

Jay Cummings

Curriculum Vitae

Employment

2016-Present **Assistant Professor**, *California State University, Sacramento*.

Education

2011–2016 **Mathematics PhD**, *University of California, San Diego*, Dissertation: Flips and Juggles, Advisor: Ron Graham.

2011–2012 **Masters of Applied Mathematics**, *University of California, San Diego*, Exams in Analysis, Applied Algebra and Statistics.

2007–2011 **Bachelor of Science**, *University of Nebraska, Lincoln*, Graduated Summa Cum Laude, *Mathematics Major*.

Teaching

2016-present **Instructor of Record**, *Sacramento State University*, Math Department.

- Have taught Math Reasoning, Calculus I, Calculus II, Combinatorics, Intro to Proofs, Real Analysis I, Real Analysis II and History of Math.
- In the below table are the numerical results of my student evaluations. Each is on a scale of 1-5.

Semester	Courses	Overall Performance
Spring 2020	Intro to Proofs (two sections), Math 1 (two sections)	TBD
Spring 2020	Intro to Proofs (two sections), Calculus I, Math 1	4.86* and 4.86*, 5.00*, 4.38*
Fall 2019	History of Math, Calculus II (two sections)	5.00, 5.00 and 4.95
Spring 2019	Real Analysis II, Calculus I (two sections)	4.96, 4.90 and 5.00
Fall 2018	Real Analysis I, Calculus II (two sections)	4.92, 4.95 and 4.95
Spring 2018	Real Analysis II, Calculus I (two sections)	5.00, 4.88 and 5.00
Fall 2017	Real Analysis I, Calculus II	5.00, 4.96
Spring 2017	Combinatorics, Calculus II (two sections),	4.94, 4.96 and 5.00
Fall 2016	Calculus I (two sections)	4.91 and 4.91

*Response rates were very low; this was the first COVID-19 semester.

Research

2019-2020 **Research Mentor**, *Sacramento State University*, Math Department.

- Was a research mentor to two CSUS students on two projects producing one paper. One student, Travell Criner, presented a poster on our work at the CSUS fall research symposium.
- Much of the work from last year stretched well into this year. The paper on counting pseudo progressions is still under review at *Involve*. The paper on Hunters and Rabbits is now under review at *Discussiones Mathematicae Graph Theory*. The paper on small pseudo-Ramsey numbers is now under review at *The PUMP Journal of Undergraduate Research*.
- A new project began with CSUS undergrad Barry Chin. We are working on a probabilistic version of the classical problem from the math of juggling. Work on it was entirely halted when COVID-19 hit, but hopefully we will be able to pick it back up this year.
- An older paper (with three coauthors) on anti-Ramsey theory was published in *AKCE International Journal of Graphs and Combinatorics*.

2018-2019 **Research Mentor**, *Sacramento State University*, Math Department.

- Was a research mentor to four CSUS students on three projects producing three papers.
- My student Deanna Bosley was a McNair Scholar. Our paper on the bullet number of graphs was published in *The McNair Scholar's Journal*.
- Two students, Quin Darcy and Morgan Throckmorton, and I were supported by an NSF-funded grant through the Center for Undergraduate Research in Mathematics. Our first paper, on counting m -pseudo progressions, is under review at *Involve*. A second paper on pseudo-Ramsey numbers is still in progress.
- These two students and I also attended conferences with my research students. We all attended, and gave talks at the following: The 2019 Northern California Undergraduate Mathematics Conference, which was at Chico State; the CSUS math department's colloquium; and the Spring 2019 AMS Western Sectional Meeting, which was at the University of Hawaii.
- My student Thoa Nguyen presented work we did on an educational project that she conceived: A website that forms study groups using ideas similar to those used by dating websites which aim to connect compatible people. She presented it at the 2018 ReinventEd competition, held at Sac State. She was the Grand Prize winner, and consequently presented her work a second time to community tech leaders. I helped her prepare for these talks.
- At the CSUS Spring Research Symposium my student Morgan Throckmorton won the award for the best presentation in the "Engineering, Science and Math" division. She then represented Sacramento State at the CSU-wide competition at CSU Fullerton. I helped Morgan prepare for both of these talks.

2017-2018 **Research Mentor**, *Sacramento State University*, Math Department.

- Was a research mentor to four CSUS students on three projects producing two papers.
- A paper with my student Joe Ezaki on a combinatorial analysis of BitTorrent Protocol was published in the *The PUMP Journal of Undergraduate Research*.
- A second paper, with my students Thomas Blankenship and Vlad Taranchuk, on the Hunters and Rabbits problem is under review at *Discrete Mathematics*.
- Started work with my student Thoa Nguyen on an educational website.

2016-2017 **Research Mentor**, *Sacramento State University*, Math Department.

- During 2016/2017, was a research mentor to three CSUS students on two projects producing three papers.
- My student Morgan Mitchell was a McNair Scholar. Our paper on using math-based magic tricks in the classroom was published in *The McNair Scholar's Journal*.
- Morgan also won first prize in the education division at the 2017 SAEOPP McNair/SSS Scholars Research Conference in Atlanta, Georgia.
- My student Vlad Taranchuk was a McNair Scholar. Our paper on palindromic Ramsey theory was published in *The McNair Scholar's Journal*.
- A third paper, with my students Thomas Blankenship and Vlad Taranchuk, on a new lower bound on van der Waerden numbers was published in the *European Journal of Combinatorics*.

Author

2020 **Intro to Proofs Textbook.**

- In January 2020 I will publish *Proofs: A Long-Form Mathematics Textbook*. This is a 300+-page, student-friendly book which introduces students to proofs and higher mathematics.
- I am aware of four universities which have used my textbook in their classes: Sacramento State University, Northeastern University, University of Nebraska–Lincoln, Portland State University, and San Diego State University. I have also heard from a handful of professors who have expressed interest in using it when they next teach real analysis, including professors at the US Naval Academy, Hendrix College, and Sonoma State University.

2018 **Real Analysis Textbook.**

- In August 2018 I published *Real Analysis: A Long-Form Mathematics Textbook*. This is a 300-page, student-friendly book that covers a one- or two-semester course in real analysis. In July 2019 I published a second edition, which is 430 pages.
- I am aware of eight universities which have used my textbook in their classes: Sacramento State University, Northeastern University, University of Nebraska–Lincoln, Portland State University, San Diego State University, CSU Long Beach, Humboldt State University, and De La Salle University Manila. Most of these I discovered accidentally, so I expect many more are using it without my knowledge.
- The book sold over 2,800 copies in its first two years and has received much praise from readers.
- MIT Press asked to republish the book under their umbrella. I declined as it would raise the cost for students and I would lose some control over it, but we are in talks about possible future projects.

2020 – ∞ **Future Textbooks.**

- I have typed up the lecture notes for all my classes. In addition to Real Analysis and Introduction to Proofs, these are Calculus I, Calculus II, Combinatorics and History of Math. These may serve as springboards to future projects.

Publications

Books

- 2021 *Proofs: A Long-Form Mathematics Textbook*, to be published in January 2021.
- 2019 *Real Analysis: A Long-Form Mathematics Textbook*, 430 pages, 2nd Edition.
- 2018 *Real Analysis: A Long-Form Mathematics Textbook*, 300 pages, 1st Edition.

Research Articles (My own undergraduate students are underlined.)

- 2020 Bounds on Pseudo-Ramsey Numbers, with Travell Criner, in preparation
- 2020 Team Juggling with Randomized Error, with Barry Chin, in preparation
- 2020 Small Pseudo-Ramsey Numbers, with Travell Criner, Quin Darcy, Natalie Hobson, Morgan Throckmorton, submitted to *The PUMP Journal of Undergraduate Research*.
- 2020 Hunters and Rabbits on Path- and Cycle-like Graphs, with Ricky Alfaro, Tom Blankenship and Ben Humburg, submitted to *Discussiones Mathematicae Graph Theory*.
- 2020 Counting Pseudo Progressions, with Quin Darcy, Natalie Hobson, Drew Horton, Keith Rhodewalt, Morgan Throckmorton and Ry Ulmer-Strack, submitted to *Involve*.
- 2020 Anti-Ramsey theory on complete bipartite graphs, with Stephan Cho, Colin Defant and Claire Sonneborn, published in *AKCE International Journal of Graphs and Combinatorics*.
- 2019 BitTorrent Protocol and a Modified Secretary Problem, with Joe Ezaki, published in *The PUMP Journal of Undergraduate Research*.
- 2019 Hunting an Invisible Rabbit Efficiently, with Deanna Bosley, published in *The McNair Scholars Journal*.

- 2018 The order of the k -letter spelling shuffle, published in *Mathematics Magazine*.
- 2017 A New Lower Bound for van der Waerden Numbers, with [Thomas Blankenship](#) and [Vladislav Taranchuk](#), published in *The European Journal of Combinatorics*.
- 2017 When and How to use Math-Based Card Tricks in the Classroom, with [Morgan Mitchell](#), published in *The McNair Scholars Journal*.
- 2017 Palindromic Ramsey Theory, with [Vladislav Taranchuk](#), published in *The McNair Scholars Journal*.
- 2017 A forest building process on simple graphs, with Z. Berikkyzy, S. Butler, K. Heysse, P. Horn, R. Luo, and B. Moran, published in *Discrete Mathematics*.
- 2016 Flips and Juggles, *PhD Dissertation*.
- 2015 On the distance spectra of graphs, with 10 coauthors, published in *Linear Algebra and its Applications*.
- 2015 Juggling card sequences, with Steve Butler, Fan Ching and Ron Graham, published in *Journal of Combinatorics*.
- 2015 Edge flipping in the complete graph, with Steve Butler, Fan Ching and Ron Graham, published in *Advances in Applied Mathematics*.
- 2014 Cospectral regular graphs with and without a perfect matching, with Zoltan Blazsik and Willem Haemers, *Discrete Mathematics* 338, 199-201.
- 2011 On the Independence and Domination Numbers of Replacement Product Graphs, with Christine Kelley, published in *Involve, a Journal of Mathematics* 9.2 (2016): 181-194..
- 2010 [REDACTED], with [REDACTED], published in *NSA Internal Publications*.

Talks

- 2020 MAA Golden Section Annual Meeting; *The Math of Juggling*
- 2020 Joint Math Meetings; *Math Poetry*
- 2020 Joint Math Meetings; *Hunters and Rabbits on Graphs*
- 2019 CSUS Math Club; *Mathematical Tricks*
- 2019 San Jose State University Colloquium; *The Math of Juggling*
- 2019 Santa Clara University Colloquium; *The Math of Juggling*
- 2019 AMS Sectional Meeting; *Counting Pseudo Progressions*
- 2019 CSUS Math Club; *The Math of Juggling*
- 2018 CSUS Teaching In Progress Seminar; *Writing for your Math Class*
- 2018 Powerhouse Science Center, "Seven Deadly Sins" Halloween Event; *The Math of Pride*
- 2018 Sonoma State M*A*T*H Colloquium; *Mathematical Tricks*
- 2018 Bay Area Discrete Math Conference; *A new lower bound on van der Waerden numbers*
- 2017 CSUS ANTC Seminar; *If God were a rabbit, how would you kill Him?*
- 2017 CSUS Math Club; *If God were a rabbit, how would you kill Him?*
- 2017 Sac Science Distilled; *Mathematical Tricks*
- 2017 CSUS Math Club; *The Math of Elections*
- 2017 CSUS STEM Lecture Series; *Counting on the Results: The Math of Elections*
- 2016 Sac Science Distilled; *The Math of Elections*

2016 CSUS Constitution and Civic Engagement Week; *The Math of Elections*

Website

2019 **Undergraduate Math Website at LongFormMath.com.**

- In July 2019 I launched LongFormMath.com as a companion website for my real analysis book (and eventually for the later textbooks I write). It includes hints to select exercises, a timeline of the history of analysis, historical research papers and recent expository articles, and many videos from YouTube on real analysis topics, all organized book's chapters.
- I have also launched a blog alongside it on all math (and math-adjacent) topics, and all focused on an undergraduate audience. My hope is to have a wide variety of people write posts for it.

Selected Activities and Involvement

2019 - 2020 **Professional Activities.**

- Interviewed on the *Meet a Mathematician* podcast.
- Ran workshop at the 2019 Expand Your Horizons conference at CSUS, which is a conference to promote STEM to middle school girls in the region. My workshop was called "Magic Tricks!"
- Gave invited talk at the Spring 2020 meeting of the MAA Golden Section.
- Started a Twitter account which I use to promote math and education. It has garnered 600 followers in its first year.

2018 - 2019 **Professional Activities.**

- Member of the editorial board for *The PUMP Journal of Undergraduate Research*. Have assigned and generally coordinated the review of submitted papers, as well as refereed papers for the journal.
- Worked more to get a new interdepartmental course on the Math of Elections approved.
- Advisor for the CSUS Math Club. Among the activities planned were several talks, a tie-dye event, π -Day games, and a panel on the Nebraska Conference for Undergraduate Women in Mathematics.
- Helped out with the debut Calculus Carnival event by running the *Jeopardy!* game.
- Ran a workshop at the Expand Your Horizons conference at CSUS, which is a conference to promote STEM to middle school girls in the region. My workshop was called "The Math of Magic Tricks."
- Was interviewed on Fox 40 ahead of my talk at the Powerhouse Science Center as part of their Halloween-themed "Seven Deadly Sins" event.
- Attended a day-long workshop on inquiry-based learning at CSUS.
- Worked on the math department's nominee for the Dean's award, including writing her nomination and, at the event at which the winner would be announced, giving her nominating speech.
- Have refereed papers for the journals *Linear and Multilinear Algebra*, *The Journal of Combinatorics*, *The Electronic Journal of Combinatorics*, *Discrete Mathematics*, *American Mathematical Monthly*, *Minnesota Journal of Undergraduate Mathematics*, and *The PUMP Journal of Undergraduate Research*.
- Regular attendee of the Mathematics Education Research Seminar, the Teaching In Progress Seminar, and the CSUS Math Department Colloquium.

2017 - 2018 **Professional Activities.**

- Designed a new interdepartmental course on the Math of Elections.
- Advised the CSUS Math Club.
- Helped to design the facade for the new Powerhouse Science Center.
- Sat on a UCSD panel of graduates for prospective PhD students.
- Sat on a CSUS Math Club panel on getting prepared for graduate school.
- Organized a meeting at Math Fest of new California math faculty to network and inform them of conferences and other opportunities.

2016 - 2017 **Professional Activities.**

- Assisted with Future Hornets Day.
- Interviewed on NPR's *Insight with Beth Ruyak*.
- Assisted with the high school *Matheletes* competition.
- Assisted with the CSUS Integration Bee.
- Designed a mural and plaque for the Powerhouse Science Center.