Math in the Mountains

June 25-30, 2023 | Jackson Hole, Wyoming

Math in the Mountains (MitM) is a new week-long math camp conceived by Paul Zeitz and Andrew Chung that will feature a unique mix of teachers, kids, and parents with a deep passion for mathematics, based at the Teton Science Schools (TSS) in Jackson Hole. The program will be led by a group of leading math educators who include the founder and faculty members from the Proof School; former coach of the USA Math Olympiad team (and USAMO winner); instructors who have taught at Epsilon Camp, Campersand, and MathCamp; applied mathematicians with investing and entrepreneurial backgrounds; and the main force behind the Global Math Project. The number of campers is deliberately very small, ensuring an unusually high instructor-to-camper ratio and significant attention to each child and parent's needs. Instruction will take place from the classrooms at TSS to outdoor locations in nearby Grand Teton National Park to create a unique environment for mathematical discourse.

Who should attend?

M

ath in the Mountains intensive, individualized program is targeted at approximately 15

highly-gifted “math kids” ages 10 to 11. The week will be filled with exciting classes, one-on-one tutorials, plenary lectures, group activities, and there will be opportunities for kids, parents and teachers to interact with each other. If your child has attended Epsilon Camp or Campersand and is about 10 years old, then this program should be fine. A MitM camper should know some algebra and geometry and understand the notion of a mathematical argument. By far, the most important things are curiosity and stamina: the prospect of doing *hours* of math each day *must* be appealing! If you are unsure about fit, first take a look at Epsilon Camp’s “Is Epsilon a Good Fit?” page. Campers interested in MitM are asked to share their favorite mathematical experiences and explorations and complete a questionnaire and problem set.

What topics will the kids and parents explore?

Mathematically, we plan to run several “parallel non-euclidean” tracks (i.e., sometimes intersecting!) for kids, teachers, and parents with topics that will include two morning sessions roughly split between algebra/computational and geometric/visual topics, and an afternoon session focused on hands-on activities. Kids who will love this program will likely be enthralled by topics that include:

- Number theory via computation and coding
- Exploring the visual beauty of complex numbers
- Topology of surfaces and knot theory
- Mathematical games - with and without Euclidean rules
- Exploring probability and infinite series
- Unsolved math problems

In a given morning, we may explore Fibonacci divisibility patterns by hand, by theory, and using Python. We may later ask the question: How many different ways can we color the edges of a dodecahedron using the colors red, green, and black? In the afternoon, we will try to tie regular heptagonal knots using strips of paper, build three-dimensional shadows of four-dimensional polytopes, and learn how to use topology and parity to perform amazing magic tricks.

Parents will be able to observe some of the children’s sessions, participate in talks with instructors to learn about their research and teaching, and spend time as a group sharing best practices on fostering their children’s love for mathematics. An important part of this will be experience sharing on specific mathematical explorations that have been meaningful to their children. We understand that you are members of a small, unusual, but beautiful community, and it is important to learn from each other.

Why Jackson Hole?

As one of the most scenic places in North America, there is abundant opportunity for this program to mix mathematical recreations with outdoor adventures in a way that invites creativity, imaginative thinking, grit and resilience, and intellectual risk-taking. True mathematicians are explorers, and the purpose of MitM is to foster those characteristics by doing amazing math in an adventurous place.

The program is done in collaboration with the Teton Science Schools (TSS), one of the top educational institutions in the world focused on conservation that touches 30,000 students each year in field education, classroom education, and educator development programs. We will be based at the Jackson campus of TSS (located about a dozen miles from the Jackson Hole airport, about three miles from downtown Jackson), which houses its pre-K through 12th grade Mountain Academy program, and some of our sessions will be done in a beautiful natural setting in Grand Teton National Park, which is less than 30 minutes away (Yellowstone National Park is just an hour further).

We will also host some optional activities to explore the Jackson Hole area, with special excursions that might include wildlife viewing, rock climbing, kayaking, hiking, or horseback riding – depending on the interest and fitness of families participating. We strongly encourage families to arrive earlier or stay afterwards to do more exploration.

Who will lead the program?

The instructors are mathematicians and advanced students with deep experience in mathematical research, camps, circles, and competitions. Led by Paul Zeitz, the instructional team will include James Tanton, Mira Bernstein, Beth Malmskog, Jason Horowitz, and Wendy and Matthew Cho. Andrew Chung, a grown-up math kid and parent of a math kid, will lead a parents' program focused on sharing best practices on raising mathematically-gifted children. One reason that we are excited about Math in the Mountains is because we have attracted amazing people to an amazing location.

- **Paul Zeitz** (co-founder, academic director) has devoted his career to mathematical outreach at all levels, from coaching the USA team for the International Math Olympiad to teaching undergraduates at the University of San Francisco to working at math camps and math circles all over the country. He has produced dozens of lectures for the National Museum of Mathematics, wrote *The Art and Craft of Problem Solving* (1999), produced a 12-hour video course for The Great Courses with the same title, and is a founder and board chairman of Proof School in San Francisco.

- **Andrew Chung** (co-founder, parent program leader) studied applied math at Harvard, and received an MBA from Wharton. He invests in breakthrough

technologies that can solve global challenges in the areas of health and sustainability. He was previously a partner at Khosla Ventures and Lightspeed, and founded 1955 Capital in 2016. He is a passionate musician who almost pursued a professional singing career. When not thinking about solving the world's food crisis by investing in edible fungi protein, Andrew can be found in the mountains with his family, rocking climbing or ski mountaineering with his SLR camera. No stranger to math programs in his youth, Andrew was an early participant in PROMYS and recently celebrated the 30th reunion of his class.

- **Mira Bernstein** received her PhD in algebraic geometry in 1999 and has taught at UC Berkeley, Stanford, and Wellesley College. She has been one of the key organizers of Canada/USA Mathcamp since 1997, was a founding faculty member and admissions director at Proof School in 2015, and co-founded the Cambridge Math Circle in 2018. In addition to her work in math education, Mira is a data science and statistics consultant. She focuses on applying mathematics to issues of social importance, such as voting rights and the effects of extending health insurance to the uninsured.

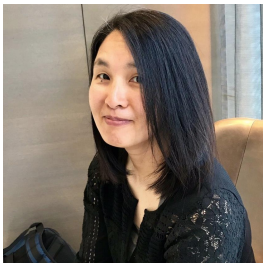
- **Wendy Cho** is a Professor at the University of Illinois at Urbana-Champaign where she has appointments in Political Science, Statistics, Mathematics, Computer Science, Asian American Studies, Law, and the National Center for Supercomputing Applications. Her son **Matthew Cho** went to Proof School, is graduating MIT, and will begin a doctoral program in combinatorics at UC San Diego this fall. They have both taught at Epsilon Camp and Campersand, and started a math circle at UIUC.

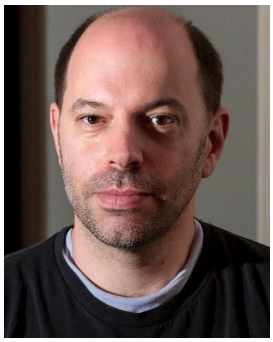
- **James Tanton** is a prolific author, youtuber, educational consultant, and proselytizer of the joy of mathematics. Trained as a topologist, he has taught mathematics at all levels all over the world and is the main force behind the Global Math Project, which has brought amazing math to millions of people.

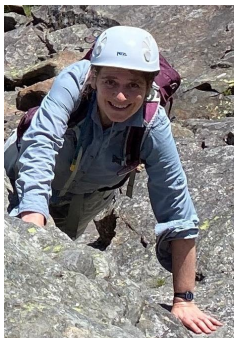
- **Jason Horowitz** is the chair of the math department at Proof School, where teaches mathematics and computer science. He received a PhD in computability theory from UC Berkeley in 2004. Before joining Proof School, he worked at Google and several start-ups. He is an active classical and jazz pianist.

- **Beth Malmskog** is an associate professor of mathematics at Colorado College. Her research is in computational number theory, algebraic geometry, and applied discrete mathematics, including mathematical approaches to understanding fairness and social choice. Beth is an award-winning writer, had a math puzzle

radio show, and has started math circles in prisons! Born and raised in Wyoming, she is very excited to do and share mathematics in Jackson this summer.



Top: Andrew and Paul hiking a few miles from TSS, Wendy, Matthew, and Beth. Bottom: Jason, James, and Mira.

FAQs

- *My child is 10, but already knows some calculus. Will she find this program boring? Conversely, my child is 11, but has early experience with algebra and geometry. Will this program be too hard?* No and no! This is not an acceleration program, and there is—literally—an infinity of possible directions to enrich any individual child's mathematical experience. We will meet any child where they are and stretch and challenge them.

- *What is the schedule?* Participants can arrive on Saturday 6/24 then participate in a wilderness welcome program with group lectures on Sunday. The formal academic program starts on Monday and concludes the afternoon of Friday 6/30. A typical daily schedule may look like this. (On some days, there may be a short plenary session between A and B or possibly in the evening.)
    - 7:30-8:30 breakfast
    - 9:00-10:30 session A
    - 11:00-12:30 session B
    - 12:30-2:30 lunch, break, tutorial
    - 2:30-4:00 session C

    - 4:00-6:00 break, tutorial
    - 6:00-7:30 dinner
    - 7:30-?? evening activities (games, socializing, etc.)

- *Where will we stay and eat?* The Jackson campus of TSS has two lodging buildings, and each family room is configured to accommodate up to six people comfortably. Excellent food is provided in the campus dining area. If you prefer to stay off campus, there are many places to stay nearby, and there's a great variety of restaurants in town.

- *What will it cost?* The program cost will include housing (if needed), dining, and instruction is commensurate with the level of attention each child and parent will receive given the high instructor-to-student ratio. We expect the cost to be around $4,000 for a family of four lodging on campus, $3,500 for a family of two lodging on campus, and $2,500 for a non-residential family. Program cost will include a wilderness excursion hosted by TSS in Grand Teton National Park, with other optional activities incurring additional cost.

- *Will we need to rent a car?* This is optional. The campus is near the airport, and the town of Jackson is close to campus. TSS may provide shuttle service, possibly bicycles, and taxis/rideshares are abundant and convenient.