Derek Smith

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Education

Ph.D., mathematics, Princeton University, 1999.
  "On Finitely-Generated Quantum Logic," advisor J. H. Conway.

M.A., mathematics, Princeton University, 1995.

B.S., mathematics, North Carolina State University, 1992.

Awards and Grants

Thomas Roy Jones and Lura Forrest Jones Award, 2021.

Co-PI (with E. McMahon), Research Experience for Undergraduates Site (DMS–1560222),
  $275K, National Science Foundation, 2017–20.

Richard King Mellon Research Fellowship, Lafayette College, 2000, 2014.

Dolciani Mathematics Enrichment Grant, Mathematical Association of America, 2012.

Marquis Distinguished Teaching Award, Lafayette College, 2010.

Jones Faculty Lecture Award for Excellence in Teaching and Scholarship,
  Lafayette College, 2003.

Project NExT Fellow, Mathematical Association of America, 1999.

Princeton University Graduate Fellowship, 1992–97.

Co-Valedictorian, North Carolina State University, 1992.

Positions

Professor, Lafayette College, 2021–present.

Associate Professor, Lafayette College, 2006–2021.
  Assistant Department Head, 2018–2021.

Lafayette Visiting Professor, Jacobs University Bremen, spring 2013 and 2016.

Assistant Professor, Lafayette College, 1999–2006.

Lecturer, Princeton University, 1997–98.

Graduate Instructor, Princeton University, 1996.

Books

[B] *Exploring Mathematics: An Engaging Introduction to Proof* (with J. Meier), Cambridge University Press, 2017.

[A] *On Quaternions and Octonions: Their Geometry, Arithmetic and Symmetry* (with J. H. Conway), AK Peters/CRC Press, 2003.

Other Publications
Student co-authors designated by *

[14] Planarity, Duality, and Laplacian Congruence (with L. Traldi and W. Watkins), *Journal of Combinatorial Mathematics and Combinatorial Computing*, **113** (2020) 299–321.

[13] Geodesics in the Sierpinski Carpet and Menger Sponge (with E. Berkove), *Fractals*, **28** (2020), 2050120.

[12] A Note on 2-isomorphisms and the Signed Laplacian Matrix of a Graph (with L. Traldi and W. Watkins), *Linear Algebra and its Applications* **563** (2019) 277–286.

[11] A Note on Dehn Colorings and Invariant Factors (with L. Traldi and W. Watkins), *Journal of Knot Theory and Its Ramifications*, **27**, no. 14 (2018) article 1871003.

[10] Duality and the Signed Laplacian Matrix of a Graph (with L. Traldi and W. Watkins), *Linear Algebra and its Applications*, **548** (2018) 1–18.

[9] Lattice Embeddings of Planar Point Sets (with M. Knopf*, J. Milzman*, D. Zhu*, and D. Zirlin*), *Discrete & Computational Geometry*, **56** (2016) 693–710.

[8] From the Outside In: Solving Generalizations of the Slothouber-Graatsma-Conway Puzzle, in *The Mathematics of Various Entertaining Subjects: Research in Recreational Math*, J. Beineke and J. Rosenhouse eds., Princeton University Press (2015).

[7] Common Left- and Right-hand Divisors of a Quaternion Integer (with M. Abouzaid*, J. Alper*, S. DiMauro*, and J. Grosslight*), *Journal of Pure and Applied Algebra*, **217** (2013) 779–785.

[6] The Playground, a problem-solving column in the quarterly *Math Horizons* (2007–2013). Editor of 20 columns in total.

[5] On Cosets of the Unit Loop of Integral Octonions (with M. Abouzaid*, J. Alper*, S. DiMauro*, and J. Grosslight*), *Communications in Algebra*, **35** (2007) 207–214.

[4] Group-Valued Measures on the Lattice of Closed Subspaces of a Hilbert Space (with J. Harding and E. Jager*), *International Journal of Theoretical Physics*, **44** (2005) 539–548.

[3] Orthomodular Bell-Kochen-Specker Theorem, *International Journal of Theoretical Physics*, **43** (2004) 2023–2027.

[2] Algebraic Partial Boolean Algebras, *Journal of Physics A*, **36** (2003) 3899–3910.

[1] Factorization in the Composition Algebras, *Lecture Notes in Computer Science*, W. Bosma ed., Springer, **1838** (2000) 533–538.

Works In Progress

[15] Geodesics in Generalizations of the Sierpinski Carpet (with E. Berkove and E. Karangozishvili*), preprint.

Short paths in fractals (with M. Auerbach*, E. Berkove, A. Hodapp*, and R. Whitman*).

A trivialization conjecture for signed Laplacian matrices (with L. Traldi and W. Watkins).

Lattice embeddings of 3-dimensional point sets.

16-dimensional extensions of the octonions (in part with J. H. Conway).

Research Presentations

On geodesics in fractals

"Geodesics in Generalizations of the Sierpinski Carpet," AIMS Conference on Dynamical Systems, Differential Equations and Applications, Atlanta, 2020 (postponed to 2021).

"Short Paths in Generalizations of the Sierpinski Carpet," Math Department Colloquium, Metropolitan State University of Denver, 2020.

"Short Paths in Generalizations of the Sierpinski Carpet," Fractal Geometry and Dynamical Systems special session, AMS Fall Southeast Sectional Meeting, Gainesville, 2019.

"Short Paths in the Sierpinski Carpet and Menger Sponge," joint with E. Berkove, Algorithmic Dimensions and Fractal Geometry special session, Joint Mathematics Meeting, Baltimore, 2019.

"Travels through the Sierpinski Carpet, Menger Sponge, and Beyond," Math Department Seminar, Pacific University, 2017.

"Travels through the Sierpinski Carpet, Menger Sponge, and Beyond," Math Department Seminar, Lafayette College, 2017.

On lattice embeddings of planar point sets

"Planar Embeddings of Integer Distance Sets," Discrete Structures Seminar, University of Bayreuth, 2016.

"Integer Distance Problems," Experimental and Constructive Algebra Seminar, RWTH Aachen Graduate School, 2016.

"Integer Distance Problems," Math Department Colloquium, Vassar College, 2015.

On octonions and related rings and loops

"The Integral Octonions," Experimental and Constructive Algebra Seminar, RWTH Aachen Graduate School, 2013.

"Factorization in the Composition Algebras," Math Colloquium, Jacobs University, 2013.

"The Integral Octonions," Algebra Seminar, Warsaw University, 2008.

"Factorization in the Composition Algebras," Algebra and Number Theory Seminar, Silesian University, Katowice, 2007.

"The Integral Octonions," MASS Colloquium, Penn State, 2006.

"Octonion Multiplication Theorems," Nonassociative Algebra special session, Joint Mathematics Meetings, Phoenix, 2004.

"On Cosets of the Unit Loop of Integral Octonions," Loops '03, Prague, Czech Republic, 2003.

"On Cosets of the Unit Loop of Integral Octonions," AMS Spring Eastern Sectional Meeting, NYU, 2003.

"The Integral Octonions," Mathematics Research Colloquium, Bell Labs, 2003.

"The Integral Octonions," Seminar, University of Georgia, Athens, 2002.

"The Integral Octonions," 6th International Conference on Clifford Algebras, Cookeville, TN, 2002.

"Factorization in the Composition Algebras," ANTS IV, Leiden, Netherlands, 2000.

"The Geometry and Arithmetic of the Composition Algebras," Math Department Colloquium, Lehigh University, 2000.

"Factorization in the Composition Algebras," Math Department Colloquium, Vanderbilt University, 2000.

On partial Boolean algebras and other structures in quantum logic

"Finite Measures on the Subspaces of $\mathbb{R}^n$," Discrete Math Seminar, University of Delaware, 2012.

"Finite Configurations in Quantum Logic," Combinatorics Seminar, MIT, 2005.

"Group-valued Measures on Hilbert space," International Quantum Structures Association Meeting, Denver, 2004.

"Algebraic Partial Boolean Algebras," Quantum Structures special session, AMS Spring Southeastern Sectional Meeting, Atlanta, 2002.

"Finitely-generated Partial Boolean Algebras in Orthomodular Lattices," International Quantum Structures Association Meeting, Cesenatico, Italy, 2001.

"Four-generator Partial Boolean Algebras in Orthomodular Lattices," Joint Mathematics Meetings, New Orleans, 2001.

"A Problem from Quantum Logic," Discrete Mathematics Seminar, Princeton University, 1997.

"Finitely-generated Partial Boolean Algebras," Joint Mathematics Meetings, San Diego, 1997.

On other topics

"Duality, Planarity, and Signed Laplacian Matrices," Graphs and Matrices special session, AMS Fall Southwest Sectional Meeting, 2020 (postponed to 2022).

"Pondering Packing Puzzles: Research in Recreational Mathematics," Math Department Colloquium, Gettysburg College, 2014.

"Solving a Duplication Problem on a Square Grid," Experimental Mathematics in Number Theory, Analysis, and Combinatorics special session, AMS Fall Eastern Sectional Meeting, Dalhousie University, 2014.

"Solving Generalizations of the Slothouber-Graatsma-Conway Puzzle," MOVES 2013 Conference, MoMath, NYC, 2013.

"The Middle Levels Conjecture," Jagellonian University, Krakow, 2008.

"A Symmetric Chain Decomposition of Young's Lattice, $L(5, n)$, When n is Odd," Joint Mathematics Meetings, San Diego, 2002.

"4-dimensional Point Groups via Quaternions," Algebra Seminar, SUNY-Binghamton, 2000.

Other Presentations

"The Batfox Assignment, and Other 3D Printing Adventures in Third-Semester Calculus," Fall EPaDel MAA Sectional Meeting, 2019.

"Pondering Pirate Puzzles Purposefully," with J. Arfin*, M. Shulman*, and B. Strickland*, MOVES 2015, MoMath/CUNY, 2015.

Mathematical animations for "2ˆ57,885,161-1," a modern ballet based on number theory, directed by choreographer N. Gibson. Philadelphia premiere, 2015, and Lafayette College, 2016.

"Student-Generated 3D Mathematical Symmetry," Lightning Round talk, LVAIC Digital Tools Conference, Moravian, 2015.

Thomas L. Pirnot Lecture in Mathematics, Kutztown University, 2014.

Preconcert lecture on gambling in *Guys and Dolls*, Swarthmore College, 2014.

"The Fitch Cheney Five-Card Trick," Hands-on presentation at MOVES 2013, MoMath/NYC, 2013.

"Investigating a Family of Packing Puzzles," Jacobs University Math Society, 2013.

"A Math Fair Celebration at River Valley Waldorf School," Mathematical Outreach Programs poster session, Joint Mathematics Meetings, San Diego, 2013.

"Problems, Problems, Problems" panelist, MAA Northeast Sectional Meeting, Bridgewater State University, 2012.

"Never Cross a Sea Urchin: A Problem in 3-Dimensional Geometry," MAA Northeast Sectional Meeting, 2012.

"Quaternions for Fun and Profit," Math Department Colloquium, Susquehanna University, 2007.

"Quaternions for Fun and Profit," Lafayette-Lehigh Conference on Graduate School, 2006.

Math Department Colloquium, Middlebury College, 2005.

"Extra-curricular Student Math Activities" panelist, Project NexT EPADEL Spring Meeting, 2005.

"Irrational Geometry," Epsilon Talk, Moravian College, 2005.

Undergraduate Math Conference Keynote Address, Shippensburg University, 2005.

"Quaternions and Octonions, Flipbooks and Party Hats," Math Department Colloquium, Susquehanna University, 2003.

"Mathematical Card Tricks," a 2-day workshop with C. Mulcahy, Math Jubilee, University of Georgia, Athens, 2002.

"Reading and writing (and speaking!) in mathematics" panelist, Project NExT, New Orleans, 2001.

"The Pizza Problem, and other proofs without words," Vanderbilt University, 2000.

Teaching

Courses (Lafayette course number)
Modeling and Differential Calculus (Math 125)

Discrete Structures (Math 146/182)

Calculus I, II, and III (Math 161, 162, and 263)

Applied Statistics (Math 176/186)

Differential Equations with Linear Algebra (Math 264)

Vector Spaces (Math 275)

Transition to Theoretical Mathematics (Math 290)

Geometry (Math 323)

Number Theory (Math 328)

Abstract Algebra (Math 351)

Real Analysis (Math 356)

Combinatorial Game Theory (Math 370, special topic)

Lattices and More Lattices (Math 371, special topic)

Conjecture and Prove (Math 377, special topic)

Gambling: Here and Everywhere (VaST 282)

Honors theses
Slim Ghodhbane '21: Automatic Coverage Path Planning for 3D Objects (CS), outside reader 2020–21.

Mike Van Ness '20: Lattices and cryptography, co-advisor Jon Dahl, 2019–20.

Ben Adenbaum '19: Signed Laplacian matrices and graphs, 2018–19.

Helen Hutchens '15: Study of an expansion tube (Mech E), outside reader 2014–15.

Heidi Verheggen '12: Diophantine analysis, 2011–12.

Peter McGrath '11: Lattice basis reduction, 2010–11.

Brian Kronenthal '07: Combinatorial game theory, 2006–07.

Ekaterina Jager '06: Coding theory, 2005–06.

Carrie Abildgaard '04: Foundations of financial mathematics, 2003–04.

Volkan Öktem '04: Image processing (ECE), outside reader 2003–04.

Steve DiMauro '02: Combinatorial game theory, 2001–02.

Lafayette EXCEL research students

Elene Karangozishvili '21, summer and fall 2018.

Andrej Ilievski '20, fall 2017, spring 2018.

Dantong Zhu '16, summer 2014 (in an REU group).

Liang Zhang '13, winter 2013.

Edward Karasiewicz '11, winter 2009.

Brian Kronenthal '07, spring 2005.

Ekaterina Jager '05, summers 2002, 2003, and 2005, and winter 2005.

Steve DiMauro '02, summer 2001 (in an REU group).

Other teaching and mentorship

REU research group mentor, summers 2001, 2014, and 2019.

Summer research with Dantong Zhu '16 on Graph Nim, 2015 and 2016.

Independent study with Jason Saied '16 on combinatorial game theory, fall 2014.

Independent study with Heidi Verheggen '12 on factorization in rings, spring 2011.

Math 400 project with Jon Maier '06, fall 2006.

Lafayette Problem Group organizer and instructor, all semesters not on leave.

GRE Math Subject preparation sessions, 2005, 2009, 2011-13, 2015.

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Departmental Service

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Department Committees

Tenure-track search, 2017–18.

Sophomore Course Curriculum, 2016–17.

Assessment, 2013–14.

Technology in the Curriculum, 2013–14.

Visitor search, 2002 and 2012.

Common Room planning, 2007. Chair.

Calculus I, 2005–06. Chair.

Department Newsletter, 2004–08.

Mathematical Adventures and Diversions (MAAD), 2003–05.

Other

Assistant Department Head, 2018–2021.

Administration and programming for the REU Program, 2016–19.

Putnam Mathematics Exam coordinator, 2001–present.

Summer/Career Opportunities in Mathematics information sessions, 2003–present.
Gateway Career Center Faculty Career Connector Award, 2020.

GRE Math Subject Test preparation sessions, many years from 2003–present.

Individual Barge Mathematics Exam, 2000 and 2017.

Webmaster, 2013–15.

WITS ("What I did This Summer") student speaker series coordinator, 2004–present.

Math Club advisor, 2003–15, 2019–2021.

Presentations given for the REU program (2013, 2004), Pi Mu Epsilon (2012, 2003),
Departmental Seminar (2016, 2002), and MAAD series (2000).

College Service

Faculty and Trustee Committees

Promotion, Tenure, and Review, 2018–2019, 2019–2022.

Enrollment Planning, 2008–11, 2017–18.
Chair, 2009–11, 2017–18.

Faculty Compensation, 2001–04, 2014–15.

Appeal and Grievance, 2013–14.

Educational Policy (Trustee), 2010–12.

Faculty Academic Policy, 2000–01, 2011–12.

Athletics and Student Affairs (Trustee), 2006–07.

Governance, 2004–07.

Other

Off-Campus Studies Advisory committee, 2014–15, 2018–2020.
Chair, 2018–2019.

International Risk committee, 2019–2021.

Optimal Working Group, 2019–20.

Assistant VP of Financial Aid search committee, 2018.

January Cohort Working Group, 2018.

Panelist for "Grant Proposals to the National Science Foundation and National Institutes of Health," 2017.

Director, Study Abroad at Jacobs University Bremen, 2013 (with Bill Hornfeck) and 2016.

Assistant Director of Off-Campus Studies search committee, 2015.

Goldwater Scholarship selection committee, 2012–14.

VAST Faculty Liaison, 2011–12.

ITS search committee, fall 2011.

Climate Study working group, 2009.

Budget subcommittee of FAP, 2008–09.

Faculty Issues subcommittee of Strategic Planning committee, 2006–07.

Recreation Services Advisory committee, 2006–07.

Student Movement Against Cancer advisor, 2005–07.

Admissions Office search committee, spring 2001.

Presentations given for XLC (2014), Alumni College (2005), Family Weekend (2004), Trustees (2001), and Sigma Xi (1999).

Professional Service

MAA Yueh-Gin Gung and Charles Y. Hu Award committee, 2020–2024.

Project NExT mentor, 2019–present.

Dolciani Mathematics Enrichment Grant review panel, 2017 and 2018.

MAA Joint Mathematics Meetings Invited Address committee, 2016.

Editorial Board, *Math Horizons*, 2008–13.

Problem Section editor/co-editor of *Math Horizons*, 2007–13.
   Sole editor for four years during 2008–2012.

Referee for *American Mathematical Monthly*, *Ars Combinatorica*, *Beiträge zur Algebra und Geometrie*, *Integers*, *Journal of Algebra*, *Journal of Number Theory*, *London Mathematical Society*, *Proceedings of the AMS*, and *Sociology Compass*.

August 2021