Applied and Computational Mathematics, B.S.

The Department offers a B.S. in Applied and Computational Mathematics. Within this program there are four tracks; besides the standard track, there is one specialization (in Mathematical Biology) and two concentrations (in Mathematical Finance and Data Science). In addition, the Department offers a B.S. in Mathematics (http://catalogue.uci.edu/schoolofphysicalsciences/departmentofmathematics/mathematics_bs/) (which focuses more on topics in pure mathematics) and minors in Mathematics (http://catalogue.uci.edu/schoolofphysicalsciences/departmentofmathematics/mathematics_minor/) and Mathematics for Biology (http://catalogue.uci.edu/schoolofphysicalsciences/departmentofmathematics/mathematicsforbiology_minor/).

Undergraduate mathematics courses are of several kinds: courses preparatory to advanced work in mathematics, the exact sciences, and engineering; courses for students of the social and biological sciences; and courses for liberal arts students and those planning to enter the teaching field.

Students may be admitted to the Applied and Computational Mathematics major upon entering the University as freshmen, via change of major, or as transfer students from other colleges and universities. Information about change of major policies is available in the Physical Sciences Student Affairs Office and at the UCI Change of Major Criteria website (https://changeofmajor.uci.edu/). For transfer student admission, preference will be given to junior-level applicants with the highest grades overall and who have satisfactorily completed the required coursework of one year of approved calculus. Additional course work in multivariable calculus, linear algebra, and differential equations is strongly recommended.

All students must meet the University Requirements (http://catalogue.uci.edu/informationforadmittedstudents/requirementsforabachelorsdegree/).
School Requirements: None.
Core Requirements for all Applied and Computational Mathematics Majors

Lower-Division Requirements:	
A. Complete the following:	
MATH 2A- 2B	Single-Variable Calculus I and Single-Variable Calculus II
MATH 2D	Multivariable Calculus I
MATH 2E	Multivariable Calculus II
MATH 3A	Introduction to Linear Algebra
MATH 3D	Elementary Differential Equations
MATH 9	Introduction to Programming for Numerical Analysis
MATH 13	Introduction to Abstract Mathematics
Upper-Division Requirements:	
A. Complete the following:	
MATH 105A- 105LA	Numerical Analysis I and Numerical Analysis Laboratory
MATH 105B- 105LB	Numerical Analysis II and Numerical Analysis Laboratory
MATH 121A- 121B	Linear Algebra I and Linear Algebra II
MATH 130A	Probability I
MATH 140A- 140B	Elementary Analysis I and Elementary Analysis II

Requirements for the Applied and Computational Mathematics Major

Core requirements for all Applied and Computational Mathematics majors plus:	
Lower-Division Requirements:	
A. Select three lower-division courses from the following:	
BIO SCI 93- 93L	From DNA to Organisms and DNA to Organisms - Introduction to Biology Research
BIO SCI 94- 94L	From Organisms to Ecosystems and Organisms to Ecosystems - Introduction to Biology Research Analysis
BIO SCI 97	Genetics
CHEM 1A	General Chemistry
CHEM 1B	General Chemistry
CHEM 1C	General Chemistry

MATH 10	Introduction to Programming for Data Science
PHYSICS 7C	Classical Physics
PHYSICS 7D	Classical Physics
PHYSICS 7E	Classical Physics
STATS 7	Basic Statistics
Upper-Division Requirements:	
A. Complete:	
MATH 112A- 112B	Introduction to Partial Differential Equations and Applications I and Introduction to Partial Differential Equations and Applications II
MATH 115	Mathematical Modeling
B. Select three additional upper-division MATH courses from the following:	
MATH 107- 107L	Numerical Differential Equations and Numerical Differential Equations Laboratory
MATH 110A	Optimization I
MATH 110B	Optimization II
MATH 112C	Introduction to Partial Differential Equations and Applications III
MATH 113A	Mathematical Modeling in Biology I
MATH 113B	Mathematical Modeling in Biology II
MATH 115	Mathematical Modeling
MATH 117	Dynamical Systems
MATH 118	The Theory of Differential Equations
MATH 120A	Introduction to Abstract Algebra: Groups
MATH 130B	Probability II
MATH 130C	Stochastic Processes
MATH 134A	Fixed Income
MATH 134B	Mathematics of Financial Derivatives
MATH 140C	Analysis in Several Variables
MATH 147	Complex Analysis
MATH 176	Mathematics of Finance
MATH 178	Mathematical Machine Learning
C. Select two 4-unit upper-division courses in an area outside of mathematics from the below list or obtain advanced approval from an Applied and Computational Mathematics advisor for courses outside of this list:	
COMPSCI 122A	Introduction to Data Management
COMPSCI 161	Design and Analysis of Algorithms
COMPSCI 171	Introduction to Artificial Intelligence
COMPSCI 172B	Neural Networks and Deep Learning
COMPSCI 178	Machine Learning and Data-Mining
COMPSCI 183	Introduction to Computational Biology
ECON 100A	Intermediate Economics I
ECON 105A	Intermediate Quantitative Economics I
ECON 105B	Intermediate Quantitative Economics II
MGMT 101	Management Science
MGMT 105	Introduction to Marketing
MGMT 107	Introduction to Management Information Systems
PHILOS 104	Introduction to Logic
PHILOS 105A	Introduction to Set Theory and Mathematical Reasoning
PHILOS 105B	Metalogic
PHYSICS 100	Computational Methods
PHYSICS 111A	Classical Mechanics
PHYSICS 111B	Classical Mechanics
PHYSICS 116	Relativity and Black Holes

PHYSICS 125A	Mathematical Physics
PHYSICS 125B	Mathematical Physics
STATS 110	Statistical Methods for Data Analysis I
STATS 111	Statistical Methods for Data Analysis II
STATS 112	Statistical Methods for Data Analysis III
STATS 120B	Introduction to Probability and Statistics II

Sample Program — Applied and Computational Mathematics

Freshman		
Fall	**Winter**	**Spring**
MATH 2A	MATH 2B	MATH 2D
PHYSICS 7C or CHEM 1A	PHYSICS 7D or CHEM 1B	PHYSICS 7E or CHEM 1C
General Education/Elective	General Education/Elective	General Education/Elective
General Education/Elective	General Education/Elective	General Education/Elective
Sophomore		
Fall	**Winter**	**Spring**
MATH 2E	MATH 3A	MATH 3D
MATH 9	MATH 13	General Education/Elective
General Education/Elective	General Education/Elective	General Education/Elective
General Education/Elective	General Education/Elective	General Education/Elective
Junior		
Fall	**Winter**	**Spring**
MATH 105A- 105LA	MATH 105B- 105LB	MATH 121B
MATH 130A	MATH 121A	Upper-Division Math Elective
General Education/Elective	Upper-Division Math Elective	General Education/Elective
General Education/Elective	General Education/Elective	General Education/Elective
Senior		
Fall	**Winter**	**Spring**
MATH 112A	MATH 112B	MATH 115
MATH 140A	MATH 140B	Non-Math Elective
Upper-Division Math Elective	Non-Math Elective	General Education/Elective
General Education/Elective	General Education/Elective	General Education/Elective

The Applied and Computational Mathematics major offers two concentrations and one specialization. Note that all require the completion of an application and an interview with the faculty advisor for that concentration or specialization. **Admission into a concentration or specialization is not guaranteed.** Students must complete the basic "Core" requirements for the B.S. in Applied and Computational Mathematics along with the lower- and upper-division requirements specified for each concentration and specialization. Students choosing to specialize or concentrate can only do so with a single specialization/concentration.

Requirements for Applied and Computational Mathematics Major with a Concentration in Data Science

Admission to this concentration requires approval in advance by the Mathematics Department. Students need a GPA of 3.0 in all lower-division and upper-division MATH courses to be admitted to the concentration. Before applying, students should have finished all lower-division requirements for the Data Science concentration. The admissions process begins with completing a Data Science concentration advising form and includes an interview with the Department's advisor for the concentration. This approval should be applied for no later than the end of the junior year.

Core requirements for all Mathematics majors plus:	
Lower-Division Requirements:	
A. Complete:	
MATH 10	Introduction to Programming for Data Science
STATS 7	Basic Statistics
PHYSICS 7C	Classical Physics
Upper-Division Requirements:	
A. Complete:	
MATH 110A- 110B	Optimization I and Optimization II
MATH 130B	Probability II
B. Complete five electives from the list below, with at least one course outside of MATH. Other options may be chosen in consultation with the Data Science concentration advisor	

MATH 115	Mathematical Modeling
MATH 117	Dynamical Systems
MATH 118	The Theory of Differential Equations
MATH 120B	Introduction to Abstract Algebra: Rings and Fields
MATH 130C	Stochastic Processes
MATH 134A	Fixed Income
MATH 134B	Mathematics of Financial Derivatives
MATH 140C	Analysis in Several Variables
MATH 147	Complex Analysis
MATH 162A	Introduction to Differential Geometry I
MATH 162B	Introduction to Differential Geometry II
MATH 173A	Introduction to Cryptology I
MATH 173B	Introduction to Cryptology II
MATH 175	Combinatorics
MATH 176	Mathematics of Finance
MATH 178	Mathematical Machine Learning
STATS 110	Statistical Methods for Data Analysis I
STATS 111	Statistical Methods for Data Analysis II
COMPSCI 171	Introduction to Artificial Intelligence
COMPSCI 172B	Neural Networks and Deep Learning
COMPSCI 177	Applications of Probability in Computer Science
COMPSCI 178	Machine Learning and Data-Mining
COMPSCI 179	Algorithms for Probabilistic and Deterministic Graphical Models
COMPSCI 183	Introduction to Computational Biology
COMPSCI 184A	Artificial Intelligence in Biology and Medicine
COMPSCI 184C	Computational Systems Biology

Sample Program — Applied and Computational Mathematics Major Concentrating in Data Science

Freshman		
Fall	**Winter**	**Spring**
MATH 2A	MATH 2B	MATH 3A
STATS 7	PHYSICS 7C	MATH 9
General Education/Elective	General Education/Elective	General Education/Elective
General Education/Elective	General Education/Elective	General Education/Elective
Sophomore		
Fall	**Winter**	**Spring**
MATH 2D	MATH 2E	MATH 3D
MATH 13	MATH 10	General Education/Elective
General Education/Elective	General Education/Elective	General Education/Elective
General Education/Elective	General Education/Elective	General Education/Elective
Junior		
Fall	**Winter**	**Spring**
MATH 105A- 105LA	MATH 105B- 105LB	MATH 121B
MATH 130A	MATH 121A	Upper-Division Math Elective
General Education/Elective	MATH 130B	Upper-Division Math Elective
General Education/Elective	General Education/Elective	General Education/Elective
Senior		
Fall	**Winter**	**Spring**
MATH 140A	MATH 110A	MATH 110B
Non-Math Elective	MATH 140B	Upper-Division Math Elective
General Education/Elective	Upper-Division Math Elective	General Education/Elective
General Education/Elective	General Education/Elective	General Education/Elective

Requirements for Applied and Computational Mathematics Major with a Concentration in Mathematical Finance

Admission to this concentration requires approval in advance by the Mathematical Finance advisor. Students need a GPA of 3.0 in lower-division and upper-division mathematics courses to be admitted to the concentration. The department may limit the number of students admitted into this concentration during impacted years. The admissions process begins with completing a form and submitting it to the Mathematical Finance advisor, followed by an interview. This approval should be applied for after the student has completed ECON 20A-ECON 20B, but no later than the end of the junior year.

Core requirements for all Mathematics majors plus:	
Lower-Division Requirements:	
A. Complete:	
MATH 10	Introduction to Programming for Data Science
STATS 7	Basic Statistics
PHYSICS 7C	Classical Physics
ECON 20A- 20B	Basic Economics I and Basic Economics II
Upper-Division Requirements:	
A. Complete the following upper-division MATH courses:	
MATH 130B	Probability II
MATH 130C	Stochastic Processes
MATH 134A	Fixed Income
MATH 134B	Mathematics of Financial Derivatives
MATH 134C	Mathematical Models for Finance
MATH 176	Mathematics of Finance
B. Complete the following six required upper-division ECON courses:	
ECON 105A- 105B- 105C	Intermediate Quantitative Economics I and Intermediate Quantitative Economics II and Intermediate Quantitative Economics III
ECON 122A	Applied Econometrics I
or ECON 123A	Econometrics I
ECON 132A	Introduction to Financial Investments
ECON 134A	Corporate Finance
or ECON 161A	Money and Banking

Sample Program - Applied and Computational Mathematics Major Concentrating in Mathematical Finance

Freshman		
Fall	**Winter**	**Spring**
MATH 2A	MATH 2B	MATH 2D
STATS 7	MATH 9	MATH 10
General Education/Elective	General Education/Elective	General Education/Elective
General Education/Elective	General Education/Elective	General Education/Elective
Sophomore		
Fall	**Winter**	**Spring**
MATH 2E	MATH 3A	MATH 3D
ECON 20A	ECON 20B	MATH 13
PHYSICS 7C	General Education/Elective	General Education/Elective
General Education/Elective	General Education/Elective	General Education/Elective
Junior		
Fall	**Winter**	**Spring**
MATH 130A	MATH 130B	MATH 130C
MATH 121A	MATH 121B	MATH 134A
ECON 105A	ECON 105B	ECON 105C
General Education/Elective	General Education/Elective	General Education/Elective
Senior		
Fall	**Winter**	**Spring**
MATH 105A- 105LA	MATH 105B- 105LB	MATH 134C

ECON 134A	MATH 140A	MATH 140B
ECON 132A	MATH 134B	ECON 122A
General Education/Elective	MATH 176	General Education/Elective

Requirements for Applied and Computational Mathematics Major with a Specialization in Mathematical Biology

Admission to this specialization requires approval in advance by the Mathematical Biology advisor. The admissions process begins with completing a form at the Mathematical Biology advisor and includes and interview. This approval should be applied for no later than the end of the junior year.

Core requirements for all Mathematics majors plus:	
Lower-Division Requirements:	
A. Complete:	
BIO SCI 93- 93L	From DNA to Organisms and DNA to Organisms - Introduction to Biology Research
BIO SCI 94- 94L	From Organisms to Ecosystems and Organisms to Ecosystems - Introduction to Biology Research Analysis
MATH 10	Introduction to Programming for Data Science
Upper-Division Requirements:	
A. Complete the following upper-division MATH courses:	
MATH 112A- 112B	Introduction to Partial Differential Equations and Applications I and Introduction to Partial Differential Equations and Applications II
MATH 113A- 113B	Mathematical Modeling in Biology I and Mathematical Modeling in Biology II
MATH 115	Mathematical Modeling
B. Complete three elective courses, at least two MATH courses numbered 100-189. The third elective may be either a MATH course numbered 100-189 or a 4-unit upper-division Biological Sciences courses with advanced approval by the Mathematical Biology advisor.	

Sample Program - Applied and Computational Mathematics Major Specializing in Mathematical Biology

Freshman		
Fall	**Winter**	**Spring**
MATH 2A	MATH 2B	MATH 2D
BIO SCI 93- 93L	BIO SCI 94- 94L	General Education/Elective
General Education/Elective	General Education/Elective	General Education/Elective
General Education/Elective	General Education/Elective	General Education/Elective
Sophomore		
Fall	**Winter**	**Spring**
MATH 2E	MATH 3A	MATH 3D
MATH 9	MATH 10	MATH 13
General Education/Elective	General Education/Elective	General Education/Elective
General Education/Elective	General Education/Elective	General Education/Elective
Junior		
Fall	**Winter**	**Spring**
MATH 113A	MATH 113B	MATH 115
MATH 105A- 105LA	MATH 105B- 105LB	MATH 130A
General Education/Elective	General Education/Elective	General Education/Elective
General Education/Elective	General Education/Elective	General Education/Elective
Senior		
Fall	**Winter**	**Spring**
MATH 112A	MATH 112B	MATH 140B
MATH 121A	MATH 121B	Upper-Division Math Elective
Upper-Division Bio Sci Elective	MATH 140A	General Education/Elective
General Education/Elective	Upper-Division Math Elective	General Education/Elective

NOTE: Students majoring in Applied and Computational Mathematics may not minor in Mathematics or Mathematics for Biology and may not double major in Mathematics. Likewise, students majoring in Mathematics may not minor in Mathematics or Mathematics for Biology and may not double major in Applied and Computational Mathematics. Students wishing to specialize or concentrate within the Applied and Computational Mathematics major may only do so in one specialization/concentration.

The Honors Program in Applied and Computational Mathematics is designed for students contemplating graduate work in applied mathematics. The program is open to junior and senior Mathematics majors who meet the minimum academic qualifications of a 3.5 GPA in Mathematics courses and a 3.2 GPA overall. It is highly recommended that students meet with the Honors Advisor by the beginning of their junior year to begin planning courses. Students should officially apply for the Honors Program no later than the fall quarter of their senior year. Recognition for completing the program is conferred upon graduation.

Participants must meet the following requirements:

A. Complete the requirements for the major in Applied and Computational Mathematics (in any one of its tracks)	
B. Complete:	
MATH 130B- 130C	Probability II and Stochastic Processes
C. Complete one of the following series:	
MATH H140A	Honors Introduction to Graduate Analysis I
MATH H140B	Honors Introduction to Graduate Analysis II
MATH H140C	Honors Introduction to Graduate Analysis III
or	
MATH 140C and MATH 134A-MATH 134B	
or	
MATH 140C and MATH 112A-MATH 112B	
or	
MATH 140C and MATH 113A-MATH 113B	
or	
MATH 140C and MATH 117-MATH 118	
or	
MATH 140C and MATH 110A-MATH 110B	
D. Complete one quarter of MATH 199 or a research project and thesis approved by the Honors Program Advisor.	

These requirements are in addition to the Applied and Computational Mathematics major requirements and the requirements for any specialization/concentration. MATH H140A-MATH H140B-MATH H140C may be used to satisfy upper-division electives or taken in place of MATH 140A-MATH 140B-MATH 140C and MATH 141.

NOTE: If all requirements are completed and the student's work and final GPA satisfies the program restrictions, the student will graduate with Honors in Mathematics, and this distinction is noted on the transcript.

Sample Program - Applied and Computational Mathematics Major Honors Program

Freshman		
Fall	**Winter**	**Spring**
MATH 2A	MATH 2B	MATH 2D
STATS 7	PHYSICS 7C	MATH 13
General Education/Elective	General Education/Elective	General Education/Elective
General Education/Elective	General Education/Elective	General Education/Elective
Sophomore		
Fall	**Winter**	**Spring**
MATH 2E	MATH 3D	MATH 10
MATH 3A	MATH 9	General Education/Elective
General Education/Elective	General Education/Elective	General Education/Elective
General Education/Elective	General Education/Elective	General Education/Elective
Junior		
Fall	**Winter**	**Spring**
MATH 105A- 105LA	MATH 105B- 105LB	MATH 130C
MATH 130A	MATH 130B	MATH 121B
Upper-Division Math Elective	MATH 121A	Non-Math Elective
General Education/Elective	General Education/Elective	General Education/Elective
Senior		
Fall	**Winter**	**Spring**
MATH H140A	MATH H140B	MATH H140C
MATH 112A	MATH 112B	MATH 115

| MATH 199 | Upper-Division Math Elective | Upper-Division Math Elective |
| Non-Math Elective | General Education/Elective | General Education/Elective |

In order to prepare for independent study/independent research, it is highly recommended that students take at least one course sequence in the field they are interested in studying. The following list contains the major mathematical disciplines and the course work suggested for completion prior to doing independent study in that field:

- Applied Mathematics: MATH 117 and MATH 118
- Algebra: MATH 120A-MATH 120B-MATH 120C
- Probability and Statistics: MATH 130A-MATH 130B-MATH 130C
- Analysis: MATH 140A-MATH 140B-MATH 140C
- Logic: MATH 150
- Geometry: MATH 162A-MATH 162B
- Number Theory: MATH 180A-MATH 180B

For all Mathematics majors, or prospective majors, assistance in planning a program of study is available from the School of Physical Sciences academic counselors, as well as from the Mathematics Department Undergraduate Advisor for the various tracks. The application process for the specializations and concentrations requires students to plan a program of study with the assistance of a faculty advisor (https://www.math.uci.edu/undergraduate-studies/concentrations-and-specializations (https://www.math.uci.edu/undergraduate-studies/concentrations-and-specializations/)).

- Applied and Computational Mathematics, B.S.
- Mathematics for Biology, Minor
- Mathematics, B.S.
- Mathematics, M.S.
- Mathematics, Minor
- Mathematics, Ph.D.