QUEEN'S MATHEMATICAL
COMMUNICATOR
FALL 2021
An aperiodical issued by the
Department of Mathematics and Statistics
Queen s University, Kingston, Ontario, Canada K7L 3N6

WELCOME FROM THE HEAD, JAMIE MINGO

As I write this, the new Head of Department, Troy Day, has started his term, so this is my last Welcome from the Head. In the past 5 years the Department has seen steady growth in all our programs. We have hired many new faculty and staff, and have a fresh outlook and youthful bounce to our teaching and research. In part, this has been made possible by a new budget procedure in the Faculty of Arts and Science that grants more autonomy to departments. In addition the Department has been the beneficiary of many generous gifts from alumnae and alumni. In particular, I am very pleased to report the establishment of a new postdoctoral fellowship, the Coleman-Taylor Postdoctoral Fellowship, made possible by a generous gift from Susan Loube, BSc'75 (Biochemistry) and Bill Acton, BSc'75 (Math). This fellowship honours the work of our Communicator editor and former Head, Peter Taylor, and long-time Head (20 years) John Coleman, who provided scientific, pedagogical, and administrative leadership to the Department over a period going back 61 years.

We have all struggled to adapt to the new world of COVID-19. We have been forced to think hard about science and society. The mathematical and statistical models needed to formulate public policy depend on results in fundamental mathematics and statistics developed long before COVID-19. That research was done mainly to satisfy our curiosity about the world. When our students learn that they too can participate in this quest, it awakens a yearning to contribute to the huge trove of statistical and mathematical knowledge that we draw on in times of crisis such as these. With our new appointments, we are in a strong position to meet the needs of these current and future students.

DEPARTMENT NEWS

TROY DAY AND ONTARIO'S FIGHT AGAINST THE PANDEMIC

Photo by Jennifer Roberts.

In last year's issue we reported that Troy had been chosen to be on the Ontario Modelling Consensus Table. This group, along with a number of other groups of experts of different kinds have been closely engaged for over a year now in developing new understandings of the rapidly evolving COVID-19 pathogen.

This past June, Troy rose to sudden prominence in the public media around the discussion of the new "delta-variant" B.1.617, which was rapidly increasing in frequency. It turns out that, last December, before most people knew what a variant was, Troy had already begun a mathematical study of COVID variants.

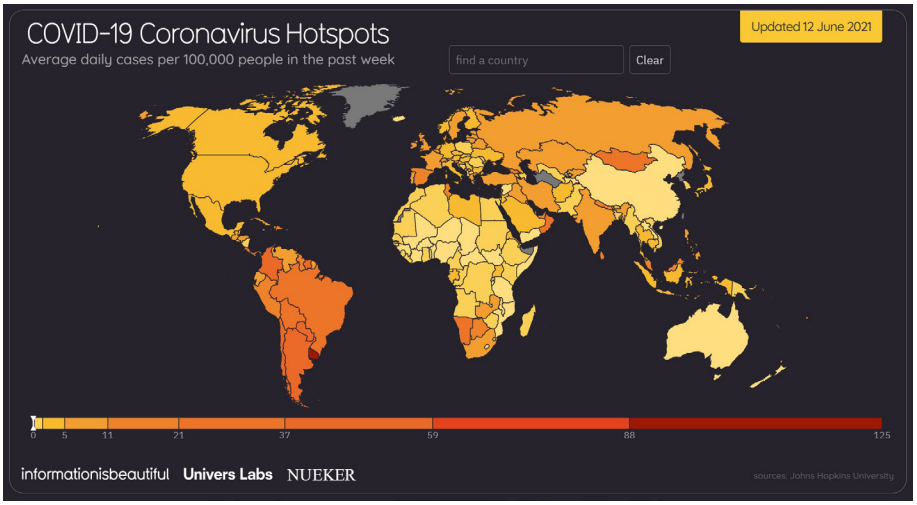
What Troy studied was how the behaviour of a variant can depend on the value of a number of model parameters, leading to different infectivities, different mortalities, and different responses to vaccination schedules.

His engagement with these effects was recently discussed in the Queen's Alumni Review:

One significant finding around the delta variant is that two doses of the vaccine were found to give significantly more protection than one (something like 70% as opposed to 30%) and that in fact is what caused Ontario to change course from their "one-shot in every arm" policy to a more rapid provision of the second dose.

Certainly, one striking effect of the pandemic is a new public awareness of the role of abstract models, in predicting, not only the behaviour of the pathogen, but also the effects of different kinds of responses, such as handwashing, wearing masks, and opening schools.

Every day, in discussions on the media and in the news, we see examples of exponential change and logarithmic scales. Mathematics is the language not only of science, but of the world.



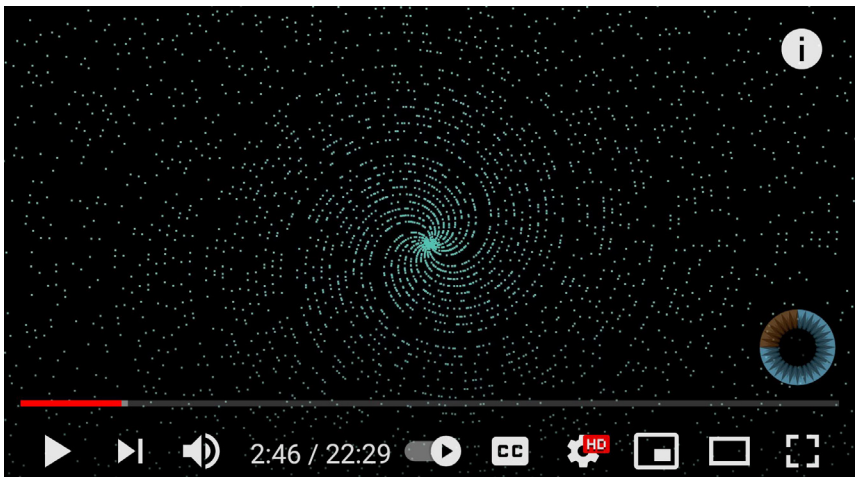
RAM MURTY

THE FIELDS INSTITUTE ACADEMY PROGRAM

The Fields Institute offers graduate level courses through its Academy program. Each December there is a call for proposals for these courses from the Institute's nine Principal Sponsoring Universities, of which Queen's is one. This year Ram Murty's proposal for a course on Probability and Number Theory was accepted. Ram will teach this course in Winter 2022.

Number theory deals with the study of the distribution of prime numbers. Since prime numbers seem to behave randomly, it is not surprising that methods of probability theory can be used to study their distribution. The 20th century gave birth to a new field of mathematics called probabilistic number theory and this new field is still in evolution. It has already revolutionized our understanding of prime numbers but there are still some new challenges ahead. This course will explore some of these themes and it will be accessible to graduate students in all Ontario universities.

Editorial Comment
Ram says that "prime numbers seem to behave randomly" that certainly hasn't stopped generations of mathematicians from trying to find patterns in primes. I recall being struck when I laid eyes on this striking spiral pattern, recently discussed in one of Grant Sanderson's 3blue1brown videos:
Here we take all the pairs of primes: (2,2), (3,3), (5,5), (7,7), (11,11), …and plot them in polar coordinates, so that the point (p, p) is plotted a distance p from the origin at an angle of p radians with the positive x-axis, then the points form these spiral patterns. Is that not a striking "non-random" pattern in the primes?



No it is not, as Grant explains in his usual masterful way; rather the pattern would be seen, and even more clearly, in a plot of all integer pairs (n, n). So, it really has nothing to do with primes and Ram's assertion is not contradicted. But Grant, true to form, plays with it anyway and leads us to a wonderful theorem of Dirichlet (1837) about the distribution of the last digit of large prime numbers (not only in base 10)!

DEVON LIN

PROMOTED TO FULL PROFESSOR

I am honored to receive this promotion. I joined the Department of Mathematics and Statistics at Queen's University in 2008 right after I obtained my doctoral degree from Simon Fraser University. I am very fortunate and grateful to work with excellent undergraduate and graduate students, outstanding colleagues, and dedicated staff in this department.

I was Chair of Undergraduate Studies during 2016-2019 and witnessed the exponential growth of our mathematics and statistics undergraduate programs. The number of concentrators was more than doubled such that our second-year core courses such as MATH 280 and MATH 281 had to be split into two sections.

I enjoy teaching and have found it very rewarding particularly when students write back to me after their graduation to say that what they learned from their courses was useful in their career. I enjoy watching students grow, evolve, and progress academically and socially. This enthusiasm as they learn, and master new ideas is one of the best parts of my job.

I am also very fortunate to have a group of graduate students and collaborators sharing similar research interests. These primarily in efficient data collection and statistical analysis. Undoubtedly, data is everywhere, and data is the new oil. Good data is power. It is the key to scientific discoveries, disruptive technology generation, the development of new products, and the improvement of processes. Getting good data can be complex, costly, time-consuming, or even sometimes impossible, without innovative methods. One powerful indispensable way to acquire good data is through the design of experiments. Through experiments, data is collected and used to investigate processes and products. I have also made contributions to uncertainty quantification, computational statistical methods, and their applications to the physical sciences, engineering, and the social sciences.

With colleagues from SFU at the 2018 annual meeting of the Statistical Society of Canada at McGill

FELICIA MAGPANTAY

PROMOTED TO ASSOCIATE PROFESSOR

Felicia works with our Mathematical Biology Group and this past year taught BIOM 300 our key course for the Mathematics and Biology Specialization.

Her research objectives are to derive new methods in mathematical analysis and statistical inference to aid in our understanding of infectious disease systems. The focus will be on systems that exhibit long-lasting transient dynamics (e.g., the honeymoon period of childhood diseases after the start of mass vaccination campaigns) and complex dynamics arising from delays in the system (e.g., the effect of delays in public health interventions during epidemic outbreaks). Other work focuses on numerical analysis and the stability of state-dependent delay differential equations.

And just this past July it was announced that Felicia was awarded a John R. Evans Leaders Fund grant.

FRANCESCO CELLAROSI

PROMOTED TO ASSOCIATE PROFESSOR

I am humbled by this promotion and I am excited to continue working in the Department of Mathematics and Statistics. Since I joined Queen's University in 2015, our department has expanded by hiring several talented mathematicians and statisticians, and I am grateful for such an interactive environment in which the exchange of ideas across different fields has made me a better scientist and educator. In addition to my colleagues and students, I want to extend my gratitude to the wonderful staff of the department.

As a proud Queer mathematician, I have personally experienced a very inclusive environment at Queen's, for which I am grateful, but I do recognize that we have a long way to go to make our offices and classrooms even more welcoming to all equity seeking groups. I have served on the Equity, Diversity, Inclusion, & Indigeneity Implementation Committee of the Faculty of Arts and Science for two years; working together through difficult conversations (involving students, faculty, and staff members) we tried to provide resources and identify best practices to address the biases and dismantle the institutional barriers many marginalized groups face. I hope our department will not shy away from such important tasks in the years to come. As a member of SPECTRA (an association of LGBTQ+ mathematicians and their allies) and QUAQE (the Queen's University Association for Queer Employees), I wish to continue supporting inclusivity in our academic community.

My research has been focussed on the interplay between Probability Theory, Number Theory, and Dynamics. I am interested in studying to what extent number-theoretical objects behave in a random fashion. Probabilistic questions in the context of Number Theory can rarely be answered with purely probabilistic tools, since such problems naturally lead to sequences of strongly dependent random variables. Dynamics and Ergodic Theory provide the right tools to address such problems. For instance, the randomness (or lack thereof) in the square-free integers one tackled by studying the spectral properties of certain symbolic shifts, and to understand the limiting behaviour of certain exponential sums one can use flows on homogenous spaces. I also find the applications of some of these ideas to problems in Mathematical Physics very exciting.

In the past few years I have supervised (or co-supervised) three postdocs (Maria Avdeeva, Jory Griffin, and Abdul Zalloum) and two graduate students (Tariq Osman and Neil MacVicar), and sat on numerous MSc and PhD thesis committees. I have learnt a lot from these incredibly dedicated people, and I look forward to sharing more exciting mathematical discoveries with students, postdocs, and colleagues.

I have taught several undergraduate and graduate courses since I joined the department. Particularly dear to me are MATH 120 (Differential and Integral Calculus), MATH 328 (Real Analysis), MATH 427/827 (Introduction to Deterministic Dynamical Systems), MATH 429/829 (Functional Analysis and Quantum Mechanics), and MATH 895 (Core Probability Theory). The interaction with students at all levels is one the most inspiring parts of academic life. I enjoy spending time discussing math with them, challenging them with exciting problems, and witnessing the "aha" moments when some seemingly distant concepts come together.

NEW DEPARTMENTAL APPOINTMENTS

TROY DAY
DEPARTMENT HEAD

There's an old saying that if you want a job done well, pick the busiest person you can find, and Troy might well fit that description. He began his time at Queen's as a PhD student and indeed won the NSERC Doctoral prize upon his graduation. After a time at UBC and Toronto, he found his way back to us (perhaps it was the joys of living in Yarker) and sparked a revitalization of our Mathematical Biology Group with a strong focus on the evolution of disease (just in time, you might indeed say).

While his research is known world-wide, he has also contributed to undergraduate education with a textbook on evolutionary ecology with Sally Otto at UBC aimed at senior students and a calculus text with Jim Stewart popular for life-science students.

SERDAR YÜKSEL
CHAIR OF MATHEMATICS AND ENGINEERING

Serdar's research focuses on the ways in which the rate and the quality of the information that can be accessed affects our capacity to control and stabilize a dynamic system. For example, if the information is incomplete, or arriving at too slow a rate, or is corrupted, how does that change our decision-making and what is the ultimate effect on the optimum stable performance of the system?

These questions are central to optimal control and intersect with areas of topology, geometry, game theory, coding theory and, of course, probability.

Serdar writes: Despite my consuming work, I am happy to serve as the chair of our celebrated Mathematics and Engineering Program. This program is a source of pride not only for our Department and Queen's FAS and FEAS faculties, but for Canada at large also, as it serves our society immensely by training highly qualified individuals towards a diverse collection of intellectually rewarding careers.

ANDREW LEWIS
ASSOCIATE HEAD

When asked to comment on this significant event, Andrew shifted into his well-known bullet-point mode.

Andrew is very very excited about being asked to act as Associate Head. This is not hard to believe. The job is rife with letters, emails, reports and schedules--like meeting job candidates at 8 in the morning at the Belvedere Hotel, all being aspects of administrative life that Andrew thrives on.

He has weathered the pandemic, holed up in his home on Loughborough Lake, on sabbatical, with his partner Jane and their 3-4 dogs

His research efforts are directed at using differential geometry and functional analysis to understand finicky stuff about differential equations

And in the two years before his 2020-2021 sabbatical, Andrew developed a strange system-theory course (MTHE 335) and hopes to teach less strange subjects some day.

We just missed Andrew. He was sitting in the southern-most chair watching the setting sun. Andrew keeps a rigid schedule and is always on time. It is the photographer who was late.

WE WELCOME A NEW MEMBER OF FACULTY

DR. KEXUE ZHANG

Kexue Zhang started a 3-year appointment as an Assistant Professor on July 1, 2021. His main responsibilities will be teaching in our first- and second-year programs in both Engineering and Arts & Science.

Kexue graduated from China University of Petroleum with a BSc and an MSc degree both in Applied Mathematics. He received a Ph.D. in Control Theory and Control Engineering from Shandong University, China, and a Ph.D. in Applied Mathematics from the University of Waterloo. He then joined Queen's University as a Coleman Postdoctoral Fellow. Before moving back to Kingston, he held a PIMS Postdoctoral Fellowship with the University of Calgary.

Kexue's research interests revolve around hybrid systems and control. More specifically, he is interested in differential equations on time scales, time-delay systems, impulsive systems, distributed control, and optimization.

In his spare time, Kexue enjoys hiking, ice skating, and playing volleyball. He is looking forward to re-exploring the local region.

FAREWELL TO...

BAHMAN GHARESIFARD

JULY 2021

Bahman Gharesifard accepted a position at UCLA, Electrical & Computer Engineering Department starting July 1, 2021.

This is certainly a loss for us, but we plan on keeping close contact with him over the years. He was one of our outstanding PhD students, graduating in 2009, and after postdoctoral fellowships at University of California, San Diego and University of Illinois, Urbana-Champaign, we lured him back to Queen's to join our Engineering & Applied Science Group.

Last year's Communicator featured an article celebrating Bahman's Humboldt Research Fellowship which provided details of his research. His interests lie within the areas of systems and controls and intersects with network sciences and graph theory, stochastic processes, algorithm design, machine learning, social and economic networks, and game theory. And his students loved him: in his short time here, he won the Engineering First-Year Instructor Teaching Award not once but twice.

As a final editorial note, a top researcher like Bahman has almost a duty to take on the kinds of new challenges and opportunities for growth that the position at UCLA offers. But this was still a tough decision for him and we have great hopes that we might find him back at Queen's one way or another one day.

STUDENT AWARDS

DAMARA GAGNIER

MEDAL IN MATHEMATICS AND STATISTICS

Awarded annually to the graduating candidate who has demonstrated academic excellence in an honours degree with the highest standing in Mathematics and Statistics courses.

THE IRENE MACRAE PRIZE

Established by Margaret Crain in memory of Irene MacAllister MacRae, Arts '14, who was vice-president of the Mathematical Club while at Queen's. Awarded to the medalist in Mathematics and Statistics.

Having always liked sciences, for a long time I thought I should grow up and be an experimentalist, wear a white lab coat, and do whatever it is kids think scientists do.

Eventually, when it came time to apply for universities, I realized that I cared more about the inner workings of things; I liked to learn what really made things tick, without giving as much thought to error and the pains of physically realizing ideas. It was upon this realization that I set myself on a path to major in math.

Of course, like most high school students, I didn't really understand what math was at the time. Luckily, as first year progressed and the epsilons and deltas rolled in, I found that math and I fit together as well as ever. And with Queen's math came the amazing community. I spent much of my free time in the Math Help Centre and the Undergraduate Student Lounge (old and new), solving problem sets and playing games of Set with my peers. Every Thursday of the cold winter months was spent in the Jeffery Hall basement at Math Club, learning about some novel and fun topic over pizza. On Pi Day came pi recitation contests and baked goods. Even as pandemic measures set in, I never lost this great sense of community. We still kept in touch, sharing math memes and voice calling on weekends.

This fall I will continue to study, now at UBC, learning broadly about combinatorics, statistics, and number theory. I'm looking forward to whatever the future brings, but I will always look fondly on my time at Queen's.

EMILY WRIGHT

MEDAL IN MATHEMATICS & ENGINEERING

Awarded annually to the graduating candidate who has demonstrated academic excellence in an honours degree, and who is deemed by a Department to have achieved the highest standing in a Plan offered by that Department.

J.B. STIRLING GOLD MEDAL
ONTARIO PROFESSIONAL ENGINEERS FOUNDATION OF EDUCATION MEDAL FOR ACADEMIC ACHIEVEMENT

These two awards are Faculty-wide. In both her final year and throughout her four years at Queen's, Emily has earned the highest academic standing in the Faculty of Engineering and Applied Science.

Following my graduation from Queen's, I will work towards an M.Sc. in Physics at the University of Victoria. My research will focus on quantum control and quantum algorithms in the presence of noise.

The span of the coursework involved in the mathematics and engineering program, which included topics in electromagnetism, programming, and digital systems, coupled with the foundational first year for all engineering students at Queen's gave me the confidence to apply to a program in a different department from my bachelor's degree. I believe my background in mathematics, particularly in linear algebra and control theory, will allow me to devise innovative solutions for problems in the field of quantum computing.

Beyond my master's degree, I anticipate pursuing a Ph.D., although whether that be in mathematics, physics, quantum technology, or something else entirely is undetermined. While I presently envision beginning work in the quantum computing industry, I aspire to have a varied career spanning other interests such as sports analytics or architecture. I hope that as I continue to grow, the mathematics and engineering program also evolves, welcoming a more diverse student body and faculty alike.

The mathematics and engineering program at Queen's was a fantastic academic challenge; however, I still found the time for my other passions including triathlon, rock climbing, swing dancing and hockey. I had a great time at Queen's University, and I will always fondly remember hours spent in the "Apple lounge" collaborating on assignments with my friends!

Emily is an amazing student; full of energy and ideas, and enthusiasm for learning. Even though one of my classes started at 8:30am, she was up at 5:30am Vancouver time just to attend the synchronous sessions and didn't miss a class!
Serdar Yüksel

BRIELLE THORSEN

QUEEN'S ENGINEERING STUDENT EARNS ORDER OF THE WHITE ROSE SCHOLARSHIP

Brielle Thorsen graduated from the Queen's Mathematics and Engineering program in 2020 and is now doing graduate studies here in Mechanical Engineering. In December it was announced that she was the 2020 recipient of the Order of the White Rose scholarship.

The $30,000 scholarship is awarded annually by the Polytechnique Montréal administration to a woman engineering student who intends to undertake graduate studies in engineering (Master's or PhD) at the institution of her choice, in Canada or elsewhere in the world.

Polytechnique Montréal created the Order of the White Rose as a tribute to the victims as well as the wounded, the families, the faculty members, the employees and the students who were forever affected by the 1989 Montreal Massacre. White roses have become the symbol of Polytechnique Montréal's commemorative activities to mark the tragedy.

"I want to follow in the footsteps of my father, who is also an engineer," Thorsen said in a statement. "Throughout my academic career I've had the opportunity to explore different facets of mechanical engineering. I'm now in a position to make an informed choice about what inspires me most, which is specializing in sustainable energy. I am a strong *nehiyaw iskwew* (Cree woman) and a fearless female engineer. I plan to use my knowledge to benefit Indigenous communities in the North, and to run my own business." Brielle is a member of the Saddle Lake Cree Nation.

In addition to her studies, Brielle has worked in robotics engineering for the Counter-Terrorism Technology Centre at Defence and Research Development Canada as well as in engineering data management for Suncor Energy. Since January 2021, she has been a member of the Circle of Advisors to the Aboriginal Access to Engineering initiative of the Faculty of Engineering and Applied Science. The Circle is made up primarily of Indigenous leaders in engineering, business, and education, with an aim to provide guidance and support to the Director, while simultaneously retaining focus on a broad range of Indigenous voices, cultural values and practices.

Brielle was on the women's varsity rowing team in her first year at Queen's (2016) and represented Team Alberta at the 2017 Canada Summer Games in the women's single and double sculls

Queen's Engineering Dean Kevin Deluzio, also a Mathematics and Engineering graduate, expressed his congratulations: "Brielle has overcome a number of obstacles not only to thrive in engineering, but to become an inspiration to young women and Indigenous youth," he said. "It is particularly important to celebrate and support the accomplishments of young engineers who face systemic challenges in both our schools and the profession. Brielle's courage and resilience in not only overcoming sexual violence and discrimination, but being willing to speak to it, is a call to action for all of us.

Read more about Brielle Thorsen and the Order of the White Rose scholarship on the Polytechnique Montréal website.

EVAN ARSENAULT

ANNIE BENTLEY LILLIE PRIZE IN MATHEMATICS

Awarded to a graduating student in Mathematics and Engineering who has the highest average on courses in mathematics in the final year.

"I don't know why I chose the Apple Math program, but I'm glad I did. I've really grown to love mathematics and the way it gives a beautiful answer for a complex problem, not to mention the immense satisfaction of struggling with a theorem until it suddenly shifts to clarity. The faculty and staff from the Math department at Queen's, in addition to my friends from the program, helped develop a great community that made learning math all the better. The late nights of group-study at Jeffery Hall were some of my favourite experiences at Queen's, and I'm eternally grateful for that opportunity.

I hope to foster a similar sense of community this fall when I start a Master's of Applied Science at the University of Toronto. The Apple Math program introduced me to the field of control theory and I'm excited to learn more through my research in safety for autonomous systems. It's become a dream of mine to direct my passion for math into research, and I hope I'll be able to share that passion with future generations as a professor one day."

From left: Katie Noble, Riley Cooper, Evan Arsenault, Quinn Yetman, Grace Waddington
Applemath '21

ADAM PUKIER

D.S. ELLIS MEMORIAL AWARD

An Engineering Faculty-wide award to the graduating student who, in the opinion of classmates, has contributed to university life through extra-curricular activities and athletics.

After my first year of studies, I elected to specialize in mathematics and engineering without any hint of a plan. Little idea what I wanted to pursue as a career, I picked the Applied Mathematics program because I thought it would be challenging and open doors in the future. Both facts held true after three years of study; yet, I struggled mightily trying to understand where I would go with my degree. I enjoyed the rigorous thinking taught by Thomas Barthelmé and Andrew Lewis in my second- and third-year courses respectively. However, it was exactly that, the way of thinking – the logical progression of ideas — that gave me excitement, less so the technical application of our content. Searching for where I could apply my mathematics, I reached away from the classroom.

Adam celebrating Queen's triumph over McGill in the 2018 National University Ultimate Championships.

Inspiration came from the more personal interactions I had outside of lecture. I spent time competing with the Queen's' Ultimate Frisbee team while also working on a team of students managing many competing interests to more warmly welcome incoming engineers to our faculty. Further, many of the more engaging discussions I was part of at Queen's occurred with the RabbitMath team as we struggled to tailor both a challenging and teachable curriculum to high school students. It was these moments – observing and resolving conflict outside the class, which inspired me to pursue legal studies this coming fall.

On a moments' thought, law school is as far away from mathematics and engineering as one can get. In some sense, that is exactly the point! Dig a little deeper, and the connection to Apple Math jumps out: rather than working from first principles in math, I will be doing so in English – taking established principles and building more complex structures. Instead of the goal being to improve upon technology, it will be to resolve conflicting relationships.

I am thrilled to be beginning my legal education at the University of California, Berkeley this fall. Berkeley is a place where I will be able to take full advantage of my mathematics education and technical background in the legal field. I do not feel as this is the end of my math education. The past four years taught me how to think – both creatively and logically. This type of thought will not end in law school; it will just change shape. In fact, this way of thinking is crucial in resolving legal disputes.

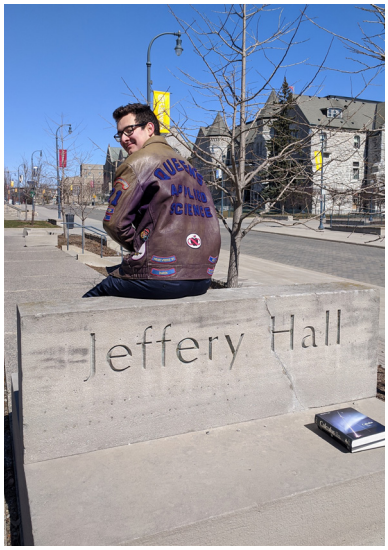
These next steps and my past four years would not be possible without the opportunities Queen's, and particularly Apple Math, afforded me. I have been surrounded by the brightest individuals I have ever met; my closest friends and I bonded by sitting outside under the sun after each Signals lecture as we prodded each other in the (sometimes futile) attempt to understand each of Dr. Lewis' ideas. Yet this is only possible because of the broader familial feel that is Queen's and Queen's Engineering. I will miss the comfort of walking into Jeffrey Hall basement and seeking out a peer to walk me through a proof on the blackboard just as I will equally miss taking a Friday afternoon off with those same peers to enjoy an early weekend at Clark Hall Pub. I look back on the most challenging four years of my life with immense gratitude; thank you to the dedicated professors and committed students that made my time at Queen's fulfilling and rewarding.

DAVID HOSKIN

PETER R. WHITE MEMORIAL AWARD

An Engineering Faculty-wide award to the graduating student who has made the most outstanding contribution to the creative arts and the development of inter-personal relations both on and off campus.

David's Reflections on Education



I still clearly remember the day in high school chemistry when our teacher Mrs. Lai, was demonstrating trends in the periodic table. She had a large plastic shield setup on the lab counter with many beakers and chemicals waiting behind it. She started by cutting a small chunk of Lithium metal and dropping it in a beaker filled with water. As soon as the Lithium hit the water, it started to spark and sizzle. It was amazing to see but I know we were all glad to have the plastic shield between us and the beaker. Next, she cut a small piece of Sodium metal, smaller than the piece of Lithium and dropped it in a new beaker of water. The reaction was even more powerful with the sodium catching fire on contact. Finally, she cut the smallest piece of Potassium metal and dropped it into the last beaker of water. The reaction between the Potassium and the water was astounding, purple flames sparked and danced across the water. Through a simple demonstration, she had found a way to connect the abstract idea of periodic trends and make it something real and exciting.

Mathematics is a beautiful subject but is often quite abstract and as a student there were times that the concepts we were learning felt far away and in a different world. I always found value in connecting abstract ideas to something visual, or to an applicable problem. Anchoring abstract ideas to something concrete was a way to see it from a new perspective and understand it on a deeper level.

I have been incredibly lucky throughout my education to have been taught by many passionate and amazing instructors. Instructors that find a way to make their course seem like the most exciting thing in the world. The passion and joy the professors in the math department felt for their subjects was infectious for their students. That passion can make all the difference for students as it can make even the hardest courses feel like a challenge worth taking.

Beyond just the classroom, some of the most valuable learning opportunities came when studying with my peers. I will always look back fondly on those afternoons and evenings spent in Jeffrey Hall discussing mathematics and engineering problems. In third year, there was a bi-weekly ritual of meeting up in one of the empty classrooms and studying hard for that week's quiz. The spirit in those rooms was something special, everyone was eagerly sharing ideas and their thoughts on concepts. Some of the best learning was done in those rooms as we all shared our joy for the subject while doing our best to make sure everyone felt confident in their understanding.

To me learning isn't something that can be done totally alone and on an island. Learning is at its best when it is done with passion and is shared with those around you. When we face challenges the support of a professor or a peer can make all the difference. Working with others we can gain a new perspective and see an idea in a way we never would have otherwise.

I had an amazing four years at Queen's in the Mathematics and Engineering program. I am so grateful to all the professors and my peers for everything they taught me. I will treasure the memories of my time in this special place and the lessons I learned. Most of all I will treasure the friendships I made.

ANDREW VASILA

ENGINEERING SOCIETY AWARD

Awarded by the Engineering Society to honour a student who contributed considerably to the welfare of the Engineering Society

As an individual who always had an interest in pursuing a career within capital markets, rather than a traditional engineering, I believed that the Mathematics and Engineering program would provide a balanced foundation upon which I could pivot towards my professional field of choice. While I may not be continuing in a field which employs the specific strains of mathematics embraced by our program, I am undeniably grateful for the friends that I would not have had the opportunity to meet without the program.

Since graduating, I have continued my work with Mackenzie Investments as an Investment Analyst in the Global Fixed Income team. Additionally, I will be completing my Bachelor's in Economics in December 2021, providing a qualitative supplement to complement the quantitative fundamentals which I further developed through the Mathematics and Engineering program. I have been involved in the formation and continued oversight of our team's quantitative models to further the investment research and portfolio management behind the Mackenzie collection of Socially Responsible Investment products. Taking a data-driven approach to analyze corporations and governments through the lenses of economic opportunity and ESG (Environmental, Social, Governance) sustainability has been an great opportunity to apply my mathematical background in my past, present, and future endeavours.

As a member of the Engineering Society, in addition to the faculty of Queen's Engineering, and the Mathematics and Engineering program, I believe that I have had an incredible opportunity to engage with a wonderful group of individuals coming together to promote excellence in all facets of the Queen's engineering experience. From our first week, when we came together to climb the fabled "Grease Pole", to our (admittedly virtual) Iron Ring ceremony, I have witnessed transformative changes in accessibility and inclusivity while continuing to embrace the historic spirit for which we have always been known.

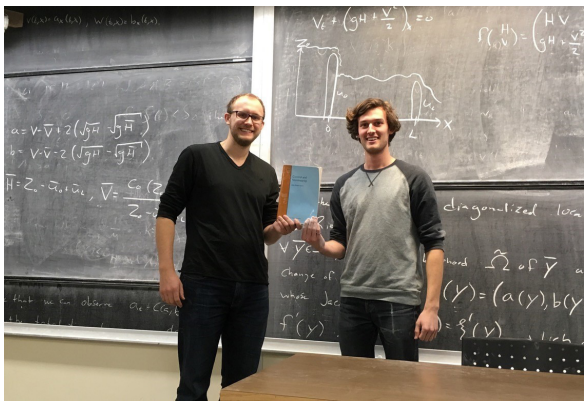
I would like to thank the friends and colleagues who have made the past four years of my life some of the most formative. I am proud to be a Queen's alumnus and leave the university grateful for the opportunities of the past four years, humbled by the continued achievements of my peers, and significantly better at the game of foosball.

DREW STEEVES, BAHMAN GHARESIFARD, AND ABDOL-REZA MANSOURI, "CONTROLLABILITY OF COUPLED PARABOLIC SYSTEMS WITH MULTIPLE UNDERACTUATIONS," SICON 57 (2019) PP. 3272-3296

SIAM ACTIVITY GROUP ON CONTROL AND SYSTEMS THEORY BEST SICON PAPER PRIZE

COMMENTS BY DREW STEEVES

Studying at Queen's was a revelatory experience for me. One highlight was a weekly partial differential equations (PDEs) seminar that I participated in with friend and fellow student Jeremy Coulson, which was led by our MASc advisors, Bahman Gharesifard and Abdol-Reza Mansouri. The long hours we spent deciphering the existing literature on control of PDEs piqued my interest enough to make this topic the focus of my MASc thesis. On several occasions, these afternoon seminars ran into the evening, as Jeremy and I toiled away on blackboard and flipboard alike while Bahman and Abdol-Reza patiently clarified bewilderment and illuminated meaning.



LtoR: Drew Steeves and Jeremy Coulson. Photo Bahman Gharesifard

Over the many months of our seminar, I noticed that the fourth floor of Jeffrey Hall was frequently used in the exact same capacity by many other students/advisors. I believe this to be a unique feature of Queen's Math & Stat.—the time and effort that advisors contribute to training their students is probably unparalleled. Another key facet of my experience at Queen's was the tolerance for small defeats: those research efforts that lead to dead ends; mistakes that invalidated a key lemma or proposition. It was through these missteps that I learned how to conduct research, while the generous time commitment of my advisors insured these ventures by ensuring my progress was commensurate with the MASc degree.

I was elated when I received the news that our two-part paper—my first ever journal paper, which summarizes my MASc research—was accepted to be published in the SIAM Journal on Control and Optimization; this great news came after enduring a long and unfamiliar review process to me, where Bahman and Abdol-Reza's guidance undoubtably ``clinched the deal''. Naturally then, I felt astonished, humbled, and then honored after receiving the news that our paper had been selected for the 2021 Best Paper Prize. Our paper studies the controllability of coupled parabolic systems, which arise in, e.g., wildfire, epidemic and lithium-ion battery modeling, and it leverages tools from functional analysis and differential geometry.

I am currently finishing up a Ph.D. at the University of California, San Diego, where I have enjoyed fruitful and also dissimilar lessons than those that educated me at Queen's (e.g., mind the stingrays when wading into the water for a surf session). I've carried on researching control of PDEs but have broadened my scope to advance a few new mathematical tools and to tackle some practical engineering problems. I'll continue my research career afterwards in some capacity, but only time can tell what part I will play.

POSTDOC PROFILES

SEOYOUNG KIM

Hi, I am a Coleman postdoctoral fellow here at Queen's University. I have been here since July 2019, right after obtaining my Ph. D. from Brown University in the United States. My research areas include number theory and arithmetic geometry, and their applications to other fields of mathematics.

In fact, as a graduate student, I visited Kingston a while ago for a conference. It was a long journey: I flew from Boston to Toronto and then took a bus from Toronto to Kingston for 4 hours. Unsurprisingly, I arrived very late at night and thought that I arrived in a very obscure corner of Canada. On the other hand, in the next couple of days, I really enjoyed my time in Kingston. I gave one seminar talk and another conference talk. And I had inspiring discussions with Prof. Ram Murty. This greatly improved my Ph. D. thesis as well. I also spent a beautiful time on the shore of Lake Ontario near the Queen's campus.

With all this in mind, I am glad to be back in Kingston. I truly enjoy interacting with everyone at Queen's. Especially I find it rewarding when students find me helpful. Last summer I ran a Polymath Jr. REU Program with 16 different professors and over 420 students from many different countries. Unfortunately, due to COVID-19, all research activities are virtual. On the other hand, we are happy to be connected with different parts of the world through the common denominator, maths!

Seoyoung is beginning her third year with us as a Coleman Fellow.

EMINE YILDIRIM

Now I have some comments on my past year of teaching. I recorded lecture videos and tried to keep them short--15 or 20 minutes, as long math videos can be hard to watch. I made good use of animations—for instance, I used GeoGebra, a free 3D visualization app, and I encouraged my students to use it as well: https://www.geogebra.org/3d?lang=en. The use of GeoGebra to draw parameterized curves helped them to understand line integrals.

I held office hours at different times to accommodate different time zones. For instance, I had one office hour at 10pm on Wednesdays. This was my third time teaching that course and that helped me a lot to be prepared for their questions.

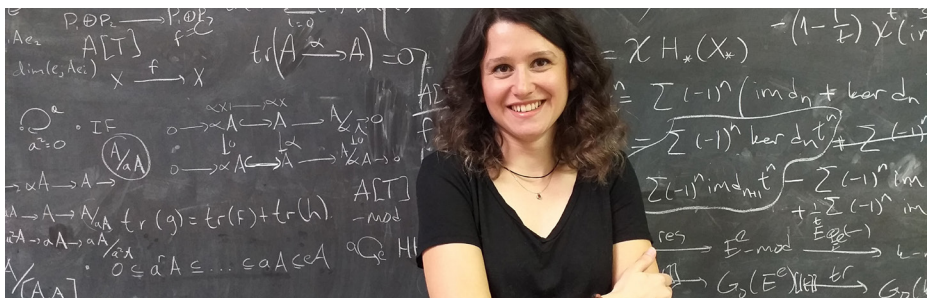
I gave them 24 hours to complete the bi-weekly tests. There were complaints because I expected them to explain their solutions in words, and I discovered that they really don't like to do that. I require this because they can often get the solutions easily online, but to be able to explain in words they really need to understand the solution.

During this year, communication has been difficult, and I was especially careful about responding to student's emails. Sometimes I would meet them over zoom.

Ultimately, I believe that my class size is too large for an online course; I feel that the students will feel more comfortable and be more active in smaller classes.

I am a Coleman Research Fellow in the Math&Stat Department. I obtained my Ph.D. in Mathematics from the Université du Québec à Montréal in 2018. I am interested in representation theory of algebras, and also in cluster algebras, their categorization and the related combinatorics. The combinatorial nature of these algebras allows me to present many examples that capture the beauty of math. This helps young students and researchers to understand the underlying concepts better. For instance, I supervised two undergraduate students, Molly and Elifnaz, at Queen's during the Fall semester in 2019 under the Directed Reading Program. During this program, they studied the fascinating combinatorics of some of these algebras I mentioned before. Molly continues her academic career as a master student. She wrote me back after she was accepted to her program and said, "Every afternoon I spend with you was happy, my true gratitude is beyond any words." It was such a unique experience that I will appreciate forever.

Emine will spend next year as an INI-Simons Postdoctoral Research Fellow at Cambridge University.



RABBITMATH SUMMER WORKSHOP

PETER TAYLOR

This summer RabbitMath is running a virtual high-school math workshop every Saturday from 10 to noon. We have about 40-50 students going into grades 9, 10, 11 and 12. Most are in the GTA. Our objective is not to "teach" them new math, but to give them a technological environment in which they can play with structures and in the process, play with one another. To keep the coding demands light, we are using Desmos for our platform.

We are also working with all these grade levels together, using problems which are called "low-floor, high-ceiling"--everyone can get into the problem but there are different dimensions of sophistication available. We use breakout rooms at different levels, mild, medium and spicy, but it is far from the case that the grade 9's are more likely to be mild and grade 12's to be spicy. We also use an open-room system and throughout the two hours students can wander from room to room and check out the action. I have a wonderful team of Queen's students (graduate and undergrad) working with me.

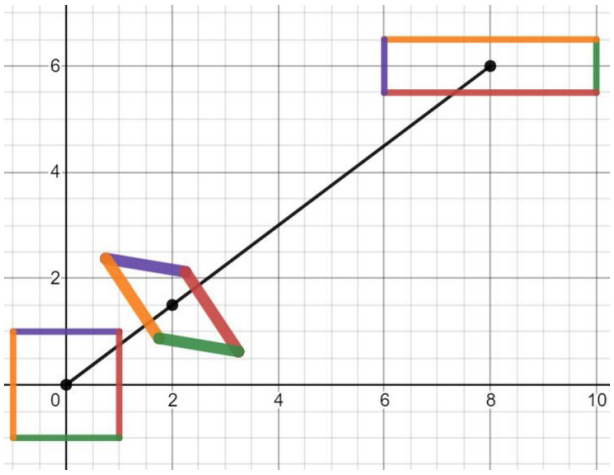
Here's an interesting animation the students were asked to construct. The problem is to transform the starting 2×2 square at the origin into the 1×4 rectangle, with every point moving to its destination along a straight line--perfect for grade 9. As a real bonus, it gives all the students their first experience with the important concept of a parameterized line.

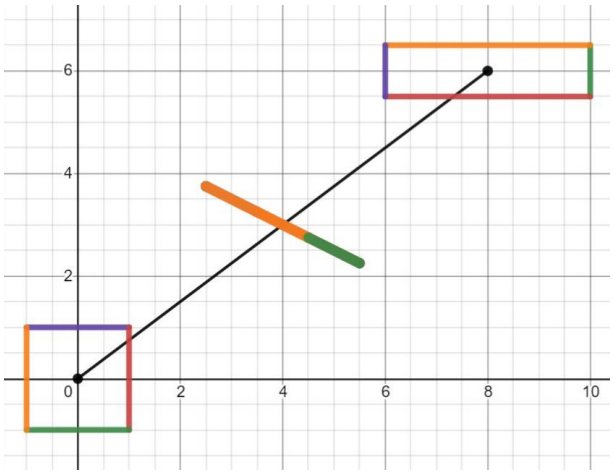
This activity spawns some nice problems. Here's one. Since the square and the rectangle have different orientation, there will have to be a time at which the parallelogram crosses itself. Will that make it a line segment? If so when will that happen? Or can it somehow cross itself without ever being 1-dimensional?

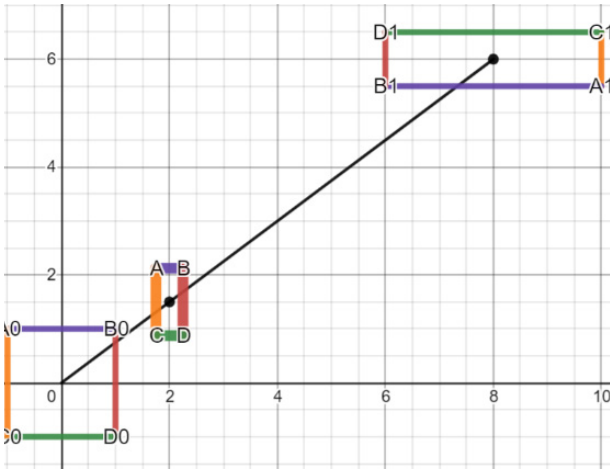
If you watch the animation you'll find that it does become a line and that it happens at half time. Is that expected?

There's some nice exploration here even for a grade 9 student. And for all you Math & Stat alumni out there, there's a lovely linear algebra argument that gives you some good insights. [Hint: try determinants.]

And here's an example that raises some new questions.



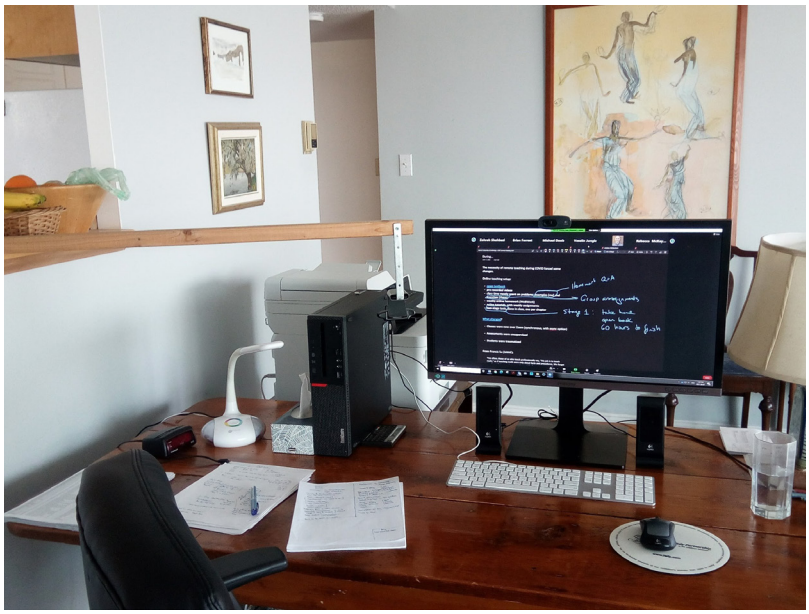




FROM THE EDITOR

Well that sure was a year!—challenges for the teachers and challenges for the learners. My perception is that the greatest challenge for our students was the loss of community. According to my daughters, that was also the greatest challenge for my grandchildren who are in elementary school. However, the two that were in high school seemed to do okay.

In the university, the challenges we faced as "teachers" were quite "instructive," and some of the insights we gained from these will change our ways going forward. One of these was certainly our relationship with technology, and I'll say a bit about that. But of course this new relationship with (and dependence on) technology penetrated every aspect of all our working lives and we are awaiting the fallout (windfall?) of that with great interest.



Some of us taught asynchronously, making videos ahead of time which the students could watch when it was convenient, and others stuck to a schedule and held regular 50-minute "synchronous" lectures two or three times a week. In this case the class was still recorded as our students were spread out over many time zones.

The advantage of the asynchronous approach was that the videos could be shorter and better targeted; on the other hand, the synchronous approach was better at building community and getting feedback. One thing that fascinated me about my first-year synchronous zoom sessions was the power of the chat. I know that in the lecture hall, students often whisper questions or comments to their neighbor, but the global zoom chat and commentary this past year was something else entirely. I can't resist an excerpt (next page).

An advantage of the past year is that research seminars were all online and therefore could easily include colleagues from all over the world. I don't see us wanting to give that up. Well that also holds for Faculty Board meetings as well. Indeed, attendance at these was well up this past year. Nice to be able to make tea quietly in the background while the meeting was getting started.

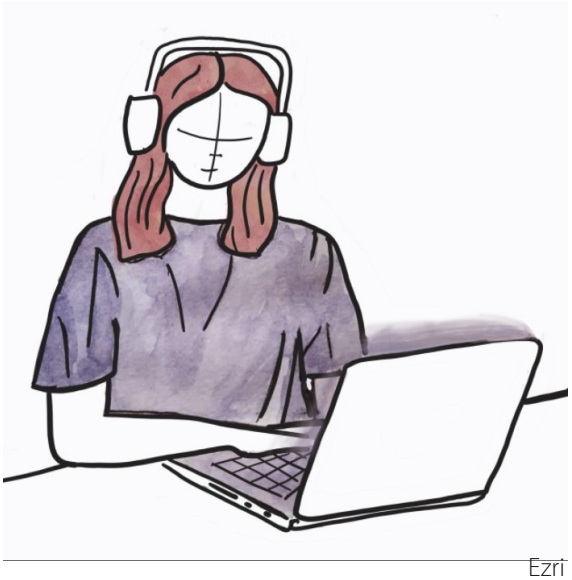
Exams are worth a comment. A few courses used a form of online proctoring, but in Math & Stats, most of us used a variety of ways to assign grades and on the whole trusted our students. For the most part, that trust was returned, and in the cases where it was not and the students were "caught" we can hope that lessons were learned. However, the task of tracking down and investigating these cases was pretty much left to the instructor, and that turned out to be a time-consuming process.

Finally, I remark that going forward, technology is sure to play a greater role in our teaching lives—at all levels. For example, it has been claimed that videos can be used to transmit information so that lectures can be devoted to what is called "active learning." Fair enough, but we need to be careful with this idea.

AN INSIDE PEEK INTO UNDERGRADUATE CHAT IN A LINEAR ALGEBRA CLASS

13:41:07: wait how do we know what r is?
13:41:20 : r=sqrt(1^2+1^2)
13:42:40 : ooohhh right I forgot r was the hypotenuse of the triangle
13:42:45 : thx
13:42:48 : No problem
13:43:02 : the man himself Abdalkarim, what a guy
13:43:09: ^
13:43:17 : Glad to help
13:43:31 : look at his face light up when u recognize him
13:43:35 : truly a good man
13:43:44 : anyone else currently watching march madness?
13:43:52 : on the left of the equation is that a 10/2 or a 10/sqrt(2)?
13:43:54 : Thanks AJ
13:44:14 : @Ezri, it is (\sqrt(2))^10
13:44:35 : That makes sense, thanks
13:55:05 : Tan ^-1
13:59:43 : ah yes discrete math returns once again
13:59:55 : just wait until next year
14:00:05 : discrete math 2: electric boogaloo
14:00:06 : what happens then?
14:00:08 : wait
14:00:24 : we gotta take that next year I think
14:00:31 : (if ur in computing)
14:00:32 : what does Re mean?
14:00:39 : real
14:00:40 : real axis
14:00:42 : real part of z
14:00:55 : oh ok thanks
14:01:27 : Never seen that before
14:01:33 : But might just have to steal it
14:02:03 : xander really went yoink
14:05:01 1/z
14:08:06 : modern problems require modern solutions
14:09:29: (x+iy)^(-1)=1/(x+iy), We want to rationalize this, so we multiply the top and bottom by the conjugate. The top becomes zbar and the bottom we already got from the previous part, it is (modulus(z))^2
14:09:45 Oh you beat me to it
14:09:47: lol
14:09:49: lol
14:11:01: Why is it 2?
14:11:15 pythag
14:11:18 : sqrt [((-1)^2 +sqrt(3)^2)]

14:11:26 : Thank you!
14:11:27 : =sqrt(1+3)=2
14:11:31 : No problem
14:19:31 : That is one big circle
14:19:41 : indeed
14:22:10 : 2^20 / 2^1 = 2^19
14:22:27 : ^
14:27:18 : thx



Ezri

IN MEMORIAM

ROBIN GILES

We mark the passing of Professor Robin Giles in his 95th year on August 19, 2020.

A brilliant physicist and mathematician, Robin started his career at age 20 teaching and researching at The University of Glasgow until moving in 1966 to Queen's where he remained until his retirement at age 68. He upheld the highest standards in both his teaching and his research which he continued with enthusiasm well past his retirement until stopping to care for his wife Jessie through her many years of battle with dementia. Remembered for his eccentricity, humility, honesty, open mindedness and generosity, he was one of a kind with a scientific, nonjudgmental view of any issue or problem.

[Excerpted from https://thewhig.remembering.ca/obituary/robin-giles-1079915788]

From the Editor: Sitting in your office in Jeffery Hall, you could always tell if Robin was coming down the hall towards you. His pace and the clip of his shoes was faster than anyone else in the Department. His energy was unflappable.

Queen's UNIVERSITY

DEPARTMENT OF
MATHEMATICS AND STATISTICS

Queen's Mathematical Communicator
Department of Mathematics and Statistics
Queen's University
Kingston, Ontario Canada K7L3N6

Queen's Mathematical Communicator
Editor: Peter Taylor
mathstat@queensu.ca
queensu.ca/mathstat/

If you are a Queen's Math & Stats or Math and Engineering graduate and are not receiving notification of this publication, our alumni records might not have your email address. You can update that information by emailing records@queensu.ca.