Alex Kazachek

alexdkazachek@gmail.com — www.akazachek.com

Education

2019 – 2023 (projected)

University of Western Ontario ('UWO')

Undergraduate

Honours Specialization in Mathematics & Major in Data Science.

Current GPA of 3.91.

Awards

2021 Fall

RBC Scholarship in Data Science

Recognized by the faculty of science and representatives from RBC as demonstrating academic achievement and interest in data science or artificial intelligence. Continues for one additional year. Minimum 80% average required to continue.

2021 Fall

Albert O. Jeffery Scholarship in Mathematics

Awarded due to academic performance among students entering their third year in the honours mathematics program. Minimum 80% average required to qualify.

2021 Summer

NSERC USRA

Received grant to support undergraduate research in mathematics.

2020 & 2021 School Years

Cecil G. Gracey Memorial Continuing Scholarship

Awarded due to academic performance among students entering their second year in the honours mathematics program. Continues for two additional years. Minimum 85% average required to qualify, 80% to continue.

2020 Winter

Borwein Memorial Prize

Attained the highest mark in Real Analysis I (Math 2122).

2019 & 2020 School Years

Dean's Honour Roll

Achieved a year average of at least 80% with no failures, taking at least 4.0 courses.

2019 Fall

Western Scholarship of Excellence

Had a university admission average at or above 90%, but less than 95%.

Work Experience

2021 Fall (on-going)

UWO Mathematics Department

Undergraduate Marker

Marking assignments and exams for Mathematical Structures (Math 2155).

Course covers logic, proof techniques, set theory including relations and functions, and elementary number theory.

2021 Summer

UWO Mathematics Department

Research Assistant

Researched mathematical physics, in particular topics in quantum state geometry and information theory. Supervised by Dr. Tatyana Barron.

Examined various quantum entanglement measures and their geometric relationships. A specific focus was given to the entanglement of formation of the states associated to certain submanifolds of the product of two Kähler manifolds.

Academic Activities

2021 Fall — **MaCAW x PASA Coffee Seminar Talk**

Title How to Differentiate a Function That Has No Derivative

Modified Abstract A Sobolev space consists of functions which admit weak derivatives. Being a Banach space, it is more well-behaved than the space of differentiable functions. Its definition is motivated by the Dirichlet problem, which is then solved via Stampacchia's theorem.

2021 Summer — **Summer of Math Exposition Entry**

Title Spectral Theorem For Dummies

Created an animated video on the spectral theorem for normal operators in collaboration with Jacqueline Đoàn. Inner products and orthogonal projections are introduced to provide a geometric interpretation of the result. Over 30,000 views on YouTube.

2021 Summer — **CUMC Student Talk**

Title A Mathematical Definition of Entanglement and Its Measurement

Modified Abstract Entangled states are formalized as operators over the tensor products of Hilbert spaces. On certain states, known as pure, the level of entanglement may be measured by entanglement entropy. This value may be extended to all states by the convex roof construction, yielding entanglement of formation.

2020 Fall — **DRP Final Presentation**

Title The Jordan-Brouwer Separation Theorem

Modified Abstract Hypersurfaces in Euclidean spaces formalize the notion of curves on a plane. The Jordan-Brouwer separation theorem says that certain hypersurfaces always have an inside and outside. The notion of transversal intersections and homotopic maps are introduced to give a visual proof, by counting the winding number of the hypersurface around a ray.

2019 Fall — **William Lowell Putnam Mathematical Competition**

Scored 3/120, ranking 1831.5/3428.

Clubs & Committees

2021 Summer — **Canadian Undergraduate Mathematics Conference ('CUMC')**

Committee Member

Created a new website for this and forthcoming CUMCs. Implemented desktop and mobile support, and bilingual localization (English & French).

Organized the career and mathematical communication panels, and sought out instructors for the Lean and Beamer workshops.

2020 Summer — *Committee Member*

Responsible for the software to rapidly move the conference online due to Covid-19.

Organized the career panel.

2020 & 2021 School Years (on-going)	**Math Club at Western ('MaCAW')** *VP Academics* Launched biweekly mathematics contests available to all undergraduate students, and helping write and grade these contests. Introduced student seminars, an opportunity for undergraduate students in mathematics or related disciplines to share their independent studies and projects.
2019 School Year	*Secretary (Pure Mathematics)* Co-ran weekly problem solving sessions, teaching recreational mathematics to and solving contest problems with other undergraduate students.

Volunteer Activities

2020 Fall	**Fall Preview Day** *Student Ambassador* Represented the UWO mathematics department in the science faculty events. Answered questions from prospective students regarding mathematics courses and modules.
2020 Summer	**SmartStart: Academics** *Panellist* Represented MaCAW at the mathematics department meet-and-greet session. Answered questions from incoming UWO students regarding the transition from secondary school to university.

Skills

Programming	Performed mathematical computations in **Python**, such as solving differential equations and implementing cryptographic protocols. Used **R** to analyse data, carry out statistical simulations, and generate visual aids. Implemented symbolic calculations in **Mathematica**, specifically to compute entanglement measures. Published several static websites written in **HTML**, **CSS**, and **Javascript** (**React**).
Design	Proficient in LaTeX, typesetting both text-based and mathematics-based documents. Knowledge of Ti*k*Z, creating plots and commutative diagrams. Familiar with Manim, a Python library for animating mathematics, such as dynamically tracing out functions and visualizing linear transforms on vectors.