Sai Sivakumar

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University of Florida

Goals

Pursuing a B.Sc. in mathematics. I intend to pursue graduate studies afterwards.

Education

July 2020 - present: B.Sc. in Mathematics with a 3.97 GPA currently, University of Florida, Gainesville, Florida. To graduate May 2024.

August 2016 - June 2020: Graduated with IB diploma with a 4.0 GPA, Stanton College Preparatory High School, Jacksonville, Florida.

Research

June - July 2022: REU at the Georgia Institute of Technology. Worked with Dr. Ashley Wheeler and two other undergraduates on a project in algebraic geometry. We studied the toric varieties given by the vanishing of principal 2-minor ideals in affine and projective space. We proved a number of properties about these varieties, and created this poster.

Talks and Presentations

October 2022: Small talk motivating representations of groups as compared with group actions and briefly mentioned their applications in Fourier analysis.

February - March 2022: Series of lectures/talks briefly outlining Fourier analysis on finitely generated Abelian groups with some neat results, as they appear in Stein and Shakarchi I.

October 2021: A classmate and I discussed the real Hamilton quaternions, their history as well as their algebraic properties, and mentioned analytic problems with functions of quaternionic variables. Also spoke about applications in computer science and physics.

October 2021, November 2022: Gave the annual LaTeX joint seminar with the UF Graduate Mathematics Association. This seminar is designed to demonstrate how LaTeX works and what it can do, and to encourage mathematics students to learn LaTeX.

June 2021: Discussed the integral definition of the inverse Laplace transform, as well as how to compute the integral using the residue theorem, at an elementary level. (YouTube) (Gave an abridged version of this talk January 2023.)

March 2021: Gave a talk on proving the fundamental theorem of calculus at a highschool/pre-real analysis level. (YouTube)

Skills

3+ years of LaTeX experience (high proficiency).

Proficiency in Java, C++, and understanding of data structures and algorithms.

Outreach/Service

September 2021 - present: Member of the Algebra seminar group.

August 2021 - present: Teaching assistant for *MAP2302* Elementary Differential Equations.

August 2021 - present: Member of the Association for Women in Mathematics' UF chapter.

August 2021 - present: Academic Director of the University Math Society at UF. I schedule all talks from professors and give talks myself, as well as encouraging other students to give talks as well.

March 2021 - present: Moderator for a large online community (exceeding 130,000 members globally) which seeks to stimulate mathematical discussion and interest, as well as to provide assistance with math problems/concepts.

August 2020 - December 2020: Typed up many solutions for *Concepts in Calculus III* by Miklos Bona and Sergei Shabanov (around 47 pages or so, working with two others to form in total 141 pages of solutions compiled in a solution manual).

August 2019 - February 2020: Started a small unofficial mathematics club (in highschool) where students presented on topics of mathematical interest; there I gave three informal talks.

Honors/Awards

Dean's list, *Fall 2020, Spring 2021, Summer 2021, Fall 2021, Spring 2022, Fall 2022.*

National Merit Scholarship Commended *2020.*

National AP Scholar *2020.*

Relevant Coursework

Items marked by a † are graduate or mixed graduate/undergraduate level courses:

MAS7397(MAT4930)†: Topics in Algebra II – Introduction to representation theory of groups and Lie algebras, from a module-theoretic view. Representation and character theory of finite groups, theorems of Burnside and Frobenius. Representation theory of finite-dimensional semisimle complex Lie algebras. Spring 2023

MTG6347(MAT4930)†: Topology II – Singular, axiomatic, and cellular homology/cohomology, and their algebraic structure and dualities. Professor's notes and tom Dieck. Spring 2023

MAA6407(MAT4930)†: Complex Analysis II – Continuation of previous semester of complex analysis. To cover Runge's theorem, Schwarz reflection, harmonic and entire functions, Picard theorems, and other topics. Professor's notes and Conway. Spring 2023

MAA6617(MAT4930)†: Analysis II – Introductory functional analysis. Theory of Banach and Hilbert spaces, linear operators, with possibly some coverage of Fourier analysis, theory of

distributions, spectral theorem, Banach algebras. Professor's notes. Spring 2023

MAS6332(MAT4930)†: Algebra II – Projective, injective, and flat modules. Introduction to homological algebra, further theory of commutative and noncommutative rings, and some algebraic geometry. Dummit and Foote. Spring 2023

MAT6932(MAT4930)†: Calculus of Variations and Optimal Control – Covered basic theory of calculus of variations and optimal control following several example problems. Professor's lectures. Fall 2022

MTG6346(MAT4930)†: Topology I – Covered the fundamental group, covering spaces, intro homotopy theory, cofibrations and fibrations, homotopy groups, CW complexes, singular homology. Chapters 1-6, 8, 9 of tom Dieck. Fall 2022

MAA6406(MAT4930)†: Complex Analysis I – Standard coverage of analytic functions, integral formulas, zeroes and singularities of functions, Morera's and Goursat's theorems, Cauchy's theorem and integral formula, Laurent series, spaces of holomorphic functions. Professor's notes and chapters 1-7 in Conway. Fall 2022

MAA6616(MAT4930)†: Analysis I – Covered and proved standard results about sigma-algebras, measures, e.g. the Lebesgue measure, signed measures, integration of measurable functions, modes of convergence, and differentiation theorems. Professor's notes. Fall 2022

MAS6331(MAT4930)†: Algebra I – Covered field and Galois theory, as well as tensor products and some coverage of projective modules. Chapters 10.4, 10.5, 13, 14 of Dummit and Foote. Fall 2022

MTG4303†: Introductory Topology II – (Self-studied material found in the first semester before enrollment in this course.) Second semester of introductory topology, covering basic algebraic topology and more topics in point-set topology. Chapters 5-6, 9-12 from Munkres. Spring 2022

MAA4212: Advanced Calculus II – Second semester of introductory real analysis, covering analysis in metric spaces and theory of functions of several real variables. Professor's notes. Spring 2022

MAP4341†: Introduction to Partial Differential Equations – Elementary theory of solving partial differential equations. Professor's notes and lectures. Spring 2022

MAS5312(MAT4930)†: Introduction to Algebra II – Second semester graduate level algebra; covering rings, fields, modules. Chapters 7-13 of Dummit and Foote. Spring 2022

MAA4211: Advanced Calculus I – First semester of introductory real analysis. Chapters 1-7 of Abbott. Fall 2021

MAS4413: Fourier Analysis – Elementary theory of Fourier analysis. Chapters 1-7 of Stein and Shakarchi I. Fall 2021

MAS5311(MAT4930)†: Introduction to Algebra I – First semester graduate level algebra; covering group theory. Chapters 1-6 from Dummit and Foote. Fall 2021

MAP4305: Ordinary Differential Equations – Second course in ordinary differential equations. Covered methods of using matrices for systems of linear ODEs, the method of Frobenius for second order ODEs, solving regular Sturm-Liouville boundary value problems, and using Green's functions. Professor's lectures. Summer 2021

MAA4402: Introductory Complex Analysis – Elementary theory of functions of a complex variable. Chapters 1-7 of Brown and Churchill. Spring 2021

MAS4105: Introductory Linear Algebra – Proof-based linear algebra. Chapters 1-6 of Friedberg, Insel, Spence. Spring 2021

MAS4203: Introductory Number Theory – Elementary concepts in number theory. Chapters 1-3 of Niven and Zuckerberg. Spring 2021

MAS4301: Introductory Abstract Algebra – Elementary group theory. Chapters 1-11 of Gallian. Spring 2021

MAC3474: Honors Calculus III – Basic multivariable calculus. Chapters 1-5 of *Concepts in Calculus III* by Miklos Bona and Sergei Shabanov. Fall 2020

MAP2302: Honors Elementary Differential Equations – Covered how to solve various basic ODEs, basic notions of existence and uniqueness, and applications to physics. Chapters 1-8 in Nagle Saff Snider 7th edition. Fall 2020

MHF3202: Sets and Logic – Taught elementary set theory and how to write basic proofs. Chapters 1,2,3, 5-10, 12, 14 in Book of Proof by Richard Hammack. Fall 2020