

Canada/USA

MATHCAMP

2022 Year-End
Report

Mathcamp is a project of the Mathematics Foundation of America, EIN 57-1035414.

Looking back: Mathcamp 2022 at Colby



“Socially, there is no other place where I have felt so at home and welcome; academically, my view of mathematics has expanded so much in all sorts of directions.”

– Cecilia Sun (Clyde Hill, WA)



Mathcamp 2022 was held July 3–August 7 at Colby College in Waterville, Maine.

From McAllen, TX to Saskatoon, Saskatchewan; from Leszczyna, Poland to Haiphong, Vietnam, this year’s campers came together from 23 U.S. states, 4 Canadian provinces, and 8 other countries. There were 49 girls, 5 non-binary students, and 69 boys; 60 alums, and 63 fantastic new campers, selected through a competitive application process (from 489 applicants!) based on their excellent essays, recommendations, and Qualifying Quiz solutions.

Challenge yourself with a Quiz problem!

Define a “digital number” in base b ($b > 1$) to be a positive integer n such that the base- b digits of n^2 add up to n .

For example, 9 is a digital number in base 10 because $9^2 = 81$, and $8 + 1 = 9$. Also, 9 is a digital number in base 7 because $9^2 = 81$ is written as 144 in base 7, and $1 + 4 + 4 = 9$.

- (a) There are five other digital numbers in base 7, aside from 9. What are they?
- (b) It is not a coincidence that base 7 = $22 + 2 + 1$ has unusually many digital numbers. Prove that for all $k \geq 2$, there are at least five digital numbers in base $k^2 + k + 1$.
- (c) Find all integers $b > 1$ such that $b + 3$ is a digital number in base b . (Prove your answer!)
- (d) Prove that in any base $b \geq 16$, every digital number is less than $b^{3/2}$. What’s the best upper bound you can prove on the largest digital number in base b , when b is large?



“Mathcamp is a whole other dimension, where the only thing you have to do is to enjoy – enjoy beautiful math, awesome people and various events.”

– Mariam Baghdasaryan (Kraków, Poland)

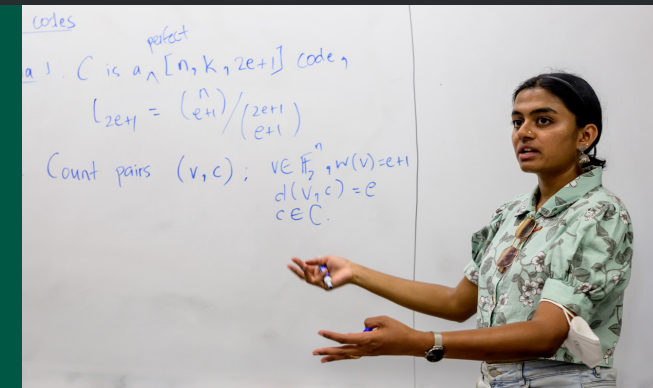


Math at Mathcamp 2022



Classes

Mathcampers begin each summer by talking with their academic advisor, whose role is to help address the question: *What kind of academic experience do you want to create this summer?* The possibilities aren't endless, but they're vast: from "Ultrafilters and combinatorics" to "Hyperbolic Geometry", students had over 100 classes to choose from. Here is just one example, from mentor Ben Dees:



"It's impossible to not get mathematically inspired in this welcoming community of well-rounded mathematicians."

—Sergio Lopez (Mexico City, Mexico)

Arrow's Impossibility Theorem

If you've heard of Arrow's Impossibility Theorem before, it might have in some form like "a good voting system doesn't exist," which leaves a bit to be desired, as a theorem statement. What do we mean by "good," or by "a . . . voting system," or by "a good voting system," for that matter?

Our first mission in this class is to clear up what, exactly, Arrow's Impossibility Theorem says. Our third mission is to prove it. If you're wondering about the second mission—it's to define and briefly discuss ultrafilters, which turn out to be useful for that "prove it" mission we just mentioned. Time permitting, we might also get to talk about the Gibbard–Satterthwaite Theorem, which says that there's always some voter who shouldn't vote for who they want to win.

"I love how much diversity there is in Mathcamp's classes: from pacing to difficulty to length to workload to subject to teaching style, there's enough diversity that you'll be able to find amazing classes to attend each week."

—Evan Lu (Windsor, ON)



Projects

The Project Fair is when our work outside classroom hours comes together. Students worked on projects ranging from reading about "Poset topology and simplicial complexes" to "Measuring Covid risks in various indoor spaces" to teaching a "Lattices and invariant theory" class to (very delicious) "Fractal baking" and "Aluminum foil dorodango".



Outside the Classroom at Mathcamp 2022



Field Trips & Activities

As always, our schedule was packed with field trips and activities. We went hiking, white-water rafting, and climbing, picked berries during berry picking, and planked every single day. We also had our first “Campus Fun Day”, with face-painting, a dunk tank, and an inflatable castle! Liquid nitrogen ice-cream and a nearby stream kept everyone cool on the hot days.



“You can’t find a more supportive community other than Mathcamp, and you can’t find a more comfortable environment other than being surrounded by Mathcamp people.”

– Yili Wen (Chengdu, China)

Annual Puzzle Hunt

Each year, the staff design a day-long Puzzle Hunt, heralded as one of our best field trips. This year’s Hunt was themed around missing flavours in the Relays candies! For a challenge, try to solve the puzzle below: “Laffy Taffy”.

“I came to Mathcamp not knowing anyone and worrying whether I would fit in. It turns out, Mathcamp is one the most welcoming places I have been to.”

– Thu Hoang (Haiphong, Vietnam)



d3

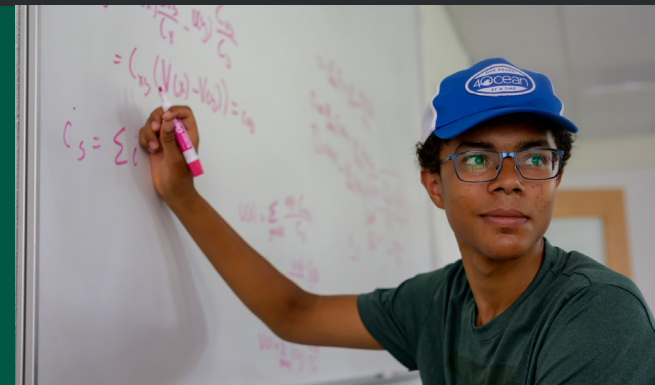
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| d3 | _____ | volume unit |
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| sp | _____ | searches for |
| | _____ | complete graphs |
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| k | _____ | daily five-letter game |
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| t | _____ | programming language creator van |
| | _____ | marsupial |
| | _____ | sculpt |
| du | _____ | fail to come to fruition |
| | _____ | delicious sound when cooking |



Supporting Mathcamp



Mathcamp 2023 will take place this summer at Champlain College, Burlington, Vermont, from July 2 to August 6. We look forward to and welcoming new campers and alumni from all walks of life, and from all over the world, all sharing a love of math!



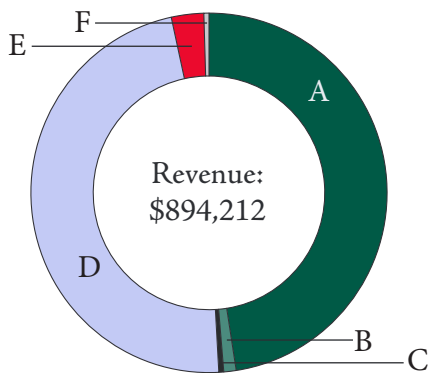
FY 2021–22 Revenue

A Tuition (after financial aid)	\$ 425,250
B NSF Grant	\$ 10,000
C AMS Epsilon Fund Grant	\$ 4,000
D Individual and Foundation Gifts	\$ 424,520
E Corporate Donations	\$ 26,305
F Misc (e.g. interest earned)	\$ 4,137

Mathcamp gives a formative intellectual and social experience to incredible kids, and one of our guiding principles is that camp should be accessible to every qualified student – whether or not they can afford the tuition. Admission is irrespective of financial aid, and we fully meet the need of every Mathcamper.

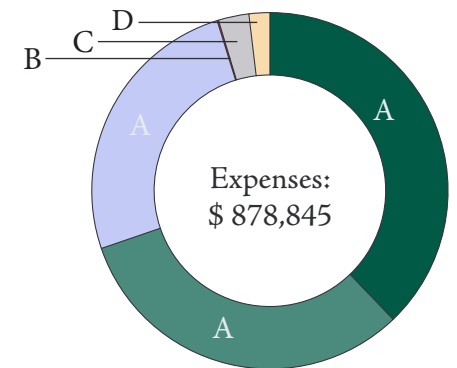
FY 2021–22 Expenses

A Mathcamp 2022	\$ 836,767
+ Staff Salaries - 40%	
+ Colby College - 34%	
+ Other Camp Expenses - 27%	
B Alumni Programming	\$ 1,072
C Administrative	\$ 24,396
D Fundraising	\$ 16,610



Donations keep Mathcamp open to all.

Mathcamp is *free* for U.S. and Canadian families with household incomes of \$75,000 and below, and we even offer *travel grants* to cover plane tickets to camp. Need-based financial aid is also available for middle-income families and international students. A small portion of our aid budget comes from the National Science Foundation and the American Mathematical Society, and the rest comes from the program's supportive alumni, families, and friends.



Give today: www.mathcamp.org/donate