

# Math Education Programs

A Representative Sample of Masters Programs in  
Mathematics and Mathematics Education

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## UC Irvine

### MS in Math Graduate Program

The Master's program serves a dual purpose. For some students it will be a terminal program of mathematics education; for others it will lead to study and research at the doctoral level. To earn the Master of Science degree, the student must: (1) satisfy course and (2) residency requirements, and (3) achieve two passes at the M.S. level among four exams in Real Analysis, Complex Analysis, Algebra or Applied Mathematics.

To satisfy the exam requirements, students are required to take qualifying exams in Real Analysis, Complex Analysis, Algebra or Applied Mathematics, which are offered in June and September or each year. Students must pass two exams by the end of their first year, and they may not attempt to pass an exam in any particular area more than three times.

First year students are expected to take either Math 205 or Math 210; specific recommendation will be determined by assessment prior to the start of the students' first year by the Vice Chair of Graduate Studies, upon consultation with the Graduate Studies Committee. The students may pass the Comprehensive Exam in Analysis in lieu of achieving an M.S. pass in one of the qualifying exams that must be obtained prior to the start of their second year.

The total number of required courses for the M.S. degree is 12, completed with satisfactory performance (B or better).

#### **Required Courses**

At least one series of the following courses: Mathematics 210A-B-C, 220A-B-C, or 230A-B-C. At most, one undergraduate course may count as an elective course, provided it is sponsored by rank faculty and approved by the Graduate Advisor. At most, one elective course (of at least three units) is allowed outside the Department.

#### **MATH 210A. Real Analysis. 4 Units.**

Measure theory, Lebesgue integral, signed measures, Radon-Nikodym theorem, functions of bounded variation and absolutely continuous functions, classical Banach spaces,  $L_p$  spaces, integration on locally compact spaces and the Riesz-Markov theorem, measure and outer measure, product measure spaces.

Prerequisite: Recommended: [MATH 140C](#) or equivalent.

#### **MATH 210B. Real Analysis. 4 Units.**

Measure theory, Lebesgue integral, signed measures, Radon-Nikodym theorem, functions of bounded variation and absolutely continuous functions, classical Banach spaces,  $L_p$  spaces, integration on locally compact spaces and the Riesz-Markov theorem, measure and outer measure, product measure spaces.

Prerequisite: [MATH 210A](#). [MATH 210A](#) with a grade of B- or better

**MATH 210C. Real Analysis. 4 Units.**

Measure theory, Lebesgue integral, signed measures, Radon-Nikodym theorem, functions of bounded variation and absolutely continuous functions, classical Banach spaces,  $L_p$  spaces, integration on locally compact spaces and the Riesz-Markov theorem, measure and outer measure, product measure spaces.

**MATH 220A. Analytic Function Theory. 4 Units.**

Standard theorems about analytic functions. Harmonic functions. Normal families. Conformal mapping.

Prerequisite: Recommended: [MATH 140C](#) or equivalent.

**MATH 220B. Analytic Function Theory. 4 Units.**

Standard theorems about analytic functions. Harmonic functions. Normal families. Conformal mapping.

Prerequisite: [MATH 220A](#). [MATH 220A](#) with a grade of B- or better

**MATH 220C. Analytic Function Theory. 4 Units.**

Standard theorems about analytic functions. Harmonic functions. Normal families. Conformal mapping.

**MATH 230A. Algebra. 4 Units.**

Elements of the theories of groups, rings, fields, modules. Galois theory. Modules over principal ideal domains. Artinian, Noetherian, and semisimple rings and modules.

Prerequisite: Recommended: [MATH 120A](#) and [MATH 121A](#) and [MATH 120B](#), or equivalent.

**MATH 230B. Algebra. 4 Units.**

Elements of the theories of groups, rings, fields, modules. Galois theory. Modules over principal ideal domains. Artinian, Noetherian, and semisimple rings and modules.

Prerequisite: [MATH 230A](#). [MATH 230A](#) with a grade of B- or better

**MATH 230C. Algebra. 4 Units.**

Elements of the theories of groups, rings, fields, modules. Galois theory. Modules over principal ideal domains. Artinian, Noetherian, and semisimple rings and modules.

Students who fail to pass the required examinations within the period specified will be recommended for academic disqualification.

MATH 199, 297, 298, 299, and 399 may not be used to fulfill course requirements.

The residency requirement ordinarily is satisfied by full-time enrollment for three quarters immediately preceding the award of the M.S. degree. When appropriate, a leave of absence may be granted between matriculation and the final quarters of study.

In order to confer the MS degree, one must advance to candidacy at the MS level, prior to the quarter in which they plan to graduate. If the candidate is not advanced before the beginning of the quarter in which all requirements are completed, the degree will not be conferred until the end of the following quarter. Deadlines for submission of the Application for Advancement to Candidacy are published on the Graduate Division website, where filing fees and deadlines may also be found.

## CSULB Math M.S. Graduate Program

### Prerequisite Courses

#### Prerequisites

A bachelor's degree in mathematics, or a bachelor's degree with a minimum of 24 upper-division units in mathematics from an accredited college or university

A grade of "C" or better in the following courses

#### **MATH 247 - Introduction to Linear Algebra (3)**

Prerequisite: [MATH 123](#).

Matrix algebra, solution of systems of equations, determinants, vector spaces including function spaces, inner product spaces, linear transformations, eigenvalues, eigenvectors, quadratic forms, and applications. Emphasis on computational methods.

#### **MATH 361A - Introduction to Mathematical Analysis I (3)**

Prerequisites: [MATH 224](#) and [MATH 233](#). Completion of 60 units.

Rigorous study of calculus and its foundations. Structure of the real number system. Sequences and series of numbers. Limits, continuity, and differentiability of functions of one real variable. Writing proofs.

#### **MATH 361B - Introduction to Mathematical Analysis II (3)**

Prerequisite: A grade of "C" or better in [MATH 361A](#).

Riemann integration. Topological properties of the real number line. Sequences of functions. Metric spaces. Introduction to calculus of several variables. Writing proofs.

#### **MATH 364A - Ordinary Differential Equations I (3)**

Prerequisites: [MATH 224](#).

Prerequisite/Corequisite: [MATH 247](#).

First-order differential equations; undetermined coefficients and variation of parameters for second and higher-order differential equations, series solution of second-order linear differential equations; systems of linear differential equations; applications to science and engineering.

#### **MATH 444 - Introduction to Abstract Algebra (3)**

Prerequisites: [MATH 247](#) and a grade of "C" or better in at least one of [MATH 341](#) or [MATH 347](#).

Groups, subgroups, cyclic groups, symmetric groups, Lagrange's theorem, quotient groups. Homomorphisms and isomorphisms of groups. Rings, integral domains, ideals, quotient rings, homomorphisms of rings. Fields. Writing proofs.

## **Advancement to Candidacy**

In addition to University requirements, the student must have completed all prerequisite courses listed above with no grade less than “C”. Students should file for Advancement upon completion of at least six units (and no more than nine units) on the Program of Study, with at least a 3.0 GPA. Program of study must be approved by the appropriate Graduate Advisor, and Director of Graduate Studies in the College of Natural Sciences and Mathematics or designee.

## **Requirements**

A minimum of 30 graduate and approved upper-division units in mathematics including:

### **Upper Division:**

#### **MATH 540 - Elements of Abstract Algebra (3)**

Prerequisite: [MATH 444](#).

Group theory including symmetric groups; group actions on sets; Sylow theorems and finitely generated abelian groups; ring theory including polynomial rings, division rings, Euclidean domains, principal ideal domains, and unique factorization domains.

#### **Two additional courses selected from:**

#### **MATH 550 - Elements of Topology (3)**

Prerequisite: [MATH 361B](#).

Fundamentals of point-set topology: metric spaces and topological spaces; bases and neighborhoods; continuous functions; subspaces, product spaces, and quotient spaces; separation properties, countability properties; compactness, compactification; connectedness; convergence of sequences; other topics, such as nets, filters and metrizability, as time permits.

#### **MATH 561 - Elements of Real Analysis (3)**

Prerequisite: MATH 361B.

Theory of measure and integration, focusing on the Lebesgue integral on Euclidean space, particularly the real line. Modes of convergence. Fatou’s Lemma, the monotone convergence theorem and the dominated convergence theorem. Fubini’s theorem.

#### **MATH 562 - Elements of Complex Analysis (3)**

Prerequisite: MATH 361B.

Axiomatic development of real and complex numbers; elements of point set theory; differentiation and analytic functions, classical integral theorems; Taylor’s series, singularities, Laurent series, calculus of residues.

#### **Two additional courses selected from:**

#### **MATH 545 - Topics in Abstract Algebra (3)**

Prerequisite: MATH 540.

Selected topics in algebra that build upon the material of MATH 540. Content will vary by semester.

**MATH 555 - Topics in Topology (3)**

Prerequisite: MATH 550.

Selected topics in topology that build upon the material of MATH 550. Content will vary by semester.

**MATH 565 - Topics in Real Analysis (3)**

Prerequisite: MATH 561.

Selected topics in real analysis that build upon the material of MATH 561. Content will vary by semester.

**MATH 566 - Topics in Complex Analysis (3)**

Prerequisite: MATH 562.

Selected topics in real analysis that build upon the material of MATH 562. Content will vary by semester.

**An additional 6 units of 500-level mathematics courses****Requirement in Geometry**

Three units must be in a course designated as fulfilling the program requirement in geometry; these courses include

**MATH 451 - Differential Geometry (3)**

Prerequisite: MATH 364A or MATH 370A.

Structure of curves and surfaces in space, including Frenet formulas of space curves; frame fields and connection forms; geometry of surfaces in Euclidean three-space; Geodesics and connections with a general theory of relativity.

**MATH 456 - Dynamics and Geometry of Chaos (3)**

Prerequisites: MATH 247, MATH 361A, or consent of instructor.

An introduction to discrete dynamical systems in one and two dimensions. Theory of iteration: attracting and repelling periodic points, symbolic dynamics, chaos, and bifurcation. May include a computer lab component.

**Complete one of the following culminating activities**

(Note: In order to satisfy the culminating activity requirement (thesis, project, or comprehensive examination dependent upon the program), students must earn at least three (3) units and no more than six (6) units related to the completion of the culminating activity:

**Comprehensive Exam Option**

Pass a comprehensive written examination in two areas of Pure Mathematics. Specific requirements for passing the comprehensive examinations can be found on the Department of Mathematics and Statistics website at [www.csulb.edu/depts/math](http://www.csulb.edu/depts/math).

**Thesis Option**

Subject to the approval of the Pure Mathematics Committee in the Department of Mathematics and Statistics, write a thesis in mathematics and defend it orally.

## CSULB Math Ed Graduate Program

### Prerequisite Courses

#### **MATH 247 - Introduction to Linear Algebra**

(3 units)

Prerequisite: MATH 123.

Matrix algebra, solution of systems of equations, determinants, vector spaces including function spaces, inner product spaces, linear transformations, eigenvalues, eigenvectors, quadratic forms, and applications. Emphasis on computational methods.

Both grading options. (Lecture 3 hrs.)

#### **MATH 310 - History of Early Mathematics**

(3 units)

Prerequisite/Corequisite: At least one of MATH 224 or MATH 233 or MATH 247.

History of mathematics through seventeenth century, including arithmetic, geometry, algebra, and beginnings of calculus. Interconnections with other branches of mathematics. Writing component; strongly recommended students enrolling have completed the G.E. A2 requirement.

Both grading options. (Lecture 3 hrs.)

#### **MATH 341 - Number Theory**

(3 units)

Prerequisite: A grade of "C" or better in MATH 233

Divisibility, congruences, number theoretic functions, Diophantine equations, primitive roots, continued fractions. Writing proofs.

Both grading options. (Lecture 3 hrs.)

#### **MATH 355 - College Geometry**

(3 units)

Prerequisite: A grade of "C" or better in MATH 247.

Euclidean geometry, geometric objects, isometry and similarity, transformations and symmetry, algebra and geometry of complex numbers, and topics in non-Euclidean geometry and the axioms of geometry. Writing proofs.

Both grading options. (Lecture 3 hrs.)

#### **MATH 361A - Introduction to Mathematical Analysis I**

(3 units)

Prerequisites: MATH 224 and MATH 233. Completion of 60 units.

Rigorous study of calculus and its foundations. Structure of the real number system. Sequences and series of numbers. Limits, continuity and differentiability of functions of one real variable.

Writing proofs.

Both grading options. (Lecture 3 hrs.)



### **MATH 364A - Ordinary Differential Equations I**

(3 units)

Prerequisites: MATH 224.

Prerequisite/Corequisite: MATH 247.

First order differential equations; undetermined coefficients and variation of parameters for second and higher order differential equations, series solution of second order linear differential equations; systems of linear differential equations; applications to science and engineering.

Both grading options. (Lecture 3 hrs.)

### **MATH 380 - Probability and Statistics**

(3 units)

Prerequisite: MATH 224.

Frequency interpretation of probability. Axioms of probability theory. Discrete probability and combinatorics. Random variables. Distribution and density functions. Moment generating functions and moments. Sampling theory and limit theorems.

Letter grade only (A-F). (Lecture 3 hrs.) Not open for credit to student with credit in STAT 380.

### **Upper Division Courses**

A minimum of 9 graduate or approved upper-division units of mathematics, including at least one 500-level mathematics course. If not previously taken for BS or credential, this course of study must include:

- MATH 444 - Introduction to Abstract Algebra
- MATH 521 - Matrix Method in Data Analysis and Pattern Recognition
- MATH 540 - Elements of Abstract Algebra
- MATH 545 - Topics in Abstract Algebra
- MATH 550 - Elements of Topology
- MATH 555 - Topics in Topology
- MATH 560 - Functional Analysis
- MATH 561 - Elements of Real Analysis
- MATH 562 - Elements of Complex Analysis
- MATH 563 - Applied Analysis
- MATH 564 - Applied Nonlinear Ordinary Differential Equations
- MATH 565 - Topics in Real Analysis
- MATH 566 - Topics in Complex Analysis
- MATH 570 - Partial Differential Equations
- MATH 573 - Advanced Scientific Computing
- MATH 574 - Stochastic Calculus and Applications
- MATH 575 - Calculus of Variations
- MATH 576 - Numerical Analysis
- MATH 577 - Numerical Solution of Partial Differential Equations
- MATH 578 - Numerical Linear Algebra
- MATH 579 - Advanced Mathematical Modeling
- MATH 590 - Selected Topics in Mathematics

A minimum of 15 graduate units of mathematics education including:

Take both of the following:

- MTED 511 - Mathematics Teaching and Learning (3 units)
- MTED 512 - Curriculum and Assessment in Mathematics (3 units)

At least 9 units in mathematics education

At least 9 units in mathematics education chosen in consultation with the Mathematics Education Graduate Advisor from the following courses:

- MTED 540 - Algebra in the School Curriculum (3 units)
- MTED 550 - Geometry and Measurement in the School Curriculum (3 units)
- MTED 560 - Analysis in the Secondary Curriculum (3 units)
- MTED 570 - Mathematical Modeling in the School Curriculum (3 units)
- MTED 580 - Probability and Statistics in the School Curriculum (3 units)
- MTED 590 - Special Topics in Mathematics Education (1-3 units)

A minimum of 6 units of approved upper division or graduate electives from mathematics, mathematics education, statistics, or approved College of Education courses, chosen in consultation with the Mathematics Education Graduate Advisor.

**CSU San Diego**  
**MA in Math Graduate Program**  
**Required Courses (30 units)**

Complete 30 units of approved 500-, 600-, and 700- level courses.

**All of the following**

**Math 620 - Groups, Rings and Fields (3 units)**

*Prerequisites:* Mathematics 320 and either 520 or 522 or 525 with a grade of C (2.0) or better in each course.

Group theory to include finite Abelian groups, isomorphism theorems, matrix groups, and permutation groups. Ring theory to include ideals, principal ideal domains, and unique factorization. Field theory to include field extensions and finite fields.

**Math 630 - Applied Real Analysis (3 units)**

*Prerequisite:* Mathematics 330 with a grade of B- (2.7) or better. Recommended: Mathematics 530 with a grade of B- (2.7) or better.

Lebesgue measure and integration, metric spaces, Banach spaces, Hilbert spaces. (Formerly numbered Mathematics 630A.)

**One of the following**

**Math 621 - Advanced Topics in Algebra (3 units)**

*Prerequisite:* Mathematics 620 with a grade of C (2.0) or better.

Topics in advanced algebra. Typical courses to include algebra-geometry dictionary, commutative algebra, groups, fields, and Galois theory. May be repeated with new content. See Class Schedule for specific content. Maximum credit six units.

**MATH 625. Algebraic Coding Theory (3)**

*Prerequisites:* Mathematics 525 and Mathematics 520 or 522 with a grade of C (2.0) or better in each course.

Algebraic theory of error correction codes and decoding algorithms used in modern communications systems. Reed-Solomon codes and algebraic decoding algorithms. Code duality, MacWilliam's identities and the linear programming bound. Probabilistic decoding of convolutional codes, low-density parity-check codes and turbo codes.

**MATH 626. Cryptography (3)**

*Prerequisites:* Mathematics 320 and 522 with a grade of C (2.0) or better in each course.

Design of secure cryptosystems with applications. Classical and public key cryptosystems. Primality testing, factoring, discrete log problem, and knapsack problem.

**One of the following**

**MATH 633. Advanced Topics in Analysis (3)**

*Prerequisite:* Mathematics 630. Recommended: Mathematics 668.

Specific topics in analysis to include Lebesgue and Sobolev spaces and spectral theory. Investigation of new theoretical tools and their applications.

**Math 668 - Applied Fourier Analysis (3 units)**

**Prerequisites:** *Mathematics 330, 524; 530 or 532 with a grade of C (2.0) or better in each course.*

Discrete and continuous Fourier transform methods with applications to statistics and communication systems.

**Other requirements**

Course selection.

At least 24 units must be in mathematics, and at least 21 units must be at the 600-level or above.

Math 600, 601, and 602 may not be part of this degree. No more than a total of six units of Math 797 and 798 will be accepted toward the degree.

Thesis.

Students must select Plan A and complete Math 797 and Math 799A. Students are advised that a thesis normally takes a year to complete.

# CSUSD Math Ed Graduate Program

## Upper Division Courses

### Mathematics Courses for Mathematics Education

#### **MATH 501A. Reasoning: Place Value and Arithmetic Operations (1)**

Prerequisites: Teaching credential and consent of instructor.

Place value and its role in development and understanding of arithmetic operations, to include numeration systems, student methods, standard algorithms, and mental computation.

#### **MATH 501B. Reasoning: Rational Numbers and Real Number Systems (1)**

Prerequisites: Teaching credential and consent of instructor.

Rational numbers and structure of real number system, to include meanings and models for fractions with attention to operations on rational numbers.

#### **MATH 504A. Reasoning: Quantities and Mathematical Relationships (1)**

Prerequisites: Teaching credential and consent of instructor.

Reasoning about measurable characteristics in problem context. and relationships among these measurements. Additive, multiplicative reasoning, and proportional reasoning in middle grades.

## Graduate Courses

### Mathematics and Science Education (MTHED)

#### **MTHED 600. Teaching and Learning Mathematics in the Early Grades (Pre-K to 4) (3)**

Prerequisites: Mathematics Education 603 or 604 and K-12 teaching experience.

Research in teaching and learning mathematics in preschool through grade four. Innovative early childhood mathematics curricula, promising instructional practices. Assessment techniques to guide instruction.

#### **MTHED 601. Teaching and Learning Mathematics in the Middle Grades (3)**

Prerequisites: Mathematics Education 604 and K-12 teaching experience.

Research on teaching and learning mathematics in grades five through eight. Innovative middle grades mathematics curricula, promising instructional practices. Assessment techniques to guide instructions.

#### **MTHED 603. Seminar on Learning Theories in Mathematics Education (3)**

Prerequisite: Consent of instructor or graduate adviser.

Application of several major learning theories (e.g. behaviorism, structuralism, radical constructivism, information processing, and sociocultural perspectives) to research on the learning and teaching of mathematics.

#### **MTHED 604. Seminar on Teaching Issues in Mathematics (3)**

Prerequisite: Consent of instructor or graduate adviser.

Mathematics education research pertaining to teaching of mathematics. Readings chosen to bridge theory and practice divide.

**MTHED 605. Algebra in the 7-14 Curriculum (3)**

Prerequisite: Consent of instructor or graduate adviser.

Curricular change in algebra, with attention to experimental curricula, to research on learning of algebra, and to influences of technology. Implications for instruction.

**MTHED 606. Selected Topics in 7-14 Mathematics Curriculum (3)**

Prerequisite: Consent of instructor or graduate adviser.

Curricular change in school mathematics, to include geometry, probability, and statistics, with attention to contemporary curricula, to research on learning and teaching in those areas, and to the influences of technology. Implications for instruction.

**MTHED 607. Seminar on Research in Undergraduate Mathematics Education (3)**

Prerequisite: Consent of instructor or graduate adviser.

Research in undergraduate mathematics education and its implications for teaching. Topics include research on student thinking on concepts from calculus through abstract algebra and the teaching and learning of proof.

**Graduate Courses  
Mathematics Courses for Mathematics Education**

**MATH 600. Chaos and Fractals (3)**

Prerequisites: Mathematics 320 and 510.

Non-linear dynamics to include Cantor sets, fixed and periodic points, fractal dimensions, fractals, iterative processes, orbit diagrams, orbits, period doubling, and self-similarity.

**MATH 601. Topics in Algebra (3)**

Prerequisites: Mathematics 320 and 330.

Unique factorization domains, rings and ideals, groups, algebraic field extensions. A course designed for secondary school teachers.

**MATH 602. Topics in Analysis (3)**

Prerequisites: Mathematics 320 and 330.

Topics in analysis, including the real number system, convergence, continuity, differentiation, the Riemann-Stieltjes integral, complex analysis, designed to give the secondary teacher a broad understanding of the fundamental concepts

## **CSU Northridge**

### **Master of Arts in Secondary Mathematics Education**

#### **Course of Study**

The program comprises 10 courses (30 units): 8 core courses and 2 electives. Core classes meet from 4:00 – 6:45 pm and 7:00 – 9:45 pm every Tuesday for four semesters. The two elective courses, in education or mathematics, are normally taken during the two-year program; some students will be able to substitute courses taken prior to this program (e.g., in a recent CSUN teaching-credential program) for these two electives.

#### **Class List/Sequence:**

##### **SED 535MA. Teaching Contemporary Mathematics (3)**

Designed specifically to assist middle school and high school mathematics teachers and supervisors in implementing a modern school mathematics program. Covers the content standards, as well as strategies for effective mathematics instruction. Also provides hands-on experience for developing expertise with graphing calculators and computer software.

##### **SED 600. Research in Secondary Education (3)**

*Prerequisite: Admission to Secondary Education M.A. degree program.* This course introduces key research in secondary education and provides opportunities to analyze educational research critically. Also addressed are types of research; the teacher as researcher; planning a research study; and collecting, analyzing and presenting data. A required department core course for M.A. degree candidates with a Specialization in Secondary Education.

##### **SED 610MA. Educational Issues and Implications for Multiethnic Mathematics Classrooms (3)**

*Prerequisite: Enrollment is restricted to students in the Master of Arts in Secondary Mathematics Education program or with department permission.* This is a required course for the Master of Arts in Secondary Mathematics Education. Through research, reading, collegial discussion, reflection and writing, masters students in secondary mathematics education will develop an understanding of some of today's most pressing educational issues and their implications for multiethnic schools and mathematics classrooms. A deep understanding of these issues will better position students for leadership as well as for personal decisions about career and professional development.

##### **SED 614. Technology in Teaching and Learning Mathematics (3)**

*Prerequisite: Enrollment is restricted to students in the Master of Arts in Secondary Mathematics Education program or with department permission.* This is a required course for the Master of Arts in Secondary Mathematics Education. This course is intended to help teachers empower all of their pupils to learn mathematics and to make content accessible through the use of technology. This course will focus on pupil learning needs and technology tools that can be used for addressing those needs. Students will identify and explore relevant external resources such as digital content located on websites. They will learn to use technology tools and resources to help pupils visualize the results of varying assumptions, explore consequences, support investigations and compare predictions with mathematical data. Special attention is paid to technology tools that enable collaborative learning. In addition, this course will provide tools for conducting research in preparation for the program's classroom research project.

**SED 625MA. Theory and Research in Teaching Secondary School Mathematics (3)**

*Prerequisite:* [SED 525MA](#) or instructor consent. Study of the present status, recent developments and current trends in secondary-school mathematics curricula. The identification of concepts resulting from recent research and their organization for inclusion in the secondary-school mathematics program are considered. Consideration also is given to research studies dealing with the rationale and structure of important new approaches to mathematics teaching.

**SED 654. Leadership in Mathematics Education (3)**

*Prerequisite:* Enrollment is restricted to students in the Master of Arts in Secondary Mathematics Education program or with department permission. This is a required course for the Master of Arts in Secondary Mathematics Education. In this culminating course for the Master's in Secondary Mathematics Education program, students take stock of what they have learned during the program and consider how to spread that learning to their classrooms, schools and wider settings. Seminar discussions and readings address various aspects of teacher leadership, with the aim of building students' personal leadership skill and style. Students examine the dynamics of school change and explore how teachers can spearhead and facilitate educational improvement. Students begin or intensify their own leadership efforts with a project to improve education at a local or broader level and hone their ability to facilitate productive work sessions among colleagues.

**SED 690MA. Advanced Research in Mathematics Education (3)**

*Prerequisite:* Enrollment is restricted to students in the Master of Arts in Secondary Mathematics Education program or with department permission. This is a required course for the Master of Arts in Secondary Mathematics Education. In this course, students will further explore current research in mathematics education, examine data collection methods and analyze data records from their own classroom research project. This course is designed to develop an advanced knowledge of data collection and analysis methods, as well as advance and refine students' skills in teaching, researching and producing scholarly work. This is the second course in a three-course sequence ([SED 600](#), [SED 690MA](#), and [SED 697](#)) that supports mathematics-education M.A. candidates in the design and implementation of their classroom research project.

**SED 697. Directed Comprehensive Studies (3)**

*Preparatory:* Restricted to and required of M.A. degree candidates in the semester in which they take the comprehensive examination for the degree.

**Two Required Elective Courses (6 units)**

For program completion, six (6) units of credential program, transfer, or other qualified coursework are needed. If you completed your credential program at CSUN within the past five years, you may be able to apply two of your credential courses to meet this requirement. Graduate courses or post-baccalaureate credential courses from other institutions may also be eligible substitutions for these electives.

Coursework at the time of graduation cannot be more than seven (7) years old. Candidates in the program without these units, in consultation with the program directors, may enroll in an Independent Study, graduate-level mathematics courses, or other appropriate coursework during the summer or regular semesters.



**CSU Fullerton**  
**Master of Arts in Mathematics, Teaching Option**

**Requirements**

Students entering the program are expected to have the equivalent of a Bachelor's degree in mathematics. The teaching option requires 30 units of graduate study approved by the graduate committee. The following course work must be included:

**MATH 581: Studies in Geometry (3)**

Topics relating to the high school curriculum from an advanced standpoint, including the axiomatic method and non-Euclidean geometry.

Prerequisite: MATH 307; or graduate standing.

Graduate-level

**MATH 582: Studies in Algebra (3)**

Topics relating to the high school curriculum from an advanced standpoint including algorithms, fields and polynomials.

Prerequisite: [MATH 302](#); or graduate standing.

Graduate-level

**MATH 584: Studies in Analysis (3)**

Topics relating to the high school curriculum from an advanced standpoint, including limits, continuity, differentiation and integration.

Prerequisite: [MATH 350](#); or graduate standing.

Graduate-level

**MATH 586: Studies in Discrete Mathematics (3)**

Topics relating to the high school curriculum from an advanced standpoint, including induction, recursion, probability and combinatorics.

Prerequisite: [MATH 335](#); or graduate standing.

Graduate-level

**MATH 587: Studies in Mathematical Problem Solving (3)**

Problem solving via non-routine and enrichment-type problems from several different branches of mathematics.

Prerequisite: [MATH 302](#); or graduate standing.

Graduate-level

**MATH 599: Independent Graduate Research (3-6 units)**

Normally taken in conjunction with required graduate courses. Also offered without being attached to any course. May be repeated for a maximum of 6 units.

Prerequisite: graduate standing.

Graduate-level

Department Consent Required

Each student will be required to take advisor-approved mathematics electives to meet the 30-unit requirement. Possible elective courses include:

**MATH 580: Studies in Mathematics History (3)**

Topics in mathematics history emphasizing impact of different cultures on mathematical thought and practice across time. Meets graduate writing requirement.

Prerequisite: [MATH 380](#); or graduate standing.

Graduate-level

One or more sections may be offered in any online format.

**MATH 583: Topics in Statistics (3)**

Calculus-based course designed to teach appropriate strategies and tools to effectively address problems in statistics. Project design, exploratory data analysis and interpretation, and effective communication of results.

Prerequisite: [MATH 338](#); or graduate standing.

Graduate-level

Other courses may be taken with the approval of the graduate advisor. Finally, all students must pass a set of four comprehensive exams. Comprehensive exams may be taken at most twice.

# Fresno Pacific University

## MA in Mathematics Education

### Required Courses (30 Units)

#### Master of Arts Core (required for both options)

##### **MSER 794 - Introduction and Literature Review** Credits 3

This course is the initial course for students whose research will culminate in the completion of a master's thesis. Students will be involved in a supervised independent inquiry of study built upon a literature review. Along with the course instructor, students will work with an assigned thesis mentor who will guide and support the student through the development and writing of a literature review and the introductory chapter of the thesis.

##### **MSER 795 - Research Methods and Project Proposal** Credits 3

A study in the nature of systematic inquiry, a survey of methods employed in research and an explanation of evaluation methodology, as well as the use of research and evaluation methods in actual school situations. Topics include identification of education research problems, use of library resources, data gathering and processing, and evaluation of research articles.

##### **MTHE 770 - Teaching Mathematics for Social Justice** Credits 3

Within this course, students will investigate a variety of critical perspectives of social justice theories and practices within mathematics education. Guidelines for incorporating social justice lessons and evaluating current research-based strategies for promoting critical thinking, problem solving, and reasoning within content instruction will be leveraged. Students will then explore, integrate, and reflect on social justice mathematics tasks.

#### Select one of the options listed below:

##### **Secondary School Option**

##### **MTHE 761 - Advanced Geometry** Credits 3

Euclidean and other geometries are developed to provide one of the basic points of view for the study of mathematics. Topics will include informal approaches to explore concepts and relationships; other geometries, such as spherical and hyperbolic; and algebraic methods involving coordinates in two or three dimensions. Vectors and transformations will be used in discussions of relations among figures and the proofs of theorems; and a study and comparison of Euclidean and hyperbolic geometries as mathematical systems.

May not be audited.

##### **MTHE 762 - Advanced Algebra** Credits 3

The course focuses on various facets of algebra that are typically taught from junior high through college. A major emphasis is on foundations and on looking at elementary algebra from an advanced standpoint, topics include Peano's postulates, equivalence relations, algebraic structures (groups, rings, and fields). Moreover, Ordered Integral Domain, induction proofs, and elements of number theory will receive special attention. Finally, the course will explore the impact of technology on approaches to the content of school algebra.

May not be audited.

**MTHE 763 - Probability and Statistics Credits 3**

Content of the course includes laws of probability, organization of data, measures of central tendency and dispersion, sampling, normal distributions, the central limit theorem, estimation, hypothesis testing, regression and correlation, chi-square, analysis of variance and nonparametric methods. The course assumes the mathematical background required for a single subject credential in mathematics.

May not be audited.

**MTHE 768 - Calculus in the Classroom Credits 3**

This course will focus on attaining a deep conceptual understanding of the important ideas of calculus. Course content will include continuity, limits of functions, derivatives, the Mean Value Theorem, L'Hopital's Rule, Riemann Integration, the Fundamental Theorem of Calculus, and Areas and Volumes. Exploration of these topics will include an in-depth understanding of definitions and technical proofs while also maintaining the larger perspective of the overarching themes and connections to the Calculus I classroom.

**MTHE 769 - Mathematical Modeling in School Credits 3**

Students will investigate, via both primary and secondary research, the realities of incorporating a strong emphasis on the Mathematical Practice of Modeling with Mathematics. Through an Action Research project incorporating video and community critique each student will develop, write, field test, report on, and have critiqued by the others a Modeling project in their classroom. They will also, via pointed secondary research, become familiar with the literature regarding this practice. Outcomes include the development of a corpus of research information on the subject of Mathematic Modeling in the classroom and a small body of field-tested modeling projects across age groups and topics.

**MTHE 771 - Role of Change in Perspective in Mathematics Credits 3**

This course is designed to have teachers of mathematics examine the role that "Change of Perspective" plays in the learning and creation of mathematics. Through a series of readings, reflective writings, and mathematical creations students will investigate the power of this mental tool in discovering and creating mathematics and the implications thereof for teaching mathematics. Just as purposely changing one's perspective from Analytic to Synthetic Geometry brings new tools to the mathematician's arsenal, this course will investigate what role this sort of shift, among others, plays in the subject.

**MTHE 772 - Data Science Credits 3**

This course will have students focusing on this increasingly important topic in the Secondary Mathematics Curriculum. Topics encountered will include accessing data through publicly available repositories, making appropriate data moves and visualizations, writing code in python or R to accomplish analytic goals, uncertainty and bias, modeling, machine learning, sampling etc. This will be a technology heavy course with all of it requiring a variety of software tools. Students will generate curricular experiences for their classrooms that reflect their interests.