Mathematics

Bachelor of Arts (BA)

The Department of Mathematics offers an undergraduate major program in mathematics, leading to the Bachelor of Arts (BA) degree. Major programs within the Department provide excellent preparation for advanced degrees in math, physical sciences, economics, and industrial engineering as well as graduate study in business, education, law, and medicine. They also prepare students for post-baccalaureate positions in business, technology, industry, teaching, government, and finance.

Students majoring in Mathematics may also choose to major with a Teaching Concentration. The new teaching concentration is designed to increase the number and quality of math teachers.

Admission to the Major

Students should contact an undergraduate adviser in 964 or 965 Evans Hall about requirements for admission to the major.

Honors Program

In addition to completing the requirements for the major in mathematics, students in the honors program must:

1. Earn a grade point average (GPA) of at least 3.5 in upper division and graduate courses in the major and *at least* 3.3 in all courses taken at the University
2. Complete either MATH 196, in which they will write a senior honors thesis, or pass two graduate mathematics courses with a grade of at least A-
3. Receive the recommendation of the Head Adviser.

Students interested in the honors program should consult with an adviser early in their program, preferably by their junior year.

Minor Program

The Department offers a minor in Mathematics.

To declare a minor, a student must fulfill the following requirements:

1. Be a declared major in a program other than Mathematics
2. Be in good standing (minimum 2.0 overall GPA at Berkeley)
3. Be enrolled in the final class(es) for the minor

To complete/confirm the minor: Once enrolled in the final course/courses to complete the Mathematics Minor, fill out a "Completion of L&S Minor" form available from the College of Letters and Science Advising Office in 206 Evans or from the L&S Advising website. Turn in to the Undergraduate Advisers in 964 or 965 Evans:

1. the completed petition for the minor; and
2. a copy of transcripts (unofficial transcripts are accepted) showing the student's completed math courses.

When final grades are available, the Department will certify completion of the Mathematics Minor to the Registrar's Office. The notation will appear on students' transcripts even if they have not yet completed their degree.

Other Major Offered by the Department of Mathematics

Applied Mathematics (http://guide.berkeley.edu/archive/2014-15/undergraduate/degree-programs/applied-mathematics) (Major only)

In addition to the University, campus, and college requirements, listed on the College Requirements tab, students must fulfill the below requirements specific to their major program.

General Guidelines

1. All courses taken to fulfill the major requirements below must be taken for graded credit, other than courses listed which are offered on a *Pass/No Pass* basis only. Other exceptions to this requirement are noted as applicable.
2. No more than one upper-division course may be used to simultaneously fulfill requirements for a student's major and minor programs, with the exception of minors offered outside of the College of Letters and Science.
3. A minimum grade point average (GPA) of 2.0 must be maintained in both upper- and lower-division courses used to fulfill the major requirements.

For information regarding residence requirements and unit requirements, please see the College Requirements tab.

Major Requirements: Pure Mathematics

Lower-division		
MATH 1A	Calculus	4
MATH 1B	Calculus	4
MATH 53	Multivariable Calculus	4
MATH 54	Linear Algebra and Differential Equations	4
MATH 55	Discrete Mathematics [1]	4
Upper-divison		
MATH 104	Introduction to Analysis	4
MATH 110	Linear Algebra	4
MATH 113	Introduction to Abstract Algebra	4
MATH 185	Introduction to Complex Analysis	4
Two semi-electives:		
Select one course from two of the following three areas:		
Computing:		
MATH 128A	Numerical Analysis	
Geometry:		
MATH 130	The Classical Geometries	
MATH 140	Metric Differential Geometry	
MATH 141	Elementary Differential Topology	
MATH 142	Elementary Algebraic Topology	
MATH 143	Elementary Algebraic Geometry	
Logic and Foundations:		
MATH 125A	Mathematical Logic	
MATH 135	Introduction to the Theory of Sets	
MATH 136	Incompleteness and Undecidability	
Two Electives: Select at least two additional upper-division or graduate mathematics courses must be taken [2]		

[1] COMPSCI 70 can be substituted for MATH 55 for students with a double major in Computer Science or Electrical Engineering and Computer Science

[2] These two electives must receive the Faculty Adviser's written approval on the Course Approval Form which is then returned to an Undergraduate Adviser in 964 or 965 Evans for the student's file. Courses in other departments may count toward this requirement provided they have substantial mathematical content and are offered for at least 3 units each.

Major Requirements: Mathematics with a Teaching Concentration

Lower-division		
STAT 20	Introduction to Probability and Statistics	4
or STAT 25	Course Not Available	
MATH 1A	Calculus	4
MATH 1B	Calculus	4
MATH 53	Multivariable Calculus	4
MATH 54	Linear Algebra and Differential Equations	4
MATH 55	Discrete Mathematics [1]	4
Upper-division		
MATH 110	Linear Algebra	4
MATH 113	Introduction to Abstract Algebra	4
Select two of the following:		
MATH 128A	Numerical Analysis	
MATH 130	The Classical Geometries	
MATH 135	Introduction to the Theory of Sets	
MATH 151	Mathematics of the Secondary School Curriculum I	4
MATH 152	Mathematics of the Secondary School Curriculum II	4
MATH 153	Mathematics of the Secondary School Curriculum III	4
MATH 160	History of Mathematics	4
Recommended courses:		
Sudents are encouraged, though not required, to take, the following:		
MATH 104	Introduction to Analysis	4
MATH 115	Introduction to Number Theory	4
MATH 185	Introduction to Complex Analysis	4

[1] COMPSCI 70 can be substituted for MATH 55 for students with a double major in Computer Science or Electrical Engineering and Computer Science.

Students who have a strong interest in an area of study outside their major often decide to complete a minor program. These programs have set requirements and are noted officially on the transcript in the memoranda section, but they are not noted on diplomas.

General Guidelines

1. All courses taken to fulfill the minor requirements below must be taken for graded credit.
2. A minimum of three of the upper-division courses taken to fulfill the minor requirements must be completed at UC Berkeley.
3. A minimum grade point average (GPA) of 2.0 is required for courses used to fulfill the minor requirements.
4. Courses used to fulfill the minor requirements may be applied toward the Seven-Course Breadth Requirement, for Letters and Science students.
5. No more than one upper-division course may be used to simultaneously fulfill requirements for a student's major and minor programs.
6. All minor requirements must be completed prior to the last day of finals during the semester in which the student plans to graduate. If cannot finish all courses required for the minor by that time, please see a College of Letters and Science adviser.
7. All minor requirements must be completed within the unit ceiling. (For further information regarding the unit ceiling, please see the College Requirements tab.)

Requirements

Lower-division		
MATH 1A	Calculus	4
MATH 1B	Calculus	4
MATH 53	Multivariable Calculus	4
MATH 54	Linear Algebra and Differential Equations	4
Upper-division		
MATH 104	Introduction to Analysis	4
MATH 110	Linear Algebra	4
MATH 113	Introduction to Abstract Algebra	4
MATH 185	Introduction to Complex Analysis	4
One Elective: Select one additional upper-division Math course		4

Undergraduate students in the College of Letters and Science must fulfill the following requirements in addition to those required by their major program.

For detailed lists of courses that fulfill college requirements, please see the College of Letters and Sciences (http://guide.berkeley.edu/archive/2014-15/undergraduate/colleges-schools/letters-science) page in this bulletin.

Entry Level Writing

All students who will enter the University of California as freshmen must demonstrate their command of the English language by fulfilling the Entry Level Writing Requirement. Fulfillment of this requirement is also a prerequisite to enrollment in all reading and composition courses at UC Berkeley.

American History and American Institutions

The American History and Institutions requirements are based on the principle that a U.S. resident graduated from an American university should have an understanding of the history and governmental institutions of the United States.

American Cultures

American Cultures is the one requirement that all undergraduate students at Cal need to take and pass in order to graduate. The requirement offers an exciting intellectual environment centered on the study of race, ethnicity and culture of the United States. AC courses offer students opportunities to be part of research-led, highly accomplished teaching environments, grappling with the complexity of American Culture.

Quantitative Reasoning

The Quantitative Reasoning requirement is designed to ensure that students graduate with basic understanding and competency in math, statistics, or computer science. The requirement may be satisfied by exam or by taking an approved course.

Foreign Language

The Foreign Language requirement may be satisfied by demonstrating proficiency in reading comprehension, writing, and conversation in a foreign language equivalent to the second semester college level, either by passing an exam or by completing approved course work.

Reading and Composition

In order to provide a solid foundation in reading, writing and critical thinking the College requires two semesters of lower division work in composition. Students must complete a first-level reading and composition course by the end of their second semester and a second-level course by the end of their fourth semester.

Breadth Requirements

The undergraduate breadth requirements provide Berkeley students with a rich and varied educational experience outside of their major program. As the foundation of a liberal arts education, breadth courses give students a view into the intellectual life of the University while introducing them to a multitude of perspectives and approaches to research and scholarship. Engaging students in new disciplines and with peers from other majors, the breadth experience strengthens interdisciplinary connections and context that prepares Berkeley graduates to understand and solve the complex issues of their day.

Unit Requirements

- 120 total units, including at least 60 L&S units
- Of the 120 units, 36 must be upper division units
- Of the 36 upper division units, 6 must be taken in courses offered outside your major department

Residence Requirements

For units to be considered in "residence," you must be registered in courses on the Berkeley campus as a student in the College of Letters and Science. Most students automatically fulfill the residence requirement by attending classes here for four years. In general, there is no need to be concerned about this requirement, unless you go abroad for a semester or year or want to take courses at another institution or through University Extension during your senior year. In these cases, you should make an appointment to see an adviser to determine how you can meet the Senior Residence Requirement.

Note: Courses taken through UC Extension do not count toward residence.

Senior Residence Requirement

After you become a senior (with 90 semester units earned toward your B.A. degree), you must complete at least 24 of the remaining 30 units in residence in at least two semesters. To count as residence, a semester must consist of at least 6 passed units. Intercampus Visitor, EAP, and UC Berkeley-Washington Program (UCDC) units are excluded.

You may use a Berkeley summer session to satisfy one semester of the Senior Residence Requirement, provided that you successfully complete 6 units of course work in the Summer Session and that you have been enrolled previously in the College.

Modified Senior Residence Requirement

Participants in the UC Education Abroad Program (EAP) or the UC Berkeley-Washington Program (UCDC) may meet a Modified Senior Residence Requirement by completing 24 (excluding EAP) of their final 60 semester units in residence. At least 12 of these 24 units must be completed after you have completed 90 units.

Upper Division Residence Requirement

You must complete in residence a minimum of 18 units of upper division courses (excluding EAP units), 12 of which must satisfy the requirements for your major.

Learning Goals for the Major

Mathematics is the language of science. In Galileo's words:

> Philosophy is written in this grand book, the universe, which stands continually open to our gaze. But the book cannot be understood unless one first learns to comprehend the language and read the characters in which it is written. It is written in the language of mathematics, and its characters are triangles, circles, and other geometric figures, without which it is impossible to understand a single word of it. Without those, one is wandering in a dark labyrinth.

Mathematics majors learn the internal workings of this language, its central concepts and their interconnections. These involve structures going far beyond the geometric figures to which Galileo refers. Majors also learn to use mathematical concepts to formulate, analyze, and solve real-world problems. Their training in rigorous thought and creative problem-solving is valuable not just in science, but in all walks of life.

Skills

By the time of graduation, majors should have acquired the following knowledge and skills:

1. Analytical skills
   - An understanding of the basic rules of logic
   - The ability to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life
   - An understanding of the role of axioms or assumptions
   - The ability to abstract general principles from examples
2. Problem-solving and modeling skills (important for all, but especially for majors in Applied Mathematics)
   - The ability to recognize which real-world problems are subject to mathematical reasoning
   - The ability to make vague ideas precise by representing them in mathematical notation, when appropriate
   - Techniques for solving problems expressed in mathematical notation
3. Communication skills
   - The ability to formulate a mathematical statement precisely
   - The ability to write a coherent proof
   - The ability to present a mathematical argument verbally

- Majors in Mathematics with a Teaching Concentration should acquire familiarity with techniques for explaining K-12 mathematics in an accessible and mathematically correct manner.

4. Reading and research skills
   - Sufficient experience in mathematical language and foundational material to be well-prepared to extend one's mathematical knowledge further through independent reading
   - Exposure to and successful experience in solving mathematical problems presenting substantial intellectual challenge

Mathematics

MATH 1A Calculus 4 Units
This sequence is intended for majors in engineering and the physical sciences. An introduction to differential and integral calculus of functions of one variable, with applications and an introduction to transcendental functions.
Rules & Requirements

Prerequisites: Three and one-half years of high school math, including trigonometry and analytic geometry, plus a satisfactory grade in one of the following: CEEB MAT test, an AP test, the UC/CSU math diagnostic test, or 32. Consult the mathematics department for details. Students with AP credit should consider choosing a course more advanced than 1A

Credit Restrictions: Students will receive no credit for 1A after taking 16B and 2 units after taking 16A.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of discussion per week

Summer: 8 weeks - 5 hours of lecture and 5 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 1B Calculus 4 Units
Continuation of 1A. Techniques of integration; applications of integration. Infinite sequences and series. First-order ordinary differential equations. Second-order ordinary differential equations; oscillation and damping; series solutions of ordinary differential equations.
Rules & Requirements

Prerequisites: 1A

Credit Restrictions: Students will receive 2 units of credit for 1B after taking 16B.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of discussion per week

Summer: 8 weeks - 5 hours of lecture and 5 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH H1B Honors Calculus 4 Units
Honors version of 1B. Continuation of 1A. Techniques of integration; applications of integration. Infinite sequences and series. First-order ordinary differential equations. Second-order ordinary differential equations; oscillation and damping; series solutions of ordinary differential equations.
Rules & Requirements

Prerequisites: 1A

Credit Restrictions: Students will receive 2 units of credit for H1B after taking 16B.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of discussion per week

Summer: 8 weeks - 5 hours of lecture and 5 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 10A Methods of Mathematics: Calculus, Statistics, and Combinatorics 4 Units
This sequence is intended for majors in the life sciences. Introduction to differential and integral calculus of functions of one variable. Representation of data, elementary probability theory, statistical models, and testing.
Rules & Requirements

Prerequisites: Three and one-half years of high school math, including trigonometry and analytic geometry

Credit Restrictions: Students will receive 2 units for 10A after taking 1A.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 3 hours of discussion per week

Summer: 8 weeks - 5 hours of lecture and 5 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 10B Methods of Mathematics: Calculus, Statistics, and Combinatorics 4 Units
Elementary combinatorics and discrete probability theory. Introduction to graphs, matrix algebra, linear equations, difference equations, and differential equations.
Rules & Requirements

Prerequisites: Continuation of 10A

Credit Restrictions: Students will receive 2 units for 10B after taking 55.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 3 hours of discussion per week

Summer: 8 weeks - 5 hours of lecture and 5 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 16A Analytic Geometry and Calculus 3 Units
This sequence is intended for majors in the life and social sciences. Calculus of one variable; derivatives, definite integrals and applications, maxima and minima, and applications of the exponential and logarithmic functions.
Rules & Requirements

Prerequisites: Three years of high school math, including trigonometry, plus a satisfactory grade in one of the following: CEEB MAT test, an AP test, the UC/CSU math diagnostic exam, or 32. Consult the mathematics department for details

Credit Restrictions: Students will receive no credit for 16A after taking 1A. Two units of 16A may be used to remove a deficient grade in 1A.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 1 hour of discussion per week

Summer: 8 weeks - 4 hours of lecture and 4 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 16B Analytic Geometry and Calculus 3 Units
Continuation of 16A. Application of integration of economics and life sciences. Differential equations. Functions of many variables. Partial derivatives, constrained and unconstrained optimization.
Rules & Requirements

Prerequisites: 16A

Credit Restrictions: Students will receive no credit for 16B after 1B, 2 units after 1A. Two units of 16B may be used to remove a deficient grade in 1A.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 1 hour of discussion per week

Summer: 8 weeks - 4 hours of lecture and 4 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 24 Freshman Seminars 1 Unit
The Berkeley Seminar Program has been designed to provide new students with the opportunity to explore an intellectual topic with a faculty member in a small-seminar setting. Berkeley Seminars are offered in all campus departments, and topics vary from department to department and semester to semester.
Rules & Requirements

Repeat rules: Course may be repeated for credit as topic varies. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of seminar per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.

MATH 32 Precalculus 4 Units
Polynomial and rational functions, exponential and logarithmic functions, trigonometry and trigonometric functions. Complex numbers, fundamental theorem of algebra, mathematical induction, binomial theorem, series, and sequences.
Rules & Requirements

Prerequisites: Three years of high school mathematics, plus satisfactory score on one of the following: CEEB MAT test, math SAT, or UC/CSU diagnostic examination

Credit Restrictions: Students will receive no credit for 32 after taking 1A-1B or 16A-16B and will receive 3 units after taking 96.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 2 hours of discussion per week

Summer:
6 weeks - 5 hours of lecture and 5 hours of discussion per week
8 weeks - 5 hours of lecture and 5 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH N32 Precalculus 4 Units
Polynomial and rational functions, exponential and logarithmic functions, trigonometry and trigonometric functions. Complex numbers, fundamental theorem of algebra, mathematical induction, binomial theorem, series, and sequences.
Rules & Requirements

Prerequisites: Three years of high school mathematics, plus satisfactory score on one of the following: CEEB MAT test, math SAT, or UC/CSU diagnostic examination

Credit Restrictions: Students will receive no credit for N32 after taking 1A-1B or 16A-16B and will receive 3 units after taking 96.

Hours & Format

Summer: 8 weeks - 12.5 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Gibson

MATH 39A Freshman/Sophomore Seminar 2 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester.
Rules & Requirements

Prerequisites: Priority given to freshmen and sophomores

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 2-4 hours of seminar per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 49 Supplementary Work in Lower Division Mathematics 1 - 3 Units
Students with partial credit in lower division mathematics courses may, with consent of instructor, complete the credit under this heading.
Rules & Requirements

Prerequisites: Some units in a lower division Mathematics class

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

Summer:
6 weeks - 1-5 hours of independent study per week
8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

MATH 53 Multivariable Calculus 4 Units
Parametric equations and polar coordinates. Vectors in 2- and 3-dimensional Euclidean spaces. Partial derivatives. Multiple integrals. Vector calculus. Theorems of Green, Gauss, and Stokes.
Rules & Requirements

Prerequisites: Mathematics 1B

Credit Restrictions: Students will receive no credit for Mathematics 53 after completing Mathematics W53, 53M; 3 units for Mathematics 50A and 1 unit for Mathematics 50B. A deficient grade in 53 may be removed by completing Mathematics W53.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of discussion per week

Summer: 8 weeks - 5 hours of lecture and 5 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH H53 Honors Multivariable Calculus 4 Units
Honors version of 53. Parametric equations and polar coordinates. Vectors in 2- and 3-dimensional Euclidean spaces. Partial derivatives. Multiple integrals. Vector calculus. Theorems of Green, Gauss, and Stokes.
Rules & Requirements

Prerequisites: 1B

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH W53 Multivariable Calculus 4 Units
Parametric equations and polar coordinates. Vectors in 2- and 3-dimensional Euclidean spaces. Partial derivatives. Multiple integrals. Vector calculus. Theorems of Green, Gauss, and Stokes.
Rules & Requirements

Prerequisites: Mathematics 1B or equivalent

Credit Restrictions: Students will receive no credit for Mathematics W53 after taking Mathematics 53. A deficient grade in Mathematics W53 may be removed by completing Mathematics 53.

Hours & Format

Summer: 8 weeks - 5 hours of web-based lecture and 5 hours of web-based discussion per week

Online: This is an online course.

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Hutchings

MATH 54 Linear Algebra and Differential Equations 4 Units
Basic linear algebra; matrix arithmetic and determinants. Vector spaces; inner product as spaces. Eigenvalues and eigenvectors; linear transformations. Homogeneous ordinary differential equations; first-order differential equations with constant coefficients. Fourier series and partial differential equations.
Rules & Requirements

Prerequisites: 1B

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of discussion per week

Summer: 8 weeks - 5 hours of lecture and 5 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH H54 Honors Linear Algebra and Differential Equations 4 Units
Honors version of 54. Basic linear algebra: matrix arithmetic and determinants. Vectors spaces; inner product spaces. Eigenvalues and eigenvectors; linear transformations. Homogeneous ordinary differential equations; first-order differential equations with constant coefficients. Fourier series and partial differential equations.
Rules & Requirements

Prerequisites: 1B

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 55 Discrete Mathematics 4 Units
Logic, mathematical induction sets, relations, and functions. Introduction to graphs, elementary number theory, combinatorics, algebraic structures, and discrete probability theory.
Rules & Requirements

Prerequisites: Mathematical maturity appropriate to a sophomore math class. 1A-1B recommended

Credit Restrictions: Students will receive no credit for 55 after taking Computer Science 70.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of discussion per week

Summer: 8 weeks - 5 hours of lecture and 5 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 74 Transition to Upper Division Mathematics 3 Units
The course will focus on reading and understanding mathematical proofs. It will emphasize precise thinking and the presentation of mathematical results, both orally and in written form. The course is intended for students who are considering majoring in mathematics but wish additional training.
Rules & Requirements

Prerequisites: 53 and 54

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of discussion per week

Summer: 8 weeks - 6 hours of lecture and 0-2 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 91 Special Topics in Mathematics 4 Units
Topics to be covered and the method of instruction to be used will be announced at the beginning of each semester that such courses are offered. See department bulletins.
Rules & Requirements

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Summer: 8 weeks - 6 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 96 College Algebra 2 Units
Elements of college algebra. Designed for students who do not meet the prerequisites for 32. Offered through the Student Learning Center.
Rules & Requirements

Repeat rules: Students will receive no credit for 96 after taking P, PS, or 32. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 4 hours of workshop per week

Summer:
6 weeks - 10 hours of workshop per week
8 weeks - 10 hours of workshop per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 98 Supervised Group Study 1 - 4 Units
Directed Group Study, topics vary with instructor.
Rules & Requirements

Repeat rules: Course may be repeated for a maximum of 4 units.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of directed group study per week

Summer: 8 weeks - 1.5-7.5 hours of directed group study per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

MATH 98BC Berkeley Connect 1 Unit
Berkeley Connect is a mentoring program, offered through various academic departments, that helps students build intellectual community. Over the course of a semester, enrolled students participate in regular small-group discussions facilitated by a graduate student mentor (following a faculty-directed curriculum), meet with their graduate student mentor for one-on-one academic advising, attend lectures and panel discussions featuring department faculty and alumni, and go on field trips to campus resources. Students are not required to be declared majors in order to participate.
Rules & Requirements

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

MATH 99 Supervised Independent Study 1 - 4 Units
Supervised independent study by academically superior, lower division students. 3.3 GPA required and prior consent of instructor who is to supervise the study. A written proposal must be submitted to the department chair for pre-approval.
Rules & Requirements

Prerequisites: Restricted to freshmen and sophomores only. Consent of instructor

Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of independent study per week

Summer: 8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

MATH C103 Introduction to Mathematical Economics 4 Units
Selected topics illustrating the application of mathematics to economic theory. This course is intended for upper-division students in Mathematics, Statistics, the Physical Sciences, and Engineering, and for economics majors with adequate mathematical preparation. No economic background is required.
Rules & Requirements

Prerequisites: MATH 53 and 54

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Formerly known as: 103

Also listed as: ECON C103

MATH 104 Introduction to Analysis 4 Units
The real number system. Sequences, limits, and continuous functions in R and R. The concept of a metric space. Uniform convergence, interchange of limit operations. Infinite series. Mean value theorem and applications. The Riemann integral.
Rules & Requirements

Prerequisites: 53 and 54

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 0-2 hours of discussion per week

Summer: 8 weeks - 6 hours of lecture and 0-2 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH H104 Honors Introduction to Analysis 4 Units
Honors section corresponding to 104. Recommended for students who enjoy mathematics and are good at it. Greater emphasis on theory and challenging problems.
Rules & Requirements

Prerequisites: 53 and 54

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 105 Second Course in Analysis 4 Units
Differential calculus in Rn: the derivative as a linear map; the chain rule; inverse and implicit function theorems. Lebesgue integration on the line; comparison of Lebesgue and Riemann integrals. Convergence theorems. Fourier series, L2 theory. Fubini's theorem, change of variable.
Rules & Requirements

Prerequisites: 104

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 110 Linear Algebra 4 Units
Matrices, vector spaces, linear transformations, inner products, determinants. Eigenvectors. QR factorization. Quadratic forms and Rayleigh's principle. Jordan canonical form, applications. Linear functionals.
Rules & Requirements

Prerequisites: 54 or a course with equivalent linear algebra content

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of discussion per week

Summer: 8 weeks - 6 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH H110 Honors Linear Algebra 4 Units
Honors section corresponding to course 110 for exceptional students with strong mathematical inclination and motivation. Emphasis is on rigor, depth, and hard problems.
Rules & Requirements

Prerequisites: 54 or a course with equivalent linear algebra content

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 113 Introduction to Abstract Algebra 4 Units
Sets and relations. The integers, congruences, and the Fundamental Theorem of Arithmetic. Groups and their factor groups. Commutative rings, ideals, and quotient fields. The theory of polynomials: Euclidean algorithm and unique factorizations. The Fundamental Theorem of Algebra. Fields and field extensions.
Rules & Requirements

Prerequisites: 54 or a course with equivalent linear algebra content

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 0-2 hours of discussion per week

Summer: 8 weeks - 6 hours of lecture and 0-2 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH H113 Honors Introduction to Abstract Algebra 4 Units
Honors section corresponding to 113. Recommended for students who enjoy mathematics and are good at it. Greater emphasis on theory and challenging problems.
Rules & Requirements

Prerequisites: 54 or a course with equivalent linear algebra content

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 114 Second Course in Abstract Algebra 4 Units
Further topics on groups, rings, and fields not covered in Math 113. Possible topics include the Sylow Theorems and their applications to group theory; classical groups; abelian groups and modules over a principal ideal domain; algebraic field extensions; splitting fields and Galois theory; construction and classification of finite fields.
Rules & Requirements

Prerequisites: 110 and 113, or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 115 Introduction to Number Theory 4 Units
Divisibility, congruences, numerical functions, theory of primes. Topics selected: Diophantine analysis, continued fractions, partitions, quadratic fields, asymptotic distributions, additive problems.
Rules & Requirements

Prerequisites: 53 and 54

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 0-2 hours of discussion per week

Summer: 8 weeks - 6 hours of lecture and 0-4 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 116 Cryptography 4 Units
Construction and analysis of simple cryptosystems, public key cryptography, RSA, signature schemes, key distribution, hash functions, elliptic curves, and applications.
Rules & Requirements

Prerequisites: 55

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 0-2 hours of discussion per week

Summer: 8 weeks - 6 hours of lecture and 0-4 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 118 Fourier Analysis, Wavelets, and Signal Processing 4 Units
Introduction to signal processing including Fourier analysis and wavelets. Theory, algorithms, and applications to one-dimensional signals and multidimensional images.
Rules & Requirements

Prerequisites: 53 and 54

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 121A Mathematical Tools for the Physical Sciences 4 Units
Intended for students in the physical sciences who are not planning to take more advanced mathematics courses. Rapid review of series and partial differentiation, complex variables and analytic functions, integral transforms, calculus of variations.
Rules & Requirements

Prerequisites: 53 and 54

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 121B Mathematical Tools for the Physical Sciences 4 Units
Intended for students in the physical sciences who are not planning to take more advanced mathematics courses. Special functions, series solutions of ordinary differential equations, partial differential equations arising in mathematical physics, probability theory.
Rules & Requirements

Prerequisites: 53 and 54

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 123 Ordinary Differential Equations 4 Units
Existence and uniqueness of solutions, linear systems, regular singular points. Other topics selected from analytic systems, autonomous systems, Sturm-Liouville Theory.
Rules & Requirements

Prerequisites: 104

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 125A Mathematical Logic 4 Units
Sentential and quantificational logic. Formal grammar, semantical interpretation, formal deduction, and their interrelation. Applications to formalized mathematical theories. Selected topics from model theory or proof theory.
Rules & Requirements

Prerequisites: MATH 113 or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 126 Introduction to Partial Differential Equations 4 Units
Waves and diffusion, initial value problems for hyperbolic and parabolic equations, boundary value problems for elliptic equations, Green's functions, maximum principles, a priori bounds, Fourier transform.
Rules & Requirements

Prerequisites: 53 and 54

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Summer: 8 weeks - 6 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 127 Mathematical and Computational Methods in Molecular Biology 4 Units
Introduction to mathematical and computational problems arising in the context of molecular biology. Theory and applications of combinatorics, probability, statistics, geometry, and topology to problems ranging from sequence determination to structure analysis.
Rules & Requirements

Prerequisites: 53, 54, and 55; Statistics 20 recommended

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 128A Numerical Analysis 4 Units
Programming for numerical calculations, round-off error, approximation and interpolation, numerical quadrature, and solution of ordinary differential equations. Practice on the computer.
Rules & Requirements

Prerequisites: 53 and 54

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Summer: 8 weeks - 6 hours of lecture, 2 hours of discussion, and 6 hours of laboratory per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 128B Numerical Analysis 4 Units
Iterative solution of systems of nonlinear equations, evaluation of eigenvalues and eigenvectors of matrices, applications to simple partial differential equations. Practice on the computer.
Rules & Requirements

Prerequisites: 110 and 128A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Summer: 8 weeks - 6 hours of lecture and 1.5 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 130 The Classical Geometries 4 Units
A critical examination of Euclid's Elements; ruler and compass constructions; connections with Galois theory; Hilbert's axioms for geometry, theory of areas, introduction of coordinates, non-Euclidean geometry, regular solids, projective geometry.
Rules & Requirements

Prerequisites: 110 and 113

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 135 Introduction to the Theory of Sets 4 Units
Set-theoretical paradoxes and means of avoiding them. Sets, relations, functions, order and well-order. Proof by transfinite induction and definitions by transfinite recursion. Cardinal and ordinal numbers and their arithmetic. Construction of the real numbers. Axiom of choice and its consequences.
Rules & Requirements

Prerequisites: 113 and 104

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 136 Incompleteness and Undecidability 4 Units
Functions computable by algorithm, Turing machines, Church's thesis. Unsolvability of the halting problem, Rice's theorem. Recursively enumerable sets, creative sets, many-one reductions. Self-referential programs. Godel's incompleteness theorems, undecidability of validity, decidable and undecidable theories.
Rules & Requirements

Prerequisites: 53, 54, and 55

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 140 Metric Differential Geometry 4 Units
Frenet formulas, isoperimetric inequality, local theory of surfaces in Euclidean space, first and second fundamental forms. Gaussian and mean curvature, isometries, geodesics, parallelism, the Gauss-Bonnet-Von Dyck Theorem.
Rules & Requirements

Prerequisites: 104

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 141 Elementary Differential Topology 4 Units
Manifolds in n-dimensional Euclidean space and smooth maps, Sard's Theorem, classification of compact one-manifolds, transversality and intersection modulo 2.
Rules & Requirements

Prerequisites: 104 or equivalent and linear algebra

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 142 Elementary Algebraic Topology 4 Units
The topology of one and two dimensional spaces: manifolds and triangulation, classification of surfaces, Euler characteristic, fundamental groups, plus further topics at the discretion of the instructor.
Rules & Requirements

Prerequisites: 104 and 113

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 143 Elementary Algebraic Geometry 4 Units
Introduction to basic commutative algebra, algebraic geometry, and computational techniques. Main focus on curves, surfaces and Grassmannian varieties.
Rules & Requirements

Prerequisites: 113

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 151 Mathematics of the Secondary School Curriculum I 4 Units
Theory of rational numbers based on the number line, the Euclidean algorithm and fractions in lowest terms. The concepts of congruence and similarity, equation of a line, functions, and quadratic functions.
Rules & Requirements

Prerequisites: 1A-1B, 53, or equivalent

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 0-1 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 152 Mathematics of the Secondary School Curriculum II 4 Units
Complex numbers and Fundamental Theorem of Algebra, roots and factorizations of polynomials, Euclidean geometry and axiomatic systems, basic trigonometry.
Rules & Requirements

Prerequisites: 151; 54, 113, or equivalent

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 0-1 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 153 Mathematics of the Secondary School Curriculum III 4 Units
The real line and least upper bound, limit and decimal expansion of a number, differentiation and integration, Fundamental Theorem of Calculus, characterizations of sine, cosine, exp, and log.
Rules & Requirements

Prerequisites: 151, 152

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 0-1 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 160 History of Mathematics 4 Units
History of algebra, geometry, analytic geometry, and calculus from ancient times through the seventeenth century and selected topics from more recent mathematical history.
Rules & Requirements

Prerequisites: 53, 54, and 113

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 170 Mathematical Methods for Optimization 4 Units
Linear programming and a selection of topics from among the following: matrix games, integer programming, semidefinite programming, nonlinear programming, convex analysis and geometry, polyhedral geometry, the calculus of variations, and control theory.
Rules & Requirements

Prerequisites: 53 and 54

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 172 Combinatorics 4 Units
Basic combinatorial principles, graphs, partially ordered sets, generating functions, asymptotic methods, combinatorics of permutations and partitions, designs and codes. Additional topics at the discretion of the instructor.
Rules & Requirements

Prerequisites: 55

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 185 Introduction to Complex Analysis 4 Units
Analytic functions of a complex variable. Cauchy's integral theorem, power series, Laurent series, singularities of analytic functions, the residue theorem with application to definite integrals. Some additional topics such as conformal mapping.
Rules & Requirements

Prerequisites: 104

Hours & Format

Fall and/or spring: 15 weeks - 3-3 hours of lecture and 0-2 hours of discussion per week

Summer: 8 weeks - 6-6 hours of lecture and 0-2 hours of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH H185 Honors Introduction to Complex Analysis 4 Units
Honors section corresponding to Math 185 for exceptional students with strong mathematical inclination and motivation. Emphasis is on rigor, depth, and hard problems.
Rules & Requirements

Prerequisites: 104

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 189 Mathematical Methods in Classical and Quantum Mechanics 4 Units
Topics in mechanics presented from a mathematical viewpoint: e.g., hamiltonian mechanics and symplectic geometry, differential equations for fluids, spectral theory in quantum mechanics, probability theory and statistical mechanics. See department bulletins for specific topics each semester course is offered.
Rules & Requirements

Prerequisites: 104, 110, 2 semesters lower division Physics

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 191 Experimental Courses in Mathematics 1 - 4 Units
The topics to be covered and the method of instruction to be used will be announced at the beginning of each semester that such courses are offered. See departmental bulletins.
Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of seminar per week

Summer:
6 weeks - 2.5-10 hours of seminar per week
8 weeks - 1.5-7.5 hours of seminar per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 195 Special Topics in Mathematics 4 Units
Lectures on special topics, which will be announced at the beginning of each semester that the course is offered.
Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MATH 196 Honors Thesis 4 Units
Independent study of an advanced topic leading to an honors thesis.
Rules & Requirements

Prerequisites: Admission to the Honors Program; an overall GPA of 3.3 and a GPA of 3.5 in the major

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

Summer:
6 weeks - 1-5 hours of independent study per week
8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

MATH 197 Field Study 1 - 4 Units
For Math/Applied math majors. Supervised experience relevant to specific aspects of their mathematical emphasis of study in off-campus organizations. Regular individual meetings with faculty sponsor and written reports required. Units will be awarded on the basis of three hours/week/unit.
Rules & Requirements

Prerequisites: Upper division standing. Written proposal signed by faculty sponsor and approved by department chair

Credit Restrictions: Enrollment is restricted; see the Course Number Guide in the Bulletin.

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 3-3 hours of fieldwork per week

Summer: 8 weeks - 3-3 hours of fieldwork per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

MATH 198 Directed Group Study 1 - 4 Units
Topics will vary with instructor.
Rules & Requirements

Prerequisites: Must have completed 60 units and be in good standing

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of directed group study per week

Summer: 8 weeks - 1-4 hours of directed group study per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

MATH 198BC Berkeley Connect 1 Unit
Berkeley Connect is a mentoring program, offered through various academic departments, that helps students build intellectual community. Over the course of a semester, enrolled students participate in regular small-group discussions facilitated by a graduate student mentor (following a faculty-directed curriculum), meet with their graduate student mentor for one-on-one academic advising, attend lectures and panel discussions featuring department faculty and alumni, and go on field trips to campus resources. Students are not required to be declared majors in order to participate.
Rules & Requirements

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of discussion per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

MATH 199 Supervised Independent Study and Research 1 - 4 Units
Rules & Requirements

Prerequisites: The standard college regulations for all 199 courses

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

Summer:
6 weeks - 1-5 hours of independent study per week
8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Mathematics/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.