The Colorado State Torus

Edition 5 October 2025

A Doctor, an Engineer, and a Mathematician Walk into an Aid Station: A Reflection on Run Rabbit Run 100

Tatum Rask

On September 12-13, I ran my first 100 mile race: Run Rabbit Run in Steamboat, CO. It was such a magical and very tough day! Perhaps I will eventually write a full race report, but for now I'll share some math-related stories and reflections.

While running 100 miles, there is plenty of time to talk to other participants. This is one of my favorite things about ultramarathons! Around mile 40, I caught up with a couple of runners: we did the basic small-talk thing and discussed what we all did for work. One was an orthopedic doctor and the other was a mechanical engineer. When I brought up that I was a graduate student in mathematics, the engineer said: "please don't tell me you do algebraic geometry!" Algebraic geometers - what did you do to deserve this reputation? I guess this engineer knows only a few mathematicians, but they *all* do algebraic geometry. I responded with "of course not: I do algebraic *topology*."

I passed these runners a little bit later - a big rain storm hit, and I was just a little faster at getting my gear out. I want to make a conjecture about mathematicians being organized here, but I fear I cannot prove it in generality. Proof by example? Anyways, imagine the engineer's surprise when he catches up with me later in the race (around mile 58) and... Ahh! An algebraic geometer in the wild! By that point I was running with my partner and recently graduated student of Renzo and Chris. This brings me to my next reflection/story.

Another thing I love about ultramarathon running is that it truly is a team sport. To do a race this long, it is extremely helpful to have a crew and pacers. For both safety and comradery, I was allowed to have folks bring me supplies, like warm clothes and headlamp batteries, at various locations. I could also have a friend running with me for the last 50 miles. I owe this race to my support team, and everyone out there helping me I know because of CSU math. Special shout-outs to Joe Geisz (current grad student and Torus editor), Seth Ireland (former grad student), Sydney Hedberg (childhood friend of Erin Dawson, a former grad student), and Madelyn Geisz (married to Joe). Thank you, CSU, for bringing me so much community!

I think that the practices of distance running and mathematics have a whole lot in common. I began the final year of my PhD while training for this race, and recently I've reflected a lot on the common lessons I have learned from both. They both require patience, consistent practice, teamwork, and *a lot* of carbs. Progress in both is nonlinear: sometimes you stare at a problem for weeks without making progress, and sometimes you quit a 20 mile long run because you get a bloody nose and are just so over it. Overcoming adversary (like a torrential downpour or getting a paper rejected) is crucial for success in both. The

challenge is what makes the end result so rewarding.

I want to approach my dissertation defense like I approached this race: it felt like a celebration of all the hard work I put in beforehand. Remember–the real treasure was the (algebraic geometry) friends we made along the way.

New Faculty Spotlight

Dr. Ben Knudsen

My name is Ben Knudsen, and I'm thrilled to be joining you here at CSU! Most recently, I was an assistant professor at Northeastern; before that I was an NSF postdoc at Harvard, and before that a graduate student at Northwestern. I'm an algebraic topologist, which roughly means that I'm interested in quantitative descriptions of qualitative features of space. A little more specifically, much of my research has been focused on configuration spaces of non-colliding particles, with a particular emphasis on homology calculations. At the more applied end of things, I've done a fair amount of work on topological characterizations of the complexity of collision-free motion planning on graphs. Did you know that it's precisely as difficult to plan the motion of a billion robots on a network with five nodes as it is to plan the motion of ten? Strange but true! I like to get outside as often as I can, whether on foot or on a bicycle, and I enjoy chess, the guitar, meditation, and baking. Speaking of which, I'm in need of a new sourdough starter...

Open Disks claim Victory after 2 years!!

The math graduate student intramural frisbee team won a frisbee game on Monday for the first time in the teams existence. After a brutal 2024 season, expectations were low for the "Open Disks" as they rallied for a second year of friz. Their first game, against the teams main rival - "Z-scored" (the stats department team) - was lost in a nail-biting 10-7 defeat. The following week the "Grasshoppers" completely anihilated the forlorn Disks with an embarrasing score of 14-4. The poor Disks were given a chance to recover when the following week, their game against the "Green and Gold" was rained out. After so much adversity, when the team walked on the field on Monday they had no choice but to hold their heads high - they couldn't sink any lower. But as the game started off with "The Ramily" taking a 2 point lead, the Disks started to rally. Under the fearless leadership of captains Chris Liu and Ian Jorquera, the Open Disks began to score, one point after another. The Ramily wasn't about to go down easily - they kept the score close. But in the end the Open Disks came out victorius! With an incredible score of 11-7, the Open Disks could celebrate under the IM field lights - proud of their hard-earned accomplishment.

Classifieds

Crossword Writter Needed
The Colorado State Torus is seeking a full time crossword or puzzle writer, to create a monthly crossword or puzzle to be included in each edition of the newsletters. Must be able to type. Unpaid position.

Looking for the true identity of Yukon Cornelius
If you know anything about Yukon Cornelius, please contact our hotline: 720-984-1541. Any leads in their identification will be rewarded.

Dean, Beans, & a Burrito Breakfast

The next Burrito Day is at 8:30-9:30am on October 7th in the GradSpace, General Services building, room 203.

October PotM

Provided by **Sandra Nair**

Given $$x + \frac{1}{x} = \sqrt{3}$$

Find $$x^{1000} + \frac{1}{x^{1000}}$$

Foto(s) del Mes

CSU's Precalculus Center

The precalculus courses here at CSU consist of 117, 118, 124, 125, 126, and 120 (also, 127 used to be a thing).

$$117 + 118 + 124 = 120$$
$$(117 + 118 + 124 + 125 + 126 = 127)$$

MTH 120 is an in person class and is currently coordinated by Jason DeMoulpied. The other courses are one credit each. It is designed this way so that different majors can be pickier about what math classes they need, we can be more specific about prerequisites for our many calculus courses, and to give students more pacing options.

117 College Algebra in Context I
118 College Algebra in Context II
124, Logarithmic and Exponential Functions
125, Numerical Trigonometry
126, Analytical Trigonometry

Prereqs for 141 are 117 and 118
Prereqs for 155 are 117, 118, 124, and 125
Prereqs for 160 are 117, 118, 124, 125, and 126

For this semester, all the one credit courses are online. More specifically, all the homeworks, content, and review exams are online, and whether they need to take exams in our on campus testing center depends on which section they enrolled in. If someone enrolled in section 001, they are to take exams in person. If someone enrolled in 002, their exams are taken online with their webcam and screen share recorded and reviewed by an undergrad working in the Precalc Center.

If you are interested in being an assistant director here for your GTA assignment, please reach out to us at precalc_math@colostate.edu or get a hold of Page Wilson. We are looking to fill the position for Spring in the next week or so!

Seminars and Clubs

Fall 2025

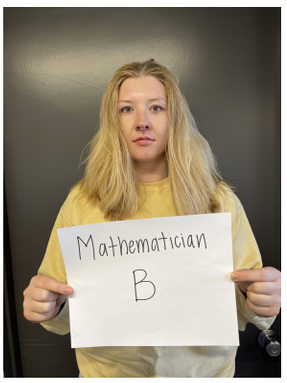
Seminar	**Time**
Mathematics Education (bi-weekly)	Mon 2–3pm
Applied Category Theory	Tue 12–1pm
Topology	Tue 4–5pm
Pattern Analysis Laboratory	Wed 4pm
Number Theory	Thu 12–1pm
Greenslopes	Thu 11am–12pm
Inverse Problems/Data Science/Applied Math	Thu 3–4pm
FRAGMENT: Front Range Geometry and Number Theory	Thu 3–4:30pm
MMARGS/MERG Moduli and Enumeration Research Group	Fri 10–11am
Algebraic Combinatorics	Fri 4–6pm

Clubs	**Time**
Math Club	Wed 4–5pm
Student Chapter of AWM	First Monday of the Month
Putnam	Fri 11-12pm
Student Chapter of SIAM	See online schedule

United Campus Workers

We are the faculty, staff, and student workers of CU and CSU. It is we who teach classes, we who conduct research, and we who support students at the two largest public universities in the state. We are a union of professionals seeking to improve our workplaces.
Our mission is to champion and defend the interests and well-being of all University labor, as well as to build and sustain social and economic justice in our workplaces and in our communities. Join us! ucwcolorado.org/csu

Faculty Problem of the Month
Who are these people?



(A) Mathematician A is Kylie and Mathematician B is Kelsey

(B) Mathematician A is Kelsey and Mathematician A is Kylie

(C) They are both Kylie

(D) They are both Kelsey

(E) I have no idea who these people are

September PotM solution

$$\int \frac{1-7\cos^2(x)}{\sin^7(x)\cos^2(x)}dx$$
$$= \int \frac{1}{\sin^7(x)\cos^2(x)}dx - 7\int \frac{\cos^2(x)}{\sin^7(x)\cos^2(x)}dx$$
$$= \int \frac{\sec^2(x)}{\sin^7(x)}dx - 7\int \frac{1}{\sin^7(x)}dx$$

We now apply integration by parts on the first integral:

$$\int \frac{\sec^2(x)}{\sin^7(x)}dx$$
$$= \frac{\tan(x)}{\sin^7(x)} - \int \frac{(-7)\cos(x)}{\sin^8(x)}\tan(x)dx$$
$$= \frac{\tan(x)}{\sin^7(x)} + 7\int \frac{1}{\sin^7(x)}dx$$

Going back to the original integral:

$$\int \frac{1-7\cos^2(x)}{\sin^7(x)\cos^2(x)}dx$$
$$= \frac{\tan(x)}{\sin^7(x)} + 7\int \frac{1}{\sin^7(x)}dx - 7\int \frac{1}{\sin^7(x)}dx$$
$$= \frac{\tan(x)}{\sin^7(x)} + c$$

Comparing with the given answer, we identify $g(x) = \tan(x)$. Thus,

$$g'(0) + g''(\frac{\pi}{4}) = \sec^2(0) + 2\sec^2(\frac{\pi}{4})\tan(\frac{\pi}{4})$$
$$= 1 + (2 \times (\sqrt{2})^2 \times 1)$$
$$= 5$$

From the Editorial Board of the Torus

We hope you have enjoyed the fifth edition of The Colorado State Torus! The success of the Torus requires article submissions from our readers, do you have an idea for an article or comic but just haven't had the time to write it? We hope you take the chance to do something creative and submit a contribution for a future article: You can email your submission to our email address **MATH_ColoradoStateTorus@mail.colostate.edu**. We also want to remind our fellow graduate students that participation in the newsletter is required for graduation, this is a threat.

Love from your editors,
Ian, Joe and Page

October '25 Crossword

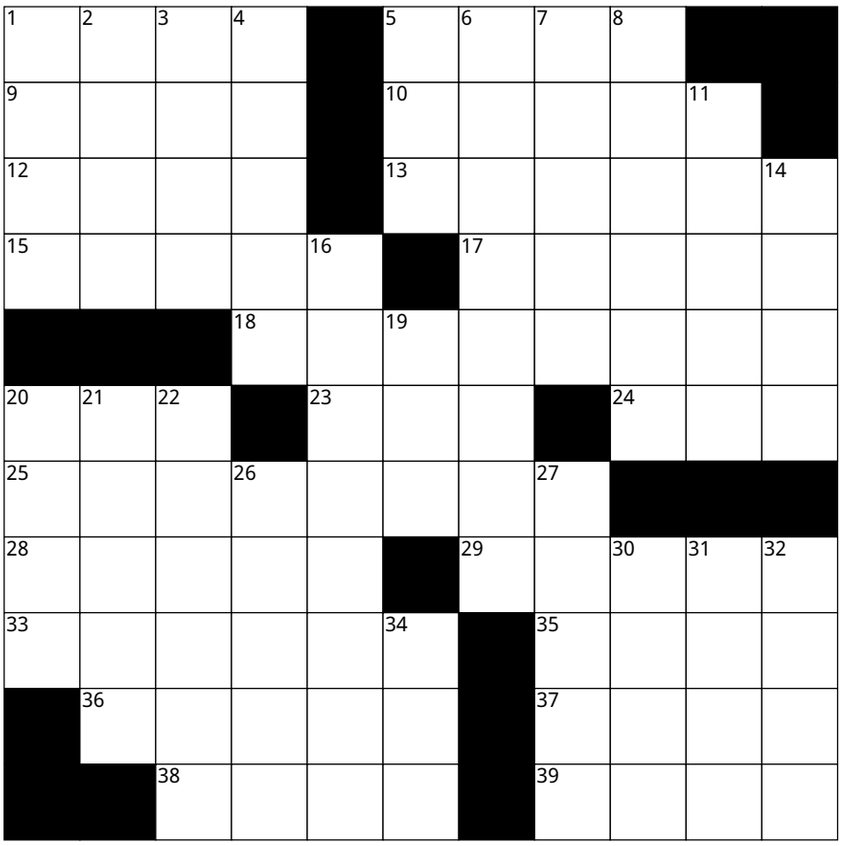
Kyle Salois

ACROSS

1 On top of
5 Surprised greeting
9 Uno preceder
10 Intends (to)
12 Tournament placement
13 Big fan of masonry?
15 Cumulus, for one
17 Girl's name
18 Big fan of multicolored eyes?
20 Spanning: abbr.
23 Nourished
24 Navigation aid
25 Big fan of storage solutions?
28 Australian cosmetics brand
29 Pie flavor
33 Big fan of princess's sleeping problems?
35 Land unit
36 Steel-type Pokemon that looks like a gear
37 Burn
38 Designer Marc
39 Excitement

DOWN

1 Banana Slugs sch.
2 What you might do to a banana
3 They have a "banana split" flavored cookie
4 "Yeah, obviously"
5 Heading over: abbr.
6 All better now
7 Islamic equivalent of kosher
8 Unit on a diamond
11 Dawn
14 Body art, briefly
16 "Get Lucky" band
19 Peaceful
20 Put ___ on (limit)
21 Part of the face
22 Secondhand
26 Sega hedgehog
27 Instruct
30 Sore
31 "Dang it!"
32 Dog-training command
34 Ref's call



September Solutions