

RACHEL ARNOLD

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EDUCATION

Virginia Tech

- Ph.D. in Mathematics *May 2012*
Dissertation: *The Discrete Hodge Star Operator and Poincaré Duality*
Advisor: Peter Haskell
- M.S. in Mathematics *May 2008*
Thesis: *Complex Analysis on Planar Cell Complexes*
Advisor: Peter Haskell
- B.S. in Mathematics *May 2006*
Summa Cum Laude, GPA: 3.96

EXPERIENCE

Virginia Tech

August 2017 - Present

Mathematics Collegiate Assistant Professor

- Courses Taught: Advanced Calculus (Math 3224), Introduction to Proofs (Math 3034), Introduction to Linear Algebra (Math 2114)

Virginia Tech

August 2014 - Present

Mathematics GTA Coordinator

- Fostered a culture among ~ 50 GTAs each academic year that promotes regular reflection on effective teaching, facilitated professional development, fostered leadership and peer support among GTAs, and developed course policies.

Digital Bazaar, Inc.

January 2018 - Present

Consulting Mathematician

- Writing mathematical proofs for the correctness of algorithms, and suggesting efficiency improvements. Digital Bazaar, Inc. is a leader in the creation of open payments, identity, and blockchain solutions for the Web.

Virginia Tech

August 2012 - August 2017

Mathematics Instructor

- Courses Taught: Advanced Calculus (Math 3224), Introduction to Proofs (Math 3034), Intro Multivariable Calculus (Math 2204), Multivariable Calculus (Math 2224), Introduction to Linear Algebra (Math 2114), Calculus of a Single Variable II (Math 1226), Integral Calculus (Math 1206), Differential Calculus (Math 1205)

- Courses Taught: Introduction to Proofs (Math 3034), Honors Multivariable Calculus (Math 2224H), Multivariable Calculus (Math 2224), Integral Calculus (Math 1206), Differential Calculus (Math 1205), Vector Geometry (Math 1224)
- Senior Graduate Teaching Assistant (Spring 2009 - Spring 2011): coordinated GTA Peer Mentor Program, organized biweekly Graduate Issues Seminars, maintained resource website for GTAs, assisted with teaching orientation/workshops for GTAs.

CURRICULUM, SEMINAR, & PROFESSIONAL DEVELOPMENT

- Plan and facilitate biweekly professional development seminars for mathematics graduate student teachers. Fall 2014 - present.
- Led weekly research meetings for the Mathematical Induction Research Group. Fall 2018 - present
- Co-revised Jimmy Arnold's Math 3034 Textbook *Introduction to Mathematical Proofs* with Robert Rogers. January 2015 - present.
- Developed teaching handbooks for the engineering calculus sequence (Math 1225-1226) intended to offer teachers insight into common student misconceptions and useful teaching strategies section by section of the course syllabus. Summer 2017 - present
- Held biweekly meetings with new GTAs teaching Math 1225-6 to discuss the topics included in the teaching handbooks (above). Fall 2016 - Spring 2017.
- Facilitated the development and revision of the GTA Peer Mentor Program via a 3-week seminar with GTA input. Spring 2017.
- Created and led Teaching for Robust Understanding (TRU) Math 7-week Seminar Series for GTAs on Schoenfeld's Five Dimensions of Mathematically Powerful Classrooms. Fall 2016.
- Co-revised and developed Virginia Tech's new engineering calculus sequence (Math 1225, 1226, 2204). August 2012 - August 2014.
- Team member of course redesign project funded by the state of Virginia 4VA Initiative to co-revise life science's calculus sequence, Department of Mathematics, Virginia Tech, Blacksburg, VA. Summer - Fall 2013.
- Co-developed Da Vinci Living-Learning Community Math Seminar, College of Science, Virginia Tech, Blacksburg, VA. Summer 2012 - Spring 2013.

SERVICE TO THE UNIVERSITY AND DEPARTMENT

- Mathematics GTA Coordinator August 2014 - present
- Mathematics Department Undergraduate Program Committee August 2013 - present
- Faculty Mentor Committee for GTAs (*creator & chair*) August 2016 - present
- MAA College Mathematics Instructors Development Source (*member*) February 2016 - present
- Faculty Scholar of the Virginia Tech Academy for GTA Excellence January 2018 - present
- Teaching Certification Committee (*chair*) August 2015 - present
- Virginia Tech Mathematics Instructor Search Committee (*member*) May 2018
- Undergraduate Advisor (Mathematics - Traditional Option) December 2012 - May 2018
- VCCS Math Pathways Project (*VT Rep for Calculus*) August 2016 - August 2017

- Teaching Certification Committee (*member*) August 2014 - May 2015
- Math 1205 Course Coordinator August 2012 - May 2014
- Calculus Working Group Committee August 2012 - August 2013
- Common Time Exam Committees Fall 2012 - present
 - Wrote problems, proofread, and edited various common time multiple choice finals for Math 1205, 1206, 1226, 2204, and 2114.

AWARDS/GRANTS

- VT CETL Instructional Innovation Grant 2019
- VT Favorite Faculty Curiosity Award 2018
- Promotion to Mathematics Collegiate Assistant Professor August 2017
- VT Mathematics Department Instructor of the Year Award 2017
- VT Favorite Faculty 2013, 2015, 2016, 2017
- VT Graduate Student Teaching Excellence Award (university-wide) 2010
- Outstanding Teaching by a VT Math Graduate Assistant 2009
- Mathematics Department Outstanding Senior - Traditional Option 2006
- Phi Beta Kappa 2006

PUBLICATIONS

1. Submitted: R. Arnold & D. Longley, "Zero-Knowledge Proofs Do Not Solve the Privacy-Trust Problem of an Attribute-Based Credential System," *IEEE ComSoc Magazine*, Dec, 2019.
2. Accepted for publication: Arnold, R., & Longley, D. (2019). 'Continuity: A Byzantine Fault Tolerant Asynchronous Consensus Algorithm Without Rounds', in Hyland-Wood, D., Johnson, S., & Khatchadourian, S. *Blockchain Consensus Algorithms*. New York City: Springer Nature.
3. Norton, A. & Arnold, R. (in press, 2019), Meeting the cognitive demands of proof by induction: the case of Ben. *Proceedings of the Forty-First Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. St. Louis, MO.
4. Arnold, R., & Longley, D. (2018). *Continuity: A Byzantine Fault Tolerant Asynchronous Consensus Algorithm Without Rounds*. IP.com. Retrieved from <https://priorart.ip.com/IPCOM/000252899>.
5. Norton, A., & Arnold, R. (2017), Logical implication as the object of mathematical induction. *Proceedings of the Thirty-Ninth Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. Indianapolis, IN.
6. Arnold, R., & Norton, A. (2017), Mathematical actions, mathematical objects, and mathematical induction. *Proceedings of the Twentieth Annual Conference on Research in Undergraduate Mathematics Education*. San Diego, CA.
7. Haider, M.A., Olander, J.E., Arnold, R.F., Marous, D.R., McLamb, A.J., Thompson, K.C., Woodruff, W.R., & Haugh, J.M. (2011). A phenomenological mixture model for biosynthesis and linking of cartilage extracellular matrix in scaffolds seeded with chondrocytes, *Biomechanics and Modeling in Mechanobiology*, 10, 915-924. DOI: 10.1007/s10237-010-0282-y.

TALKS & CONFERENCES

- *Meeting the cognitive demands of proof by induction: the case of Ben.* PME-NA 2019 Annual Meeting, St. Louis, MO. November, 2019.
- MAA CoMInDS Workshop, University of Tennessee, Knoxville, TN. March 2019. Led two sessions on instructional design.
- *Majoring in mathematics: the traditional option.* Math 1004, guest lecturer, Blacksburg, VA. October 2018 and October 2017.
- *Logical implication as the object of mathematical induction.* PME-NA 2017 Annual Meeting, Indianapolis, IN. October, 2017.
- *Mathematical actions, mathematical objects, and mathematical induction.* SIGMAA on RUME 2017 Conference, San Diego, CA. February, 2017.
- *Mathematical actions, mathematical objects, and mathematical induction.* Virginia Tech Mathematics Education Seminar, Blacksburg, VA. January, 2017.
- *Creating confident learners.* Graduate School GTA Workshop, Virginia Tech, Blacksburg, VA. October 2018, September 2017, September 2016, September 2015, October 2011, October 2010.
- MAA CoMInDS Summer Workshop, University of Maine, Orono, ME. June 2016.
- Virginia Mathematics Summit, Virginia State University, Petersburg, VA. April 2016.
- MAA CoMInDS Regional Workshop, Duke University, Durham, NC, February 2016.
- *Balancing graduate life and study.* Mathematics SGTA Seminar, Virginia Tech, Blacksburg, VA. November 2014 and October 2013.
- *Tips from an experienced award-winning GTA.* Graduate School GTA Workshop, Virginia Tech, Blacksburg, VA. August 2011.