Luis Modes

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"Being happy is the greatest form of success." – unknown

Profile and Skills

Interests: Algebraic geometry, topology, number theory, and math contests
Skills: Problem-solving, math olympiad coaching, and mentoring
Languages: English (Advanced), Spanish (Native), and Japanese (Intermediate)
Programming: Python, LaTeX, and SageMath

Education

Massachusetts Institute of Technology — Cambridge, MA
Undergraduate — *September 2021 – Present*

Academia Interamericana de Panamá sede Cerro Viento — Panama, Panama
High School Diploma — *March 2008 – December 2020*

Selected Honors and Awards

Hartley Rogers Jr. Prize at MIT Summer Program in Undergraduate Research — August 2024
International Mathematical Olympiad (IMO): Bronze Medal — July 2021
International Mathematical Olympiad (IMO): Bronze Medal — September 2020
Panamanian Mathematical Olympiad: Gold Medal, rank 1st in 2019 and 2020 — 2016 – 2020
Asian Pacific Mathematical Olympiad (APMO): Silver Medal — 2019

Research Experience

Summer Program in Undergraduate Research (SPUR) — MIT 2024 - Present

- Generalized a theorem about the spherical Hall algebra of $\operatorname{Spec}\mathbb{Z}$ to the spherical Hall algebra of $\operatorname{Spec}\mathcal{O}_K$, where K is a number field with class number 1 and $\mathcal{O}_K$ is its ring of integers. Currently working on generalizing this theorem for any number field K.
  Reference: Zhiwei Yun

18.821 Project Laboratory in Mathematics — MIT 2024

- Worked with a group on two research problems throughout the semester. Wrote a paper and gave a presentation for each of them.
  Reference: Roman Bezrukavnikov

Directed Readings and Programs

Directed Reading Program — MIT, 2023-2024

- Read and made a presentation about h-cobordisms and Smale's theorem
  Reference: Joye Chen
- Read and made a presentation about *Using the Borsuk-Ulam Theorem* by Jiří Matoušek
  Reference: Elia Portnoy

Preliminary Arizona Winter School — MIT, 2023-2024

- Watched recorded lectures and worked on problem sets with a TA for 9 weeks. The topics were elliptic curves with complex multiplication in 2023 and local fields in 2024.
  References: Ju-Lee Kim and Bjorn Poonen

18.099 Independent Study: Low-dimensional topology MIT, 2024

- Read *Knots and Links* by Dale Rolfsen
  Reference: Joshua Wang

18.099 Independent Study: The geometry of complex analysis MIT, 2023

- Read *An Introduction to the Theory of Analytic Functions of One Complex Variable* by Lars Ahlfors
  Reference: Joshua Wang

Volunteer Roles, Teaching, and Coaching

HMMT Problem Czar August 2022 – May 2023

- Wrote and chose problems for the February tournament and helped with the November tournament

Panamanian Mathematical Olympiad Member January 2021 – Present

- Wrote a handout and gave a lecture about Circle Geometry in a seminar for high school teachers
- Organized the shortlist of proposed problems for the 2021 and 2022 Panamanian Mathematical Olympiad
  Reference: Pedro Marrone

Panamanian Training Program Instructor October 2020 – Present

- Served as Panama's Deputy Leader at the 2023 International Mathematical Olympiad
- Currently serve as a math olympiad instructor, mainly in Geometry and Algebra
- Gave the new students an introductory LaTeX course
- Served as Panama's Deputy Leader at the 2020 Iberoamerican Mathematical Olympiad
- Served as a jury member at the 2020 Central American and Caribbean Mathematical Olympiad
  Reference: Pedro Marrone

AIPCV Math Olympiad Coach April 2018 – December 2020

- Trained the AIPCV school's team for the first and second rounds of the National Olympiad
- Wrote a virtual book to train the team

Work Experience

MIT PRIMES Mentor MIT, 2023-2024

- Mentored high school students through the material of *The Knot Book* by Colin Adams and *Thinking Geometrically: A Survey of Geometries* by Thomas Q. Sibley
  Reference: Marisa Gaetz and Mary Stelow

Undergraduate Assistant for 18.901 Introduction to Topology MIT, 2023

Undergraduate Math Association Mentor MIT, 2022

- Provided mentorship to students in introductory real analysis and algebra classes

Grader for 18.101 Analysis and Manifolds MIT, 2023

Grader for 18.100B Real Analysis MIT, 2022

Selected Coursework

Algebra

- 18.725 Algebraic Geometry I
- 18.721 Introduction to Algebraic Geometry
- 18.705 Commutative Algebra
- 18.701 Algebra I and 18.702 Algebra II

Topology

- 18.905 Algebraic Topology I and 18.906 Algebraic Topology II
- 18.904 Seminar in Topology
- 18.901 Introduction to Topology

Number Theory

- 18.785 Number Theory I and 18.786 Number Theory II
- 18.783 Elliptic Curves
- 18.782 Introduction to Arithmetic Geometry

Analysis

- 18.101 Analysis and Manifolds
- 18.100B Real Analysis

Combinatorics

- 18.217 Combinatorial Theory

Programming

- 6.100B Introduction to Computational Thinking and Data Science
- 6.100A Introduction to Computer Science and Programming in Python