

MATHEMATICS (MATH)

MATH 1314 College Algebra

The fundamentals of algebra; polynomials and graphs; conic sections; systems of linear equations, matrices; sequences and series; mathematical induction and the binomial theorem.

Prerequisites: Completion of Texas Success Initiative (TSI) mathematics requirements, appropriate level developmental course sequence, an minimum ACT Mathematics score of 19 with an ACT Composite score of 23 or above, a minimum SAT Mathematics score of 500 with a SAT Total score of 1,070 or above, or a Redesigned SAT Mathematics score of 530 or above.

TCCN: MATH 1314

MATH 1316 Plane Trigonometry

In-depth study and applications of trigonometry including definitions, identities, inverse functions, solutions of equations, graphing, and solving triangles. Additional topics such as vectors, polar coordinates and parametric equations may be included. Students completing both MATH 1314 and MATH 1316 may satisfy MATH 2412 requirement at TAMU.

Prerequisites: ACT Mathematics score of 27 or above, an SAT Mathematics score of 630 or above, a Redesigned SAT Mathematics score of 650 or above, or MATH 1314.

TCCN: MATH 1316

MATH 1324 Business Math I

The application of common algebraic functions, including polynomial, exponential, logarithmic, and rational, to problems in business, economics, and the social sciences are addressed. The applications include mathematics of finance, including simple and compound interest and annuities; systems of linear equations; matrices; and linear programming.

Prerequisites: Completion of Texas Success Initiative (TSI) Mathematics requirements or appropriate level developmental course sequence.

TCCN: MATH 1324

MATH 1325 Business Math II

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.

Prerequisites: MATH 1324.

TCCN: MATH 1325

MATH 1332 Mathematics for Liberal Arts I

This course is 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.

Prerequisites: Completion of Texas Success Initiative (TSI) Mathematics requirements or appropriate level developmental course sequence.

TCCN: MATH 1332

MATH 1342 Introductory Statistics

Topics include collection, analysis, presentation and interpretation of data, and probability. Analysis includes descriptive statistics, correlation and regression, confidence intervals and hypothesis testing. Use of appropriate technology is recommended.

Prerequisites: Completion of Texas Success Initiative (TSI) Mathematics requirements or appropriate level developmental course sequence.

TCCN: MATH 1342

MATH 1348 Analytic Geometry

Lines, circles, and other conic sections; transformation of coordinates; polar coordinates; and parametric equations.

Prerequisites: MATH 1316 or MATH 2412.

MATH 1350 Fundamentals of Mathematics I

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. This course is primarily intended for students enrolled in the degree programs with various levels of certification.

Prerequisites: MATH 1314, MATH 1324, MATH 1332, or MATH 1342.

TCCN: MATH 1350

MATH 1351 Fundamentals of Mathematics II

Probability, statistics, and geometry. This course cannot be used to fulfill Core Curriculum requirement.

Prerequisites: MATH 1350.

TCCN: MATH 1351

MATH 2330 Elementary Geometry

Introduction to classical Euclidean Geometry. Postulates, congruency, similarity and classical construction. Introduction to solid geometry and transformations in the plane. (Formerly MATH 3320)

MATH 2412 Pre-Calculus

In-depth combined study of algebra, trigonometry, and other topics for calculus readiness. Topics include: Analytic geometry, complex numbers, and systems of algebraic equations; algebraic, exponential, logarithmic and trigonometric functions and applications; sequences and applications. Students will receive credits for at most two courses from MATH 1314, 1316 and 2412.

Prerequisites: ACT Mathematics score of 25 or above, an SAT Mathematics score of 600 or above, a Redesigned SAT Mathematics score of 620 or above, MATH 1314, or successful completion of Pre-Calculus Placement Exam.

TCCN: MATH 2412

MATH 2413 Calculus I

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. Course credits may be received for an AP score of 3 or more for Mathematics Calculus AB.

Prerequisites: ACT Mathematics score of 29 or above, an SAT Mathematics score of 660 or above, a Redesigned SAT Mathematics score of 690 or above, MATH 1316, or MATH 2412.

TCCN: MATH 2413

MATH 2414 Calculus II

Techniques and applications of integration of differentiation and integration of transcendental functions; parametric equations and polar coordinates; techniques of integration; sequences and series; improper integrals. Course credits may be received for an AP score of 3 or more for Mathematics Calculus BC.

Prerequisites: MATH 2413.

TCCN: MATH 2414

MATH 2415 Calculus III

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.

TCCN: MATH 2415

MATH 3195 Seminar

Seminar on various topics in mathematics. May be repeated for credit with departmental approval.

MATH 3295 Seminar

Seminar on various topics in mathematics. May be repeated for credit with departmental approval.

MATH 3310 Introduction to Linear Algebra

Introduction to linear transformations and matrices; vector spaces, vector operations.

Prerequisites: MATH 2415.

MATH 3318 Advanced Linear Algebra

A continuation of MATH 3310. Focuses on more abstract aspects as well as computational aspects. Topics include inner product spaces, spectral theorems, diagonalization, Hermitian matrices, quadratic forms, numerical linear and Jordan canonical.

Prerequisites: MATH 3310.

MATH 3320 Modern Geometry

Modern development of Euclidean geometry (Hilbert axioms) with historical and philosophical context; independence of the parallel postulate; models of hyperbolic non-Euclidean geometry, as well as transformational geometry, with techniques from linear algebra. Intended primarily for students seeking secondary certification.

Prerequisites: MATH 3310.

MATH 3325 Geometry

Selected topics from the foundations of Euclidean and non-Euclidean geometries. Includes the study of spherical and hyperbolic geometries, as well as transformational geometry, with techniques from linear algebra. Intended primarily for students seeking secondary certification.

Prerequisites: MATH 3310.

MATH 3328 Advanced Geometry

Study of Neutral, Euclidean and Hyperbolic geometrics from an axiomatic perspective.

Prerequisites: MATH 3365.

MATH 3330 Ordinary Diff Equations

Solution of first order differential equations. Study of second and higher order equations with constant coefficients. Power series solutions. Laplace Transform and Linear Systems. A brief introduction to numerical methods.

Prerequisites: MATH 2414.

MATH 3360 Statistical Analysis

Fundamentals of probability, distribution theory, random variables, law of large numbers, central limit theorems, statistical inequalities.

Prerequisites: MATH 2414.

MATH 3365 Discrete Mathematics

This course is a study of elements of discrete mathematics. Topics covered: logic; counting techniques; mathematical induction; the binomial theorem; number theory; sets, relations and functions.

Prerequisites: MATH 2413.

MATH 3371 Communications in Mathematics

This course is designated to enhance students' communication skills in mathematics. Emphasis will be placed in writing proofs. Topics include set theory, logic and properties of numbers at an elementary level. Substantial writing in mathematics using LaTeX is required.

Prerequisites: ENGL 1302 and MATH 3365.

MATH 3390 Principles of Math for Elem Ed

An in-depth study of the mathematical principles and concepts underlying the traditionally computational techniques for the teaching of mathematics at early childhood and elementary school levels. The course content includes problem solving; arithmetic, algebra, geometry, probability, logic, counting, numeration and number systems (including natural, integer, rational, and real number systems), and their historical development; content based teaching; integrating various areas of mathematics; and examining connections of college-level mathematics course contents with the mathematics content of and its effective teaching at the early childhood and elementary school levels. In addition, TExES Mathematics Standards V-IX covering Mathematical Processes, Mathematical Perspectives, Mathematical Learning and Instruction, Mathematical Assessment and Professional Development will be emphasized. Students must earn a "C" or better to successfully complete the course. The course may not be counted toward a major or minor in Mathematics or for certification in secondary mathematics. Open only to early childhood/elementary education majors. It is strongly recommended to take this course concurrently with Block II.

Prerequisites: Completion of Block I and a grade of at least "C" in MATH 1350 and 1351.

MATH 3395 Seminar

Seminar on various topics in mathematics. May be repeated for credit with departmental approval.

MATH 4152 Internship In Mathematics

A directed internship in a public/private organization that is appropriate to the student's career objective or desire in a mathematical science setting. Students will apply mathematical knowledge in a real world setting and receive on-the-job training experience. Seminar and training will be held to discuss field experience from theoretical and applied perspectives.

Prerequisites: Permission of the instructor and advisor.

MATH 4252 Internship in Mathematics

A directed internship in a public/private organization that is appropriate to the student's career objective or desire in a mathematical science setting. Students will apply mathematical knowledge in a real world setting and receive on-the-job training experience. Seminar and training will be held to discuss field experience from theoretical and applied perspectives.

Prerequisites: Permission of the instructor and advisor.

MATH 4305 Number Theory

Divisibility, congruence, power residues, quadratic reciprocity, Diophantine equations, Euler's function, Fermat's theorem, primitive roots, Legendre and Jacobi symbols.

Prerequisites: MATH 3365 and MATH 3310.

MATH 4310 Abstract Algebra I

Introduction to abstract algebra. Topics include Introduction to Ring theory: arithmetic in integers, modular arithmetic, fields, arithmetic in the Ring of polynomials. Unique factorization in integers and polynomials. Introduction to Group theory: definition and examples, subgroups, quotient groups, symmetry groups and permutation groups.

Prerequisites: MATH 3365.

MATH 4315 Abstract Algebra II

Continuation of MATH 4310. Topics in group theory: group actions, Sylow theorems, fundamental theorem of Abelian groups, and finite simple groups. Topics in Ring theory: ideals and quotient rings, Euclidean domain, principal ideal domain and unique factorization domain. Topics in Field theory: vector spaces, field extensions, finite field, and Galois Theory.

Prerequisites: MATH 4310.

MATH 4330 Numerical Linear Algebra

Numerical methods for problems of linear algebra, including the solution of large systems, eigenvalues and eigenvectors.

Prerequisites: MATH 3310

MATH 4335 Advanced Calculus

A course in real analysis. It will include topology, continuity, differentiation, integration, sequences, series and power series.

Prerequisites: MATH 2414 and MATH 3365.

MATH 4340 Numerical Analysis I

Error analysis, solutions of non-linear functions, systems of linear equations, eigenvalue problems, interpolation theory, numerical differentiation and integration, numerical methods for ordinary differential equations.

Prerequisites: MATH 3330 and MATH 3310.

MATH 4341 Numerical Analysis II

Finite difference methods and finite element methods for elliptic, parabolic and hyperbolic equations.

Prerequisites: MATH 4340 and MATH 4350.

MATH 4345 Complex Variables

This is a course in complex variables which will include analytic functions, power series, the theory of residues and conformal mappings.

Prerequisites: MATH 4335 or permission of instructor.

MATH 4350 Partial Differential Equations

Theory of partial differential equations and boundary value problems with applications to the physical sciences and engineering. Detailed analysis of the wave equation, the heat equation, and the potential equation. Numerical methods to solving partial differential equations will also be discussed.

Prerequisites: MATH 3330.

MATH 4352 Internship in Mathematics

A directed internship in a public/private organization that is appropriate to the student's career objective or desire in a mathematical science setting. Students will apply mathematical knowledge in a real world setting and receive on-the-job training experience. Seminar and training will be held to discuss field experience from theoretical and applied perspectives.

Prerequisites: Permission of the instructor and advisor.

MATH 4355 Selected Topics in Math

Topics selected from the fields of pure or applied mathematics. May be repeated when topic changes.

Prerequisites: Senior standing and permission of instructor.

MATH 4360 Introduction to Topology

Basic concepts of point-set topology including connectedness, compactness, etc. and metric spaces.

Prerequisites: MATH 3365 and 4335.

MATH 4365 Geometry of Curves&Surfaces

This course will present geometry of curves and surfaces in three dimensional Euclidean space. Topics include 1) From Curve Theory: Parametrized Curves, Arc Length, Frenet-Serret Frame, Singularities, Theory of Contact, Curvature, Torsion, Intrinsic Equation of Curves, Global Properties of Curves; 2) From Surface Theory: Parametrized Surfaces, Tangent Plane and Normal Line, First and Second Fundamental Forms, Curvature of Surfaces.

Prerequisites: MATH 2415, 3310.

MATH 4380 Undergraduate Research in Math

Students work on a theoretical or applied research project. The plan of study is negotiated by the faculty member and the student. Course may be repeated under different topic for credit. Evaluation of performance in this course is on a Pass/Fail basis.

Prerequisites: Consent of the instructor and the department.

MATH 4385 History of Mathematics

Topics from arithmetic and computation, algebra, geometry, trigonometry, calculus, number theory, linear algebra, etc. from ancient recorded history to modern times intertwined with historical perspectives, biographies of several mathematicians from different cultures and times, their contributions, and that of their cultures, to mathematics and society.

Prerequisites: Nine semester hours of advanced mathematics.

MATH 4390 Math in Middle & High School

Explore contemporary issues, connections among various mathematics topics, and specialized pedagogical content knowledge for teaching mathematics at the secondary school level. Content topics may include: using sequences and series to solve problems in the mathematics of finance, relate geometry and algebra by representing transformations as matrices, apply probability concepts to make inferences in statistics, and essential understandings of functions in both higher-level mathematics and in real-world contexts, among others. Concurrent enrollment in Block II is strongly recommended.

Prerequisites: Completion of Block I and at least twelve upper-level mathematics SCH.

MATH 4395 Senior Mathematics Project

A study project under the direction of a member of the mathematics faculty. Required will be a written report, oral presentation and approval by both the advisor and one additional mathematics faculty member.

Prerequisites: Senior standing and permission of instructor.

MATH 4452 Internship in Mathematics

A directed internship in a public/private organization that is appropriate to the student's career objective or desire in a mathematical science setting. Students will apply mathematical knowledge in a real world setting and receive on-the-job training experience. Seminar and training will be held to discuss field experience from theoretical and applied perspectives.

Prerequisites: Permission of the instructor and advisor.

MATH 5191 Mathematics Seminar

A seminar presents diverse topics from pure and applied mathematics.

Students are encouraged to present a series of articles, journals and portions of monographs during the class meetings. May be repeated once when topics vary. (Formerly MATH 5190)

Prerequisites: Graduate standing and permission of instructor.

MATH 5252 Internship in Mathematics

Students are encouraged to have directed internships in a public or private organization appropriate to the student's career objective/desire. Taken during the last year of the student's program of study, student has to provide that the nature of the assignment undertaken in the organization has relevant mathematics components.

Prerequisites: Graduate standing and permission of the department and instructor.

MATH 5290 Research Mthds in Mathematics

This course deals with the basic tools of the mathematics to better understand mathematical research. Analytical concepts, survey research, in some cases, statistical/computational software and their methods will be the basis of this course.

Prerequisites: Graduate standing and permission of the instructor.

MATH 5303 Number Theory I

This first course in number theory introduces algebraic number theory as well as the analytic methods. Topics include: Number fields, algebraic integers, ideals and units, ideal class groups, ramification theory, quadratic and cyclotomic fields, zeta-functions and L-series.

Prerequisites: Graduate standing and permission of instructor.

MATH 5304 Number Theory II

Topics include: Artin reciprocity law, topics from field theory; modular functions and elliptic curves, Diophantine equations, distribution of prime numbers, computations applications of algebraic curves over finite fields such as elliptic curve cryptography and coding.

Prerequisites: MATH 5303.

MATH 5305 Real Analysis I

This is a course on Lebesgue measure and integration. The classical L_p spaces will be defined and basic results established, such as the Holder and Minkowski inequalities and completeness of the spaces.

Prerequisites: Graduate standing and permission of instructor.

MATH 5306 Linear Algebra

Topics include: Canonical structure theorems, diagonalization, the spectral theorem, inner-product spaces, and their applications and extensions.

Prerequisites: Graduate standing and permission of instructor.

MATH 5311 Real Analysis II

Topics include: Fourier series, introduction to Hilbert Spaces, the spectral theorem for compact linear operators on Hilbert spaces with applications to differential equations.

Prerequisites: MATH 5305, and knowledge equivalent to MATH 3310.

MATH 5312 Functional Analysis I

This is the first course in Functional Analysis. Topics include: Topological vector spaces, Banach spaces, the open mapping and closed graph theorems, the Hahn-Banach theorem, duality and weak topologies.

Prerequisites: MATH 5305 and knowledge equivalent to MATH 3310.

MATH 5315 Combinatorics

This course discusses discrete mathematical structures, especially the enumeration and the optimization problems related to them. Algorithmic (constructive) aspects will be emphasized. Course work involves computer programming projects. Topics include: basic tools of combinatorics, graphs and networks, relations, the counting problems, the existence problems, the combinatorial optimization.

Prerequisites: Graduate standing and permission of instructor.

MATH 5316 Graph Theory

This is a basic course in graph theory. Fundamental concepts of graph theory will be investigated. Topics include: directed graphs, trees and distance, spanning trees, coloring of graphs, planar graphs, edges and cycles.

Prerequisites: Graduate standing and permission of instructor.

MATH 5320 Complex Variables I

This is the first course on functions of one complex variable. It will begin with the complex number system and will treat topics such as power series, analytic functions, Mobius transformations, complex integrations, residue calculus, singularities, and Schwarz's Lemma.

Prerequisites: Graduate standing and consent of instructor.

MATH 5321 Complex Variables II

This is the second course on functions of one complex variable. Topics include: conformal mappings, convex functions, the Hadamard Three Circles Theorem, compactness, convergence in the space of analytic functions, Runge's theorem, analytic continuation and Riemann surfaces, harmonic functions, entire functions, and Picard's Theorems.

Prerequisites: MATH 5320.

MATH 5330 Abstract Algebra I

This is the first course in Abstract Algebra. The main topics in this course will be groups, rings, fields, subgroups, quotient groups, ideals, homomorphisms and introduction to field extensions. There will be classical examples of permutation groups, polynomial rings and integral domains, questions of factorization, ideals and fundamental homomorphism theorems.

Prerequisites: Graduate standing and consent of instructor.

MATH 5331 Abstract Algebra II

Topics include modules, finite fields, Fundamental Theorem of Field Theory, algebraic extensions, the classification of finite fields, Fundamental Theorem of Galois Theory, and the cyclotomic extension.

Prerequisites: MATH 5330.

MATH 5340 Differential Geometry

This course is an introduction to the differential geometry of n -dimensional manifolds. Topics include: Riemannian manifolds, differential forms and Stokes Theorem. (Note that differential geometry is relevant to differential equations, mathematical physics, as well as other areas of sciences.)

Prerequisites: MATH 5365 and knowledge equivalent to MATH 2415 and MATH 4335.

MATH 5350 Ordinary Diff Equations I

This is the first course in ordinary differential equations. The course will include systems of linear differential equations, two dimensional autonomous systems, existence, uniqueness and continuation of solutions, dependence of solutions on initial conditions and parameters.

Prerequisites: Graduate standing and permission of instructor.

MATH 5355 Advanced Topics in Mathematics

Advanced topics selected from the fields of pure or applied mathematics. May be repeated when topic changes.

Prerequisites: Graduate standing and permission of instructor.

MATH 5360 Partial Differential Equations

This is a basic course in partial differential equations. The course will cover the following: first order linear partial differential equations, classification of second order equations and canonical forms, Fourier series and integrals, the wave equation, the Cauchy problem for hyperbolic equations, the heat equation, the weak maximum principle, the strong maximum principle, the Laplace equation, Green's function and Poisson's formula.

Prerequisites: MATH 5350.

MATH 5365 Topology

This is an introductory course in point-set topology. The course will include topological spaces, continuous functions, connectedness, and separation axioms. Tychonoff's theorems, para-compactness, complete metric spaces and function spaces will also be discussed.

Prerequisites: Graduate standing and permission of instructor.

MATH 5367 Numerical Methods for PDE I

A study of algorithms for the numerical solution of hyperbolic and parabolic partial differential equations using the finite difference method; stability and convergence of methods and error bounds. Applications from physics and engineering will be emphasized.

Prerequisites: Graduate standing and permission of instructor.

MATH 5368 Numerical Methods for PDE II

A study of algorithms for the numerical solution of elliptic partial differential equations using the finite difference method; stability and convergence of methods and error bounds. Applications from physics and engineering will be emphasized.

Prerequisites: Graduate standing and permission of instructor.

MATH 5370 Mathematical Modeling

This is the first course in mathematical modeling. Topics include: linear equations and models, non-linear equations and models, modeling with linear systems, modeling with non-linear systems, mathematical modeling and dynamical systems, non-homogeneous systems, empirical models and linear regression, bifurcation and chaos. Working knowledge of a computer programming language is preferred.

Prerequisites: Graduate standing and permission of instructor.

MATH 5375 Probability

Topics include: distribution functions, random variables, expectation, independence, convergence concepts, law of large numbers, characteristic functions, the central limit theorem, conditional expectation, martingales and Brownian.

Prerequisites: MATH 5305.

MATH 5395 Graduate Research in Math

Students work on a theoretical or applied research project. The plan of study is negotiated by the faculty member and the student. Course may be repeated under different topic for credit. Offer only "Pass/Fail" grades.

Prerequisites: Consent of the instructor and the department.

MATH 5398 Thesis I

This course is designed to be the first step towards the successful completion of the Mathematics thesis. Students schedule the coursework in consultation with their advisor. Evaluation of performance is CR/NC. Students will receive credit for the class when they have a proposal approved by their thesis committee and the required evidence of progress on a draft. If the grade of IP is received, the student must enroll again for credit. Approval of the major professor and the department chair. All core courses should be completed prior to beginning thesis work, preferably during the last year of the student's program of study.

Prerequisites: Graduate standing and permission from the student's thesis advisory committee.

MATH 5399 Thesis II

This course is designed to be the final step towards the successful completion of the Mathematics thesis. Students schedule the coursework in consultation with their advisor. Evaluation of performance is CR/NC. Students will receive credit for the class when they have successfully written and defended their thesis to their thesis committee. If the grade of IP is received, the student must enroll again for credit.

Prerequisites: Graduate standing, MATH 5398: Thesis I, permission from the student's thesis advisory committee and approval of the major professor and the department chair.

MATH 5699 Thesis II

This course is designed to be the final step towards the successful completion of the Mathematics thesis. Students schedule the coursework in consultation with their advisor. Evaluation of performance is CR/NC. Students will receive credit for the class when they have successfully written and defended their thesis to their thesis committee. If the grade of IP is received, the student must enroll again for credit.

Prerequisites: Graduate standing, MATH 5398: Thesis I, permission from the student's thesis advisory committee and approval of the major professor and the department chair.

MATH 5999 Thesis II

This course is designed to be the final step towards the successful completion of the Mathematics thesis. Students schedule the coursework in consultation with their advisor. Evaluation of performance is CR/NC. Students will receive credit for the class when they have successfully written and defended their thesis to their thesis committee. If the grade of IP is received, the student must enroll again for credit.

Prerequisites: Graduate standing, MATH 5398: Thesis I, permission from the student's thesis advisory committee and approval of the major professor and the department chair.