Nicolas Banks

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EDUCATION

PhD Pure Mathematics `2021-2025`
University of Waterloo, Waterloo, ON
    Supervised by Dr. David McKinnon
    Cumulative GPA: 88.33/100

MMath Pure Mathematics `2020-2021`
University of Waterloo, Waterloo, ON
    Supervised by Dr. David McKinnon
    Research Paper: Galois Actions on Smooth Projective Surfaces Up to Picard Rank Four
    Cumulative GPA: 94.67/100

BEd. Secondary Education in Mathematics and Science (Incomplete) `2017-2019`
Mount Saint Vincent University, Bedford, NS
    Cumulative GPA: 4.15/4.30

BSc. First Class Honours in Mathematics `2012-2016`
Dalhousie University, Halifax, NS
    Supervised by Dr. Dorette Pronk
    Thesis: Orbit Categories and a Demonstration of Equivalence
    Cumulative GPA: 3.99/4.30

WORK EXPERIENCE

Peer Success Coach `Fall 2021-Present`

University of Waterloo Student Success Office, Waterloo, ON

- Conducted one-on-one study coaching appointments with students
- Identified problem areas with students and discussed relevant strategies and resources
- Provided a safe space for students to discuss their learning and studying concerns
- Worked as a teaching assistant for the SSO's UNIV 101 course to work one-on-one with students on academic probation

Teaching Assistant `Fall 2020-Present`

University of Waterloo, Waterloo, ON

- Conducted in-person help sessions to interact with students and answer assignment-related questions
- Graded and proctored assignments, tests, and final exams
- Conducted oral exams to gauge student progress and understanding
- Answered questions on the course's online forum

- Coordinated marking schemes with colleagues to ensure consistency

- Created marking schemes for each graded assessment

- Held virtual office hours

- Created supplementary video lectures on Gaussian integers and the geometry of Pythagorean triples

Calculus, Statistics, and Linear Algebra Tutor — 2014-2020
Various locations, Halifax, NS

- Dalhousie's Studying for Success Program, Dalhousie's Indigenous Student Centre, and Halifax West High School

- Motivated students to develop problem-solving skills

- Multitasked by tutoring several students and classes at once in the Indigenous Student Centre

- Recognized educational barriers present for Indigenous students at Dalhousie

- Identified problem areas for students and designed lessons accordingly

Mathematics 8 and 10 Tutor — 2019-2020
Novaread, Halifax, NS

- Interacted with students of various skill levels in grade 8 and 10 mathematics

- Fostered the development of respect for mathematics

- Prepared activities for students, including those with learning disabilities

- Experienced, through certain students, the benefits and drawbacks of accelerated private school curricula

Mathematics Student Teacher — 2017-2018
Halifax West High School, Halifax, NS

- Organized accurate and relevant activities for two grade 10 academic math classes

- Developed familiarity with mathematics curriculum documents and using them to prepare lessons

- Implemented classroom management techniques for students with autism and ADHD

- Designed personalized lessons for students with intellectual disabilities

Math Learning Strategies Student Teacher — 2017-2018
Halifax West High School, Halifax, NS

- Developed relationships with special needs students of various cognitive levels

- Created differentiated lesson plans for students to ensure that all felt included

- Initiated teachable moments

- Learned rudimentary American Sign Language to communicate effectively with a deaf student

Mathematics Research — 2015-2016
Dalhousie University, Halifax, NS

- Conducted mathematical research under the supervision of Dr. Dorette Pronk

- Analyzed current mathematical literature to find relevant information

- Demonstrated an ability to make abstract concepts accessible by presenting my findings to Dalhousie's Mathematics and Statistics Colloquium Seminar

- Submitted a written Honours thesis containing my findings and relevant background information

AWARDS AND RECOGNITIONS

Graduate Research Studentship `Winter 2023`
University of Waterloo, Waterloo, ON

- $1,170 Canadian dollars

University of Waterloo Staff and Faculty Endowment Fund Graduate Scholarship `Fall 2022`
University of Waterloo, Waterloo, ON

- Recognizes academic excellence among holders of the Ontario Graduate Scholarshop.
- $5,000 Canadian dollars

Ontario Graduate Scholarship `Spring 2022-Winter 2023`
University of Waterloo, Waterloo, ON

- Merit-based scholarship which encourages excellence in graduate studies.
- $15,000 Canadian dollars

President's Graduate Scholarship `Spring 2022-Winter 2023`
University of Waterloo, Waterloo, ON

- Awarded to outstanding graduate students who hold certain major federally and provincially funded competition-based scholarships.
- $10,000 Canadian dollars

Graduate Research Studentship `Fall 2022`
University of Waterloo, Waterloo, ON

- $1,170 Canadian dollars

Math Domestic Graduate Student Award `Winter 2022`
University of Waterloo, Waterloo, ON

- $2,000 Canadian dollars

Graduate Research Studentship `Spring 2022`
University of Waterloo, Waterloo, ON

- $1,170 Canadian dollars

Outstanding Teaching Assistant Award `Fall 2021`
University of Waterloo, Waterloo, ON

- Awarded to a pure math graduate student whose work as a teaching assistant was deemed excellent by the student awards committee.
- $100 Canadian dollars

Math Domestic Graduate Student Award `Fall 2021`
University of Waterloo, Waterloo, ON

- $2,000 Canadian dollars

Pure Math Graduate Award `Winter 2021`
University of Waterloo, Waterloo, ON

- $900 Canadian dollars

Pure Math Graduate Award `Fall 2020`
University of Waterloo, Waterloo, ON

- $870 Canadian dollars

Deans' List First Class Honour `2017`
Mount Saint Vincent University, Bedford, NS

- Awarded to a student who has obtained a GPA of 3.7/4.30 in five units of credit, with no grade below a B-.

Peter and Anne Ellen Filmore Memorial Scholarship in Mathematics `2017`
Dalhousie University, Halifax, NS

- Awarded to an outstanding student in mathematics or statistics who is interested in pursuing a career in education.
- $3,100 Canadian dollars

Dalhousie In-Course Scholarship `2015-2016`
Dalhousie University, Halifax, NS

- Awarded to students who achieved a minimum SGPA of 3.70/4.30 over the previous two academic terms, over at least 30 credit hours of coursework.
- $500 Canadian dollars

Dalhousie In-Course Scholarship `2014-2015`
Dalhousie University, Halifax, NS

- Awarded to students who achieved a minimum SGPA of 3.70/4.30 over the previous two academic terms, over at least 30 credit hours of coursework.
- $500 Canadian dollars

Dalhousie In-Course Scholarship `2013-2014`
Dalhousie University, Halifax, NS

- Awarded to students who achieved a minimum SGPA of 3.70/4.30 over the previous two academic terms, over at least 30 credit hours of coursework.
- $1,000 Canadian dollars

Dalhousie Entrance Scholarship `2012-2013`
Dalhousie University, Halifax, NS

- $1,500 Canadian dollars

PAPERS AND REPORTS

Galois Actions on Smooth Projective Surfaces Up to Picard Rank Four `Spring 2021`
University of Waterloo, Waterloo, ON

- Research paper, supervised by David McKinnon and prepared for completion of the MMath Pure Math degree at the University of Waterloo
- In this paper, we computed all possible actions of the absolute Galois group of the rational numbers on smooth rational projective surfaces up to Picard rank four. We accomplished this by computing the effective and nef cones of said surfaces; this determined the possible Galois actions, since the minimal generators of these cones are permuted by said action. This is motivated by McKinnon's 2007 conjecture concerning rational approximations to rational points on varieties. Specifically, this conjecture states that if a rational point on a variety lies on a rational curve, then the best approximations to that point also lie on a rational curve. Since Galois-invariant curves are defined over the rationals, computing these actions will provide information about the rational curves in question.
- Available at `https://www.researchgate.net/publication/353668742_Galois_Actions_on_Smooth_Projective_Surfaces_Up_to_Picard_Rank_Four`

Difference Algebra: Introduction and Applications `Winter 2021`
University of Waterloo, Waterloo, ON

- Prepared for Emma Knight's course PMATH 646 - Commutative Algebra
- Co-authored by Christine Eagles
- An introduction to the fheory of difference rings, including relationships between difference ideals, and applications to algebraic geometry

Valuations, Local Fields, and Teichmüller Representatives — Winter 2021
University of Waterloo, Waterloo, ON

- Prepared for Wentang Kuo's course PMATH 641 - Algebraic Number Theory

- An introductory exposition on valuations, the algebraic structure of local fields, and the construction of Teichmüller representatives, with applications to the p-adic numbers

Burnside's Theorem on Solvable Groups — Fall 2020
University of Waterloo, Waterloo, ON

- Prepared for Wentang Kuo's course PMATH 745 - Representations of Finite Groups

- A presentation of a character-theoretic proof of the titular theorem, along with necessary background on group theory and Galois theory

The Leech Lattice, Ideal Lattices, and Ideal Class Groups — Fall 2020
University of Waterloo, Waterloo, ON

- Prepared for Cam Stewart's course PMATH 940 - The Geometry of Numbers

- An exploration on Maurice Craig's cyclotomic construction of the Leech lattice; connections to Eva Bayer-Fluckiger's work on modular lattices and the celebrated Kronecker-Weber theorem on Abelian number fields

Orbit Categories and a Demonstration of Equivalence — Winter 2016
Dalhousie University, Halifax, NS

- Honours thesis, supervised by Dorette Pronk and prepared for the completion of the BSc Honours in Mathematics degree at Dalhousie University

- Exposition on orbit categories and their use in equivariant homotopy theory, including example calculations

- Available at `https://www.researchgate.net/publication/346972482_Orbit_Categories_and_a_Demonstration_of_Equivalence`

PRESENTATIONS

The Geometry of Elliptic Curves: Dual Isogenies, the Weil Pairing, and Endomorphism Rings — Winter 2023
University of Waterloo, Waterloo, ON

- Presented at the University of Waterloo's elliptic curves learning seminar seminar

- Overview of the classification of endomorphism rings of elliptic curves

- Based on parts of Silverman's *The Arithmetic of Elliptic Curves*

Étale Cohomology Groups and the Weil Conjectures — Winter 2022
University of Waterloo, Waterloo, ON

- Prepared for Matt Satriano's course PMATH 965 - Algebraic Stacks

- Introduction to sheaf cohomology on sites, focusing on the étale cohomology and applications to proving the Weil conjectures

Galois Actions on Surfaces of Small Picard Rank — Spring 2021
University of Waterloo, Waterloo, ON

- Based on my MMath research paper, supervised by David McKinnon

- Presented at the University of Waterloo's algebraic geometry working seminar

- Introductions to absolute Galois groups, intersection theory, and effective and nef cones, followed by calculations of Galois actions on Picard groups of ranks two and four

Introduction to Difference Rings — Winter 2021
University of Waterloo, Waterloo, ON

- Prepared for Emma Knight's course PMATH 646 - Commutative Algebra
- Introduction to the basic definitions of difference algebra, including examples and geometric motivation

Witt Vectors and the de Rham-Witt Complex
<div align="right">Fall 2020</div>

University of Waterloo, Waterloo, ON

- Prepared for Matt Satriano's course PMATH 965 - Deformation Theory with a Viewpoint Toward Moduli Spaces
- Construction of the Witt vectors and connections to the p-adic integers; a brief motivation and introduction to the de Rham-Witt complex and crystalline cohomology

A Cyclotomic Construction of the Leech Lattice
<div align="right">Fall 2020</div>

University of Waterloo, Waterloo, ON

- Prepared for Cam Stewart's course PMATH 940 - The Geometry of Numbers
- Overview of Maurice Craig's cyclotomic construction of the Leech lattice, along with a review of the requisite algebraic number theory

Fixed Points and Orbit Categories
<div align="right">2016</div>

Dalhousie University, Halifax, NS

- Honours presentation, supervised by Dorette Pronk
- Presented at Dalhousie University's mathematics and statistics honours colloquium
- Exposition on orbit categories and their use in equivariant homotopy theory, including example calculations

RESEARCH INTERESTS

- Algebraic geometry
- Arithmetic geometry
- Representation theory
- Commutative algebra

TEACHING STATEMENT

I have had the privilege to connect with many different students through mathematics, and through my significant teaching experience, I discovered a joy in helping people understand math. In guiding people to the solution to a problem or puzzle, but always leaving the "aha!" moment for them. Because that is what it means to learn math - to discover a solution to a problem through pattern recognition, deep thought, and sometimes a bit of inspiration. My goal when teaching math is to help students understand that math is a beautiful world of mysteries and to be their curator through their mathematical journey.

PERSONAL INTERESTS AND HOBBIES

- Educational content creation
- Film-making and screenwriting