculus) but are not ready for MTH 1320. Topics include solving equations and inequalities, polynomials, rational functions, exponential functions, and logarithms. Begins 5 weeks into the semester. Does not apply on major. Does not satisfy the mathematics requirement for any degree.

### MTH 1301 Ideas in Mathematics (3)

Significant ideas of mathematics. Topics will be chosen from: voting theory, apportionment, financial analysis, linear and exponential growth, statistics and opinion polls. Designed primarily for liberal arts students. Does not apply toward the major.

### MTH 1308 Precalculus for Business Students (3)

A study of the types of function that arise in business calculus, including linear, quadratic, and other polynomial functions, rational functions, and exponential and logarithmic functions. Does not apply on the Arts and Sciences mathematics requirement nor on a mathematics major. Credit may not be received after receiving credit in MTH 1320.

### MTH 1309 Calculus for Business Students (3)

Prerequisite (s): A grade of C or better in MTH 1320 or MTH 1308 or a satisfactory performance on the SAT or RSAT or the ACT or the ALEKS. Differentiation of rational, exponential, and logarithmic functions of one and several variables, integration of functions of one variable, and applications to business problems. Does not apply on the major. Credit may not be received after receiving credit in MTH 1321.

### MTH 1315 Patterns, Relationships, and Number Concepts (3)

Pre-requisite(s): EDC (ELE, MMTH, MELR, MSST, MSCN, SEDA) majors only  
 Advanced perspectives on topics taught in grades EC-8 including number concepts, patterns, and functions. Does not satisfy the liberal arts mathematics requirement and does not apply toward the mathematics major.

### MTH 1316 Geometry and Measurement (3)

Pre-requisite(s): A grade of C or above in MTH 1315  
 A continuation of MTH 1315. Topics in MTH 1316 will be geometric figures, motions of geometry, and measurement. Does not apply toward the mathematics major.

### MTH 1320 Precalculus Mathematics (3)

Pre-requisite(s): Either a score of 61 or better on the ALEKS; or a satisfactory score on either the RSAT Math, SAT Math, or ACT Math  
 Basic concepts of college algebra, trigonometry, and elementary functions and an introduction to limits. Satisfactory performance on a department examination. Designed as preparation for MTH 1321; does not apply on the major.

### MTH 1321 Calculus I (3)

Pre-requisite(s): Either MTH 1320 with a grade of B- or better; or a score of 80 or better on the ALEKS; or a satisfactory score on either the RSAT Math, SAT Math, or ACT Math  
 Differential calculus of a single variable. Introduction to the definite integral and the Fundamental Theorem of Calculus.

### MTH 1322 Calculus II (3)

Pre-requisite(s): A grade of C or above in MTH 1321  
 Integral calculus of a single variable, differential equations, slope fields, and power series.

**MTH 2311 Linear Algebra (3)**

Pre-requisite(s): A grade of C or above in MTH 1322

Vectors, matrix operations, linear transformations, fundamental properties of vector spaces, systems of linear equations, eigenvalues, and eigenvectors.

**MTH 2316 Algebra and Functions (3)**

Pre-requisite(s): A grade of C or above in MTH 1316 or concurrent enrollment

Designed for the prospective teacher seeking mathematics certification for grades 4-8. A study of the algebraic and transcendental functions which play a primary role in calculus. An emphasis will be placed on mathematical models which arise from lab-based activities, on connections to areas within and outside of mathematics, and on developing the ability to communicate mathematical ideas to individuals at various levels. Does not apply toward the mathematics major.

**MTH 2317 Functions and the Mathematics of Change (3)**

Pre-requisite(s): A grade of C or above in MTH 2316

Designed for the prospective teacher seeking mathematics certification for grades 4-8. A continuation of MTH 2316. An investigation of the derivative and integral from an algebraic, geometric, and numerical perspective. Credit may not be received after completion of MTH 1321. Does not apply toward the mathematics major.

**MTH 2321 Calculus III (3)**

Pre-requisite(s): A grade of C or above in MTH 1322

Differential and integral calculus of several variables, Green's Theorem.

**MTH 2V90 Introduction to Research in Mathematics (1-3)**

Pre-requisite(s): Consent of Instructor

Beginning independent study or research in topics not available in other courses. May be repeated for a maximum of 3 hours.

**MTH 3300 Foundations of Mathematics (3)**

Pre-requisite(s): A grade of C or above in MTH 1321

Core concepts of advanced mathematics: proofs, induction, sets, functions, equivalence relations, divisibility, modular arithmetic, real numbers, sequences and limits.

**MTH 3312 Foundations of Combinatorics and Algebra (3)**

Pre-requisite(s): A grade of C or above in MTH 3300 or departmental consent required

Elementary counting principles, fundamental properties of the integers, the ring of integers modulo  $n$ , rings of polynomials, and an introduction to groups, rings and fields.

**MTH 3318 Data and Chance (3)**

Pre-requisite(s): A grade of C or above in MTH 1316

Designed for the prospective teacher seeking an EC-4 mathematics certification. Core ideas from probability and statistics, including collection of data, patterns in data, and inference from data, in an active lab-like environment. Credit may not be received after completion of MTH 2381 or MTH 3381. Does not apply toward the mathematics major.

**MTH 3323 Introduction to Analysis (3)**

Pre-requisite(s): A grade of C or above in MTH 2321 and MTH 3300

A rigorous treatment of the real number system, sequences of real numbers, limits, continuous functions, and elements of differentiation and integration.

**MTH 3324 Numerical Methods (3)**

Cross-listed as CSI 3324

See CSI 3324 for course information.

**MTH 3325 Ordinary Differential Equations (3)**

Pre-requisite(s): A grade of C or above in MTH 2321 or concurrent enrollment

Differential equations of first order, linear equations of order two and higher, introduction to power series methods, elements of the Laplace Transform, some facts from linear algebra and systems of differential equations.

**MTH 3326 Partial Differential Equations (3)**

Pre-requisite(s): A grade of C or above in MTH 2321 and 3325

Partial differential equations of physics, the method of separation of variables, orthogonal sets of functions, Fourier Series, boundary value problems, Fourier integrals and applications.

**MTH 3327 Partial Differential Equations for the Social Sciences (3)**

Pre-requisite(s): C or better in MTH 3325 and C or better in MTH 2321

Introduction of partial differential equations that model social behavior, from crowd dynamics to optimal control

Topics include linear and nonlinear transport equations, Hamilton-Jacobi equations, and diffusions, with some applications to game theory.

**MTH 3340 Mathematics through Technology (3)**

Pre-requisite(s): Credit for twelve hours of mathematics courses, at least three hours of which are at the 2000 level or above

(This prerequisite cannot be satisfied using any hours transferred in under the generic titles MTH 1000 or MTH 2000.) Designed for the prospective mathematics teacher seeking certification for grades 4-8 or 8-12. Use of technology to explore, communicate, and reinforce mathematical concepts and problem solving from several areas of mathematics. Attention given to graphing calculators, interactive geometry computer packages, computer-based algebra packages, and spreadsheets or statistical packages. Written and oral presentations. Does not apply toward the mathematics major.

**MTH 3345 Intermediate Logic (3)**

Cross-listed as PHI 4345

See PHI 4345 for course information.

**MTH 3350 Structure of Modern Geometry (3)**

Pre-requisite(s): A grade of C or above in MTH 2311 or 2317

A study of the foundations of Euclidean geometry by synthetic methods with a brief introduction to non-Euclidean geometry.

**MTH 3351 Proof and Reasoning in Mathematics for Middle School Math Teachers (3)**

Pre-requisite(s): A grade of C or better in both MTH 2317 and 3318, or concurrent enrollment

Concepts taken from probability and statistics, algebra and number concepts, and Euclidean and non-Euclidean geometry, with a focus on the role and history of proof and reasoning as the cornerstone in arriving at mathematical conclusions. Does not apply toward the mathematics major or as a secondary mathematics elective.

**MTH 3370 Mathematical Methods of Operations Research (3)**

Pre-requisite(s): A grade of C or above in MTH 2311

A survey of models and methods used in operations research. Topics include linear programming, dynamic programming, and game theory, with emphasis on the construction of mathematical models for problems arising in a variety of applied areas and an introduction to basic solution techniques.

**MTH 3374 Introduction to Mathematical Modeling (3)**

Pre-requisite(s): A grade of C or above in MTH 1322 or in both MTH 2317 and 3318

An introduction to the process of mathematical modeling, including problem identification, model construction, model selection, simulation, and model verification. Individual and team projects.

**MTH 3V90 Advanced Undergraduate Research in Mathematics (1-3)**

Pre-requisite(s): Consent of Instructor

Advanced independent study or research in topics not available in other courses. May be repeated for a maximum of 3 hours.

**MTH 3V9R Research (3)**

Pre-requisite(s): Consent of the instructor

Undergraduate research undertaken with the supervision of a faculty member. May be taken for a maximum of 6 hours.

**MTH 4312 Cryptology (3)**

Pre-requisite(s): A grade of C or above MTH 3300 or CSI 2350; or consent of instructor

Introduction to cryptology, the study of select codes and ciphers. Included is a historical context, a survey of modern crypto systems, and an exposition of the role of mathematical topics such as number theory and elliptic curves in the subject. Mathematical software will be available.

**MTH 4313 Number Theory (3)**

Pre-requisite(s): A grade of C or above in MTH 3300 or consent of instructor

Algebraic number theory including linear Diophantine equations, distribution of primes, congruence, number theoretic functions, Euler's and Wilson's theorems, Pythagorean triples, Mersenne and Fermat primes, Fibonacci numbers, and sums of squares. Continued fractions, quadratic reciprocity, Mobius inversion, Bertrand's postulate, prime number theorem, and zeta function may also be included.

**MTH 4314 Abstract Algebra (3)**

Pre-requisite(s): A grade of C or above in MTH 2311 and MTH 3312; or consent of instructor

Fundamentals of group, ring, and field theory. Topics include permutation groups, group and ring homomorphisms, direct products of groups and rings, quotient objects, integral domains, field of quotients, polynomial rings, unique factorization domains, extension fields, and finite fields.

**MTH 4316 Linear Algebra and Matrix Theory (3)**

Pre-requisite(s): A grade of C or above in MTH 2311 and MTH 3300

Matrix calculus, eigenvalues and eigenvectors, canonical forms, orthogonal and unitary transformation, and quadratic forms. Applications of these concepts.

**MTH 4322 Numerical Analysis (3)**

Cross-listed as CSI 4322

Pre-requisite(s): A grade of C or above in MTH 2321

Numerical evaluation of derivatives and integrals, solution of algebraic and differential equations, and approximation theory.

**MTH 4324 Systems of Ordinary Differential Equations (3)**

Pre-requisite(s): MTH 3325 and MTH 2311

A continuation of MTH 3325 with emphasis on systems of ordinary differential equations. Topics include matrix and first order linear systems of differential equations, eigenvalues and eigenvectors, two-dimensional autonomous systems, critical point analysis, phase plane analysis, Liapunov, stability theory, limit cycles and Poincare-Bendixson theorem, periodic solutions, perturbation methods, and some fixed point theory.

**MTH 4326 Advanced Calculus I (3)**

Pre-requisite(s): A grade of C or above in MTH 2321 and MTH 3323 or consent of instructor

The real and complex number systems, basic topology, numerical sequences and series, continuity, differentiation, integration, sequences and series of functions.

**MTH 4327 Advanced Calculus II (3)**

Pre-requisite(s): A grade of C or above in MTH 4326

Line and surface integrals, Green, Gauss, Stokes theorems with applications, Fourier series and integrals, functions defined by integrals, introduction to complex functions.

**MTH 4328 Numerical Linear Algebra (3)**

Cross-listed as CSI 4328

Pre-requisite(s): A grade of C or above in MTH 2311

Numerical methods for solution of linear equations, eigenvalue problems, and least squares problems, including sparse matrix techniques with applications to partial equations.

**MTH 4329 Theory of Functions of a Complex Variable (3)**

Pre-requisite(s): A grade of C or above in MTH 2321

Number systems: the complex plane; fractions, powers, and roots; analytic functions; elementary functions; complex integration; power series; mapping by elementary functions; calculus of residues.

**MTH 4343 Topics in Mathematics for Prospective Teachers (3)**

Pre-requisite(s): A grade of C or above in MTH 3312, 3323, or 3350

Prospective middle and secondary school mathematics teachers engage in an in-depth analysis of mathematical topics encountered in the middle and secondary curriculum. Does not apply toward the mathematics major.

**MTH 4375 Linear Programming (3)**

Pre-requisite(s): A grade of C or above in MTH 2311 and 3370

An introduction to the theory and applications of linear programming, including the simplex algorithm, duality, sensitivity analysis, parametric linear programming, and integer programming, with applications to transportation, allocation problems, and game theory.

**MTH 4V90 Topics in Mathematics (1-3)**

Pre-requisite(s): Consent of instructor

Topics in contemporary mathematics not covered in other courses. May be repeated once for credit if content is different.

**MTH 4V9R Research (3)**

Pre-requisite(s): Consent of the instructor

Undergraduate research undertaken with the supervision of a faculty member. May be taken for a maximum of 6 hours.