Srijan Sundar

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NATIONALITY

US Citizen

RESEARCH INTERESTS

Number theory (Elementary, Analytic, and Diophantine Equations) and its interplay with Geometry and Combinatorics

EDUCATION

St Catherine's College, Oxford
Master of Mathematics (MMath), Oct. 2023 - Jun. 2027

Plano East Senior High School, International Baccalaureate World School
IB Diploma (2021-2023), HS Diploma (2019 - 2023)

COURSEWORK

Undergraduate Courses (Oxford)

Year 1 Linear Algebra I & II, Groups and Group Actions, Analysis (I, II, & III), Probability, Introductory Calculus, Statistics, Constructive Mathematics, Geometry, Dynamics, Multivariable Calculus, Fourier Series and PDEs, Computational Mathematics. **Grade: Distinction.**

Miscellaneous Undergraduate Courses

- Collin College Dual-credit. Calculus III: Differential Equations and Multivariable Calculus (2021-2022). Grade A.

AP Exams (out of 5)

2022-23 Statistics (5).

2021-22 Computer Science A (5), English Language and Composition (5), French Language and Culture (5), US History (5), Physics C: Electricity and Magnetism (5), Physics C: Mechanics (5).

2020-21 Calculus BC (5), Chemistry (5), World History (5), European History (5).

2019-20 Human Geography (4).

IB Exams (out of 7)

2022-23 English HL (7), French HL (6), Computer Science HL (7), Mathematics Application and Interpretation SL (7), Economics SL (7).

2021-22 Biology SL (7).

TOK: A, EE: A.

Total: 44/45.

High School

- ACT - 36 (Jul 2022), SAT - 1540 (Nov 2021), PSAT/NMSQT - 1500 (Oct 2021), Subject SAT Math Level II - 800 (Dec 2020).

- GPA: 4.72 / 4.0 (weighted), 4.0 / 4.0 (unweighted).
- Class Rank: 5 (out of a graduating class of 1405 students)
- National Merit Scholarship Finalist

PUBLICATIONS

1. An Asymptotic Analysis on the Distribution of Primes via a Continuous Extension of the Factorial Function *Jan. 2024*

Mathematical Reflections 1 2024: [https://awesomemath.org/]

Abstract: We discuss some introductory ideas from analytic number theory in a way that is accessible to the high-school student. In particular, we present an intuitive derivation of the Gamma function and subsequently derive Stirlings Approximation. We then apply these methods to demonstrate the truth of Bertrands Postulate as proven by Ramanujan in 1919.

2. Solutions for the Frobenius Number of Three Variables (independent research) *Jan. 2023*

Mathematical Reflections 1 2023: [https://awesomemath.org/]

Abstract: In this paper, we investigate a general method of solving for the Frobenius number of three coprime integers, a, b, c, denoted $g(a, b, c)$, which is the largest positive integer that cannot be expressed in the form $ax + by + cz$ for non-negative integers x, y, z. We divide the problem into three main subcases and show how to solve for the Frobenius number in those cases and give complete solutions for all cases, except for the third case where we impose an additional condition.

3. English Diplomacy via German Relativity: The 1919 Eclipse Expedition to Show "Light-Rays, When Near the Sun, DO NOT GO STRAIGHT" *2022*

The Texas Historian Vol. LXXXI, Annual Issue 2022

Having placed 1st at the Texas State History Day in the paper category, and subsequently qualifying for Nationals, I was invited to publish my paper in the Texas Historian. The Texas Historian is "one of the few historical journals in the nation dedicated to publishing the work of secondary students in Texas."

EXPERIENCE

Weak-type regularity and the Bergman Projection, Polymath Jr. REU *Summer 2024*

Investigated whether the Bergman Projection satisfied weak-type estimates on Hartog's Triangles. Generalized known results to the n dimensional case.

AwesomeMath Summer Program TA *Summer 2024*

Trained students for mathematical olympiads. Handled problem sessions and graded student's homework daily.

Oxford Computational Mathematics Course (Python) *October 2023 - March 2024*

I completed two projects as a part of the Computational Mathematics course. The first project concerned primality testing, and I implemented the Fermat and Miller-Rabin tests. I further calculated some statistics, e.g. sampling the proportion of successes among odd composites and generating few counterexamples. The second project concerned Percolation, for which I wrote a program that could generate arbitrarily sized grids in which each cell was randomly open or full. I also wrote a depth-first search algorithm that could determine if a given grid percolated and display the percolation status of the grid.

NASA High School Aerospace Scholars (Moonshot invitee) *2021-2022*

Upon successful completion of the 16-week High School Aerospace Scholars program, I was invited to participate in the MoonShot program, a five-day virtual summer project-based learning experience. In MoonShot, I worked with a team under the guidance of NASA scientists and researchers to solve an engineering design challenge.

Cisco STEM High School Job Shadow Program (Cisco Systems, Inc.) *July-August 2021*

Our team worked on a Network Automation project during this internship. The goal of the project was to create a product that addressed disaster scenarios such as outage planning, failure scenarios, and rule testing. My role was to create a path-searching algorithm that determined the shortest path between two devices using a combination of RIP and OSPF routing protocols. We designed a Python-based product in which the end user can enter specific limits on traffic, capacity and network groups. Our product can then find a shortest route that complies with those parameters.

AwesomeMath Summer Program *2019, 2020*

I took the following courses at AwesomeMath under the following instructors:

Number Theory Level 1 — Mr. Alessandro Ventullo (2019)
Topics Covered: Divisibility, Linear Diophantine Equations, Prime Numbers, Chinese Remainder Theorem, Arithmetic Functions, Modular Arithmetic, Fermat/Euler's/Wilson's Theorems, p-adic Valuation, Number Bases.

Number Theory Level 2 — Mr. David Altizio (2020)
Topics Covered: Modular Arithmetic, Chinese Remainder Theorem, Divisibility, Multiplicative Functions, Möbius Inversion, General Diophantine Equations and related techniques, Hensel's Lemma, Quadratic Reciprocity, Legendre symbol, Primitive Roots/Order of an Integer.

Combinatorics Level 1 — Mr. Regis Barbosa (2019)
Topics Covered: Counting, Combinatorial arguments, Principle of Inclusion /Exclusion, Stars and Bars, Set theory, Graph theory, Handshaking lemma, Combinatorial number theory, recursive functions, Fibonacci sequence, Lucas sequences.

Algebra 2.5 — Mr. Matthew Babbit (2020)
Topics Covered: Techniques relating to Polynomials and Roots, Polynomials with Integer Coefficients, Fundamental Theorem of Symmetric Polynomials, Analytic Trigonometry, Complex Numbers/Roots of Unity/Euler's Identity, Recursive Sequences, Characteristic Polynomials of Linear Recursions, Inequalities.

Geometry Level 1 — Mr. Nikolay Grantcharov (2020)
Topics Covered: Triangle Properties/Centers, Quadrilateral Properties, Cyclic Quadrilaterals, Orthogonal Quadrilaterals, Nine-point Circle, Homothety, Euler Line, Simpson Line, Radical Axis, Radical Lemma, Ceva's/Menelaus Theorems.

SERVICE

Oxford Maths Ambassador *2023*-present

As an Oxford Maths Ambassador, I help with the various outreach efforts conducted by the Oxford Mathematical Institute. I assisted with the Oxford Online Maths Club and MAT Livestream, appearing live multiple times and helping with chat moderation. I also helped plan future elementary and middle school outreach activities in addition to volunteering at the Oxford Maths Festival.

Head MathCounts Coach *2019-2023*

I was the head MathCounts Coach at Otto Middle School. I coached weekly and developed my own cur-

riculum for coaching, with emphasis on algebra, number theory, combinatorics, geometry, and mental-math strategies. During my tenure, I was honored to have helped send six students to the State MathCounts Competition.

Service Project 2022-2023: *I developed a Java program that simulates a MathCounts CountDown Round. The purpose of this project is to help students achieve speed and accuracy in my sessions by creating a buzzer system that could determine if entered answers are right, wrong, and/or unsimplified. It is my hope that many middle schoolers as well as future MathCounts coaches may benefit from this.*

History Club Officer *2020-2023*

Role: Vice-President (2022-2023)

I held the Vice President position at my school's history club. As an officer, I assisted in planning each of our biweekly meetings during the NHD competition season. Our officer team also worked to approve topics proposed by members for the History Fair; I was in charge of approving topics for the paper category. We also worked to set up and execute our school fair competition in January.

Math Club Officer *2021-2023*

Role: President (2022-2023)

As an officer, I helped create the presentations for our weekly meetings. Our presentations were centered around high school contest problems and preparation for upcoming individual and team events. As President, I shifted the club to a math circle format, where we went beyond contest math to discuss mathematics beyond the high school curriculum.

Mu Alpha Theta Honor Society *2020-2023*

I was a member of my school's Mu Alpha Theta Chapter. Mu Alpha Theta is a Mathematical Honor Society.

Richardson Public Library Teen Advisory Board Member *2019-20, 2022-2023*

The Teen Advisory Board organizes events for the Richardson Public Library and meets monthly.

National Honor Society *2020-2023*

As an NHS member, I have partaken in numerous service projects.

AWARDS / HONORS / DISTINCTIONS

Oracle Certified Associate, Java SE 8 *2023*

USA Physics Olympiad (USAPhO) Honorable Mention *2023*

I qualified for the USA Physics Olympiad after scoring 20 (out of 25) in the F=ma contest.

2x American Invitational Mathematics Examination (AIME) qualifier *2022, 2023*

USA Mathematical Talent Search *2017-2023*

The USAMTS is an annual proof-based mathematical competition which has three rounds, each spanning over the duration of a month. Each round was out of 25 points, for a total of 75 points. Here are my results:

- *2022-2023: Silver Medal (65)*
- *2022-2023: Gold Medal (***perfect score***, AIME Qualified)*

- *2022-2023: Silver Medal (66)*
- *2022-2023: Bronze Medal (55)*

Link to contest: [https://usamts.org/]

1st Place Texas State History Day (National Qualifier) *2022*

I qualified for the National History Day after winning 1st place in the Senior Division Individual Historical Paper Category at the Texas State History Day.

Jewish History Award, presented by the Texas Jewish Historical Society *2022*

I was awarded the Jewish History Award at the Texas State History Day which recognizes excellence in papers presenting Jewish history.

United States National Chemistry Olympiad Qualifier (USNCO) *2022*

The USNCO is a national-level examination in chemistry. I was invited to take part in the 2022 USNCO after qualifying from the Dallas-Ft. Worth Metroplex local section.

State History Fair Competitor *2019, 2020, 2022*

Throughout high school, I have written Historical Papers for the annual National History Day Competition. I was invited to participate in the Texas State History Day competition after advancing from the regional history fair in 2019, 2020, and 2022.

AP Scholar Award With Distinction *2021, 2022, 2023*

The College Board AP Scholar Award recognizes students who have achieved an average score of at least 3.5 on all AP Exams taken.

Le Grand Concours Bronze Medalist *2020*

Les Grands Concours is an annual National French Competition.

MathCounts State Qualifier *2019*

President's Education Awards Program Outstanding Academic Excellence *2019*

The Outstanding Academic Excellence award recognizes Middle Schoolers for maintaining an A in all classes throughout Middle School.

TEAM COMPETITIONS

BMathX Math Competition (Oxford-Cambridge-École Polytechnique) *Fall 2023*

This is a two-person team competition that featured eight (undergraduate) problems to be solved over four days. My team ranked 18^{th} place out of 112 registered teams.

Purple Comet Math Meet *Spring 2020 - Spring 2023*

This is a 30-question, 90-minute annual team competition that occurs in the spring. Here are my team's results:

- *2023: 4^{th} in Texas State, 30^{th} (out of 346) in the US, 35^{th} (out of 604) internationally.*
- *2021: 1^{st} in Texas State.*
- *2020: 3^{rd} in Texas State, 30^{th} in the US, and 40^{th} globally.*

Link to contest: [https://purplecomet.org/]

Texas A&M Math Competition Power Round *2019 - 2022*

This team competition spans over the duration of a week. This is a proof-based mathematics competition with a set of roughly 10 theme-based problems. Here are my team's results:

- *2023: 3^{rd} place.*
- *2022: 2^{nd} place.*
- *2021: 6^{th} place.*
- *2020: 8^{th} place.*

Link to contest: `[https://www.math.tamu.edu/outreach/highschoolcontest/]`

Winter Trinity Mathematics Competition *2020-2021*

This is a 90-minute online team mathematics competition. This competition has a set of 30 problems, each weighted in accordance with its respective difficulty.

- *2021: 1^{st} (out of 170 competitive teams).*
- *2020: 10^{th} (out of 327 competitive teams).*

Link to contest: `[https://sites.google.com/view/trinmac-nyc/trinmac-virtual/archive/]`

HISTORICAL RESEARCH PAPERS

The following papers were written for the National History Day Competition.

Goa, the Portuguese Anachronism *2023*

This historical paper concerns the annexation of Goa and its international effects.

English Diplomacy via German Relativity: The 1919 Eclipse Expedition to Show "Light-Rays, When Near the Sun, DO NOT GO STRAIGHT" *2022*

This historical paper concerns the diplomatic significance of the 1919 Eclipse Expedition, led by Sir A.S. Eddington, to confirm Einstein's theory of Relativity right after WWI.

A Controversy Unlike any Other: A Simple Dispute of Science and Faith, or a Politically-Fueled Power Struggle? *2021*

This historical paper concerns the controversy between Science and Religion during the post-Renaissance era.

The Unprecedented Maxim: The Presumption of Innocence and the Revolution it Sparked on Law and Society *2020*

This historical paper talks about the beginnings of the Presumption of Innocence and its legacy in today's society.

From Pure Imagination to Science: Jules Verne's Literary Legacy Inspiring Triumph and Foreshadowing Tragedy in Modern Society *2019*

This historical paper talks about Jules Verne, and his contributions to modern society.

PROGRAMMING LANGUAGES

TEX Fluent, 5+ years of experience. I am well-versed with plain-TEX, $\mathcal{AMS}$-LATEX, and am familiar with BIBTEX. This CV is typeset entirely in plain-TEX.

Asymptote Fluent, 5+ years of experience. I specialize in drawing geometry diagrams for contest

problems using Asymptote. I have written up my own classes for finding different triangle centers, including the excenters and nine-point center. I have used the graph module to draw all graphs within my IB Extended Essay.

Java Oracle Certified Associate.

Python Moderate. I learned modules such as SymPy and Matplotlib as a part of the Oxford Computational Mathematics Course.

BASH Script Moderate. I have been learning BASH out of a desire to better understand how my computer works. I use BASH for several personal projects, including efficient access and storage of my college coursework and automation of various scripts associated with TEX.

Wolfram Script Moderate. I learned the Wolfram Script for use when developing my solutions to the Frobenius number for three variables. I generated test cases and used its Frobenius number algorithm to verify my solutions.

Miscellaneous Basic knowledge of C++, HTML, CSS, JavaScript, and Adobe PostScript.

LANGUAGES

Proficiency in English and French (Reading, Speaking, Writing); Tamil (fluency in speaking).

HOBBIES

I enjoy the nuances of Mathematics. In high school, I contributed to the Art of Problem Solving Wiki by adding original solutions to past contest problems. I now dedicate more time to solving problems proposed in problem-solving journals such as Mathematical Reflections.

I enjoy finding mathematical patterns in art and nature. I especially love to draw suzhi kolam, a traditional South Indian art form, that is both aesthetically pleasing and has some interesting knot-theoretic properties.

I am a voracious reader! My all-time favorite books are Jules Verne's Paris in the Twentieth Century, Twenty-Thousand Leagues Under the Sea, Agatha Christie's Hercule Poirot Series, and J.R.R Tolkien's The Silmarillion, The Hobbit, and The Lord of the Rings Trilogy. I recently enjoyed Fyodor Dostoevsky's Crime and Punishment.

I also enjoy learning about European History. In particular, I love to learn about the World Wars.

I enjoy watching French and Tamil films with my family.

I also enjoy playing Board Games, including Quoridor, Sequence, Klask, and solving 1000-piece puzzles with my family during the holidays.

Other hobbies: Reading, Biking, Jump-roping.
