

# Mathematics (MATH)

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## Courses

### **MATH 110. College Algebra. 4 Units.**

Prerequisites: Placement determined by campus placement standards and consultation with an advisor. Graded A through C-/No Credit

Offered: Fall, Winter and Spring

Functional notation, graphs and inverses of linear, polynomial, and rational functions, rational exponents, arithmetic and geometric progressions, logarithmic and exponential functions, systems of linear equations. (GE-B1).

### **MATH 110L. College Algebra Lab. 1 Unit.**

Additional Instruction in college algebra for students registered in MATH 110. Activities include problem solving; may include computer-aided instruction. Placement determined by campus placement standards and advising. Co-requisite: MATH 110. Graded Credit/No credit.

### **MATH 111A. Accelerated Stretch College Algebra A. 4 Units.**

Function notation, graphs and inverses of linear, polynomial, and rational functions, linear equations. First quarter of a two-quarter version of MATH 110. Placement determined by campus placement standards and advising. Graded A through C-/No Credit.

### **MATH 111AL. Accelerated Stretch College Algebra A Lab. 1 Unit.**

Additional instruction in college algebra for students registered in MATH 111A. Activities include problem solving; may include computer-aided instruction. Placement determined by campus placement standards and advising. Graded Credit/No credit. Co-requisite: MATH 111A.

### **MATH 111B. Accelerated Stretch College Algebra B. 4 Units.**

Prerequisites: Passage of MATH 111A

Continued emphasis on functions and function notation. Topics include rational exponents, arithmetic and geometric progressions, logarithmic and exponential functions. Second quarter of a two-quarter version of MATH 110. Graded A through C-/No Credit. (GE-B1).

### **MATH 111BL. Accelerated Stretch College Algebra B Lab. 1 Unit.**

Additional instruction in college algebra for students registered in MATH 111B. Activities include problem solving; may include computer-aided instruction. Placement determined by campus placement standards and advising. Graded Credit/No credit. Co-requisite: MATH 111B.

### **MATH 112A. Stretch College Algebra A. 4 Units.**

Function notation, graphs and inverses of linear functions, linear equations. First quarter of a three-quarter version of MATH 110. Placement determined by campus placement standards and advising. Graded A through C-/No Credit. 4 (units).

### **MATH 112AL. Stretch College Algebra A Lab. 1 Unit.**

Additional instruction in college algebra for students registered in MATH 112A. Activities include problem solving; may include computer-aided instruction. Placement determined by campus placement standards and advising. Graded Credit/No credit. Co-requisite: MATH 112A.

### **MATH 112B. Stretch College Algebra B. 4 Units.**

Prerequisites: Passage of MATH 112A

Continued emphasis on functions and function notation. Topics include polynomial functions, rational functions, rational exponents, logarithmic and exponential functions. Second quarter of a three-quarter version of MATH 110. Graded A through C-/No credit.

### **MATH 112BL. Stretch College Algebra B Lab. 1 Unit.**

Additional instruction in college algebra for students registered in MATH 112B. Activities include problem solving; may include computer-aided instruction. Placement determined by campus placement standards and advising. Graded Credit/No credit. Co-requisite: MATH 112B.

### **MATH 112C. Stretch College Algebra C. 4 Units.**

Prerequisites: Passage of MATH 112B

Further work in functions and function notation. including study of rational exponents, arithmetic and geometric progressions, as well as continued modeling with linear, polynomial, logarithmic and exponential functions. Third quarter of a three-quarter version of MATH 110. Graded A through C-/No credit. (GE-B1).

### **MATH 112CL. Stretch College Algebra C Lab. 1 Unit.**

Additional instruction in college algebra for students registered in MATH 112C. Activities include problem solving; may include computer-aided instruction. Placement determined by campus placement standards and advising. Graded Credit/No credit. Co-requisite: MATH 112C.

### **MATH 115. The Ideas of Mathematics. 4 Units.**

Prerequisites: Placement determined by campus placement standards and consultation with an advisor. Graded A through C-/No Credit  
Offered: Fall, Winter and Spring

Topics in college mathematics applied to daily life. Personal finance, statistics and probability. (GE-B1).

### **MATH 115L. Ideas of Math Lab. 1 Unit.**

Additional instruction in college algebra for students registered in Math 115. Activities include problem solving; may include computer-aided instruction. Placement determined by campus placement and standard advising. Graded Credit/ No credit. Co-requisite: Math 115.

### **MATH 116A. Accelerated Stretch Ideas of Math A. 4 Units.**

Topics in college mathematics applied to daily life. Personal finance, statistics and probability. First quarter of a two-quarter version of Math 115. Placement determined by campus placement standards and advising. Graded A through C-/ No credit.

### **MATH 116AL. Accelerated Stretch Ideas of Math A Lab. 1 Unit.**

Additional instruction in college algebra for students registered in Math 116A. Activities include problem solving; may include computer-aided instruction. Placement determined by campus placement and standard advising. Graded Credit/ No credit. Co-requisite: Math 116A.

**MATH 116B. Accelerated Stretch Ideas of Math B. 4 Units.**

Continued emphasis on topics in college mathematics applied to daily life. Personal finance, statistics and probability. Second quarter of a two-quarter version of Math 115. Graded A through C-/ No credit. Prerequisite: MATH 116A (GE B1).

**MATH 116BL. Accelerated Stretch Ideas of Math B Lab. 1 Unit.**

Additional instruction in college algebra for students registered in Math 116B. Activities include problem solving; may include computer-aided instruction. Placement determined by campus placement and standard advising. Graded Credit/ No credit. Co-requisite: Math 116B.

**MATH 117A. Stretch Ideas of Math A. 4 Units.**

Topics in college mathematics applied to daily life. Personal finance, statistics and probability. First quarter of a three-quarter version of Math 115. Placement determined by campus placement standards and advising. Graded A through C-/ No credit.

**MATH 117AL. Stretch Ideas of Math A Lab. 1 Unit.**

Additional instruction in college algebra for students registered in Math 117A. Activities include problem solving; may include computer-aided instruction. Placement determined by campus placement and standard advising. Graded Credit/ No credit. Co-requisite: Math 117A.

**MATH 117B. Stretch Ideas of Math B. 4 Units.**

Prerequisites: MATH 117A

Continued emphasis on topics in college mathematics applied to daily life. Personal finance, statistics and probability. Second quarter of a three-quarter version of Math 115. Graded A through C-/ No credit.

**MATH 117BL. Stretch Ideas of Math B Lab. 1 Unit.**

Additional instruction in college algebra for students registered in Math 117B. Activities include problem solving; may include computer-aided instruction. Placement determined by campus placement and standard advising. Graded Credit/ No credit. Co-requisite: Math 117B.

**MATH 117C. Stretch Ideas of Math C. 4 Units.**

Prerequisites: MATH 117B

Further work in college mathematics applied to daily life. Personal finance, statistics and probability. Third quarter of a three-quarter version of Math 115. Graded A through C-/ No credit. (GE B1).

**MATH 117CL. Stretch Ideas of Math C Lab. 1 Unit.**

Additional instruction in college algebra for students registered in Math 117C. Activities include problem solving; may include computer-aided instruction. Placement determined by campus placement and standard advising. Graded Credit/ No credit. Co-requisite: Math 117C.

**MATH 120. Pre-Calculus Mathematics. 4 Units.**

Prerequisites: Placement determined by campus placement standards and consultation with an advisor or passage of MATH 110. Graded A through C-/No Credit

Offered: Fall, Winter and Spring

Trigonometric functions, trigonometric identities, right angle trigonometry, complex numbers, conic sections, binomial theorem, induction. (GE-B1).

**MATH 165. Introductory Statistics and Hypothesis Testing. 4 Units.**

Prerequisites: Placement determined by campus placement standards and consultation with an advisor. Graded A through C-/No Credit

Offered: Fall, Winter and Spring

Introductory statistics with applications to a variety of disciplines. Topics will include descriptive statistics, correlation, distribution or random variables, sampling distributions, interval estimation, hypothesis testing, and elementary Bayesian theory. (GE-B1).

**MATH 180. Critical Thinking Through Applications of Mathematical Logic. 4 Units.**

(GE=A4)

Offered: Fall, Winter and Spring

Analysis of logical implication, logical equivalence and valid argument using symbolic logic. Applications drawn from a wide variety of practical examples. Emphasis on problem solving techniques.

**MATH 192. Methods of Calculus. 4 Units.**

Prerequisites: MATH 110. This course does not substitute for any course in the calculus sequence MATH 211, MATH 212, MATH 213, MATH 251, MATH 252 required for majors in chemistry, computer science, mathematics or physics

(GE=B1)

Offered: Fall, Winter and Spring

A short course in calculus with emphasis on applications.

**MATH 199. Problem Solving for Teachers Using Technology. 3 Units.**

Offered: Winter and Spring

Exploration of central ideas in secondary school mathematics through problem solving using technology. Introduction to technological and software tools for teaching and learning geometry, algebra, and additional topics relevant to secondary school mathematics. Prerequisite: MATH 120 or equivalent.

**MATH 211. Basic Concepts of Calculus. 4 Units.**

Prerequisites: Satisfactory score on a department placement exam or grade of C-or better in MATH 120

(GE=B1)

Offered: Fall, Winter and Spring

An introduction to limits and continuity, differentiation of functions in one variable (including trigonometric functions) and antiderivatives with applications.

**MATH 212. Calculus II. 4 Units.**

Prerequisites: MATH 211 (or MATH 200) with a grade of C or better

Offered: Fall, Winter and Spring

Techniques and applications of integration, differentiation and integration of transcendental functions.

**MATH 213. Calculus III. 4 Units.**

Prerequisites: MATH 212 (or MATH 201) with a grade of C or better

Offered: Fall, Winter and Spring

Sequences and series, numerical techniques, polar coordinates, parametric equations.

### **MATH 229. Geometry in Two and Three Dimensions. 4 Units.**

Prerequisites: completion of the general education requirement in mathematics

Offered: Spring

Axiomatic foundations of Euclidean geometry and their relation to absolute, affine, and ordered geometry. Isometry and similarity in the Euclidean plane and three-space. Inversive transformations and construction of the real projective plane. Formerly MATH 129.

### **MATH 241. Problem Solving in Calculus. 2 Units.**

Prerequisites: some programming experience and MATH 212.

Recommended: MATH 213

Offered: Fall, Winter and Spring

An approach to solving calculus-based problems incorporating a computer algebra system. Projects will include interpolation, numerical methods, differential equations and graphical approaches. One hour lecture and three hours laboratory.

### **MATH 251. Multivariable Calculus I. 4 Units.**

Prerequisites: MATH 212 with a grade of C or better

Offered: Fall, Winter and Spring

Vectors and vector geometry in two and three dimensions. Elementary linear algebra. Multivariable functions. Parametrization of space curves.

### **MATH 252. Multivariable Calculus II. 4 Units.**

Prerequisites: MATH 251, and MATH 213 with a grade of C or better

Offered: Fall, Winter and Spring

Differentiation and integration of vector functions with applications, multiple integration, line and surface integrals. Partial and directional derivatives. Theorems of Green and Stokes.

### **MATH 262. Applied Statistics. 4 Units.**

Prerequisites: MATH 120

Prerequisite/Corequisite: MATH 211

Offered: Fall, Winter and Spring

Basic concepts of probability and statistics. Important probability models such as the binomial, Poisson and normal. Statistical procedures, particularly in relation to estimation, hypothesis testing and modeling. Computer simulations and computations. May not be taken for credit by students who have received credit for MATH 305.

### **MATH 270. Elementary Differential Equations. 4 Units.**

Prerequisites: MATH 252

Offered: Fall and Spring

First order equations, second order linear equations, linear equations with constant coefficients, variation of parameters, applications.

### **MATH 272. Discrete Mathematics. 4 Units.**

Prerequisites: completion of the general education requirement in mathematics

Offered: Fall, Winter and Spring

Boolean algebra. Computer arithmetic including hexadecimal, octal and binary numeration. Relations and functions. Vectors and matrices. Introduction to graph theory.

### **MATH 299. Problem Solving and Mathematical Reasoning for Teachers I. 4 Units.**

Prerequisites: Math 120 or equivalent

Development of problem solving skills, mathematical habits of mind, and mathematical practices, for secondary teachers. Introduction to algebraic thinking through a problem solving approach using multiple approaches. Topics include proportional reasoning and structure of number systems with connections to geometry. Graded ABC/NC.

### **MATH 301A. Fundamental Concepts Mathematics Educators: Fundamental Concepts Arithmetic and Geometry. 4 Units.**

Prerequisites: completion of MATH 115 and the general education requirements in written communication, oral communication, and critical thinking. Graded ABC/no credit

Offered: Fall, Winter and Spring

A course sequence for future teachers that develops knowledge of mathematics related to the K-8 curriculum, but that is considerably deeper than the standard K-8 content. Students completing the sequence will develop conceptual understanding, problem solving skills, and communication skills in mathematics. May not be counted toward fulfilling requirements in the mathematics major. Fundamental Concepts of Arithmetic and Geometry. Mathematical reasoning behind the structure and arithmetic of real number system. Connections between numbers, measurement, and geometry.

### **MATH 301B. Fundamental Concepts Mathematics Educators: Transition Concrete to Abstract Algebra and Geometry. 4 Units.**

Prerequisites: completion of MATH 301A with a grade of C or better.

Graded ABC/no credit

Offered: Fall, Winter and Spring

A course sequence for future teachers that develops knowledge of mathematics related to the K-8 curriculum, but that is considerably deeper than the standard K-8 content. Students completing the sequence will develop conceptual understanding, problem solving skills, and communication skills in mathematics. May not be counted toward fulfilling requirements in the mathematics major. Transition from Concrete to Abstract in Algebra and Geometry. Development of algorithmic and algebraic thinking. Investigation of linear and proportional relationships through multiple representations. Introduction to geometric reasoning about figures in 2 and 3 dimensions.

### **MATH 301C. Fundamental Concepts Mathematics Educators: Further Developments in Algebra and Geometry. 4 Units.**

Prerequisites: completion of MATH 301B with a grade of C or better.

Graded ABC/no credit

Offered: Fall, Winter and Spring

A course sequence for future teachers that develops knowledge of mathematics related to the K-8 curriculum, but that is considerably deeper than the standard K-8 content. Students completing the sequence will develop conceptual understanding, problem solving skills, and communication skills in mathematics. May not be counted toward fulfilling requirements in the mathematics major. Further Developments in Algebra and Geometry. Conceptual foundations of advanced algebra, including polynomial and other nonlinear functions. Extended geometric reasoning about figures in 2 and 3 dimensions, including concepts of congruence, similarity, and geometric transformations.

### **MATH 302. Problem Solving in Mathematics. 4 Units.**

Prerequisites: completion of the general education requirements in mathematics, written communication, oral communication and critical thinking

Offered: Fall, Winter and Spring

Use of heuristic techniques, such as analogy and induction, in problem solving. Elementary and recreational problems selected from algebra, logic, number theory, combinatorics and probability. May not be counted toward fulfilling requirements in the mathematics major.

### **MATH 308. Problem Solving Through Theory and Practice. 2 Units.**

Prerequisites: MATH 301C with a grade of at least C or consent of instructor

Offered: Fall, Winter and Spring

Heuristic techniques in solving contextual problems from algebra, number theory, geometry, logic, probability and statistics. May not be counted toward fulfilling requirements in the mathematics major. May not be taken for credit by students who have completed MATH 302. Two hours seminar.

### **MATH 320. Mathematical Interest Theory. 4 Units.**

Prerequisites: MATH 213 and 241

Offered: Spring

Development of the mathematical theory of interest in both finite and continuous time, including the accumulation function and special cases of simple and compound interest, valuation of the discrete and continuous streams of payments, and nominal and effective interest and discount rates. Application of the theory, with computer applications, to actuarial science, including amortization of lump sums, fixed income securities, and depreciation.

### **MATH 329. Transformation Geometry. 4 Units.**

Prerequisites: MATH 251 and high school geometry or equivalent

Offered: Fall, Winter and Spring

Development of Euclidean plane geometry in terms of congruence and similarity transformations. Classification of affine transformations with applications to classical theorems. Introduction to inversive transformations and related constructions.

### **MATH 331. Linear Algebra. 4 Units.**

Prerequisites: MATH 251 or consent of instructor

Offered: Fall, Winter and Spring

Vector spaces over a field, linear dependence, dimension; matrices and systems of linear equations; the theory of linear transformations; characteristic values and vectors; applications.

### **MATH 345. Number Theory and Proof. 4 Units.**

Prerequisites: MATH 213

Offered: Fall, Winter and Spring

Introduction to ideas and techniques of proof and historical topics in classical number theory. Theory of divisibility, primes and linear congruences. Theorems of Fermat, Euler and Wilson. Primitive roots and indices. Number theoretic functions.

### **MATH 355. Analysis and Proof. 4 Units.**

Prerequisites: MATH 213

Offered: Fall, Winter and Spring

Introduction to ideas and techniques of proof with an emphasis on analysis. Topics chosen from: logic, set theory, functions, cardinality and analysis.

### **MATH 372. Combinatorics. 4 Units.**

Prerequisites: MATH 213; or MATH 211, MATH 262 and MATH 272

Offered: Fall, Winter and Spring

Permutations and combinations, recurrence relations with applications and topics in graph theory.

### **MATH 395A. Directed Study. 1 Unit.**

Prerequisites: consent of instructor and departmental approval of a written proposal of a project submitted on a standard application filed in advance of the quarter in which the course is to be taken

Reading and library research in mathematics conducted under the direction of a faculty member. A total of four units may apply toward the major.

### **MATH 395B. Directed Study. 2 Units.**

Prerequisites: consent of instructor and departmental approval of a written proposal of a project submitted on a standard application filed in advance of the quarter in which the course is to be taken

Reading and library research in mathematics conducted under the direction of a faculty member. A total of four units may apply toward the major.

### **MATH 395C. Directed Study. 3 Units.**

Prerequisites: consent of instructor and departmental approval of a written proposal of a project submitted on a standard application filed in advance of the quarter in which the course is to be taken

Reading and library research in mathematics conducted under the direction of a faculty member. A total of four units may apply toward the major.

### **MATH 395D. Directed Study. 4 Units.**

Prerequisites: consent of instructor and departmental approval of a written proposal of a project submitted on a standard application filed in advance of the quarter in which the course is to be taken

Reading and library research in mathematics conducted under the direction of a faculty member. A total of four units may apply toward the major.

### **MATH 399. Mathematics and Teaching: Observation and Reflection. 2 Units.**

Prerequisites: MATH 299 and MATH 329. MATH 329 may also be taken concurrently

Offered: Fall and Winter

Supervised learning experience in the secondary mathematics classroom. Observation and participation that provides future teachers with first-hand experience and the opportunity to analyze and reflect on the teaching and learning of mathematics as well as to link their undergraduate mathematics course work with classroom experience. Includes weekly meetings on campus and observations of a secondary classroom. Graded ABC/no credit.

### **MATH 455. Fourier Analysis. 4 Units.**

Prerequisites: MATH 270 and MATH 355

Fourier series and the Fourier transform. Convergence properties and orthogonality. Applications to differential equations.

### **MATH 465. Probability Theory. 4 Units.**

Prerequisites: MATH 252 and MATH 372

Offered: Fall, Winter and Spring

Probability spaces, independence, conditional probability, densities, mass and distribution functions, moments, joint and marginal distributions, moment generating functions, Chebychev's inequality, law of large numbers and other topics.

### **MATH 470. Ordinary Differential Equations. 4 Units.**

Prerequisites: MATH 270 and 331

Offered: Winter

Topics from among: first order equations, linear equations, systems of equations, iterative methods, series solutions, Laplace transformations, applications.

### **MATH 474. Numerical Methods. 4 Units.**

Prerequisites: CSE 201 and MATH 331

Introduction to numerical methods for finding solutions of non-linear equations, systems of linear equations and ordinary differential equations. Discussion of errors and numerical instabilities; numerical differentiation; numerical integration.

### **MATH 480. Topics in History of Mathematics. 4 Units.**

Prerequisites: MATH 252, MATH 329, MATH 345 and MATH 355

Offered: Fall, Winter and Spring

Exploration of the historical and topical development of interconnected areas of mathematics, such as algebra, geometry and analysis. Discussion of the influence of culture and society on the development of mathematical ideas and discovery will be included.

### **MATH 485. Differential Geometry. 4 Units.**

Prerequisites: MATH 252, 331 and 355

An introduction to the differential geometry of curves and surfaces, including first and second fundamental forms, curvatures, geodesics, minimal surfaces, and Gauss-Bonnet Theorem.

### **MATH 499. Problem Solving and Mathematical Reasoning for Teachers II. 4 Units.**

Prerequisites: MATH 199, MATH 329, MATH 331 and MATH 399

Offered: Winter and Spring

Continued development of problem solving skills using multiple approaches, mathematical habits of mind, and mathematical practices, for secondary teachers. Includes topics from algebra and geometry as related to secondary mathematics. Emphasizes communication, argumentation, mathematical structure and connections. Graded ABC/no credit.

### **MATH 510. Topics in Mathematics. 4 Units.**

Prerequisites: senior or graduate standing

Study of selected areas of advanced mathematics. May be repeated for credit with consent of instructor as topics change.

### **MATH 529. Advanced Geometry. 4 Units.**

Prerequisites: MATH 329, MATH 331 and MATH 345

Offered: Fall, Winter and Spring

Topics in affine and projective geometry with applications to Euclidean 2 and 3 space and to modern algebra.

### **MATH 531. Advanced Linear Algebra. 4 Units.**

Prerequisites: MATH 331

Inner product spaces; duality of vector spaces; canonical forms; spectral theory; quadratic forms.

### **MATH 545. Abstract Algebra I. 4 Units.**

Prerequisites: MATH 331, MATH 345 and MATH 355

Offered: Fall, Winter and Spring

An introduction to algebraic structures, including groups, rings and fields.

### **MATH 546. Abstract Algebra II. 4 Units.**

Prerequisites: MATH 545

Offered: Spring

Continuation of MATH 545.

### **MATH 553. Analysis I. 4 Units.**

Prerequisites: MATH 252 and MATH 355

Offered: Fall, Winter and Spring

Continuous and differentiable functions, infinite series. Uniform convergence, computation with series, functions represented by integrals, theory of integration.

### **MATH 554. Analysis II. 4 Units.**

Prerequisites: MATH 553

Offered: Spring

Continuation of MATH 553.

### **MATH 555. Introduction to Point-Set Topology. 4 Units.**

Prerequisites: MATH 355

Topics to include topological and metric spaces, compactness, product spaces, connectedness, separation properties.

### **MATH 557. Complex Variables. 4 Units.**

Prerequisites: MATH 252 and 355

Analytic and harmonic functions, power series, Cauchy's Theorem and Cauchy's Formula.

### **MATH 565. Mathematical Statistics. 4 Units.**

Prerequisites: MATH 465

Likelihood ratio, estimators, distributions of estimators, theory of hypothesis testing, linear statistical models.

**MATH 570. Partial Differential Equations. 4 Units.**

Prerequisites: MATH 270 and MATH 355. MATH 241 recommended  
Classification of partial differential equations; heat equation, Laplace's equation, boundary value-problems; separation of variables. Applications of Fourier and Laplace transforms, numerical methods.

**MATH 576. Introduction to Mathematical Methods. 4 Units.**

Prerequisites: CSE 201, MATH 331 and MATH 465  
Topics from linear and probabilistic models, computer simulation, difference and differential equation models.

**MATH 595A. Independent Study. 1 Unit.**

Prerequisites: MATH 331 and 553, a minimum overall grade point average of 3.0, consent of instructor and departmental approval of a written proposal of a project submitted in advance of the quarter in which the course is to be taken

An independent study course for senior mathematics majors. A total of four units may apply toward the major.

**MATH 595B. Independent Study. 2 Units.**

Prerequisites: MATH 331 and 553, a minimum overall grade point average of 3.0, consent of instructor and departmental approval of a written proposal of a project submitted in advance of the quarter in which the course is to be taken

An independent study course for senior mathematics majors. A total of four units may apply toward the major.

**MATH 595C. Independent Study. 3 Units.**

Prerequisites: MATH 331 and MATH 553, a minimum overall grade point average of 3.0, consent of instructor and departmental approval of a written proposal of a project submitted in advance of the quarter in which the course is to be taken

An independent study course for senior mathematics majors. A total of four units may apply toward the major.

**MATH 595D. Independent Study. 4 Units.**

Prerequisites: MATH 331 and MATH 553, a minimum overall grade point average of 3.0, consent of instructor and departmental approval of a written proposal of a project submitted in advance of the quarter in which the course is to be taken

An independent study course for senior mathematics majors. A total of four units may apply toward the major.

**MATH 599. Senior Seminar for Future Mathematics Educators. 2 Units.**

Prerequisites: MATH 480 and MATH 499

Offered: Fall and Spring

Culminating experience in problem solving for secondary mathematics teachers. Each student will complete a reflective portfolio that is representative of their undergraduate work and makes connections to secondary mathematics. Graded A,B,C/no credit.

**MATH 601. Assessment Portfolio. 0 Units.**

Prerequisites: advancement to candidacy

Preparation of an acceptable student portfolio assessing and documenting academic progress. For detailed requirements see the MAT graduate coordinator.

**MATH 604. Seminar in Problem Solving I. 4 Units.**

Prerequisites: MATH 329, MATH 331, MATH 345, MATH 355 and MATH 372

A problem solving seminar emphasizing induction and analogy in the style of George Polya.

**MATH 605. Seminar in Problem Solving II. 4 Units.**

Prerequisites: MATH 604

Continuation of MATH 604.

**MATH 610. Topics in Mathematics. 4 Units.**

Prerequisites: graduate standing

Study of selected areas of advanced mathematics to be determined by the instructor. May be repeated for credit with consent of instructor as topics change.

**MATH 611. Operations Analysis. 4 Units.**

Scientific approach to the resolution of operational problems. Structure and function of models and decision strategy commonly used in national policy analysis including measures of effectiveness, uncertainty and the misuse of modeling. May not be counted toward fulfilling the requirements in the mathematics major.

**MATH 614. Studies in Geometry. 4 Units.**

Prerequisites: MATH 529, MATH 545 and admission to the M.A. in Mathematics program

Advanced topics in affine, projective, elliptic, and hyperbolic geometry. Comparison of synthetic and analytic methods of proof.

**MATH 616. Studies in Algebra. 4 Units.**

Prerequisites: MATH 546 and admission to the M.A. in Mathematics program

Advanced topics in algebra to include constructability, transcendence and solvability of groups and equations.

**MATH 618. Studies in Analysis. 4 Units.**

Prerequisites: MATH 553; either MATH 554, MATH 555, or MATH 557; and admission to the M.A. in Mathematics program

Theory of multivariable calculus with applications, to include the Inverse Function Theorem, as well as Stokes and Greens theorems.

**MATH 631. Algebra from a Teaching and Problem Solving Perspective. 6 Units.**

Prerequisites: admission to the MAT in Mathematics program and MATH 345, or consent of instructor

Algebraic structure and its development. Equations and systems of equations. Teaching strategies and curriculum issues. Applications and problem solving will be stressed throughout. Students will adapt methods from this course to a teaching setting and report on this experience.

**MATH 632. Geometry from a Teaching and Problem Solving Perspective. 6 Units.**

Prerequisites: MATH 329 and admission to the MAT in Mathematics program, or consent of instructor

The transition from geometry as an empirical study first to local proofs and then to axiomatic systems. Comparisons of traditional approaches to geometric proof with those of analytic geometry. Focus on construction to illustrate and motivate teaching strategies and curriculum issues. Students will adapt methods from this course to a teaching setting and report on this experience.

### **MATH 633. Trigonometry from a Teaching and Problem Solving Perspective. 6 Units.**

Prerequisites: MATH 213, MATH 251, and admission to the MAT in Mathematics program, or consent of instructor. MATH 631 and MATH 632 are recommended

Trigonometric functions, identities and equations as foundation for study of the complex numbers, the complex plane, polar coordinates, de Moivre's theorem, and definition of trigonometric functions in terms of exponential functions. Geometric and analytic properties of the conic sections. Problem solving, curricular and pedagogical issues emphasized throughout. Students will adapt methods from this course to a teaching setting and report on this experience.

### **MATH 634. Calculus from a Teaching and Problem Solving Perspective. 6 Units.**

Prerequisites: MATH 213, 251, and admission to the MAT in Mathematics program, or consent of instructor. Math 631, 632, and 633 are recommended

Focus on non-standard problems and theoretical issues in calculus that lend themselves to multiple problem-solving approaches and pedagogical strategies. Students will adapt methods from this course to a teaching setting and report on this experience.

### **MATH 635. Statistics and Probability from a Teaching and Problem Solving Perspective. 6 Units.**

Prerequisites: MATH 372 and admission to the MAT in Mathematics program, or consent of instructor. Math 631, 632, and 633 are recommended

Basic probability and descriptive and inferential statistics emphasizing active learning teaching strategies. Students will design and carry out an investigative project. Students will adapt methods from this course to a teaching setting and report on this experience.

### **MATH 664. Project Design in Teaching Mathematics. 2 Units.**

Prerequisites: advancement to candidacy and consent of instructor  
Steps and processes involved in the design and development of research proposals with emphasis on the master's project. Graded credit/no credit.

### **MATH 678. Teaching Practicum. 2 Units.**

Prerequisites: admission to the masters program in teaching with a major in mathematics

Supervised practice in individual and/or classroom teaching. May be repeated for a total of four units.

### **MATH 695B. Graduate Independent Study. 2 Units.**

Prerequisites: advancement to candidacy in the M.A. or M.A.T. in Mathematics program; a grade point average of at least 3.5 in courses in the program; consent of the instructor and approval by the graduate committee. A written proposal for a project must be submitted to the graduate committee no later than the ninth week of the quarter preceding that in which the independent study is to be pursued  
An independent study course for graduate students in mathematics.

### **MATH 695C. Graduate Independent Study. 3 Units.**

Prerequisites: advancement to candidacy in the M.A. or M.A.T. in Mathematics program; a grade point average of at least 3.5 in courses in the program; consent of the instructor and approval by the graduate committee. A written proposal for a project must be submitted to the graduate committee no later than the ninth week of the quarter preceding that in which the independent study is to be pursued  
An independent study course for graduate students in mathematics.

### **MATH 695D. Graduate Independent Study. 4 Units.**

Prerequisites: advancement to candidacy in the M.A. or M.A.T. in Mathematics program; a grade point average of at least 3.5 in courses in the program; consent of the instructor and approval by the graduate committee. A written proposal for a project must be submitted to the graduate committee no later than the ninth week of the quarter preceding that in which the independent study is to be pursued  
An independent study course for graduate students in mathematics.

### **MATH 696. Masters Degree Project I. 3 Units.**

Prerequisites: graduate standing, consent of instructor, approval of the project proposal by the graduate committee and approval of at least five contributions to the assessment portfolio of the seven listed under 6b and 6c in the requirements for graduation  
Dissertation preparation and assessment portfolio completion. A written proposal for a project must be submitted to the graduate committee no later than the ninth week of the quarter preceding enrollment in MATH 696.

### **MATH 697. Masters Degree Project II. 1 Unit.**

Prerequisites: MATH 696 and consent of instructor  
Finalizing the masters project including approval of the dissertation format by the Office of Graduate Studies, an oral presentation of the project to the department, and formal acceptance of the completed dissertation.

### **MATH 698A. Continuous Enrollment for Graduate Candidacy Standing. 1 Unit.**

Prerequisites: advancement to candidacy and approval of program graduate coordinator or, if an interdisciplinary studies major, consent of the Dean of Graduate Studies  
Independent study leading to completion of requirements (other than course work) for the master's degree. To retain classified standing in the master's program, a student must enroll in 698 each quarter until the project or thesis is accepted or the comprehensive examination passed. Students who enroll in 698 through the university have full use of all university facilities. See Culminating Experience: Exam, Thesis, or Project in Graduate Degree and Program Requirements section of the Bulletin of Courses. 698 is a variable unit course, see fee schedule in the Financial Information section of the Bulletin of Courses. Earned units are not degree-applicable nor will they qualify for financial aid.

**MATH 698B. Continuous Enrollment for Graduate Candidacy Standing. 2 Units.**

Prerequisites: advancement to candidacy and approval of program graduate coordinator or, if an interdisciplinary studies major, consent of the Dean of Graduate Studies

Independent study leading to completion of requirements (other than course work) for the master's degree. To retain classified standing in the master's program, a student must enroll in 698 each quarter until the project or thesis is accepted or the comprehensive examination passed. Students who enroll in 698 through the university have full use of all university facilities. See Culminating Experience: Exam, Thesis, or Project in Graduate Degree and Program Requirements section of the Bulletin of Courses. 698 is a variable unit course, see fee schedule in the Financial Information section of the Bulletin of Courses. Earned units are not degree-applicable nor will they qualify for financial aid.

**MATH 698C. Continuous Enrollment for Graduate Candidacy Standing. 3 Units.**

Prerequisites: advancement to candidacy and approval of program graduate coordinator or, if an interdisciplinary studies major, consent of the Dean of Graduate Studies

Independent study leading to completion of requirements (other than course work) for the master's degree. To retain classified standing in the master's program, a student must enroll in 698 each quarter until the project or thesis is accepted or the comprehensive examination passed. Students who enroll in 698 through the university have full use of all university facilities. See Culminating Experience: Exam, Thesis, or Project in Graduate Degree and Program Requirements section of the Bulletin of Courses. 698 is a variable unit course, see fee schedule in the Financial Information section of the Bulletin of Courses. Earned units are not degree-applicable nor will they qualify for financial aid.

**MATH 698D. Continuous Enrollment for Graduate Candidacy Standing. 4 Units.**

Prerequisites: advancement to candidacy and approval of program graduate coordinator or, if an interdisciplinary studies major, consent of the Dean of Graduate Studies

Independent study leading to completion of requirements (other than course work) for the master's degree. To retain classified standing in the master's program, a student must enroll in 698 each quarter until the project or thesis is accepted or the comprehensive examination passed. Students who enroll in 698 through the university have full use of all university facilities. See Culminating Experience: Exam, Thesis, or Project in Graduate Degree and Program Requirements section of the Bulletin of Courses. 698 is a variable unit course, see fee schedule in the Financial Information section of the Bulletin of Courses. Earned units are not degree-applicable nor will they qualify for financial aid.

**MATH 698E. Continuous Enrollment for Graduate Candidacy Standing. 5 Units.**

Prerequisites: advancement to candidacy and approval of program graduate coordinator or, if an interdisciplinary studies major, consent of the Dean of Graduate Studies

Independent study leading to completion of requirements (other than course work) for the master's degree. To retain classified standing in the master's program, a student must enroll in 698 each quarter until the project or thesis is accepted or the comprehensive examination passed. Students who enroll in 698 through the university have full use of all university facilities. See Culminating Experience: Exam, Thesis, or Project in Graduate Degree and Program Requirements section of the Bulletin of Courses. 698 is a variable unit course, see fee schedule in the Financial Information section of the Bulletin of Courses. Earned units are not degree-applicable nor will they qualify for financial aid.

**MATH 698F. Continuous Enrollment for Graduate Candidacy Standing. 6 Units.**

Prerequisites: advancement to candidacy and approval of program graduate coordinator or, if an interdisciplinary studies major, consent of the Dean of Graduate Studies

Independent study leading to completion of requirements (other than course work) for the master's degree. To retain classified standing in the master's program, a student must enroll in 698 each quarter until the project or thesis is accepted or the comprehensive examination passed. Students who enroll in 698 through the university have full use of all university facilities. See Culminating Experience: Exam, Thesis, or Project in Graduate Degree and Program Requirements section of the Bulletin of Courses. 698 is a variable unit course, see fee schedule in the Financial Information section of the Bulletin of Courses. Earned units are not degree-applicable nor will they qualify for financial aid.

**MATH 698Z. Continuous Enrollment for Graduate Candidacy Standing. 0 Units.**

Prerequisites: advancement to candidacy and approval of program graduate coordinator or, if an interdisciplinary studies major, consent of the Dean of Graduate Studies

Independent study leading to completion of requirements (other than course work) for the master's degree. To retain classified standing in the master's program, a student must enroll in 698 each quarter until the project or thesis is accepted or the comprehensive examination passed. Students who enroll in 698 through the university have full use of all university facilities. See Culminating Experience: Exam, Thesis, or Project in Graduate Degree and Program Requirements section of the Bulletin of Courses. 698 is a variable unit course, see fee schedule in the Financial Information section of the Bulletin of Courses. Earned units are not degree-applicable nor will they qualify for financial aid.

**MATH 699. Master of Arts in Teaching Mathematics Thesis. 4 Units.**

Prerequisites: graduate standing, consent of the instructor, approval of the thesis proposal by the graduate committee and submission of at least three contributions to the Assessment Portfolio. A written proposal for a thesis following departmental guidelines must be submitted to the graduate committee no later than the ninth week of the quarter preceding enrollment in MATH 699. Formerly MATH 600

Written thesis, an oral presentation of the thesis to the department and a complete Assessment Portfolio. May not be counted toward fulfilling the requirements of the Master of Arts in Mathematics. Graded credit/no credit.



**MATH 999A. Comprehensive Examination:  
Written. 0 Units.**

Prerequisites: advancement to candidacy, approval of department, completion of course work in the masters program, and in good academic standing

An assessment of the students ability to integrate the knowledge of the area, show critical and independent thinking and demonstrate mastery of the subject matter.

**MATH 999B. Comprehensive Examination:  
Oral. 0 Units.**

Prerequisites: advancement to candidacy, approval of department, completion of course work in the masters program, and in good academic standing

An assessment of the students ability to integrate the knowledge of the area, show critical and independent thinking and demonstrate mastery of the subject matter.