

# Gaurav Goel

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## Education

- 2030 **(Expected) Ph.D. in Mathematics**, Princeton University, Princeton, NJ
- 2025 **(Expected) MAST in Mathematics**, University of Cambridge, Cambridge, UK  
Part III of the Mathematics Tripos at Trinity College
- 2024 **A.B.**, Harvard University, Cambridge, MA, (*summa cum laude*)  
Double concentration in Mathematics & Germanic Languages and Literatures with secondary in Music
- 2019 *Pace Junior Science College Andheri (PJSC)*, Mumbai, India
- 2017 *Thakur Public School (TPS)*, Mumbai, India

## Writing

### Publications and Preprints

- [1] On Powerful Integers Expressible as Sums of Two Coprime Fourth Powers (with Noam D. Elkies). *Res. Number Theory* **9**, 78 (2023) (proceedings of ANTS-XV, 2022). doi: 10.1007/s40993-022-00415-9
- [2] The Chow Ring Classes of  $\mathrm{PGL}_3$ -Orbit Closures in  $\mathbb{G}(1, 5)$ . 2022. [arXiv Preprint]  
Presented at the HCURA National Collegiate Research Conference (NCRC) 2023.

### Research Article(s) In Preparation

- [3] Chow Classes of the Varieties of Secant and Tangent Lines to a Projective Variety. Advisor: Hannah Larson.

### Theses and Expository

- [4] The Joys of the Atiyah-Singer Index Theorem. Senior Thesis. Advisors: Joe Harris and Dan Freed.  
Recipient of the Hoopes Prize, the Fay Prize, and the Friends Prize.  
The thesis and several other expository articles are available on my webpage.

## Teaching and Mentorship

### Course Assistant, Department of Mathematics, Harvard University

Led discussion and review sessions, held office hours, graded homework, and prepared solutions.

- Spring 2024 **Math 222: Lie Groups and Lie Algebras**, taught by Noam D. Elkies; see the course webpage.
- Fall 2023 **Math 213A: Advanced Complex Analysis**, taught by Curt McMullen; see the course webpage.
- Spring 2023 **Math 129: Number Fields**, taught by Salim Tayou.
- Fall 2022 **Math 114: Analysis of Function Spaces, Measure and Integration**, taught by H. T. Yau.
- Spring 2022 **Math 132: Differential Topology**, taught by Dennis Gaitsgory.
- Fall 2021 **Math 55A: Honors Group Theory and Abstract Algebra**, taught by Denis Auroux.  
In addition, served as a volunteer course assistant for the following.
- Spring 2021 **Math 132**, taught by Joe Harris.
- Spring 2021 **Math 55B: Honors Real and Complex Analysis**, taught by Denis Auroux.
- Fall 2021 **Math 55A**, taught by Denis Auroux.

## Other

- Summer 2021 **Counselor and Course Assistant, Ross Mathematics Program USA**  
Led discussion sessions for high school students for a number theory course. Also served as CA for *Rational Points on Curves*, an advanced course on arithmetic geometry aimed at counselors taught by Stefan Patrikis.
- Summer 2020 **Course Head, Math 57, Math Online Summer Program**  
Taught group theory to high school students as part of a program organized by Alec Sun.
- 2018 - 19 **Teaching Assistant, Math Olympiad Program, PJSC**  
Taught students in grades 8 through 12 advanced math in preparation for the IMO.

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## Talks

### Invited

- April 2024 **The Atiyah-Singer Index Theorem and Almost Complex Spheres**, Talk by Friends Recipient, Harvard
- April 2024 **The Chow Ring Classes of  $\mathrm{PGL}_3$ -Orbit Closures in  $\mathbb{G}(1, 5)$** , gradieNTAG, Simon Fraser University
- Mar 2024 **Chow Classes of Varieties of Secant and Tangent Lines**,  
Special Student Algebraic Geometry Seminar, Stanford University

### Contributed

- May 2024 **(Almost) Complex Structures on 4-Manifolds**, Harvard University Math Table
- Nov 2022 **Emmy Noether: Mathematician Extraordinaire**, HMMT Education Session
- Aug 2022 **On Powerful Integers Expressible as Sums of Two Coprime Fourth Powers**, ANTS-XV, U. of Bristol
- Feb 2022 **The Three-Sphere in Dante's *Divine Comedy***, HMMT Education Session
- Nov 2021 **The Inverse [Quadratic] Central Potential and the Cubic Equation**  
Harvard Society of Physics Students (SPS), Undergraduate Chalk Talks Series
- Aug 2021 **Galois Cohomology and Hilbert's Theorem 90**, Ross 2021, Dorm Lecture for *Rational Points on Curves*
- Oct 2019 **Fermat's Little Theorem and its Applications to Cryptography**, Harvard University Math Table

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## Honors and Awards

### Academic

- 2024 **Lt. Charles H. Fiske III Scholarship**, Harvard-Cambridge Scholarship to Trinity College
- 2024 **David B. Mumford Mathematics Prize**, "to the most promising senior concentrator(s) in mathematics."
- 2023 **Phi Beta Kappa (PBK), Senior 48**, national academic honor society.
- 2023, '22, '20 **John Harvard Scholarship**, awarded to students in the top 5% of their class.

### For Writings

- 2024 **Captain Jonathan Fay Prize**, \$2500 for [4], given to "top theses of Harvard College's graduating class".
- 2024 **Thomas Temple Hoopes Prize**, \$5000 for [4], awarded for "outstanding scholarly work or research."
- 2024 **Friends Prize**, for the top two theses presented to The Friends of the Harvard Math Department, interviewed in the 2024 Harvard Math Newsletter.

### Research Funding

- 2022 **Fellow, Herchel Smith Undergraduate Science Research Program**, \$4500 for [2].
- 2022 **Fellow, Harvard College Program for Research in Science and Engineering (PRISE)**
- 2020 **Harvard College Research Program**, \$2700 for [1].

### Other

- 2024 **Caroline Isenberg Award**, Lowell House
- 2023 **Elliot & Mary Perkins Prize**, Lowell House
- 2019, '18 **Merit Award, Indian National Mathematics Olympiad (INMO)**
- 2017 **Thakur Ramnarayan Memorial Award**, TPS

## Positions and Extracurricular Activities

- 2024 **Mentor, HARMONY, Harvard PBHA**: taught underprivileged students in Cambridge to play piano.
- 2022 - 24 **Member, Harvard MIHNUET**: performed music in hospices and senior living communities.
- Harvard Undergraduate Gender Inclusivity in Mathematics (HUGIIM)**
- 2022 - 23 **Co-president**: Organized projects and socials, collaborated with other inclusivity organizations, and served as student representative in the Math Department Community Committee.
- 2021 - 22 **Mentorships Co-Chair**: Co-organized the *Math Includes* mentorship program.

## Arts

- 2022 - 24 **Member, Harvard University Choir**, and Ferris Choral Fellow for AY 2023-24.
- Feb 2022 ***Bard, If A Picture Never Lies*, Harvard Classics Club**. See this article in the Harvard Crimson.
- 2021 - 23 **Member, Harvard Choruses New Music Initiative**
- 2019 - 23 **Fellow, Holden Voice Program**
- 2019 - 24 **Member, Harvard Glee Club**

## Other

- Software: Python, Java, C++, SageMath, Pari/GP, Macaulay2
- Languages: English (first language), Hindi (first language), German (fluent), Spanish (beginner)