Benjamin Greene

(860) 989-4894 • ben.greene@duke.edu • linkedin.com/in/benjaminagreene • github.com/greeneb

Education

Duke University Durham, NC

Bachelor of Science in Mathematics • GPA 3.9 of 4.0 *Expected May 2027*

- *Relevant Graduate Level Coursework:* Algebraic Geometry, Algebraic Topology I, Commutative Algebra, Algebraic Structures I/II, Geometric Central Limit Theorems, Real Analysis, General Relativity, Theory & Algorithms for Machine Learning, Introduction to Algorithmic Trading, Applied Stochastic Processes
- *Relevant Undergraduate Level Coursework:* Topological Data Analysis, Advanced Linear Algebra, Advanced Introduction to Probability, Advanced Multivariable Calculus, Data Structures and Algorithms

Wesleyan University Middletown, CT

Concurrent enrollment while in high school • GPA 4.2 of 4.0 *Aug. 2022 - May 2023*

- *Relevant Coursework:* Topology II (Graduate Level), Introduction to Real Analysis, Linear Algebra

Research Experience

Research Assistant Oct. 2023 – Present

Duke University (mentor: Prof. Ezra Miller, Ph.D.) *Durham, NC*

- Develop explicit closed form for combinatorial minimal free resolutions of arbitrary monomial ideals.
- Lead reading group on combinatorial commutative algebra and existing research regarding constructions of canonical combinatorial minimal resolutions.
- Mentor high school student, including mini-lessons on advanced topics in commutative algebra.

Research Assistant May 2024 – Present

Duke University (mentor: Prof. Alex Dunlap, Ph.D.) *Durham, NC*

- Conjecture and prove theorems to predict behavior of unsupervised learning algorithm.
- Use techniques from measure theory and partial differential equations to study behavior of clustering algorithm on continuous and discrete distributions, mirroring behavior on machine learning training data.
- Develop novel analytical and computational approaches to improve existing bound by 76% to decrease training speeds of machine learning models.

Research Assistant May 2025 – July 2025

Duke University (mentors: Profs. R. Clark, Ph.D., G. Herschlag, Ph.D., J. Mattingly, Ph.D.) *Durham, NC*

- Create novel framework for assessing community membership based on public data.
- Develop and optimize graph diffusion algorithm to calculate travel accessibility between neighboring areas.
- Determine importance of various demographics using machine learning and structural axial coding.
- Apply network analysis, and weighted graph clustering algorithms to demographic and geospatial data.

Actuarial Research Intern June 2022 – Jan. 2023

Goldenson Center for Actuarial Research (mentor: Prof. Jeyaraj Vadiveloo, Ph.D.) *Storrs, CT*

- Develop financial model that creates smart budgeting tools for consumers to hone fiscal habits.
- Present to 40+ actuarial executives at annual board meeting.

Papers in Development

2. *Several Applications of Sum-of-Norms Clustering*
   (with K. McLaughlin, S. Yu, A. Dunlap) in preparation

1. *Who's My Neighbor: Data Driven Community Detection*
   (with L. James, A. Shen, R. Clark, G. Herschlag, J. Mattingly) in progress

Academic Engagement and Service

President, *Duke University Math Union* *May 2025 – Present*
- Oversee all operations of math majors union, including coordinating executive team members' responsibilities.
- Liaison with Math department and other department-related organizations.

Treasurer, *Duke University Math Union* *May 2024 – May 2025*

Co-organizer, *Duke Undergraduate Math Seminar* *May 2025 – Present*

Course Grader, *Math 601: Introductory Graduate Algebra* *July 2025 – Present*

Member, *Weekly Research Lab/Discussion Group (mentor: Prof. Ezra Miller, Ph.D.)* *Oct. 2023 – Present*
- Collaborate with faculty and graduate students weekly to gain exposure to mathematical research processes and concepts in combinatorial commutative algebra, topological data analysis, and geometric measure theory.
- Give feedback on draft papers, posters, and lectures; mentor two high school students.

Private Math Tutor, *Self-Employed* *Aug. 2023 – Present*
- Develop independent tutoring business providing individualized curricula tailored to individuals' learning styles.
- Communicate with parents to share progress and personalize learning goals.

Projects

Efficient solver for sparse linear equations over finite fields • *NumPy, galois* April 2025 – Present
- Implemented Block Wiedemann and Berlekamp-Massey algorithms in Python.
- Applied algorithms to computational algebra, coding theory, and quantum error correction.

Volatility Surface Momentum Trading • *QuantConnect, pandas, SciPy, Scikit-learn* Jan. 2025 – April 2025
- Engineered systemic delta-neutral options trading algorithm using Principal Component Analysis and bivariate cubic spline interpolation to exploit implied volatility surface momentum patterns.
- Implemented comprehensive risk management system featuring stop-loss/take-profit target and daily delta hedging, maintaining market-neutral exposure throughout 10-day maximum holding periods.
- Achieved strong out-of-sample performance with 49.4% average annualized return rate over three backtest periods.

Multiparameter Persistent Homology • LaTeX Nov. 2023 – Dec. 2023
- Presented on Multiparameter Persistent Homology to Topological Data Analysis Class.
- Composed expository paper covering the fundamentals of Category Theory, Module Theory, and Multiparameter Persistent Homology.

Fast Fourier Transform App • *Java* Nov. 2023 – Dec. 2023
- Created a Java-based application to demonstrate applications of the Fast Fourier Transform algorithm.
- Developed a day-long minicourse on introductory Fourier Analysis; presented to 100+ students.

Honors and Awards

Duke Trading Competition live trading 1st place, 1st in live trading case, 4th place overall. *March 2025*

First-year Julia Dale Prize, highest honor given to first-year students by Duke Math department. *April 2024*

Honorable Mention, M3 Challenge, one of top 22 of 650 submissions; awarded $1000. *March 2023*

DAR Good Citizen Award, nominated by faculty for dependability, service, and leadership *February 2023*

Community Leadership and Engagement

Duke Student Government (Associate Vice President) • Duke Partnership for Service (Mentor; Fellow) • Few Quad Council (Academic Engagement Chair) • Project BUILD (Orientation Leader) • Duke Climbing Club (President)

Skills and Interests

Technical Tools: LaTeX, Python, Vim, Git, Rust, Bash, Linux, GIS (QGIS, GeoPandas)
Strategies: Strong proof skills, data analysis & visualization, machine learning, sentiment analysis, regression
Languages: English (Native), Spanish (Proficient), Chinese (Beginner)
Interests: Rock climbing, puzzle solving, cooking/baking