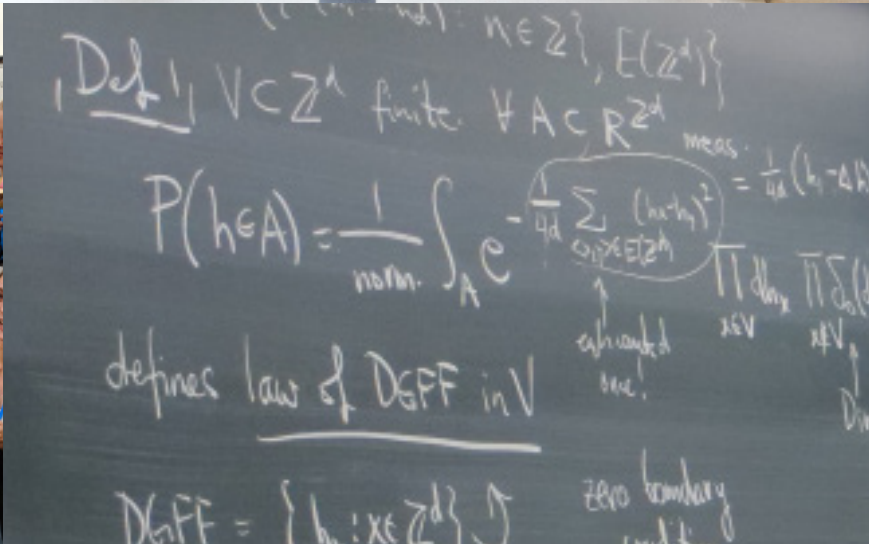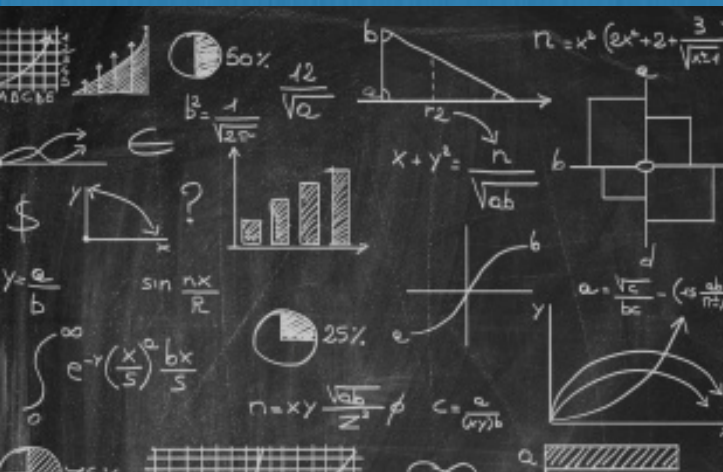# 2020 PIMS Diversity In Mathematics: High School Summer Math Camp

Week 1: August 4 - 7, 2020
ONLINE PROGRAM

Photo: Sgt Johanie Maheu, Rideau Hall

Message from the Governor General on the occasion of the third edition of the Diversity in Mathematics program

Math is the language of science, technology and engineering. And in math, there is a place for everyone—all genders, races, identities and orientations. *Every voice*. After all, inclusivity in math, and in all STEM fields, brings diversity in knowledge—differing points of view that shape the direction and velocity of innovation.

Whether you are in high school or university, you all share an interest in math and a curiosity to see where it can take you. The possibilities are endless and the sky is not the limit. The Diversity in Mathematics program is a chance to discover the types of careers you could have and find like-minded people who can inspire you to pursue your dreams.

And when the program is over, remember that each of you has something to bring to this unique world we share. Your wit, your passion and your contributions are needed in every field.

Thank you to the University of British Columbia, Simon Fraser University and the Pacific Institute for the Mathematical Sciences for offering such a challenging opportunity to young, inquisitive minds!

I wish all of you a productive and informative program.

$$e^{i\pi} + 1 = 0$$

Message de la gouverneure générale à l'occasion de la troisième édition du programme Diversité en mathématiques

Les mathématiques sont la langue des sciences, de la technologie et de l'ingénierie. Et en mathématiques, chaque personne fait partie de l'équation : peu importe son genre, sa race, son identité et son orientation. *Chaque perspective compte*! Après tout, l'inclusion dans les mathématiques, et dans tous les domaines des STIM, favorise la diversité des connaissances et des points de vue et permet d'influencer l'orientation et la vitesse de l'innovation.

Que vous soyez au secondaire ou à l'université, vous avez tous un intérêt pour les mathématiques et une envie de découvrir où elles peuvent vous mener. Sachez que les possibilités sont infinies, qu'il n'y a aucune limite. Le programme Diversité en mathématiques vous permettra de découvrir les différentes carrières qui s'offrent à vous et de côtoyer des personnes aux vues similaires qui pourraient vous inspirer à poursuivre vos rêves.

Et une fois le programme terminé, n'oubliez pas que vous avez une contribution à apporter à ce monde unique qui est le nôtre. Votre vivacité d'esprit, votre passion et vos compétences seront les variables d'une formule gagnante dans tous les domaines.

Merci à l'Université de la Colombie-Britannique, à l'Université Simon Fraser et au Pacific Institute for the Mathematical Sciences de proposer une expérience aussi stimulante aux jeunes esprits avides de connaissances!

Je vous souhaite un programme formateur et enrichissant.

$$e^{i\pi} + 1 = 0$$

Week One:

Q: Where do I check in on the first day?

Online, though the zoom link on page 3.

Q: Will the program change?

Program changes and updates will be announced at each session.

Q: Should my video always be off?

No, please have your video on so that your colleagues and the instructors can see you. If you need to step away for a few minutes, you can turn it off, but let your colleagues know through the chat.

Q: Where can I go for help during the sessions?

If you need assistance or have a question during the summer school, please connect with the High School Coordinator

Q: What is the joint High School Session about?

In these sessions, undergraduates are paired up with students from the DIM High School Summer camp, and will work on various STEM issues together

Course #1: Callysto Mini-course

Course Instructor: Laura Gutierrez-Funderburk

Course Description: How can we use data and mathematics to understand events happening in our daily lives? In this three-part workshop series, you'll learn , explore , and implement math and data science skills to understand the spread of disease. You'll also explore how data science and mathematics can be used to find solutions. No programming experience is required to attend these sessions.

Session 1: Learning:

In this session, we'll learn about mathematical models — what they are, when they are used,and how they can be useful. We'll analyze an example using the "Susceptible, Exposed, Infected and Recovered" (SEIR) model used in epidemiology, the study of how disease occurs in populations. By the end of the session, participants will be familiar with the concept of mathematical modelling and feel comfortable talking about the SEIR model.

Session 2: Implementing:

This session will begin with an introduction to data science and computational thinking. High school and undergraduate students will then work together to build an interactive simulation of the SEIR model from the "learn" session using Python and Jupyter notebooks. Undergraduate students will act as mentors and help as we explore the math behind the model. Together we'll implement mathematical equations in our code. At the end of the session, the instructor will facilitate a Q & A on what is like to work as a data scientist.

Session 3: Exploring:

We've implemented a mathematical simulation. Now, it's time to explore what happens when we change conditions in a simulation! In this session, we'll take our simulation from the "implement" session to change initial conditions, and observe and interpret results from those changes. We'll compare our simulation results against open COVID-19 data and graphs (provided by the facilitator). By the end of this session, participants will have an understanding of how the model they worked on relates to real data, its limitations and areas of improvement.

Course #2: An Introduction to Mathematical Thinking and the Power of Visualization

<u>Course Instructor</u>: Shawn Desaulniers

Course Description: The course aims to introduce participants to aspects of mathematical thinking that are beneficial when pursuing post-secondary studies and solving real problems. The main theme is centred on viewing mathematics as a language and learning to read between the lines. Students will practice hearing what is not said and developing the ability to visualize ideas.
Pre-requisites: Grit and growth mindset.

PIMS Public Lecture: John Mighton, Jump Math

All Things Being Equal: Why Math is the Key to a Better World.

Math provides us with mental tools of incredible power. When we learn math we learn to see patterns, to think logically and systematically, to draw analogies, to perceive risk, to understand cause and effect--among many other critical skills. Yet we tolerate and in fact expect a vast performance gap in math among students and live in a world where many adults aren't equipped with these crucial tools. This learning gap is unnecessary, dangerous and tragic, and it has led us to a problem of intellectual poverty which is apparent everywhere--in fake news, political turmoil, floundering economies, even in erroneous medical diagnoses. The study of math is an ideal starting point to break down social inequality and empower individuals to build a smarter, kinder, more equitable world. In this talk Mighton will share his vision for a numerate society for all, not just a chosen few.

Program Overview: Week One

Time	MON 3 (BC STAT)	TUE 4	WED 5	THUR 6	FRI 7
8:30am - 8:50am					
9:00am- 10:00am			Callysto With Laura G Funderburk **HS Only (presentations?)**	**Problem Session #2**	**Career talks** **Andrew Poelstra, Blockstream.** **Kristen Bystrom, Lululemon**
10:00am- 10:30am		**Registration, & Welcome from PIMS Deputy Director:Prof. Marni Mishna Intro of Instructors & students**	**Break**	**Break**	**Problem Session #4**
10:30am- 11:30am		Callysto With Laura G Funderburk **HS Only**	**10:30am- 11:30am** **Problem Session #1**	**10:30am- 11:30am** **Problem Session #3**	**10:30am- 12:00pm** **High School Math Camp: Joint Session 2 With Shawn Desauliniers**
11:30am- 12:00pm		Lunch			
12:00pm- 1:00pm					
1:00pm- 4:00pm		**1:30pm- 3:00pm** **High School Math Campus Joint Session 1** Callysto With Laura G Funderburk	**1:00pm- 4:00pm** **Lecture by** **Shawn Desaulniers**	**1:00pm- 3:00pm** **Lecture by** **Shawn Desaulniers** **3:00pm-4:15pm** **John Mighton** **Public Lecture**	**1:00pm- 4:00pm** **Lecture by** **Shawn Desaulniers**

Zoom Links:

- **John Mighton Webinar:** https://www.pims.math.ca/scientific-event/200806-pspljm

Week 1: High School Participants

1. Promise Ajayi, Holy Trinity High School, Fort McMurray
2. Benjamin Bai, Fleetwood Park secondary
3. Allan Cao, Westmount Charter School
4. Dennis Cofler, Pinetree Secondary School
5. Giselle Del Valle, Picture Butte Highschool
6. Anna Gordon, UTP
7. Haoran Guo, St. George's School
8. Heidi Hansch, Santa Catalina School
9. Hannah Herman PMSS
10. Skye Higgins, Lord Byng Secondary School
11. Tony Hu, Westmount Charter School
12. Benjamin Hultin, Sir Charles Tupper
13. Konrad Jakobs, Sir Charles Tupper Secondary
14. Mariane Kalliny, Ecole Secondaire Notre Dame
15. Kristina Law, Gleneagle Secondary Student
16. Kai Jordan Li, Pinetree Secondary School
17. Nathaniel Leonard, Esquimalt High School
18. Genevieve Lyder, Louis St. Laurent
19. Mark McSween, Mission Secondary School
20. Sarah Mushumanski, Nechako Valley Secondary School
21. Shahan   Nedadahandeh, Pinetree Secondary
22. Emily Ng, École Alpha Secondary School
23. Tyler Ngo, Fleetwood Park Secondary
24. Peter Pham, Holy Cross Regional High School
25. Carleen Platero, Holy Trinity Catholic High School
26. Oliver Ridge, Rossland Summit School
27. Ben Roberts, Ballenas Secondary School
28. Ainslie Senger, BCHS
29. Sun Sur, Pinetree Secondary School
30. Katie Tamura, Louis St. Laurent
31. Angelina Timis, Golden Secondary School
32. Eknoor Toor, École Panorama Ridge Secondary School
33. Teresa Tran, Spectrum Community School
34. Danijel Velinov, Kwatlen Park Secondary
35. Portia Wainwright,Merritt Secondary School
36. Matthew Wang, Semiahmoo secondary
37. Jun Wu, Renert School
38. Shenxiaozhu Xu, Pinetree Secondary School
39. Vincent Yee, Dr. E.P. Scarlett High School, Calgary
40. Olivia Zaccagnini, Queen Elizabeth High
41. Sunny Zhang, Western Canada High School
42. Sophie Zhao, Pinetree Secondary School

2020 Organizers

1. Pacific Institute for the Mathematical Sciences
2. Malgorzata Dubiel, SFU
3. Veselin Jungic, SFU
4. Malabika Pramanik (Committee Chair), UBC
5. Annie Li, UBC

Speaker Biographies (Alphabetical)

Kristen Bystrom- Lululemon

Kristen Bystrom is a data analyst for the product analytics and data science team at lululemon athletica in Vancouver. At lululemon, she loves working on machine learning models, optimizing inventory flow, defining statistical distributions for product sizes, and developing apps that help the business make important decisions. She has also worked at Electronic Arts and Statistics Canada. Kristen graduated with a BSc from Simon Fraser University in 2019 where she majored in Statistics and minored in Computing Science. Kristen has a passion for using mathematics in all areas of life, from optimizing her workout plan to competing in hackathons. When she's not having fun with math, Kristen likes to volunteer with Destination Imagination, play board games, watch musicals, and go on camping trips.

Shawn Desaulniers- Instructor UAlberta

Shawn Desaulniers is a Metis Canadian who grew up in Thunder Bay, Ontario. He received his Honours Bachelor of Science degree from Lakehead University in mathematics. After earning a doctorate degree in theoretical mathematics from the University of Alberta in 2008 he worked at Okanagan College and the University of British Columbia. In 2017 he returned to the University of Alberta where he primarily works with teaching candidates and on Indigenous student initiatives. In the past, he has helped to organize several conferences and workshops relating to mathematics and mathematical education, as well as problem-solving events and puzzle exhibits in BC and Alberta.

Laura Gutierrez-Funderburk: Callysto Instructor

Laura Gutierrez-Funderburk is a data scientist for the [Callysto](#) project, a federally-funded initiative in Canada helping students and teachers learn data science skills (coding, data analysis, and data visualization). Laura has developed numerous data science teaching resources for students and teachers alike. She is experienced in research, conference organization, and facilitating data science learning experiences which celebrate diversity and are tailored to a variety of skill levels. Laura holds a Bachelor of Mathematics from Simon Fraser University (SFU). Her alma mater recognized her work in creating enriching learning experiences by awarding her the Terry Fox Gold medal. Laura enjoys sharing her enthusiasm for coding and problem solving, and hopes this will inspire students to explore mathematics and data science.

John Mighton, Jump Math Founder

Dr. John Mighton is a playwright turned mathematician and author who founded JUMP Math as a charity in 2001. His work in fostering numeracy and in building children's self-confidence through success in math has been widely recognized. He has been named a Schwab Foundation Social Entrepreneur of the Year, an Ernst & Young Social Entrepreneur of the Year for Canada, an Ashoka Fellow, an Officer of the Order of Canada, and has received five honorary doctorates. John is also the recipient of the 10th Annual Egerton Ryerson Award for Dedication to Public Education.

John developed JUMP Math to address both the tragedy of low expectations for students and that of math anxiety in teachers. John began tutoring children in math as a financially-struggling playwright, and his success in helping students achieve levels of success that teachers and parents had thought impossible fueled his belief that everyone has great untapped potential.

The experience of repeatedly witnessing the heart-breaking paradox of high potential and low achievement led him to conclude that the widely-held assumption that mathematical talent is a rare genetic gift has created a self-fulfilling prophecy of low achievement. A generally high level of math anxiety among many elementary school teachers, itself an outcome of that belief system, creates an additional challenge. John had to overcome his own "massive math anxiety" before making the decision to earn a Ph.D. in Mathematics at the University of Toronto. He was later awarded an NSERC Fellowship for postdoctoral research in knot and graph theory. He is currently a Fellow of the Fields

Institute for Research in Mathematical Sciences and has taught mathematics at the University of Toronto. He has also lectured in philosophy at McMaster University, where he received a master's degree in philosophy. His plays have been performed around the world and he is the recipient of several national awards for theatre, including two Governor General's Awards. He played the role of Tom in the film Good Will Hunting.

Andrew Poelstra, Blockstream

Andrew Poelstra is the director of research at Blockstream, a company founded by Hashcash creator Adam Back and 8 others in 2014 to advance the development of Bitcoin Core. He is a mathematician and software developer with published papers on topics such as cryptography, privacy, and bitcoin.Poelstra is known for his research in confidential transactions and multi-signatures, and has also written the Rust-bitcoin library.Additionally he has made contributions to Mimblewimble, the blockchain structure utilized by the privacy-focused blockchain project Grin. In 2016, he wrote a whitepaper (downloads pdf file) in addition to Grin's founding document as a member of the project's decentralized community. In the paper, he details Mimblewimble's cryptographic mathematics and provides an argument for its security.