

# Andrew Ortegaray

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## EDUCATION

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### University of California, Santa Barbara (UCSB)

*PhD in Mathematics*

Santa Barbara, CA

*Sep. 2024 – Present*

### California Institute of Technology (Caltech)

*Bachelor of Science in Mathematics and Physics*

Pasadena, CA

*Sep. 2016 – June 2020*

## EXPERIENCE

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### UCSB

*Teaching Assistant*

Santa Barbara, CA

*Sep. 2024 – Present*

Ma 3A (Differential Calculus): Lead sections, office hours, and reviews for students in an introductory differential calculus course. Graded and designed assignments and created custom review material for sections and reviews.

Ma 3B (Integral Calculus): Lead sections, office hours, and reviews for students in an introductory integral calculus course. Graded and designed assignments and created custom review material for sections and reviews.

Ma 34B (Integral Calculus): Lead sections, office hours, and reviews for students in an introductory integral calculus course. Graded and designed assignments and created custom review material for sections and reviews.

### SpaceX

*Starlink Analyst*

Seattle, WA

*Sep. 2022 – Sep. 2024*

Developed tools to monitor and measure the health of the Starlink network. Collaborated with various subsystem teams across the Starlink program to integrate diverse sources of data. Developed new scalable measures of network performance and optimized existing systems to scale with the growth of the program. Managed the health of orbital assets, terrestrial network interconnections, broadcasting sites, and global points of presence.

### Art of Problem Solving Academy

*Math Instructor*

Bellevue, WA

*Sep. 2022 – Sep. 2024*

Lead several advanced-level extracurricular classes in mathematics. Courses ranged from pre-calculus to competition courses at the level of the AMC 12. Classes were generally as large as 15 students and included students of various ages and backgrounds.

### UPchieve

*Math and Science Coach*

Seattle, WA

*Jan. 2023 – Sep. 2024*

Assisted students on a weekly and daily basis with various aspects of on high-school level mathematics and science classes. Promoted critical thinking and fostered open-ended thinking towards problem solving.

### Wolfram Research

*Symbolic Algorithms Researcher*

Seattle, WA

*Aug. 2020 – Aug. 2021*

Fast Number Theoretic Transforms (FNTTs): Implemented FFT-style algorithms for computing FNNTs over number fields in the Wolfram Language. Constructed fast methods for matrix computation of small transforms and a fast, iterative divide-and-conquer strategy for larger transforms. New FNTTs are published and available on current Wolfram Language distributions.

Fast Multipole Methods (FMMs): Designed FMMs for fast evaluations of many-particle potentials in 1D, 2D, and 3D in the Wolfram Language. Permitted high control of accuracy in near and far regions of the potential distribution. The new implementations performed with  $O(n)$  complexities at evaluation compared to default  $O(n^2)$  methods with computation timing crossovers at practical particle distribution sizes ( $n > 8000$ ).

**Caltech***Teaching Assistant*

Pasadena, CA

*Mar. 2018 – Dec. 2019*

Ma 0 (Proofs): Held weekly office hours and graded student assignment on course material including the Peano axioms, strong induction, and formal logic.

Ma 5 (Group Theory): Managed student work, wrote new solution sets, and assisted students with course material including groups, homomorphisms, Sylow's theorem, and group actions.

Ph 1 (Classical Mechanics): Managed student work, wrote new solution sets, and assisted students with course material including kinematics, dynamics, special relativity, and relativistic electromagnetism.

Ph 2 (Quantum and Statistical Mechanics): Managed student work, wrote new solution sets, and assisted students with course material including waves, particle statistics, and thermodynamics.

**PROJECTS AND SERVICE**

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**Women in STEM***Undergraduate Mentor*

Santa Barbara, CA

*Jan. 2025 – Present***Mathematics Department Directed Reading Program***Project Mentor*

Santa Barbara, CA

*Jan. 2025 – Present***Wolfram Summer Program***Developer*

Champaign, IL

*June 2020 – Aug. 2020*

Developed new methods in the Wolfram Language to construct Vietoris-Rips complexes from point cloud data and compute persistent homology of the resulting complexes including access to homology generators. Implementation widely available on current Wolfram Language distributions. See publications below.

**Summer Undergraduate Research Fellowship***Research Fellow*

Pasadena, CA

*June 2016 – June 2017*

Analyzed binary vectors representing the presence or absence of syntactic structures in languages with statistical algebro-geometric and topological methods. Used nearest-neighbor methods to estimate statistical interdependence of syntactic structures in the language data. Constructed and reproduced phylogenetic trees of different language families. See publications below.

**Youth Math League***Lead Coach*

Arcadia, CA

*Jan. 2019 – June. 2020*

Organized a youth math program to prepare advanced 5th/6th grade girls for Olympiad-style competitions.  
Organized and lead practices and lessons for students weekly.

**PUBLICATIONS**

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Heat Kernel Analysis of Syntactic Structures (with R. Berwick and M. Marcolli), *Mathematics in Computer Science*, Vol. 15 (2021), 643–660

Phylogenetics of Indo-European Language Families via an Algebro-Geometric Analysis of Their Syntactic Structures (with K. Shu, R. Berwick, and M. Marcolli), *Mathematics in Computer Science*, Vol. 15 (2021), 803–857

An Implementation of Persistent Homology, *Wolfram Summer Program* (2020)