

MATHEMATICS

DEPARTMENT OF MATHEMATICS AND STATISTICS

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Programs Offered

Mathematics

Bachelor of Arts in Mathematics

Bachelor of Science in Mathematics

Cooperative Master of Arts in Mathematics (with San Francisco State University)

Minor in Mathematics

Minor in Math for Teachers

Preparation For Teaching

Statistics – See the Statistics portion of this Catalog

Bachelor of Arts in Applied Statistics

Bachelor of Science in Statistics

Minor in Applied Statistics

Preparation for Actuarial Exams

About Mathematics

Mathematics is a rapidly growing discipline whose concepts and applications play an ever-increasing part in modern life. Mathematics has always been an essential tool in the physical sciences, and has more recently been applied extensively in such diverse areas as medical and biological research, environmental studies, management science, behavioral and social sciences, statistics, and computer science.

Our basic curriculum is designed to give students the mathematical skills necessary for success in business, industry, government, and teaching, as well as to provide a sound background for continuation of study toward advanced degrees in mathematics, computer science, statistics, and related fields.

The B.A. in mathematics provides preparation for teaching, general application of mathematics, and graduate study in mathematics. The bi-disciplinary concentration allows a student to combine mathematics with another discipline.

The B.S. in mathematics offers concentrations in applied mathematics and computer science. These programs prepare students for graduate study in mathematics and for work in a variety of other fields: computer science, work in government and industry, biostatistics, actuarial work, and consultative problem-solving in modern industry.

| Degree Requirements | Units |
|--|------------|
| General education | 51 |
| Major | 45-55 |
| Electives | 14-24 |
| Total units needed for graduation | 120 |

Core Curriculum

| | |
|---|-----------|
| MATH 161 Differential and Integral Calculus I (3 units in GE) | 4 |
| MATH 211 Differential and Integral Calculus II | 4 |
| MATH 220 Higher Mathematics: An Introduction | 3 |
| MATH 261 Multivariable Calculus | 4 |
| MATH 340 Real Analysis I | 4 |
| Total units in core curriculum | 19 |

B.A. Program (Pure Mathematics)

| Core Curriculum | 19 Plus |
|---|---------|
| MATH 241 Differential Equations with Linear Algebra | 4 |
| MATH 306 Number Theory or | |
| MATH 308 Geometry | 3 |
| MATH 320 Modern Algebra I | 4 |
| MATH 322 Linear Algebra | 3 |
| MATH 360 Complex Variables | 3 |
| MATH 418 Topology or | |
| MATH 420 Modern Algebra II or | |
| MATH 440 Real Analysis II | 3 |

Supporting Courses

| | |
|---|--------------|
| MATH 180 Computing for Math/Science or | |
| CS115 Programming I (3 units in GE) | 2-4 |
| PHYS 114 Intro to Physics (3 units in GE) | 4 |
| Total units in B.A. program | 45-47 |

B.A. Program (Secondary Teaching)

This B.A. program satisfies state requirements for subject matter preparation in mathematics for the Single Subject Teaching Credential.

Core Curriculum

19 Plus

| | |
|---|-----|
| MATH 222 Elementary Applied Linear Algebra or | |
| MATH 322 Linear Algebra | 3 |
| MATH 250 Probability and Statistics | 3 |
| MATH 306 Number Theory | 3 |
| MATH 308 College Geometry | 3 |
| MATH 310 History of Mathematics | 3 |
| MATH 316 Graph Theory and Combinatorics or | |
| MATH 416 Graph Theory and Combinatorics | 3 |
| MATH 320 Modern Algebra I | 4 |
| MATH 345 Probability Theory or | |
| MATH 470 Mathematical Modeling | 3-4 |
| MATH 390 Fieldwork and Seminar: Secondary Mathematics Teaching | 2 |
| MATH 490 Capstone Seminar: Secondary Mathematics Teaching | 1 |

Supporting Courses

| | |
|---|-----|
| MATH 180 Computing for Math/Science or | |
| CS 115 Programming I (3 units in GE) | 2-4 |
| PHYS 114 Intro to Physics (3 units in GE) | 4 |

Total units in secondary teaching program 53-56

Note: Students considering graduate school in mathematics are advised to choose MATH 322 instead of MATH 222. MATH 241 is highly recommended.

B.A. Program (Bi-disciplinary Mathematics)

This B.A. concentration allows a student to combine mathematics with another discipline.

Core Curriculum

19 Plus

| | |
|--|---|
| MATH 161 Differential and Integral Calculus I (3 units in GE) | 4 |
| MATH 211 Differential and Integral Calculus II | 4 |
| 22 additional units selected from the following list, including a minimum of 14 at the upper-division level: | |
| MATH 165 Elementary Applied Statistics | 4 |
| MATH 180 Computing for Mathematics and Science | 2 |
| MATH 220 Higher Mathematics: An Intro. | 1 |
| or MATH 210 Intro. to Proof | 1 |
| or MATH 142 Discrete Structures | 3 |
| MATH 222 Elementary Applied Linear Algebra | 3 |

| | |
|--|-----|
| MATH 241 Differential Equations with Linear Algebra | 4 |
| MATH 261 Multivariable Calculus | 4 |
| MATH 265 Intermediate Applied Statistics with SPSS | 4 |
| MATH 306 Number Theory | 3 |
| MATH 308 College Geometry | 3 |
| MATH 310 History of Mathematics | 3 |
| MATH 316 Graph Theory and Combinatorics | 3 |
| or MATH 416 Graph Theory and Combinatorics | 3 |
| MATH 320 Modern Algebra I | 4 |
| MATH 322 Linear Algebra | 3 |
| MATH 330 Techniques of Problem Solving | 2 |
| MATH 331 Differential Equations II | 3 |
| MATH 340 Real Analysis I | 4 |
| MATH 345 Probability Theory | 4 |
| MATH 352 Numerical Analysis | 3 |
| MATH 360 Introduction to Complex Variables | 3 |
| MATH 375 M*A*T*H Colloquium | 1 |
| MATH 418 General Topology | 3 |
| MATH 420 Modern Algebra II | 3 |
| MATH 430 Linear Systems Theory | 3 |
| MATH 431 Partial Differential Equations and Integral Transformations | 3 |
| MATH 440 Real Analysis II | 3 |
| MATH 441 Operations Research | 3 |
| MATH 470 Mathematical Models | 3 |
| MATH 485 Selected Topics | 1-3 |

A minimum of 22 additional units in another program (outside of the Department of Mathematics and Statistics), at least 12 upper-division level, chosen in consultation with and approved by the Mathematics and Statistics Department Chair.

Total units in Bi-disciplinary Mathematics program 52

B.S. Program (Applied Mathematics)

This B.S. concentration prepares students for employment in industry and graduate schools in scientific fields.

Core Curriculum

19 Plus

| | |
|---|---|
| MATH 241 Differential Equations with Linear Algebra | 4 |
| MATH 316 Graph Theory and Combinatorics or | |
| MATH 416 Graph Theory and Combinatorics | 3 |
| MATH 322 Linear Algebra | 3 |
| MATH 331 Differential Equations II | 3 |
| MATH 345 Probability Theory | 4 |
| MATH 352 Numerical Analysis | 3 |
| MATH 360 Complex Variables or | |
| MATH 431 Partial Differential Equations | 3 |
| MATH 441 Operations Research | 3 |
| MATH 470 Mathematical Modeling | 3 |

Supporting Courses

| | |
|---|---|
| MATH 180 Computing for Math/Science | 2 |
| PHYS 114 Intro to Physics (3 units in GE) | 4 |

Total units in applied mathematics program 54

B.S. Program (Computer Science Option)

This B.S. concentration prepares students for computer industry employment and graduate schools in computer-science-related fields. Students who are interested in the mathematical foundations of computer science generally opt for this major.

| <i>Core Curriculum</i> | <i>19 Plus</i> |
|--|----------------|
| MATH 241 Differential Equations with Linear Algebra | 4 |
| MATH 316 Graph Theory and Combinatorics or | |
| MATH 416 Graph Theory and Combinatorics | 3 |
| MATH 322 Linear Algebra | 3 |
| MATH 345 Probability Theory | 4 |
| MATH 352 Numerical Analysis | 3 |
| CS 110 UNIX | 1 |
| CS 115 Programming I | 4 |
| CS 215 Programming II | 4 |
| CS 315 Data Structures | 4 |
| CS 415 Algorithm Analysis (4) or | |
| CS 355 Database Management Systems Design (4)* or | |
| CS 375 Computer Graphics (4)* or | |
| CS 454 Theory of Computation* | 3-4 |
| <i>* Course may be substituted by arrangement with the math advisor.</i> | |
| Supporting Course | |
| PHYS 114 Intro to Physics (3 units in GE) | 4 |
| Total units in computer science program | 55-57 |

Sample Four-Year Program for Bachelor of Arts in Mathematics

| FRESHMAN YEAR:: 30 Units | |
|----------------------------------|-----------------------------------|
| <i>Fall Semester (16 Units)</i> | <i>Spring Semester (14 Units)</i> |
| MATH 161 (GE) (4) | MATH 211 (4) |
| GE (3) | PHYS 114 (GE) (4) |
| ENGL 101 (3) | MATH 180 (2) |
| GE (3) | GE (3) |
| Freshman Seminar (3) | MATH 175 (elective) (1) |
| SOPHOMORE YEAR:: 29 Units | |
| <i>Fall Semester (13 Units)</i> | <i>Spring Semester (16 Units)</i> |
| MATH 241 (4) | MATH 261 (4) |
| MATH 220 (3) | MATH 322 (3) |
| GE (3) | GE (3) |
| GE (3) | GE (3) |
| | GE (3) |
| JUNIOR YEAR:: 32 Units | |
| <i>Fall Semester (16 Units)</i> | <i>Spring Semester (16 Units)</i> |
| MATH 308 or Elective (3) | MATH 340 (4) |
| MATH 320 (4) | Elective or MATH 306 (3) |

| GE (3) | GE (3) |
|---------------------------------|-----------------------------------|
| GE (3) | UD GE (3) |
| UD GE (3) | GE (3) |
| SENIOR YEAR:: 29 Units | |
| <i>Fall Semester (16 Units)</i> | <i>Spring Semester (13 Units)</i> |
| MATH 418 or 440 or Elective (3) | MATH 360 (3) |
| UD GE (3) | MATH 420 or Elective (3) |
| Elective (3) | Elective (4) |
| Elective (3) | Elective (3) |
| Elective (4) | |
| TOTAL UNITS:: 120 | |

Statistics

For the Department's Statistics offerings (majors, minor, and actuarial science preparation), see the Statistics section of this Catalog.

Cooperative Master of Arts in Mathematics

The Department of Mathematics participates in a cooperative Master of Arts in mathematics with San Francisco State University. Through this program, students who have been accepted into the Master's degree program at San Francisco State may complete up to 12 units of course work in residence at Sonoma State University. Students interested in this cooperative program should contact the chair of the mathematics department for further information.

Minor in Mathematics

Twenty units of mathematics are required. These must include MATH 161 (or its equivalent) and at least 6 units of upper-division mathematics courses, not including MATH 300A, MATH 300B, MATH 390, MATH 395, MATH 399, or MATH 490. Approval of the mathematics department should be obtained by the junior year in order to plan the minor properly.

Minor in Math for Teachers

This program provides the mathematical background to teach effectively at the elementary, middle school, and early high school levels. Twenty-two units are required. These must include MATH 300A, MATH 103 or 150, MATH 142 or 200 or 220, MATH 107 or 161, MATH 250 or 300B, and two courses chosen from MATH 306, MATH 310, MATH 316, and MATH 470. Additional recommendations for students pursuing this minor are MATH 390, and MATH 222 for those who intend to take the mathematics CSET exam.

Preparation for Teaching

Secondary

The B.A. program for secondary teaching is designed for students planning to teach mathematics in middle, junior high, and high

schools. This program is fully accredited by the *California Commission on Teacher Credentialing* and satisfies the subject matter competency requirement for a Single Subject Teaching Credential. (An alternative route for demonstrating subject matter competence is passing a battery of commercial exams.) Most students complete the B.A. program, then a one-year teaching credential program to earn the Single Subject Credential. Any student interested in teaching mathematics at the secondary level should consult a mathematics department education advisor as early as possible in his or her college career. The advisor can provide information about Sonoma State's Single Subject Credential Program and can help the student design a plan for taking the required mathematics and education courses to complete both degree and credentialing requirements efficiently.

Elementary

The Department of Mathematics also offers coursework for students planning to teach in elementary schools or preschools. The minimal college-level mathematics preparation recommended for elementary teachers is three courses: MATH 150, MATH 300A, and MATH 300B. Particular subject matter preparation programs for elementary teachers may have additional requirements or may offer the option of a mathematics concentration; consult advisors in the program for additional details.

Middle School or Elementary Mathematics Specialist

Students interested in teaching mathematics in middle school, or in specializing in mathematics at the elementary level, should consider the math minor for teachers. This minor also helps students who wish to prepare for the CSET (California Subject Examination for Teachers) exam in mathematics, especially at the Foundational level. The Foundational level credential in mathematics is appropriate for elementary, middle, and early high school teaching.

Entry-Level Mathematics (ELM) Requirement

Unless exempted, the Entry-Level Mathematics Examination must be taken within the past five years before enrollment in any general education course or developmental mathematics course (MATH 35 or 45). The ELM results will place the student in the appropriate level of mathematics courses. Note that if placement in the developmental mathematics sequence is necessary, satisfactory completion of MATH 45 is required for placement in MATH 103, 104, 105, 107, 111, 131, 141, 150, and 165. Please consult the Schedule of Classes or telephone the Office of Testing Services for times and places of examination. The examination will be given in conjunction with the English Placement Test. For additional information, please see the Admissions section of this catalog.

Grading Policy in the Department of Mathematics and Statistics

Nonmajors

All mathematics courses except MATH 35, 45, 103, 104, 105, 107, 111, 131, 141, 150, 161, and 165 are available in the Cr/NC grading mode to nonmathematics majors.

All Students

MATH 175, 210, 295, 330, 390, 395, and 499 are available only as Cr/NC.

Mathematics and Statistics Majors

A mathematics major must take all mathematics courses used to meet major requirements in the traditional grading mode, with the exceptions of courses offered only in the Cr/NC modes: MATH 107W, 161W, 175, 210, 211W, 295, 330, 390, 395, and 499, and any course taken as credit by challenge examination (please see more information on this in the Admissions section of this catalog).

Majors are advised to take PHIL 102 for the GE category A3 (Critical Thinking).