Curriculum Vitae

Jack Westbrook

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Education

Imperial College London, MSc in Pure Mathematics — Sept 2025 – Aug 2026

Coursework in arithmetic geometry, number theory, and cohomology.

University of Wisconsin–Madison, Bachelor of Arts in Mathematics — May 2025

Graduate Math GPA: 3.91/4.00 Overall GPA: 3.63/4.00

Research Experience

Research Assistant (REU), University of Michigan–Ann Arbor — Summer 2024
Supervisor: Dr. Austyn Simpson
- Constructed two-parameter families of Segre product rings answering a question posed by Prof. Ilya Smirnov; coauthored a paper on the results.
- Contributed foundational constructions to a project on lifting F-purity to perfectoid purity in mixed characteristic; coauthored a paper submitted to a journal.
- Implemented Macaulay2 algorithms for Segre and Veronese presentations; groundwork for a future package release.

Research Assistant (REU), University of Wisconsin–Madison — Summer 2022
Supervisor: Dr. Betsy Stovall
- Computed Newton polygons associated to iterated Lie brackets in low dimensions.
- Designed geometric and combinatorial tools to identify outermost polygon vertices.
- Presented results at three seminars; coauthored a forthcoming paper.

Undergraduate Researcher, Madison Experimental Mathematics Lab — Fall 2022
Supervisor: Dr. Feng Zhu
- Constructed isometries in $\mathrm{PSL}(2,\mathbb{R})$ corresponding to hyperbolic surfaces.
- Studied Teichmüller theory and presented research in a poster session.

Publications and Preprints

- **On Deformation of Perfectoid Purity in Gorenstein Domains**, with Baily, Dovgodko, Simpson. arXiv:2504.02966
- **Some Applications of the Brenner–Monsky Quartic**, with Dovgodko and Simpson. In preparation, 2025. (Formerly titled "Hilbert–Kunz Multiplicity in a Two-Parameter Family")
- **Examples of Lie Algebras with Specified Newton Polygons**, with Alwan, K. Huang, T. Huang, Stovall. In preparation, 2025.

- **The Rising Sea: Solutions and Commentary**, self-authored.
  150+ page solutions to Vakil's textbook, including original arguments in category theory.
  GitHub

Selected Presentations

- "Hilbert–Kunz Multiplicity in a Two-Parameter Family," *University of Michigan REU*, 2024
- "On Abelian Categories," *UW–Madison Math Club*, 2024
- "Constructing Gödel's Constructible Universe," *Directed Reading Program*, 2023
- "Curvature in Families of Curves," *UNC Analysis & PDE Seminar*, 2022
- "Newton Polygons in Higher Dimensions," *UIC Undergraduate Seminar*, 2022

Graduate Coursework

Algebra: Abstract Algebra I–II, Lie Algebras, Algebraic Number Theory, Algebraic Geometry
Topology: Topology I–II, Geometric Topology, Differentiable Manifolds
Analysis: Analysis I, Complex Analysis

Teaching and Mentorship

Course Assistant, Math Learning Center, UW–Madison 2023–2025
- Assisted students in MATH 340, 341, 421, and 551; received strong student and faculty feedback.
- Currently supporting courses in Real Analysis and Topology.

Athletic Math Tutor, UW–Madison Summer 2023
- Tutored incoming student-athletes for placement exams; created custom study materials and practice sets.

Honors and Awards

- Dean's List, UW–Madison — Spring 2023, Fall 2023, Spring 2024

Technical Skills

Programming: Macaulay2, SageMath, MATLAB, Python, Rust, C++
Tools: LaTeX, Git, HTML/CSS

Last updated: July 2025