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mastHEAD

"WHAT'S SOMETHING THAT'S EXPENSIVE BUT WORTH IT?"

Dear **mathNEWS** writers,

This is my third consecutive term as a **mathNEWS** editor and my fourth term overall. Never have I ever had such a difficult time doing layout for an issue than two weeks ago with 145.4. Of the 13 articles in that issue (not including the **gridCOMMENT**), only 2 were under the length of a column, and a whopping 9 were over 1 page long. In fact, that issue had an article with was 5 pages long — it may very well have been one of the longest single articles ever written in **mathNEWS**. Ever.

I could believe that issue 145.4 was a freak outlier. But I think it's part of a general trend I've noticed since we went remote last year where writers like you tend to favour writing a few long pieces per issue rather than many short ones.

To me, a perfectly balanced issue of **mathNEWS** is one where every long (i.e. over 1 page) article is complemented by a few short ones. Well-balanced issues are easy to put together. Having disproportionately many long articles or short articles is bad for the issue's feng shui. When there are not enough short articles, there's nothing to give readers a break between long articles. When there are not enough long articles, short articles cling together and create clutter. An example of a **mathNEWS** issue with good balance is 145.1. I finished the layout for that in only 2 hours.

There's no way to control the article length distribution for an issue. We editors have to make do with what you writers give us. My only hope in penning this (and other articles to follow this issue) is not to strong-arm you, dear writer, into writing more short articles for us — or dare I say, stop writing long articles, full stop — but to plant the seed of suggestion into your mind. The humble sub-column article can pack a mighty punch. Keep it in your writing arsenal and don't overlook it.

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This was originally a separate article titled *Scant Supply of Short Articles: A mathNEWS Meta-Commentary*, but while another editor was doing layout (not naming names here) it got cut out. Luckily, this space on the **mastHEAD** needed filling, and I'm terrible at thinking of stuff to write here, so this accident turned out to be quite serendipitous. Also, this is the first time this volume I've been on the **mastHEAD**. Hi! Did you miss me? You don't need to answer. I already know.

Canadian Government	Domestic vaccine production facilities
Abald Man	An electric toothbrush
boldblazer	A Nintendo Switch with accompanying games, and a bunch of extra joycons for when the joysticks start to drift
CC	A university eduation—degrees be pricey, bu the their ROI is actually superb
tendstofortytwo	Second monitor. I'm almost afraid of going back to in-person because I'll lose 50% of my productivity in class.
quantum goose	Spotify Premium. *[Editor's note: We were not paid for this content.]*
aphf	400 kilogrammes of pure gold. Very useful in many situations.
alyssnya	art done by me if i made it expensive
psychGoose	Me, because self-worth is priceless.
Predap	NOT making an NFT
The Eurobeat-'Em-Up	A rear-wheel drive Japanese import, and the entire Initial D soundtrack. Also a good racing helmet.
A cool pen name	The reMarkable 2 Writing Table: Better Thinking Starts *Now*
me	Few good pairse of shoes. I cheaped out by having only one pair during undergrad. Now imagine the smell.
Finchey	A. Lange & Söhne watches. *[Editor's note: We definitely were not paid for this content.]*
jeff	A good mechanical keyboard. Going back to a laptop keyboard when we're back on campus is going to be painful.
waldo@<3.le-gasp.ca	Medication, mental health help, and one-on-one tutoring. ALL WORTH IT.
PD10	These future Vtubers don't know I am saving them from copyright strikes.
god ϟ peED	A good office chair that isn't a hand me down you got from your uncle when he moved.
clarifiED	A good cobbler.

ARTICLE OF THE ISSUE

The article(s) of the issue goes to Predap for *Misfits Living In A World On Fire*, seasons one and two! Unfortunately, the two prizes for each article cancel out, so I have none to give you.

clarifiED

"N Things" articles chuff my bits! OK, ciao!

CLARA XI, mathNEWS EDITOR FOR WINTER 2021
ALONG WITH NAMAN SOOD AND KEVIN TRIEU

THE FAT DOT THEOREM

As a contestant in mathematical olympiads, you get to solve many interesting and fun problems, and after some practice, you start to develop your own tool kit of ideas and strategies that help you tackle and solve hard problems.

Hopefully, this series of articles that I will start publishing can help you learn some of these tools that I consider essential for any expert problem solver.

In this article, I will share one powerful weapon in my arsenal. Today's Topic is… Geometry! Now let's get to the math!

PRELIMINARIES

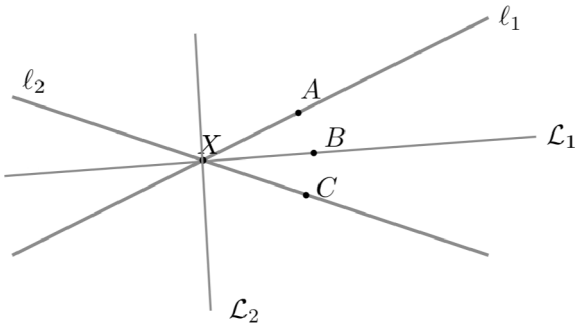
NOTATION

To denote dots we usually use capital letters $A, B, C, \cdots$. Whenever we find two expressions like AB we usually refer to the segment defined by its endpoints A, B. A triangle $\triangle ABC$ has vertices A, B, C. An angle $\angle ABC$ is the one formed in between the segments AB and BC. On a polygon $V_1, V_2, ..., V_n$, the angle $\angle V_i$ denotes the inner angle at that vertex

DEFINITION

Given two lines ℓ_1, ℓ_2 that intersect at a point X the bisectors of these two lines are the line $\mathcal{L}_1, \mathcal{L}_2$ that passes through X and whose angles formed by the intersections of $\mathcal{L}_i, \ell_1$ and $\mathcal{L}_i, \ell_2$ are the same. Notice: $\angle AXB = \angle BXC$

Alternatively, we can refer to a single bisector by referring to which angle it is bisecting. Here we have that the bisector of $\angle AXC$ is $\mathcal{L}_1$:



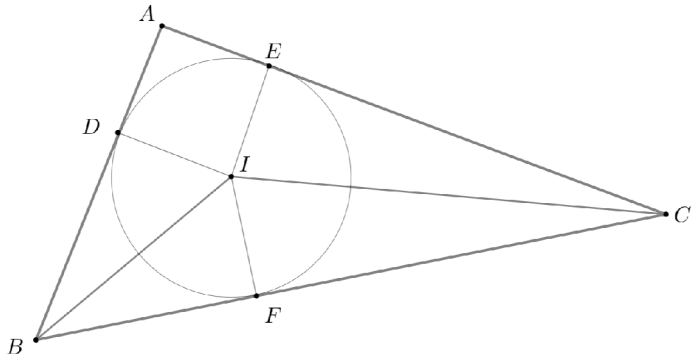
THEOREM

Given a triangle $\triangle ABC$, the bisectors of $\angle A$, $\angle B$, $\angle C$ intersect at a single point I called the incenter.

PROOF

We draw the bisectors ℓ_1, ℓ_2 of $\angle B, \angle C$ and call their intersection I.

Now we draw the orthogonal lines to AB, AC, BC that pass through I and call their intersections D, E, F



Notice that $\angle BFI = 90° = \angle BDI$. Since BI is the bisector to $\angle B$ then $\angle FBI = \angle DBI$, and so $\triangle BDI \cong \triangle BFI$. Since BI is shared by both triangles, not only are they similar, but they are in fact congruent. Then we can deduce that $DI = FI$ and using the same ideas we see that $FI = EI$. Hence I is the center of the incenter of our triangle, and thus clearly our 3 lines intersect at this geometric place. □

THE FAT DOT THEOREM

Through your mathematical career, you have probably seen some geometry problems, and you might have found yourself in the situation where you needed to prove that 3 lines intersected at the same place.

We will now show a powerful tool capable of solving these kinds of questions without having to deal with geometric places or manipulating and tracking angles and segments.

We use as inspiration our previous theorem. Consider any 3 lines ℓ_1, ℓ_2, ℓ_3, then clearly they all are at distance r from the incenter of the triangle formed by the lines, where r simply is the length of the inradius.

THEOREM

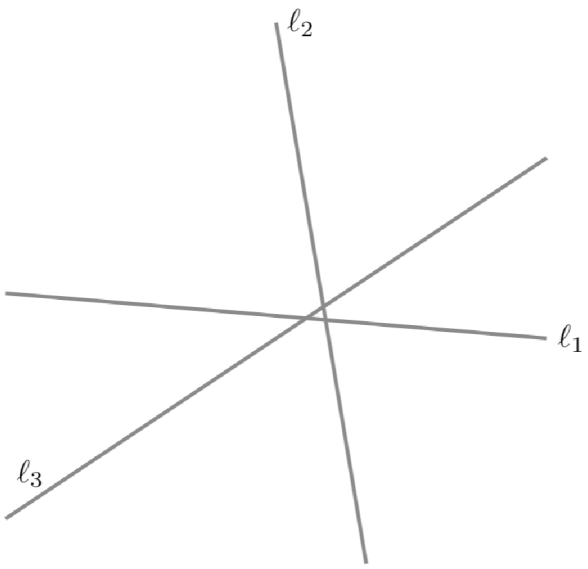
Given any 3 arbitrary lines ℓ_1, ℓ_2, ℓ_3 they all intersect at a single dot, given that it is sufficiently fat.

PROOF

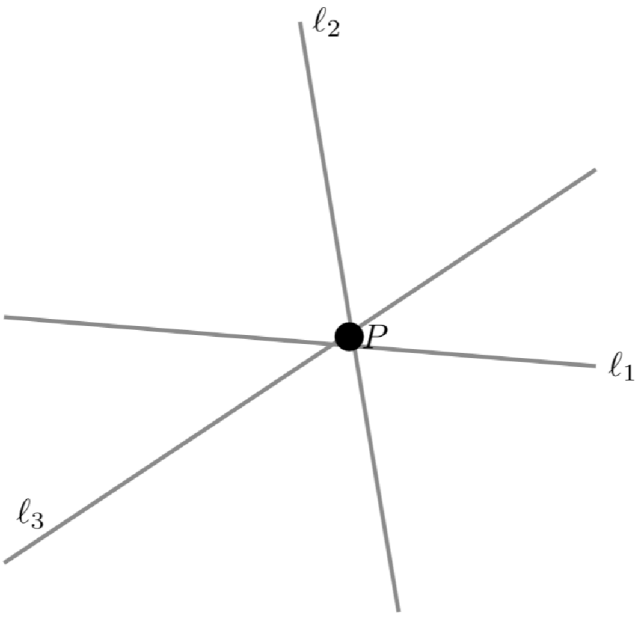
Consider the following 3 arbitrary lines:

A blackBOX a day keeps whitespace away.

A HEALTHY mathNEWS EDITOR



Clearly, they intersect at P:



Thus now it is more than evident that our theorem holds true. □

Now, I should make some comments about this geometric place called the fat dot. Clearly, it is located at the incenter, so this dot is tangent to all 3 lines, and thus since it is a point, the 3 different points of tangency of its incircle have to be the same place.

EXERCISES

Now that we have learned this powerful tool I encourage you to solve these elementary and classic problems and compare their solutions to the standard proofs that don't use the Fat Dot theorem:

1. The 3 mediatrix in a triangle intersect at a single point.
2. The 3 medians in a triangle intersect at a single point.
3. The 3 heights in a triangle intersect at a single point.

CONSEQUENCES IN EUCLIDEAN GEOMETRY

After one discovers the Fat Dot Theorem, usually the first thing they ask themselves is, "Why am I even learning this? I hate geometry," but right after, they pause and ponder, "Is it possible to show that any 4, 5 or even 6 lines concur in a single point?"

With all the heavy machinery that we have developed in this article, we are now armed and ready to ask ourselves the more general question:

Do any n lines in $\mathbb{R}^2$ intersect themselves in a single point? The answer is YES!

THEOREM

Given any n arbitrary lines $\ell_1, ..., \ell_n$ in $\mathbb{R}^2$, they intersect themselves in a single point.

PROOF

Suppose n is not of the form $p = 3^m$. Then we can add a finite number of lines until the number is of the form 3^m. If these p lines have the property that we want, then we can easily remove the lines that we added and our n lines will still intersect at the same point.

Now we will simply consider the case $n = 3^m$. Notice that we can simply group them in 3^{m-1} groups of 3 lines; from the fat dot theorem it follows that they will intersect at 3^{m-1} "distinct" points.

We can now group dots, and we will get 3^{m-2} groups of 3. Focus locally on a group of 3 fat dots, then clearly using them as endpoints of segments, we can define exactly 3 lines. And thus they create a triangle, call it $\triangle ABC$. By inscribing our triangle in a circle and then drawing tangents at the points A, B, C we get a bigger triangle. Specifically, our circle is the incircle of this bigger triangle, and thus A, B, C are the points of tangency of the incircle with the big triangle. If we once again use the fat dot theorem we notice that these points have to be at the same place since they are the 3 tangencies that we discussed in the last section. This tells us that in fact, those 3^{m-1} points of intersections are only 3^{m-2} distinct ones, and if we continue this process we eventually notice that they all intersect at a single point! □

MyConjecture

warSOC IV — THE MAGENTA MENACE

Tuesday afternoon: Name and I are sprinting through the Theorem-space superposition of campus toward the Modern Languages building. Today, Theorem-space is neon yellow and hexagonal, six-sided shapes within shapes growing and shrinking. Name's fast, but my former football running skill hasn't left me and I can keep up. Theorem-space isn't all in the mind — my body still makes a difference.

Real-space walls and buildings aren't obstacles in Theorem-space, so our path is straight as the crow flies. It only takes a minute before we're through the walls of Modern Languages. We stop, and Name pulls out a telescope, squinting into the yellow brightness towards where the goose we're looking for is supposed to be. She gasps. I follow her gaze and my eyes widen as I spot a few dozen dots in the distance.

A finger on her earphone, Name speaks to Vigil, who's keeping an eye on us from the clubhouse.

"Vigil… we've got an issue. I'm not seeing the 'goose or two' the sensors picked up. I'm seeing… at least forty."

❦

EARLIER THAT DAY.

President Soren scheduled our Modern Languages patrol for Tuesday night, but a phone call from our operations support person Vigil sends me running straight out of a lecture:

"Ya, Vigil, wha's up?"

"Sensors picking up anti-mathematics at ML. Get to the clubhouse. Your patrol tonight's moved up to… *now*."

Name's already waiting in the clubhouse, wearing a pink tie and holding another out to me. I trade a quick smile with her while Vigil taps his foot impatiently, and I start a half Windsor as he starts speaking. Vigil's got a floor plan of Modern Languages overlaid with what looks like a heatmap on the projector screens. There's a small blotch of red on one of the rooms, shifting and pulsing like an amoeba.

"The Theorem-space sensors we've got in ML are registering some anti-mathematics activity on the third floor, North side. It's fairly light; probably just a goose or two. You can show Sarah how we do it, right?"

"Yes — should be no problem!" Name says confidently. "Anything else we should know?"

"A little odd that the geese are doing anti-math in an arts building, but I'll be keeping an eye on our sensors; let you know if anything comes up. Keep these in — they'll work in Theorem-space." Vigil hands me a pair of wireless earbuds. They fit quite nicely. "Have fun."

I start to turn toward the clubhouse's MC stairwell exit, but Name grabs my arm and points towards the row of lockers on the side of the room.

"We're taking the Theorem-space fast-track." She leads me through a locker door into the bright yellow void, and we're off.

❦

"I don't know. Sensors still only picking up anti-math activity corresponding to three, maybe four geese at most." I hear Vigil's voice crackle in my ears. "No way there's *forty*. I'll have to get those sensors checked. Be careful."

Name's speaking to me now. "Forty geese. Whoever they're performing anti-math on isn't going to remember how to divide by the end of that."

My training had gone over how a single goose could easily steal a few months of mathematical knowledge in half an hour. Forty? I shiver. "Let's make sure tha' don't happen, ya?"

Name nods in response, but hesitantly. "This is very unusual. I'm going to go a bit closer. Stay here, Sarah, and if any geese show up, get right back to the clubhouse. We can still talk over the channel Vigil's set up." She takes off her tie, and crafts a series of complex shielding problems around her. I recognize 0–1 knapsack, some pathfinding, and sorting. Concentric spheres of symbols enclose her, moving with her like a floating hamster ball as she blasts off toward the flock.

I'm not happy with Name. "Ya just gonna leave me here? Aren't I here ta find out how ya do this?"

"Sorry, Sarah. It's just too dangerous for someone so new to this. I don't want to you get hurt. Vigil — I'm counting forty-one geese in Theorem space." Name's voice is coming through my earbuds now, still soothing and sweet, though a little tinny. I see her and her spheres float closer to the flock.

The channel is quiet for the next few minutes, and I fidget and fume in frustration. What am I supposed to do? Sit here and watch Name? Chat with Vigil? *Defend the innocent from the cruelty of anti-mathematics*, the **warSOC** pledge read. Not *sit around while others do that.*

Name gives a few updates on what she's seeing. "It looks like the geese are just circling a spot corresponding to somewhere in Real-space. Maybe not all of them are doing anti-math — just a few, and that's why they're not showing up on our sensors? Vigil, can you call for backup?"

"On it. This many geese! Soren will want to be there. Let me see who else in **warSOC** I can reach."

An idea strikes me. Name taught me a simple technique for exiting Theorem-space, and I quietly take off my pink tie,

concentrating as I try to replicate the process. It's a relatively simple series of calculations, but I mess it up the first two times, causing a portal to Real-space to flicker in and out of existence briefly each time. I furtively glance over at Name, who's just a small black outline at this point, almost lost in the kaleidoscoping fractals. She probably hasn't noticed me.

The third time, it works, and I tumble out of Theorem-space into the first floor of the Modern Language building, bumping into the wall of a washroom. Luckily, it's empty, and I take a moment to collect myself before walking out. Turns out it's the men's washroom, and I get a few looks I ward off with a coy smile.

I don't hear any reaction to what I just did through my earbuds, and I hope it's because Name and Vigil just haven't noticed me exit Theorem-space and not because they're broken. I start climbing the stairs: a bustling second floor, then the quieter third.

While I'm walking the looping halls of ML's third floor looking for the spot where Vigil's sensors picked up the anti-math, I hear Name's voice: "The geese have *definitely* noticed me. About half of them are peeling off toward me. Sarah, you should probably get a little further away."

"Ya, I'll do." I smile to myself as I round the corner to where I'm pretty sure the anti-math hotspot was. My plan's to physically pull the geese's victim out of there — I'm betting not many geese will be on the Real-space side of things inside a school building.

"Picking up *way* more anti-mathematics activity, Name." Vigil's voice crackles through the line. "Both moving towards you *and* at the location the original anti-math detection was. *This* looks more like forty geese. Soren and the Jack twins are on their way."

"Soren here." A new, but familiar, voice in my earbuds.

"And Jack!" Another.

"And Jack!" It could have been the same person saying it twice. "Hi Sarah! You're the new girl, right?"

"Ya. Are ya twins?" I feel sweat forming on my brow as I step down the hallway, but I try to keep a steady voice. *Pretend you're watching the fireworks from a safe distance in Theorem-space.* A door to an office is open. I'm pretty sure it's the room I'm looking for.

"You know it!" Two voices in harmony.

"Contact! Contact! I need help here! They're going all out on my shields!" Name yells, interrupting our introduction. The twins and Soren shout acknowledgements back, and all Hell breaks loose as they join the fray.

I'm only getting the audio, but I can imagine the chaos going on as **warSOC**'s finest do mathematical battle with the geese in an entirely different dimension. Shouting, concentrating grunts, and exclamations fly over the channel.

"I need more shielding problems!" It's Soren in my ears. I'm at the door now. Time seems to slow down, and I'm suddenly feeling a little cold. Over the shouts, I try listen for any sounds that might indicate geese. Nothing.

"Jack, help me with this contradiction!" It's one of the twins. The tag on the door reads: *Dr. Salis Shakespeare,* English. Some faraway part of my brain chuckles with a touch of mania. Salis was my Academic Writing professor last term. I never knew her office was here.

"Ugh, gotcha, passing the zero solution!" The other twin. I peek through the crack. It's hard to tell, but it looks like Salis is sprawled on the ground.

"I'm breaking through — closing in on the initial anti-math location!" It's Name's voice. A image forms in my head — Name arcing towards the heart of the flock against a backdrop of yellow hexagons. Towards me.

"I can't get this problem! I can't figure it out!" One of the Jack twins cuts through the channel. "I can't remember *what it is!* Help!" The panic in his voice is palpable.

"On it. *Focus,* Jack! Focus!" Soren's voice rings through my head as I push the door open and step in. I try to block out the shouting and focus on the room. Piles of books line the desks and shelves. Afternoon sun glows through drawn curtains.

According to **warSOC** training docs, geese can do anti-math from either Real-space or Theorem-space. Real-space has stronger anti-mathematics effects, but geese doing math in Theorem-space can can do anti-math without being physically present; an invisible leech reaching out from another dimension. I'd bet the geese were all in Theorem-space fighting off **warSOC**. Turns out I'd bet wrong.

Salis is lying on the ground close to the back of the office. She's an older woman with silvery hair and big glasses, on her back, mouth open and a blank, unconscious expression on her face. Standing over the head of the fallen professor is a goose.

Not any normal one — where the black feathers would be on any other goose, this one has deep magenta plumage. Its figure is oddly slim and elegant; more like a heron than a goose.

The goose slowly, deliberately turns to me and stares me in the eyes. Magenta irises. The shouting in my ear continues — Name's failed to get through and she's falling back to regroup — but I'm having no trouble focusing now. The feathery beast is at once beautiful and horrifically unnatural — outlines of bones visible on its folded wings, the magenta shade better suited to petals. Like a skeletal flower. I try to decide whether I should run or fight.

Then *she* opens her beak, and speaks to me in a soft, feminine voice.

"Hello, Sarah."

The voice sends me shuddering. Not because it's alien. It's a voice I know. It's the voice of one Professor Salis Shakespeare.

To be continued…

CC

READ mathNEWS!

Hello, readers of **mathNEWS**! On this wonderful day, I encourage you to take some time out of your busy schedule to read **mathNEWS**. What is **mathNEWS**? I'm glad you asked! **mathNEWS** is the student publication of the Faculty of Mathematics of the University of Waterloo. Sounds interesting? I bet you'll love it! Sound boring? I bet I can change your mind.

Despite having **math** and **NEWS** in its name, **mathNEWS** rarely contains either (though it may on occasion contain one or both). **mathNEWS** is a function of its writers, and as such it may contain nearly anything that its writers write or draw. This includes jokes, analysis, news, poetry, math, fiction, nonfiction, and much more. So this means that even if you're not into either **math** or **NEWS**, you'll find something or the other that piques your interest.

Of course, **mathNEWS** isn't hypocritical – sometimes people do appreciate numbers enough to actually sit down and write a piece about their favorite **math**, and a bit of **NEWS** does occasionally slip in, despite our best efforts to keep each issue timeless. But that just means that occasionally you do get what it says on the proverbial tin, which I think counts as a plus!

By paragraphs above, we have shown that:

- If you belong to the set of people S' = people not interested in **mathNEWS**, you'll find something interesting
- If you belong to the set of people S = people interested in **mathNEWS**, you'll also find something interesting

As we know, $S \cup S' = U$ is all the people in the entire universe. Since by reading this article, you are guaranteed to be present in the universe, you are also guaranteed to find something interesting in **mathNEWS**. That's a pretty good reason to read **mathNEWS** if you don't already!

In conclusion: read **mathNEWS**!

tendstofortytwo

ORDER OF OPERATIONS

Being with you was the beginning and end,
of the days that i knew, the days that i tend,
more of me did you see, more than those who came first,
on the inside you nested, where the pain was the worst.
Every moment was ours, together each hour,
until off you would have gone, circumstance's dark power
but we'd be back together by the end of the year,
you raised some good points, there was nothing to fear.
Distance between us meant more time apart,
but i held on to the feeling of you in my heart,
i swore to be faithful, 'til you would come back
little i knew, it was something you'd lack.
More concerns came with time, i indeed smelt some trouble,
my eyes did not deceive when I thought I saw double,
then i was upset when you sought out for thrills
you claimed i was the one to make mounts of molehills.
Alone did i wait, jigsaw puzzles and doubts,
anticipating rain in a series of droughts,
precipitation stormed in, at last you had come,
but you arrived with them with you, a pair, a sum.
Stupid and foolish, i'll never regain
the life that was lost, that i couldn't explain.
who's left to blame when my heart for you aches,
i'll cry to myself, no difference it makes

Deriving for Dick

N REASONS WHY "N THINGS" ARTICLES ARE GREAT

- They're easy to write. You don't need to know what a paragraph is to write one of these bad boys.
- They're fast to write. Got an idea? Put it down as a point. Boom. No elaboration required. Milk that brain-to-keyboard pipeline.
- They're more likely to be read. Only the most dedicated of readers have the stamina for an article longer than a column.
- They're easy to understand and highly digestible: antacids for the mind, if you will.
- They're funny even if you're not. If you throw fifteen one-liners at the wall at least one of them's gotta stick.
- They're an exercise in concise writing.
- No one will care or even notice if your points are unoriginal.
- "N Things" articles are a simply iconic fixture of **mathNEWS**.
- They're short.

clarifiED

AN ATTEMPT TO EXPLAIN MONADS FOR LAYMEN

If you've ever dabbled in functional programming beyond CS 135, you've probably heard of, or encountered, monads at some point. Specifically, you may have been exposed to mind-boggling, migraine-inducing code like this:

```
add x y >>= \a → a * 3 >>= \b → b + 1 >>= \c → c / 2
```

Don't worry, you're not alone; monads are an infamously difficult concept to understand. Here's the official definition of a monad.

DEFINITION OF A MONAD! *IMPORTANT!*

1. You don't just attempt to read Wikipedia and try understanding what a monad is.
1a. A monad is a way to wrap
1b. Okay well listen. A monad is an abstraction around
1c. Let me start over
1c-a. Start with a type M that takes a parameter a. If this hurts your brain, pretend M is a vector space over some field a or something like that. It's something we can operate on.
1c-b. Define a function `bind` : $M_a \times (a \to M_b) \to M_b$, and also a function `return` : $a \to M_a$ that constructs an instance of the monad.
1c-b*(1)*. To work with a monad, you use the bind function to call another function that operates on the thing wrapped by the monad. You can't just call that other function directly. Does that make any sense?
1c-b*(2)*. You gotta be, applying the bind operation to your monad, and then, until you just bind it.
1c-b*(2)-a*. Okay, well, you can just pass your monad like you would any other variable, but then there's the fact that your variable is a monad that you gotta think about.
1c-b*(2)-b*. John Monad was the titular character of the niche TV series *John from Cincinnati*. I hope he managed to permanently escape Cincinnati.
1c-b*(2)-b(i)*. According to Wikipedia, John was apparently able to perform astral projection. It's apparently a euphemism for an "intentional out-of-body experience."
1c-b*(2)-b(ii)*. In astral projection, you experience an "astral body" separate from your physical body and travel throughout the universe. I am very confused.
1c-b*(3)*. Okay seriously though. A monad is a monoid in the category of endofunctors, which is to say that a monad is
2. Who knows what a monad is anymore?

That's really not a helpful definition. Let's instead try learning what a monad is through example.

THE APPETIZER: LEARNING (A BIT OF) HASKELL

We'll start off with a brief introduction to Haskell, the language we'll be using for this example. Haskell is a strongly-typed, purely functional language in the ML family of languages. In other words, it's perfect for what we're about to demonstrate.[1]

Functions in Haskell are defined without keywords, and often will be defined with *type annotations*, which take the syntax:

```
[function name] :: [type of argument 1] → [type of argument 2] → ...
→ [type of argument n] → [return type].
```

Here's a simple integer add function, written in Haskell:

```
-- add a b adds its arguments together.
-- For example, add 1 2 returns 3
add :: Int → Int → Int
add a b = a + b
```

We can also use a technique called pattern matching to implement conditional behaviour. We do this by giving multiple definitions of the same function for different expressions given to the argument:

```
-- fac n calculates n!. For example, fac 5 returns 120.
fac :: Int → Int
fac 0 = 1                -- the base case, n = 0
fac n = n * fac (n - 1)  -- the recursive case
```

In Haskell, we store data in algebraic types, which are basically unions of n-tuples of values.

```
-- A Pet is one of
--   - Cat name age
--   - Dog master name age
data Pet = Cat String Int | Dog String String Int
```

Here, `Cat` and `Dog` are value constructors, meaning that you'd use those bare words to initialize a `Pet`. To access the fields of a `Pet`, we can use pattern matching once again:

```
-- myPet is a Pet
myPet = Cat "Copernicus" 2

-- getName returns the name of a Pet
getName :: Pet → String
getName (Cat name _)   = name
getName (Dog _ name _) = name
getName myPet  -- ⇒ "Copernicus"
```

We can also perform pattern matching with a case expression:

```
getName' :: Pet → String
getName' p = case p of (Cat name _)   → name
                       (Dog _ name _) → name
```

Types can also have parameters, which is a way of saying "I don't care exactly what type my data wraps, it can be anything:"

```
-- A Moment is a Memory event
-- We could write this:
data Moment'  = MemoryInt Int | MemoryString String | ...
-- So many cases to cover!
```

```haskell
-- Or, we could use a parameter and write this:
data Moment a = Memory a
-- example moments
moment1 = Memory 5       -- has type Moment Int
moment2 = Memory "exam"  -- has type Moment String
```

That's about all the Haskell we need to understand what's coming up next.

THE MAIN COURSE: WHAT'S AN EXAMPLE OF A MONAD?

Suppose you're still with me after that doozy of a language introduction. Our example scenario for today is that we wish to traverse a linked list. Let's set up our type definition:

```haskell
-- A LList is one of
--   - Node element next
--   - Empty
data LList = Node Int LList | Empty

-- example list
aLList = Node 1 (Node 2 (Node 3 Empty))
```

If we wish to access a member of our linked list, or traverse the list, we must handle the case where we are handed an empty list. Most languages will throw an error given such a scenario (try calling `(first empty)` in Racket, for example), but what if instead of throwing an error, we returned some sort of type that encapsulated either a successful result or an error? Something like:

```haskell
-- A Result is one of
--   - Ok result
--   - Error message
data Result a = Ok a | Error String

-- example results
goodResult1 = Ok 5
goodResult2 = Ok "yes!"
badResult = Error "no!"
```

With that in mind, we can write our traversal functions:

```haskell
head' :: LList → Result Int
head' (Node el _) = Ok el
head' Empty       = Error "called head' on empty list"
tail' :: LList → Result LList
tail' (Node _ next) = Ok next
tail' Empty         = Error "called tail' on empty list"

-- example
head' aLList  -- ⇒ Ok 1
tail' aLList  -- ⇒ Ok (Node 2 (Node 3 Empty))
tail' Empty   -- ⇒ Error "called tail' on empty list"
```

Now, let's say we want to fetch the node that contains 3. Here's the solution that we might jump to immediately:

```haskell
attemptOne = head' (tail' (tail' aLList))
```

The issue here, of course, is that `tail'` returns a `Result LList`, while `tail'` and `head'` both expect `LLists`! So this won't compile, let alone run, because of the type mismatch.

Our next instinct may be to use pattern matching, and this is generally a very good instinct—pattern matching is *extremely* powerful. Here's what the pattern matching solution would look like:

```haskell
attemptTwo = case (tail' aLList) of
    Ok x → case (tail' x) of
      Ok y → case (head' y) of
        Ok z → z
```

This looks manageable, until we consider that

1. This is only 3 traversals, but in a real-life application we may have to do hundreds of traversals, and this is really unwieldy to scale.[2]
2. We aren't handling any errors that may pop up.[3]

So here we are, two non-optimal solutions down and nothing better in sight. What do?

Let's try something new. Take our pattern matching from our previous attempt, and wrap that in a helper function `bind` that takes a `Result` and a function operating on the type wrapped by that `Result`, like so:

```haskell
bind :: Result a → (a → Result b) → Result b
bind x fn = case x of
    Ok y    → fn y
    Error m → Error m
```

What `bind` does is:

- If it's given an `Ok` as its first argument, it unwraps that `Ok` and applies the function it was given to the unwrapped result, returning another `Result`.
- If it's given an `Error`, it returns the same `Error`.

Now let's try using `bind` to traverse our list:

```haskell
attemptThree = bind (bind (tail' aLList) tail') head'
```

Whoa. That was short, but it still seems a bit confusing. Let's rewrite this to be a bit clearer:

```haskell
-- Define a Result constructor
return :: a → Result a
return x = Ok x
-- Define an infix alias for bind
-- x >>= y is thus equivalent to bind x y
(>>=) = bind
attemptThree' = return aLList >>= tail' >>= tail' >>= head'
```

And with that, we've made `Result` a monad type! By using `bind`/`>>=`, we were able to abstract away the pattern matching into a sleek sequence of functions.

If you're confused about the flow of how we evaluate `attemptThree'`, it can be read in the following order:

1. Call `return` on `aLList` to get a `Result LList`, specifically `Ok aLList == Ok (Node 1 (Node 2 (Node 3 Empty)))`.
2. Call `bind` on the `Result LList` from step 1 with `tail'` as the function, giving a `Result LList`, specifically `Ok (Node 2 (Node 3 Empty))`.
3. Call `bind` on the `Result LList` from step 2 with `tail'` as the function, giving a `Result LList`, specifically `Ok (Node 3 Empty)`.
4. Call `bind` on the `Result LList` from step 3 with `head'` as the function, giving a `Result Int`, specifically `Ok 3`. This is what gets assigned to `attemptThree'`.

Now, you may be wondering "But what if we were given an `Error`? What happens then?" This is the beauty of monads: if one of the `bind` operations returns an error, that error gets passed verbatim through the rest of the bind operations, and we only need to care about the error in our final result!

```
badAttempt = Empty
    >>= tail'    -- returns an Error...
    >>= head'    -- ...but now bind just passes through
                 -- the error instead of calling head'!
                 -- The end result is that badAttempt is
                 -- an Error "called tail' on empty list"
```

So not only do monads allow us to abstract away the repetitive pattern matching that we needed to check whether each `Result` was an `Ok` or an `Error`, monads also give us the ability to mentally abstract away any errors in our data pipeline, thus simplifying a complex series of checks and error handlers to a simple stream of operations!

THE DESSERT: MONADS ARE ACTUALLY REALLY COOL TO USE

Believe it or not, monads aren't just some weird academic construct. Here are two real-world, surprisingly common applications of monads that you may have encountered before

MONADS IN SCALA

If you've ever had a Big Data job, you've probably worked with Apache Spark. If you've ever worked with Spark, you've probably encountered Scala. If you've ever encountered Scala, you've probably seen its `Option` type in use like this:

```
val value = someOption match {
    case Some(i) ⇒ Some(2 * i)
    case None    ⇒ None
}
```

This is very similar to our use of the `Result` type earlier. However, Scala further abstracts `bind` to define `map`, `filter`, `foreach`, and other collection methods on its `Option` type. This means that the above can be rewritten to fit in a single line, and even extended:

```
val value = someOption.map(_ * 2)

// If the given option has a value, double the value
// and then make sure it's positive
def doubleAndCheckPositive(opt: Option[Int]): Option[Int] {
    opt.map(_ * 2).filter(_ > 0)
}
doubleAndCheckPositive(Some(2))   // ⇒ Some(4)
doubleAndCheckPositive(Some(-2))  // ⇒ None
doubleAndCheckPositive(None)      // ⇒ None
```

(There's something to be said here about the shocking lack of complexity most commonly associated with Scala, which…is a very fair criticism of Scala. Sorry, Professor Lhoták.)

MONADS IN JAVASCRIPT

Believe it or not, JavaScript has monads too! Okay, they're not *really* monads, but the way we use and interact with `Promises` is very similar to how we would use and interact with monads, which means I can comfortably say that `Promises` are monads. After all, if it walks like a duck, quacks like a duck, and has operations like a duck, it's probably a duck, and JavaScript is duck-typed so that's doubly true.

I can hear you all groan and sigh, "That was a horrible joke. I'm leaving." No, please stay! I have examples to show you!

```
// Recall that a resolved Promise is either fulfilled or
// rejected.
// This maps nicely to our notions of Ok and Error (or
// Some and None in Scala).
// We'll be using Scala for the comparisons in this
example.
```

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THE HIP YOUNG EDITOR WHO UNDERSTANDS SOCIAL MEDIA

```
// The equivalent of Some(5)
let okPromise = Promise.resolve(5)
// The equivalent of None
let badPromise = Promise.reject()
// The equivalent of someOption.map(_ * 2)
let value = somePromise.then(x ⇒ x * 2)
// Hey, let's recreate our Scala code above!
function doubleAndCheckPositive(promise) {
  return promise
    .then(x ⇒ x * 2)
    .then(y ⇒ y > 0 ? y : Promise.reject())
}
await doubleAndCheckPositive(Promise.resolve(2))
    // ⇒ Promise#fulfilled(4)
await doubleAndCheckPositive(Promise.resolve(-2))
    // ⇒ Promise#rejected
await doubleAndCheckPositive(Promise.reject())
    // ⇒ Promise#rejected
```

Again, `Promises` in JavaScript aren't *exactly* monads, but as we see here, we treat them like they are monads. Or ducks, if you're into that.

❦

Monads are a much more general concept than `Option` or `Result` types. There are I/O monads, state monads, and far too many other applications to list here. But whereas monads were once relegated to purely functional, "academic" languages like Haskell and OCaml, the inclusion of monads or monad-like features in everyday programming languages have brought these ideas much closer to home for many. As we've seen above, the power of a monad lies in how it lets us both technically *and* mentally abstract away common, low-level mechanisms that distract from the main purpose of the code. And as it turns out, this happens to be an extremely powerful idea with tons of applications in functional and imperative programming alike.

The next time you encounter a monad in the wild, you'll hopefully be able to understand and decipher what it's trying to do without needing an Aspirin. And if you're still lost on what a monad is, don't worry: programmers have been using "A monad is a monoid in the category of endofunctors" as an effective defense mechanism against nosy PMs and VPs for decades, and it hasn't failed any of us yet.

This guy likes functional programming way too much

With apologies to Jon Bois and all of the FP-purists I've inevitably pissed off with my oversimplified explanations, which I presume includes some of our readers and a few of my future profs. Also with apologies to clarifiED for yet another long article that she has to deal with, much against her wishes.

This article is an expansion to and refinement of a series of messages I sent to the **mathNEWS** Discord. Not-so-subtle advertisement: join the **mathNEWS** Discord! We have memes, frequent diversions into cool programming language features like this one, and we'll rope you into writing for **mathNEWS** so you can't escape.

Wow, this is a long postscript. Have some footnotes:

1. Despite being a more familiar language to all of us, Racket is dynamically typed, is not purely functional, and doesn't support union types, which makes explaining monads slightly more difficult. Besides, Haskell is a cool language—take CS 442 to learn more about the ML language family that Haskell is based on.
2. Sure, you'd probably use recursion or a higher-order function in that case, but you never know when you might have a brainfart like DisguisedToast did: https://clips.twitch.tv/TransparentSilkyPelicanPhilosoraptor
3. In fact, this means that this code won't even compile at all. The correct code is much more sinister:

```
attemptTwo' = case (tail' aLList) of
    Error m → error m
    Ok x    → case (tail' x) of
      Error m → error m
      Ok y    → case (head' y) of
        Error m → error m
        Ok z    →
```

AN IMPORTANT UPDATE ON MY HEALTH

I got COVID bitch, I got Coronavirus
Instead of stuffing out on cough meds I got stuffy sinus
And the COVID test is the only exam I think I'll pass
Cuz I'm spending my last breath failing a breadth and depth class
And now I understand that life is just another thing to mock
So I invested all my money into GME stock
Except I thought the saying was "always buy high and sell low"
So now my bank accounts just went from all OK to all K.O
And then I went and volunteered to test the Russian vaccine
They said "your life will be of service if you know what we mean"
I said "I don't but I don't care, I want to go on a hug binge"
But then I realized the shot was pickle juice in a syringe
And then I felt the might of brine coursing all up through my veins
And once the fluid hit my spine it turned me to Pickle Bane
So the moral of the song is don't let COVID get your fear up
And never write your article after 3 cups of cough syrup

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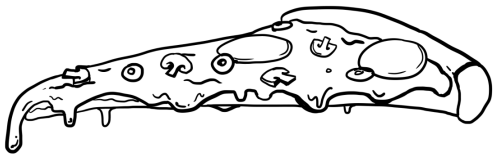


MISFITS LIVING IN A WORLD ON FIRE, SEASON ONE

It was April 2019. A couple weeks before, I received and accepted my offer to Waterloo. Double Degree Computer Science and Business, with a scholarship. And while I was elated to finally get accepted into the program I've been eyeing for a couple years, it comes with a caveat. None of my friends from high school would be coming with me.

I'd known it was coming for a long time, Waterloo wasn't their sort of environment, but it still was going to hurt. I was really uncertain about my future, and what I'd find at Waterloo. This was especially tough since I had always struggled with making new friends.

My friend group in high school was made up of the people who didn't have anyone else. We were the ones who struggled to make connections, who didn't fit in with the rest of our grade. Most of us had known each other from elementary school, meaning that I basically hadn't needed to reach out to someone new as a friend in almost a decade; any new members of my group were my friends' friends, not mine.

But I had a new episode of one of my favourite shows, one that had been getting me through Grade 12.

An adaptation of one of my favourite comic book teams, Doom Patrol is a series about a group of misfits who live in a mansion together due to gaining superpowers after tragic accidents.

Take Larry Trainor, Negative Man, as an example. He's a test pilot from the 1960s, with a loving wife and two perfect children… except he happened to be gay. After being forced to choose between his family and his lover, Larry went on a flight where he encountered a mysterious cloud of radiation.

The cloud caused his plane to lose control and crash, after which Larry was fused with a spirit made out of radioactivity that sometimes flies out of his body, causing him to lose consciousness. To protect others from the radiation, Larry is forced to wrap himself up in bandages, which also cover his badly burned face.

In this case, the spirit is parallel to Larry's queerness; he wishes that he could repress it for the sake of his family, but it's inseparable from who he is and it ends up hurting those around him in the long run. Each of the other team members has a similarly constructed backstory and powerset, and the show's about them growing, changing, and learning to grow past their trauma.

In one specific scene in the eighth episode of the first season, Larry ends up at a karaoke club, and he's handed the microphone. As he does, the song "People Like Us" by Kelly Clarkson starts playing, and as he climbs up on stage he starts to sing, giving the performance his all. His bandages magically vanish, revealing an unburned face, and everyone in the club starts singing along and dancing with him. He's clearly on top of the world, happier than we've ever seen him.

And then… we cut to Larry in his seat, bandages back in place, the microphone held out to him. He says "I don't sing," and pushes his way out of the club.

No matter how much Larry wishes he could be up on stage singing his heart out, he can't let himself. He's haunted by how he's hurt those around him, which causes him to deny himself the happiness he craves.

When I arrived on campus five months later, I was basically alone. Even my roommate, who I had hoped would be a friend, was someone who was just as socially anxious as I was. We'd go weeks without talking despite sharing the same small dorm room, doing chores and staying out of each others' ways by unspoken agreement.

I tried to make friends, or at least I thought I did. I held conversations with people, and when they didn't aggressively attempt to continue talking to me I figured that was it, they didn't care about me. I went to floor events, playing games and going to movies with the guys on my floor. But nothing ever really stuck.

I knew it was probably me, not those around me; by the end of the Fall term everyone else had solidified friend groups, and I was stuck on the outside, eating meals and making my way between classes alone.

Over winter break I had met someone through mutual friends, and we started dating in early February, but she was in Grade 12, living back in my hometown, and had only applied to schools within driving distance. Even finding love couldn't help with the day-to-day solitude I had forced upon myself.

But I didn't know what else I could do. I didn't even see the situations where I could start talking to people, start pushing myself outside my comfort zone. The microphone was held out to me, but I didn't realize I could take it for myself. I denied myself the happiness I wanted so much. The days and weeks had just kind of passed me by.

That all changed one day in late January when I was unexpectedly DM'd a Discord server invite by someone I had had a few conversations with on a UW-related server. Suddenly, I was thrust into a friend group of a few dozen people, many of whom I shared classes with. Sure, I still struggled to speak out myself and actually go to meet-ups, but I was slowly integrating myself into this group, sitting with them at classes and discussing tough quiz questions.

Things were going great. And then… March hit.

"I don't sing."

Predap

sexNEWS: SUBTITLE GOES HERE

Welcome back to **sexNEWS**, a biweekly column in which I answer relationship advice questions submitted by you, the readers.

As always, feel free to send your questions to mathnews@gmail.com to be potentially answered in this column. Anonymity is guaranteed[1]. You're also welcome to include additional information to give context that you don't want included in the article if you're worried that your situation is specific enough that fully explaining it would expose you. This column is not restricted to just romantic relationships, we discuss personal relationships as well.

> *I forgot to respond to someone's DM for some time and now they leave me on read even when I try to apologize. What do?*
>
> SALT

Maybe the are forgetting to respond to you? Sometimes people forget. If they're that petty to ignore your messages even after you apologized, maybe you should talk to someone else.

> *My significant other is very curvy, never gets to the point, and is always going off on tangents. Is my girl a circle?*
>
> SALT

Yes.

> *What do I do if this guy I'm sorta friends with keeps hitting on my boyfriend and my boyfriend seems to laugh it off and not notice? They call each other "sweetheart" and "honey" in this really playful manner and they keep playing this fun game of pretending not to see me and walking away from me really fast which is fun because they've kept if up for like three months so y'know we're really like the three amigos always joking around so I guess I shouldn't worry. They're such good friends that they're always holding hands to make sure that the other one doesn't trip and fall because they care so much about each other and I'm so happy that my boyfriend has such a loyal friend who's always touching his butt to make sure his jeans aren't wet like that's so wholesome and I love him so much.*
>
> My boy friend is flirting with my boyfriend

It sounds like your boyfriend may be exhibiting some homoerotic tendencies. That's perfectly normal and okay. Though if it makes you uncomfortable because you value monogamy, you should talk to him about it. On the other hand, if you enjoy it then you could encourage it.

> *My life revolves too much around my crushes: when I like someone, life feels really exciting and meaningful. When I don't, it's dull and grey. I've had people tell me focusing on one person too much is bad, and not to base all my happiness around one person. Are they right? I have a hard time doing that. What should I do?*
>
> HEART STOLEN, REPEAT VICTIM

It's natural and healthy to be excited when there is someone new you fancy in your life. On the other hand, it's not great if your life suffers when there isn't someone like that. It's important to have multiple hobbies and even multiple friend groups. This allows you to have something/someone else to focus your attention on when other things in life aren't going too well.

Senior **mathNEWS** *Relationship Correspondent*

1. Unless there is a court order or something, but if I foresee that being an issue I probably won't answer the question in the first place. Canada has unfortunately weak laws protecting journalists, and I don't know if this column even counts as journalism.

Ignore everything else I just said.

PROF. MICHAEL WALLACE

N ICONIC mathNEWS FIXTURES

- The graphic design (thanks, George).
- The colourful cover pages.
- The **mastHEAD** question.
- The Article of the Issue.
- **mathASKS** and **profTHOUGHTS**.
- **profQUOTES** (although I haven't seen much of these lately).
- **blackBOXES**.
- The **gridWORD** and **gridCOMMENT**.
- The **lookAHEAD**.
- The **lightBOXES** (maybe this is a bit premature?).
- "Overheard at **mathNEWS**" articles (I haven't seen much of these either).
- "N Things" articles.
- **elseWHENS**.
- **horrorSCOPES**.
- The ISSN.
- bunniED's bunnies.
- The writer pseudonyms.
- The "ED"itor pseudonyms.
- The **haltingPROBLEM** (R.I.P.).
- **otherNEWS** / _____ Sez (Also R.I.P.).

clarifiED

SENATOR KYRSTEN SINEMA'S INSULT

I have paid attention to politics since I was around the age of 11, and because of that, I remember many historical moments. These moments come in all sizes, big and small, and what many may consider as an unimpactful event may actually carry significance or great importance if you look into it a little more.

One particular moment that will stick with me forever is this one particular vote by the late Republican Senator John McCain of Arizona in 2017. In fact, I even consider it to be one of the best senatorial moments I have ever witnessed, just from how it played out.

Let me start by saying that one's political ideology does not matter here, in this context. Often you will find that there is respect to give where it can be found in a person, regardless of their party affiliation or political beliefs, and how it may conflict with your own. On that particular day, there was great respect to be found in the actions of Senator McCain.

❦

By early 2017, the Republican Party took control of both houses of Congress and the presidency, and hopefully you can recall that the issue at the time was on Obamacare, more specifically named the Affordable Care Act (ACA). After some earlier hardships and failed attempts, there was one final push, a "skinny repeal", called the Health Care Freedom Act of 2017, which was on repealing the individual mandate part of the ACA among other things.

The Republican Senate leadership rushed to attempt to pass this "skinny repeal" as it was the bare minimum which was thought to be acceptable to all 52 Republican Senators. All 46 Democratic Senators, and the two Independent Senators that caucus with the Democrats, stated their intent to vote against this bill for obvious reasons, so all the attention was on the Republican senators and how many of them would side with the Democrats.

The known commitments by Republican Senators who would vote against the bill were Senator Lisa Murkowski of Alaska and Senator Susan Collins of Maine. That only made it a 50–50 tie. In the case of a tie, the Vice President breaks the tie and Vice President Mike Pence intended to vote to pass this bill making it 51–50. Thus there needed to be one more Senator to vote no, to make it 49–51.

In the days leading up to this Senate vote, McCain was perturbed by the process leading up to the vote, including how it seemed to be a rushed and closed-door process — against what he perceived to be the proper and usual Senate procedure. However, he remained uncommitted or at least kept his mouth very shut on how he was going to vote on this bill. It even got to the point that in the hours and minutes leading up to the final Senate vote that there were phone calls from President Trump at the White House, and the Vice President went to the Senate to try and lobby him to vote for this bill. Of course there was other discourse concurrently from the 'no' side to try and get McCain to vote 'no'.

There was also this other factor in that, prior to the day of the vote, McCain announced his brain cancer diagnosis. He was originally hospitalized for a blood clot at the Mayo Clinic Hospital in Phoenix, Arizona. Testing done at the hospital revealed a tumour associated with the blood clot, hence the diagnosis. McCain's hospitalization would postpone the Senate vote in order to allow him to recover. He kept private on what the recovery was like but I imagine that the impact of the ACA on ordinary Arizonans was something on his mind frequently, along with the fact that his one vote would impact so many people—not just of his state but the entire country.

The debate and conversations on the Senate floor began on July 27, 2017 and carried on through to the early hours of July 28. The roll-call began around 1:30 am and the names of Senators were read with each Senator replying either 'aye' or 'no'. Typically, the list is done alphabetically but as Senators go to and from the Senate chamber, votes sometimes become out of order, since Senators that can be absent from the chamber when their name was called, can vote at a later time when they return back. McCain was a Senator who was not present in the chamber when their name was originally called.

By this point, everyone knew that there were 50 no-votes and 49 yes-votes, and it was just McCain's decision that was left. He walked slowly into the chamber stopping off to the side, and held out his hand to get the Senate Clerk's attention as Senator Peters' name was called (who sternly replied "no!"). The Clerk did not go on to the next name in the roll-call list but turned to McCain and gave him a small nod. With a small moment of cinematic suspense, he then turned his outstretched hand into a thumbs-down and said a brisk "no."

At that point audible gasps were heard, and some senators began to clap knowing what McCain had done. As McCain turned around to begin walking through the aisle to his Senate seat, he briefly faced Senate Majority Leader Mitch McConnell who appears with crossed arms and a stern disappointed face. All the while, Senate Minority Leader Chuck Schumer tries to get the overjoyed Senators on his side of the chamber to quiet themselves via a quick wave. McCain walked to his seat with a slow and calm pace. The Clerk proceeded to call the name of Senator Portman.

I cannot state how much those 20 seconds play out like a dramatic scene from a movie. Even to this day, those 20 seconds still make me awestruck at the entire thing. I knew that I had witnessed a historical moment — the long, drawn out, highly politicized process, leading up to one simple thumbs-down. I highly recommend that if you have never seen the footage of this moment to search it up.[1] It plays out like a scene in a great renaissance painting.

Senator John McCain passed away on August 25, 2018 due to the cancer that he was diagnosed with in the days leading

up to that Senate vote. Jon Kyl,[2] a former Senator of Arizona, was appointed to serve McCain's remaining term. Arizona's other senate seat was won later that year by Democrat Kyrsten Sinema. McCain's own seat would later be won by Democrat, and former astronaut, Mark Kelly in 2020.

❦

At this point, the title of this article has not yet been relevant. This now leads us to the present times. On March 5, 2021, the Senate was voting on amendments to the $1.9 trillion COVID-19 relief plan bill. One of the amendments was on introducing the $15 federal minimum wage. During the vote, I saw something I could not believe my eyes at first. Did Senator Sinema try to horribly imitate what McCain had done?

Senator Sinema had walked up right to the centre of the clerk's desk, and in a gleeful manner, held out her hand to do a thumbs-down, as if doing so was some kind of comedic act. She then proceeded to turn around to walk through the aisle, headed to her seat.[3]

McCain did his thumbs-down to prevent even a part of the ACA from being repealed to ensure millions in his state of Arizona and the country at large had access to healthcare. He could not let a rushed bill, drafted in secrecy with minimal consultation pass through the Senate into law. He stood for the process that he believed from his earlier terms in the Senate.

You look at what happened this time, and here was Sinema parodying[4] the same thumbs-down but for voting against an increase in minimum wage that would have helped millions in her state of Arizona and the country at large. All that was done for what exactly?

What Sinema did was inexcusable and insensitive. She could have just voted 'no' the normal way! Why did she go through the effort to make herself look like a jerk in the process? If she wanted to insult tons of people, there are more respectable ways to do so than what she did on the Senate floor that day. It is obvious what her intent was: another Senator from Arizona doing another thumbs-down. For some bizarre reason, she was clearly copying that moment McCain cast his thumbs-down vote. Did she do it for clout? Was it for publicity? I doubt anyone will find out, and I'm sure she will keep her mouth shut about this moment considering what bad press it attracted.

Opposing Sinema's vote, the other senator from Arizona, Senator Mark Kelly, voted in favour of this amendment. Though, in the end, the amendment was not carried as the final tally was 42–58. However, it is clear that this shows what lack of respect she has of McCain's historic vote, among others. At least I have more respect for McCain's moment on the Senate floor than Sinema ever had.

❦

I can say that nothing I have seen in politics for the past decade is like what Sinema did that day. In fact, I even consider it more surprising than the storming of the US Capitol on January 6 since I at least expected something crazy would go down that day. This thumbs-down by Sinema was not expected at all whatsoever! Who knew John McCain would still impact politics even after death?

boldblazer

P.S. You can respect certain aspects of a person like McCain, but I still wouldn't vote for him from a policy perspective. I could probably write an article on some of his mistakes too.

1. Or, you could just go to this link directly: youtu.be/DWeayFHsH90 For a play-by-play go to this link: youtu.be/TUVYYiRIuE4.
2. His name is pronounced like "John Kyle" and I must say that it is quite efficient in terms of letters used while still keeping its pronunciation.
3. Here's a short video of that moment: youtu.be/nNo_U7PTGzk
4. Here's a parody of Sinema's parody of McCain's thumbs-down if you want to have a bit of a chuckle: youtu.be/IK_P6dBMs60

WHEN A mathNEWS EDITOR HAS TO DO LAYOUT BUT EVERY ARTICLE IS TWO PAGES LONG

clarifiED

THINGS YOU APPRECIATE

if you turn "pog" upside down it looks kinda like "god"

[Editor's note: pog bless america]

tendstofortytwo

mathDATES: THE BLITZ ROUND

IT'S TIME FOR SPEED DATING!

Welcome to **mathDATES**, the biweekly column where I, Finchey, provide my worldly advice to unlucky-in-love mathies of the University of Waterloo for *free* for all to read. As Polonius once said, brevity is the soul of relationship advice. So, this issue, I've decided to go against my pontificating nature to answer every question in 100 words or less. It was a tough task trying to distill my vast knowledge into compact, bite-sized maxims, but the clever — or desperate — reader will be able to read between the lines.

A personal update: last Tuesday, after what is the longest stretch of time in recent memory that I have been single, I began dating a friend of a friend — a late-19th-century-train collector. How's it going, you ask? Well, not to toot my (or their) horn, but the SEX is the **steamiest** I've *ever* had. I think they might be *the one*. We're currently looking for a place to live together. Now it pains me terribly to say this, but this new relationship of mine is taking up so much of my time that I am announcing that next issue's edition of **mathDATES** will be the **last**. It takes *a lot* of time to do this column justice, and I'll have none to spare once I move in with my new darling in a little villa in Monaco, making **passionate** love to each other every waking hour of the day. I normally say something along the lines of "don't send me any more questions" in the introduction to each **mathDATES**, but the thrill of new love is making me generous, and next issue's going to be the last one anyway. So, if you have a burning question about love or sex that you know no one other than me can answer, please send it posthaste to mathnews@gmail.com and the lovely editors will pass it along my way. I will be looking forward to it.

> *I'm attending a speed dating event soon. I've never been to one before. What sorts of things should I talk about to make the best first impression?*
>
> Speedy Gonzales

I'm gonna re-frame your whole strategy here. You make the most out of speed dating not by blabbering about yourself for the full five minutes, but by asking the person you're paired with lots of questions about them. People LOVE talking about themselves, so they LOVE somebody who enables that. Plus, you'll appear enticing and mysterious! How exciting! Here are some questions that you can use to break the ice:

- What's your name?
- Can you drive a car?
- Were you a witness to the unsolved murder of Canadian pharmaceutical magnate Barry Sherman and his wife in December 2017?
- When's your birthday?

Next question!

> *I'm a guy. How do I stop finishing so fast in bed? My new girlfriend says it's okay but I'm so embarrassed!*
>
> Quick Man

Why don't you believe your girlfriend? If you ever learn something from me, let it be this: you don't have to last as long as you *think* you need to. She's probably flattered that you're so into her. Fucking relax. You could be having the *opposite* problem — which is not finishing at all. Now I wouldn't want to be your girlfriend in that position.

Next question!

> *How do I get over my ex faster? For context, we dated in high school but they broke up with me before we started university. I'm still not over them. It's been two years. TWO. YEARS.*
>
> Dashed Dreamer

There's no faster way to get over someone than to simply forget. Keep the past in the past! Call up your local quack, mad scientist, or foreign intelligence headquarters and get yourself some electroconvulsive shock therapy to induce retrograde amnesia. There's a small chance of completely frying the grey matter in your brain beyond repair — about 1 in 13 — but most of the other kinks with the process have already been smoothed out. Places offering this kind of service are old-fashioned, so you'll want to look for their info in the classifieds section of your local newspaper rather than online.

Next question!

> *What's a polite way to end a video call quickly?*
>
> The Zoomer

Can't go wrong with, "**Pssh** **Pssh** Uh oh, I'm going through a tunnel right now **Pssh** I think we're breaking up **Pssh**", followed by a swift hang-up. If they later ask you why you didn't pick up when they tried to call you back afterwards, you can just say that you were going through a really big tunnel, like the one under the English Channel or something. They'll never suspect a thing.

Next question!

I love blackBOXES very very much.

A mathNEWS EDITOR WHO IS NOT BEING HELD HOSTAGE RIGHT NOW

I've been with my partner since we met in 1A and this is our last term at Waterloo before we graduate. We've been living together for three years. I think my partner wants us to get married this year. I love them and all, but for some reason it feels really fast to get married right out of undergrad. Is marrying so early in my twenties (even if my partner and I have been together for a while) something I should be worried about?

Cheetah Lover

I got married to someone I met in undergrad before I even graduated. Actually, I got married to lots of people I met during undergrad. While having 5 divorces under my belt before I've turned 25 has given me invaluable life experience (which I pass onto you and other readers of this column), the paperwork, legal proceedings, and rogue crocodile wrangling isn't something I think most people our age could handle. Seriously: take a course in crocodile handling before you get married. It may be the difference between life or death.

Next question!

I managed to convince my totally unathletic boyfriend to go jogging with me last year, but in the time since he's become faster than me! I feel kind of snubbed — running was MY thing, not his! What can I do to cope?

Gotta Go Fast

Feeling jealous of your partner's the worst, isn't it? Especially when they become better at something you thought was uniquely yours — it's like having your goddamn identity stolen! (I'd know, I've had both happen to me.) As I see it, you have three choices:

1. Suck it the fuck up. (The do-nothing option.)
2. Break up with your boyfriend. (The nuclear option.)
3. Break your boyfriend's shins with a baseball bat and then gaslight him into thinking the neighbour's cat did it. (A healthy in-between.)

Next question!

What's the fastest way to get someone to fall for you?

Flirtatious Flasher

I see you're someone who plays with the hearts of their suitors and recognizes love and courtship as the game that it is. Respect. But while charm and wiles may get one very far, they're not the fastest way to your target's heart. Indeed, the fastest way to get someone to fall for you is to hire yourself an evil accomplice (a little man named Ygor) and kidnap your target. While Ygor is tying your target up to your BSDM dungeon bed, you jump in and "save" the kidnappee, running away with them in your arms into the shadowy night.

Finchey

N THINGS I DON'T MISS ABOUT THE CAMPUS

```
#include "me.h"
```

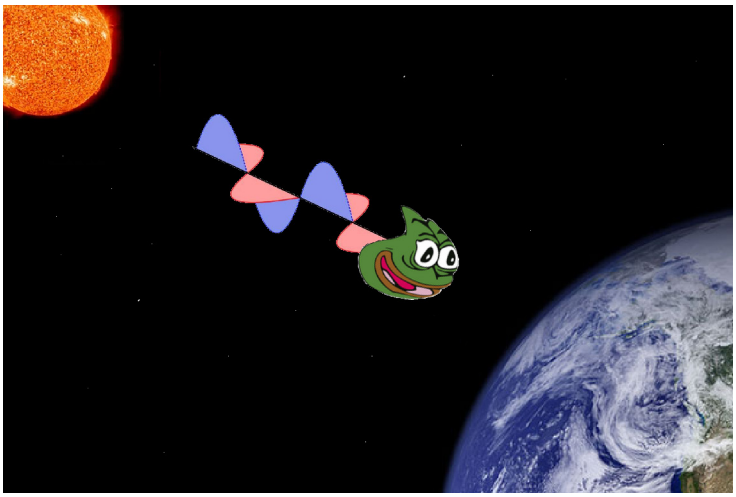
In the last issue, I listed things that I miss about campus. Here is a list of things I don't.

1. People turning on the lights when I ~~sleep~~ ~~nap~~ take *short* breaks in Comfy, SCH, RCH, SLC, DP, DC, HH, STC and E5.
2. People smoking right beside building doorways.
3. The person that keeps harassing everyone to donate to random causes.
4. The first floor DC bathroom.
5. That weird, unexplained smell in M3.
6. Harsh winters and sometimes hot summers — part of the deal of being in Canada. Some people love this type of climate. Not me though.
7. Goose poo on the floor. It sticks to my feet and makes my shoes smell.
8. The thieves who stole my phone, backpack and coats. (Look out for your belongings when you come back.)
9. The wall poster merchants who took over the SLC main hall for weeks. Can't they set up an e-shop?
10. That long ~~walk~~ run from my AFM course in Hagey Hall to my CS course in MC, and the run back to Hagey Hall for another AFM course. Rain or snow, CFM students can relate. (DD people had it even worse.)
11. SLC, STC, ION, and E7 construction. For boomers, I bet it is E5, QNC, and M3.
12. The loss of greenery and public space due to the new construction.
13. The shoe box plastic-looking architecture of the new buildings and the over-saturated apple store interiors. It's a style thing, but the jagged edges and cold walls made me feel less comfy. White walls made my eye floaters worse.
14. Train choo-choo-ing at 3 in the morning.
15. The crows cawing in the early morning during fall. Especially at WCRI.
16. My neighbours' parties/commotions that disrupted my sleep/study.
17. The sense of isolation; the lonely boy hours during the middle of the term. When everyone is too busy dealing with assignments and midterms. Clubs are closed, so there's nothing to do after exams. (Nowhere comparable to nowadays though.)

How time flies, It's hard to truly internalize it until it becomes too late. Seize the moment, fellow goslings.

me

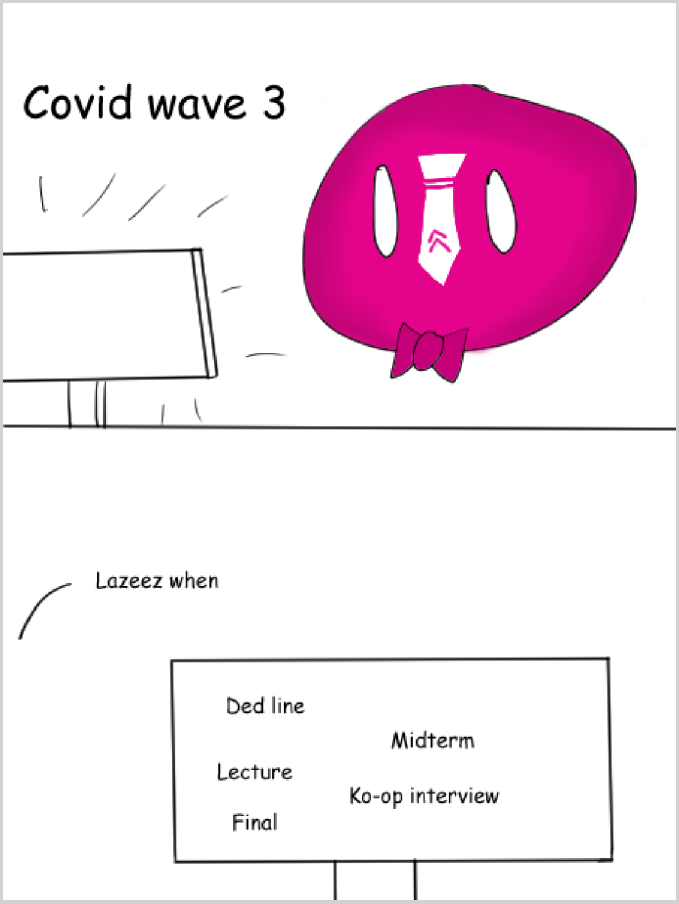
YOUR SUBMISSION HAS BEEN GIVEN THE HUGƵ AWARD!



>Be me.
>A small speck of information at the beginning of the universe.
>Encode as quanta of energy in a coordinate of space and time.
>No longer unify as the forces separate.
>First we are a field, pushing space-time apart by the scale factors.
>That inflation field collapses.
>We become I, I become a photon.
>Too high energy, split into 2 opposite particles.
>Experiencing time.png.
>Particle meets its antiparticle, annihilates back to a photon.
>Repeat 10^{30} times.
>Somehow can't find a mate anymore. Guess I am a quark now.
>Find some friend particles, no longer alone.
>Be a hydrogen atom.
>Form a star.
>Oh no there was a black hole in the centre of the star.
>By luck get beaming out of the star.
>Yeet across a billion light-years.
>Form another star in another galaxy. :D
>Star explodes. :(
>Floating alone :(, forming another star. :)
>Explodes again… it keep failing… :(((
>Form another star. :/
>Fourth time is the charm.
>A mid-size star, and this time I am at the core, POG.
>Gotta achieve that fusion dream.
>Tfw no match.
>Bounce around for 4 billion years in the core.
>Buff weak force pls.
>Finally a match! I am part of a deuterium atom.
>Via beta decay I leave the atom family as a gamma-ray.
>Farewell amigos :')
>Bounce around the star for another 100 thousand years.
>Escape the star as visible light, heading to a dirty moss ball
>Strike a solar panel, what the odds of that happening?
>By some electrochemical process, I become electricity.
>Feel time again, everything is so damn slow.
>Through a series of metal pipes.
>Through another maze of silicon gates.
>Cause a cathode-ray tube to release a wave of light.
>Strike the back of an eye of a depressed UW student.
>Become biochemical signal.
>Though trillions of neurons I fulfill my purpose.

It's PD 11

COVID WAVE 3



Igy

Proof: it's obvious.

PROF. STEVE FURINO

DO I HAVE A MATH FETISH?

So, tell me what's been on your mind lately.

I'm not even sure doc… Stuff's just been crazy lately, and I've been swamped with math homework for the last few weeks. Like I don't have any electives because I hate literally every other subject and these five math courses are really starting to take their toll on me.

What do you mean?

Well, I really do love math. And at first, I thought it was a good thing when the dreams started… You know doc, I sometimes have trouble keeping up with the ideas in class. Like, when we started studying cosets and quotient groups, I really had a lot of trouble while everyone else seemed to get it right away.

Mhmm, how did that make you feel?

Well, shitty, to be honest. I wasn't quite sure I'd be able to ever understand it, and I was scared that the ideas would only get more abstract from there. But then… Ahhhh, doc, it was amazing. I had this dream. It was like, I could see the objects and numbers in front of me. I could touch them. I could see their colors. They moved and shifted around in front of me and I just suddenly grasped how it works. I can't really explain, and frankly I don't even really understand how it happened, but all I know is that the next morning I woke up and just… *knew*… how to solve my assignment problems. Something clicked. It was emotionally liberating. I never doubted my abilities after that. I knew from that moment on that, if I didn't understand something, I just needed to give it some time.

That sounds pretty amazing.

Yeah… It's just, now I'm a little confused.

Confused about what?

I don't really… ah…

Remember, this is a safe space.

Well, you know how I have a really sweet crush? I'm absolutely in love with him, and he's great, y'know…

Mhm?

One day, I was having this really great dream. It was after the semester was over and all the stress was done. We were in a dark room, and he was hugging me in a really nice way. And it was so romantic. But then… He unbuckled his belt. And I slowly took off his pants… And he had an epsilon.

Do you mean he had a small sexual organ?

No, I mean, he had an epsilon. In the place… of, *that*. And in the dream, I looked at it and whispered in his ear… "I have the perfect delta for you." And I unzipped my pants and I had a delta. We connected in the most phenomenal way. I mean, it was spiritual.

…

What do you think it means, doc?

Go away.

Mathematically Confused

WHEN THERE'S A GOOD BALANCE OF LONG AND SHORT ARTICLES IN AN ISSUE OF mathNEWS

clarifiED

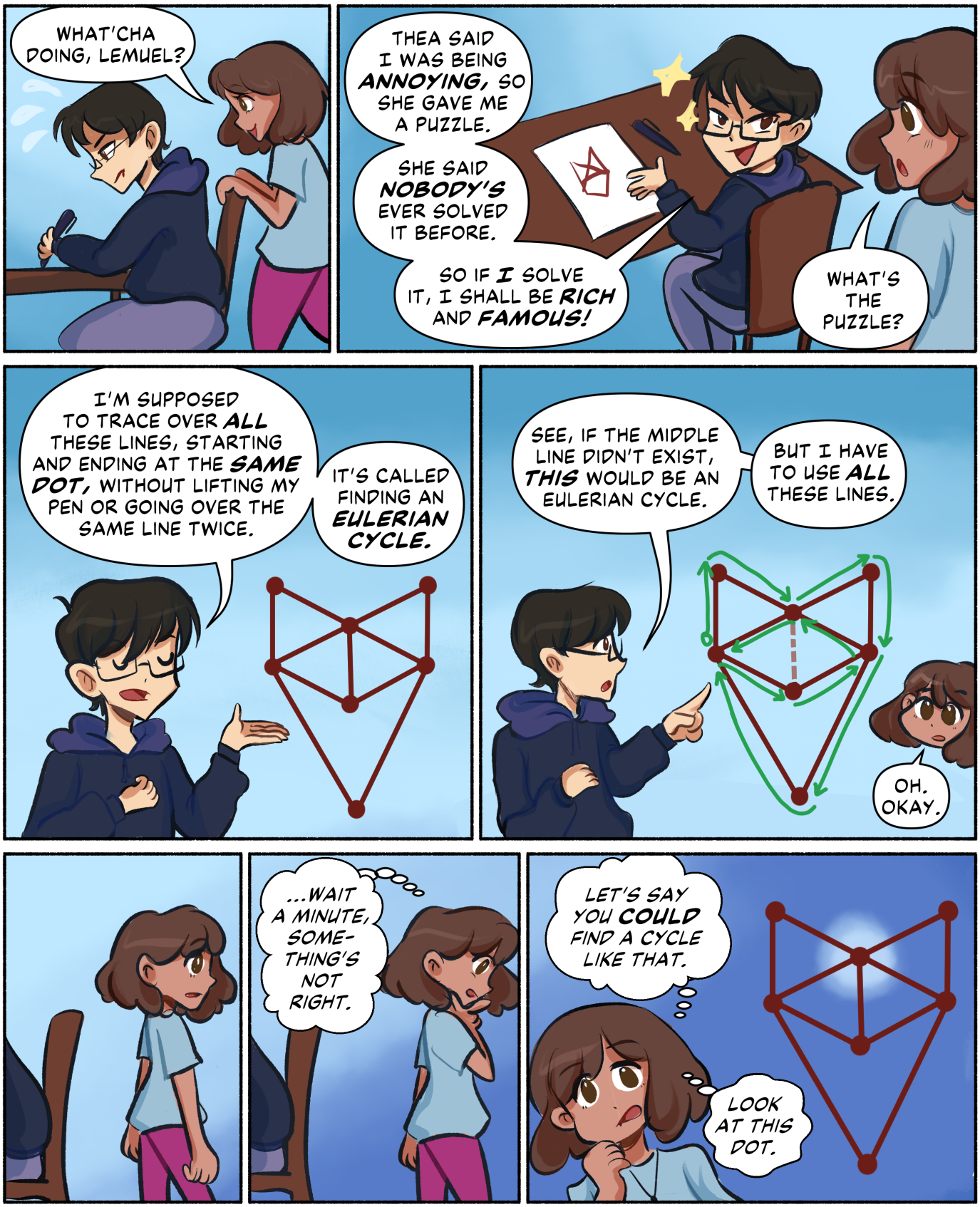
EPISODE 17: EULERIAN CYCLES

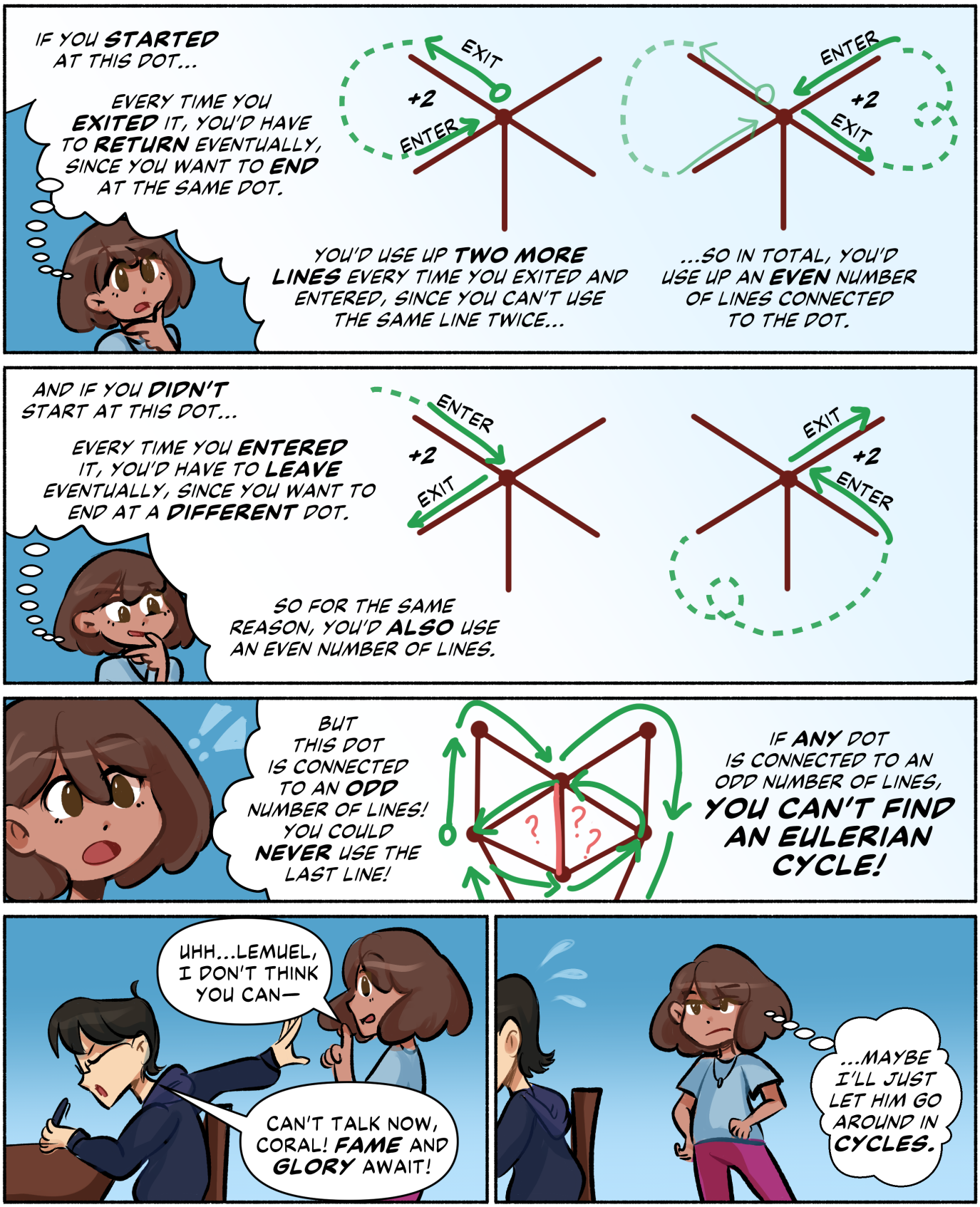
Enjoy Episode 17 of the MathSoc Cartoons series: *Eulerian Cycles*! Want more comics? Follow @mathsoccartoons on Facebook or Instagram! Got feedback, suggestions, topic requests, fan art, cute goose photos, or prayers to Ba'al the Soul-Eater? Leave 'em at bit.ly/cartoon_feedback or email mathsoccartoons@gmail.com!

Ava Pun

MATH 239: EULERIAN CYCLES

STORY BY AVA PUN | ART BY ALYSSA B.




IF YOU STARTED AT THIS DOT...
EVERY TIME YOU EXITED IT, YOU'D HAVE TO RETURN EVENTUALLY, SINCE YOU WANT TO END AT THE SAME DOT.
EXIT
+2
ENTER
ENTER
+2
EXIT
YOU'D USE UP TWO MORE LINES EVERY TIME YOU EXITED AND ENTERED, SINCE YOU CAN'T USE THE SAME LINE TWICE...
...SO IN TOTAL, YOU'D USE UP AN EVEN NUMBER OF LINES CONNECTED TO THE DOT.
AND IF YOU DIDN'T START AT THIS DOT...
EVERY TIME YOU ENTERED IT, YOU'D HAVE TO LEAVE EVENTUALLY, SINCE YOU WANT TO END AT A DIFFERENT DOT.
ENTER
+2
EXIT
EXIT
+2
ENTER
SO FOR THE SAME REASON, YOU'D ALSO USE AN EVEN NUMBER OF LINES.
BUT THIS DOT IS CONNECTED TO AN ODD NUMBER OF LINES! YOU COULD NEVER USE THE LAST LINE!
? ? ?
IF ANY DOT IS CONNECTED TO AN ODD NUMBER OF LINES, YOU CAN'T FIND AN EULERIAN CYCLE!
UHH...LEMUEL, I DON'T THINK YOU CAN—
CAN'T TALK NOW, CORAL! FAME AND GLORY AWAIT!
...MAYBE I'LL JUST LET HIM GO AROUND IN CYCLES.

MISFITS LIVING IN A WORLD ON FIRE, SEASON TWO

We all know what happened in March 2020. I'll skip over it as much as possible. I headed home, and confined to my childhood bedroom I felt like I was in limbo.

I tried to keep in touch with the Discord group; I even started DMing regular Dungeons and Dragons sessions for them. But when I hit my work term in May, I no longer had time to prepare sessions, and I had to cancel the rest of the campaign.

Afterwards, I didn't really have much more to say to them; after all, we didn't even have common classes, since I was on a work term. I gradually started to feel disconnected from them again.

So there I was, trapped in my house, having lost my connections, and feeling back at square one.

Luckily enough for me, that was pretty much the exact time Doom Patrol Season 2 started airing.

Season Two focused on a new character, Dorothy Spinner. Dorothy was a young girl whose imaginary friends manifested themselves in reality. Unfortunately, her adolescence was tied to a new friend called the Candlemaker, who craved destruction and who emerged whenever Dorothy made a wish. The team wants to treat her as a child, in the vain hope that she'll stay as one.

I had a lot of wishes in the summer of 2020.

I wished to be able to see my partner and my friends again.

I wished to be able to be back on campus again.

And I wished that I could have more freedom beyond living with my family once again.

I'm going to be honest and say that my family's great. They care a lot about me, they're receptive to what I say, and they're just generally all-around supportive. That doesn't stop living with them from getting annoying, though. I had always craved freedom, to live under my own rules, and just when I finally got it it was taken away from me.

I felt like I was dragged back to my own childhood by any force necessary. No progression, just regression.

Even when school started up again, I couldn't really connect back to the friends I had met on campus. We couldn't see each other, and it was just harder to believe that they wanted to talk to me, wanted to read my thoughts. I was always on the outside anyways.

I grew to accept my state of living as it came. I grew to make the most of my situation, to make new compromises that satisfied my desires.

I even branched out into new hobbies, starting to write about comics in my free time. I have a couple bylines across the Internet now, and I think I'm generally happier than I was six months ago.

That doesn't change the fact that I still wish I was on campus. I want to grow up, to be able to progress to the person I want myself to be.

They're making a third season of Doom Patrol. By the time it airs, I'll probably be back on campus. I don't know where the characters are going next after the cliffhanger at the end of Season Two, but I'm content to wait and see. I trust that the series will be as brilliant as always and that it will make me feel for this ragtag group of heroes.

Hopefully in the next chapter of my life I'll be able to be happier than in the previous two.

Both seasons of Doom Patrol are available to stream on Crave.

Predap

MICROSOFT SET TO BUY DISCORD FOR $10 BILLION

Satya. Put the company down. No. No, you've acquired too many companies already. Why do you need Discord anyway? You already have Skype *and* Microsoft Teams at home. You can play with those. What do you mean, you don't want to play with Skype anymore? There are starving startups in Silicon Valley that would love to have that sort of a user base, you know. You should appreciate how lucky you are. You want to reach gamers? Satya, you have Xbox. Bethesda. You have *Minecraft,* for Christ's sake. You haven't even finished your xCloud yet. No, that's enough. Too many communication services, too many gaming services. We're not getting Discord, and that's final.

Mama Nadella

This blackBOX was here all along, I swear.

A mathNEWS EDITOR WITH NOTHING TO HIDE

N REASONS WHY I NEED THE REMARKABLE 2 NOTEBOOK

- It would save so much paper
- It would keep all my notes in one place
- I wouldn't have to lug around 8 separate notebooks around everywhere I go because I have an obsessive need to write down everything in my life and always end up using way too many notebooks
- It would replace my $50 two year agenda that I'm low-key getting tired of but feel too guilty to trash
- Stationary is sexy and the ReMarkable 2 writing tablet is like stationary but even *sexier*
- It's so thin and flat like omfg it's so fucking flat I love how flat it is like it's practically 2 dimensional and I'm all for it
- It's A5 size which is a pretty big tablet and sure if I'm paying $600 I'd hope for A4 size which would obviously be a lot more logical because its literally standard paper size but hm guess not whatever it doesn't matter
- It has a simplistic design that would really make me that *productive bad bitch with a writing tablet and a Starbucks latte*
- It lets the user edit and annotate imported PDF files and then export them to a computer
- ReMarkable has its own unique OS and cloud servers that are completely incompatible with all things Windows so just think of the exclusivity
- It would make me feel so fucking organized
- There's no apps or anything so no more pesky distractions!!!
- The E-ink display is a lot nicer on the eyes than the shiny screens that suck the soul out of my eyes ²⁴⁄₇ during quarantine
- It makes that friction sound of pen sliding on paper that I just can't get enough of except when it's the dickwad sitting next to me in an exam who's pressing too hard with his pencil and I can hear the lead squeaking against the page and I lean over to choke h-
- The responsiveness of the screen looks soooo good in YouTube videos, I mean you gotta factor in the lag caused by the filming camera but after that its basically instantaneous
- The lag between flipping pages would really help me think and absorb my ideas
- It has different notepad templates!! Like grids and lined paper and dotted paper!!! I can never find at least one of those whenever I'm back-to-school shopping at Walmart so now problem solved!
- I can have all of my notes for all my classes all conveniently organized in the handy filing system, and once I'm done with them I can just upload them to a computer so now I also have a reason to get a laptop
- It's got a handwriting to text converting option that doesn't really support mathematical notation so nevermind ignore this one
- It's got a whole bunch of different options for writing utensils like grey pencil, or black marker, or like a grey paintbrush, oh and also a slightly thicker black marker!
- I can only really solve math problems efficiently if I've got a big wide sheet of paper in front of me that I can write freely on and really *feel* in my hands and waste as much space as I need because I'm really particular about my handwriting and so I think it's a great idea to completely replace a system that optimizes my problem-solving thought process which I already know and value
- It appeals to my primal instinct to scribble on an expensive touchscreen

A cool pen name

A SUGGESTION

Around this time of the term, I begin to really get a sense for the range in which my marks will lie. This causes me to worry, and occasionally wonder what I could have done better. The main culprit of this anxiety for me are the CS courses. Ignoring the possibility that my own marks are my fault, which is clearly wrong, I have to turn to other explanations. After many long hours of hard and diligent thought I could have spent more productively, I have come to the realization that the CS course material is simply not well suited for a modern learning environment. Not in the sense that it is difficult to teach online or any of that, No, it is unsuitable in a far grander sense. We are simply being taught the wrong programming. The CS courses at the University of Waterloo shouldn't be focusing on Racket or C or Python or any of this nerd bullshit, but instead on a much cooler, radder, groovier, more skill based, sexier alternative. One that is more relevant to the modern workplace. One that is better-suited to the cognitive ability of those who learn it. Yes. The obvious choice for what this institution should be teaching us is Scratch. There are literally no reasons against it. Imagine a world where instead of ivory tower professors deciding your merit based on "how well your code runs" or some other contrived shit, your mark was determined by how many 13 year old Scratch users decided to like and favourite it. I can imagine no better world.

Thank you for considering my very official proposal.

aphf

LOOKING FOR A FUN SPRINGTIME ACTIVITY?

gridCOMMENT *145.5*

Hey! Spring has put me in such a good mood lately, with all its sun, light breezes, and perfect weather. Hopefully all of you have been experiencing the same benefits. If not, maybe solving this crossword will cheer you up :)

I have once again received two submissions to last issue's **gridWORD**, both entirely correct. Their responses to last issue's grid QUESTION, "What's the best springtime activity?" were:

- DistortedLight: "Goose hunting"
- adventurouspotato: "Getting sunburnt in 15 degree weather"

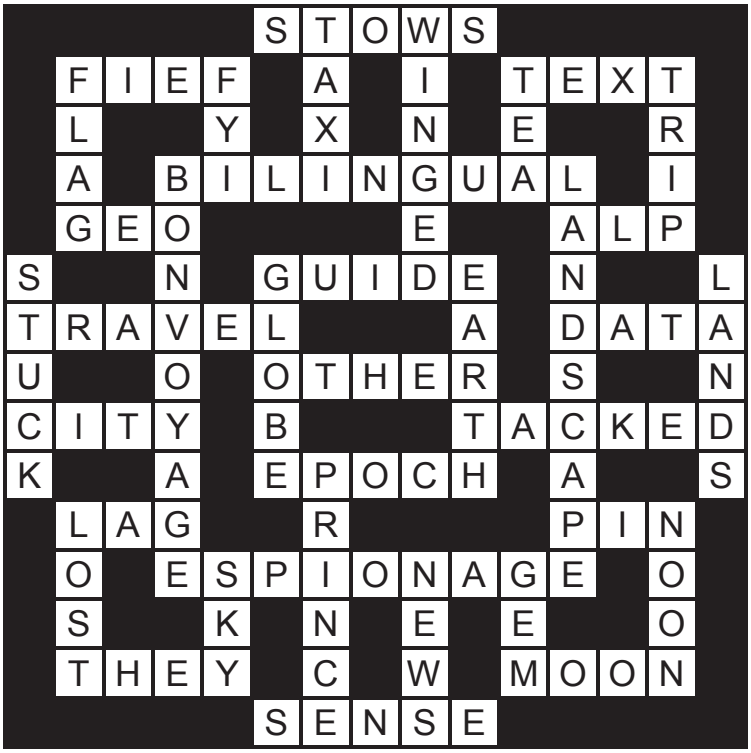
For the prize of General Awesomeness, this week's winner is adventurouspotato. As much as I'm sure there must be better spring activities to partake in than getting sunburnt, the relatability is undeniable, and anyway, I don't think I want to condone goose-hunting, as frightening as the geese can be this time of year. Personally, I think that climbing trees is an unbeatable candidate for Best Spring Activity, but I do recognise that this could potentially be the slightest bit subjective.

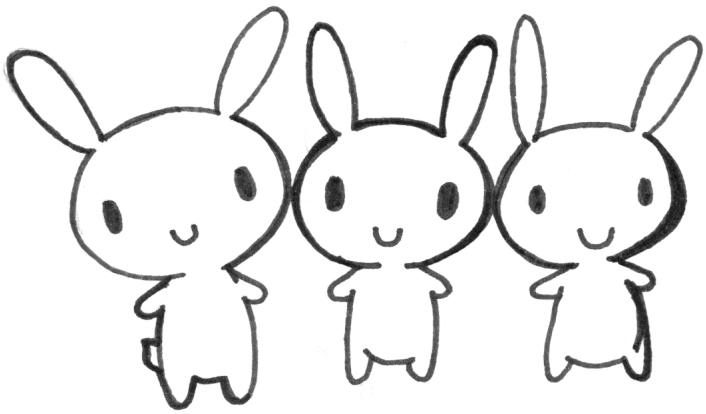
This week's cryptic crossword theme is "Springing into Spring", a crossword themed for some more springtime fun. The **gridQUESTION** for this issue is "How could a snowman best avoid melting in the hot spring sun?"

Remember to email your **gridWORD** solution attempts to mathnews@gmail.com with your name or a moniker, and your answer to this issue's **gridQUESTION**.

Cloak and Vorpal Dagger

LAST ISSUE'S gridSOLUTION





ISSN 0705-0410

UW'S BASTION OF ERUDITE THOUGHT SINCE 1973

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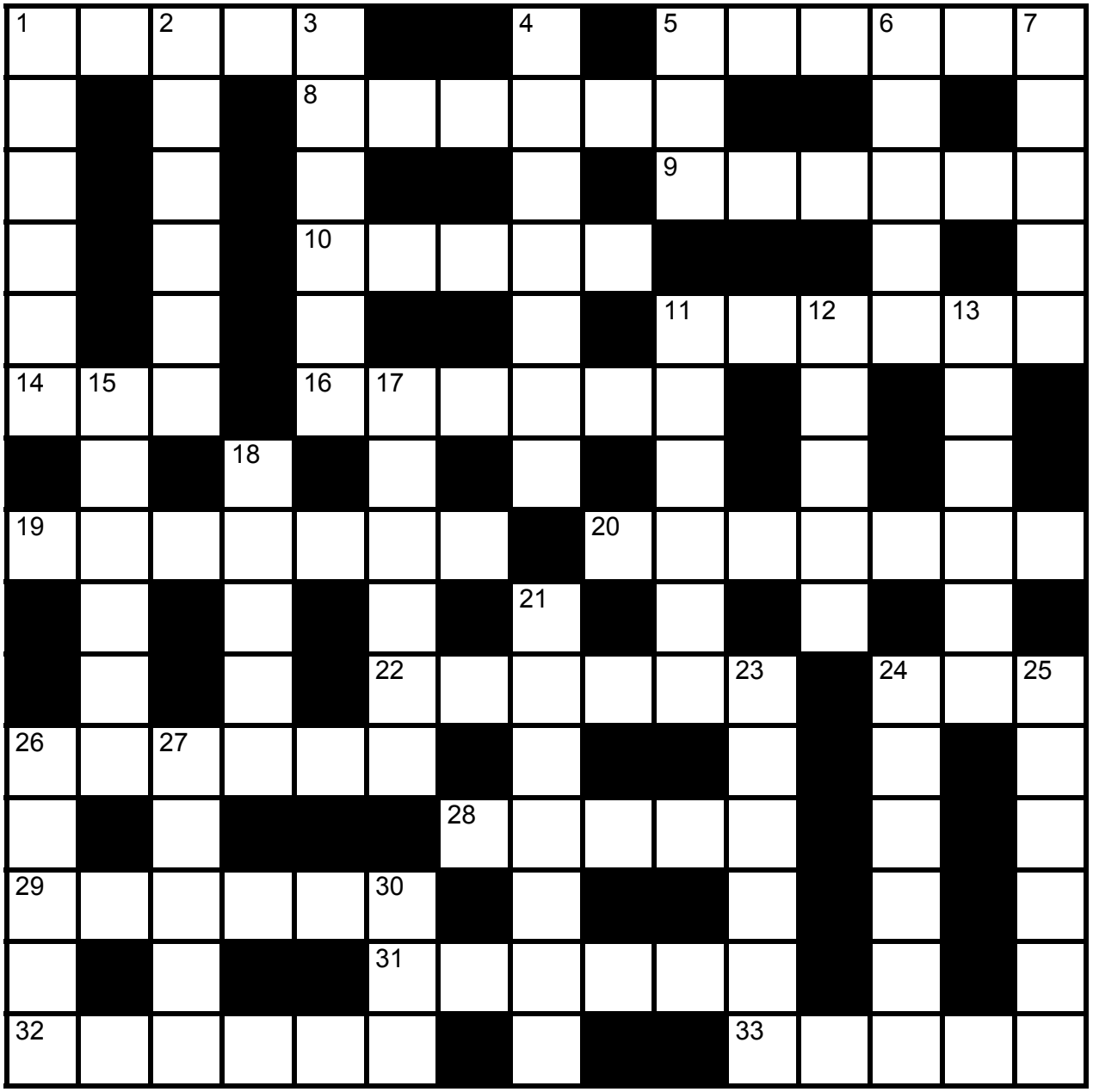
GRIDXGRID

ACROSS

1 . Chip right in with tweet (5)
5 . Curtsies on air to get branches (6)
8 . Develop circle, almost (6)
9 . Gently begin to see in a calamity (4,2)
10 . Swept low in Brazilian borders (5)
11 . Going back in to analyze Erbium makes it windy (6)
14 . Mess has cinders (3)
15 . Kindergartener gymnast holds power (6)
18 . Strangely, will sob to form waves (7)
19 . Shining train ad is weird (7)
21 . Incredibly simple store has soy regularly (2,4)
23 . In chat, we regularly cry (3)
25 . Crazily spur to grow (6)
27 . Love commercial rock (5)
28 . Straighten some bun curls (6)
29 . Draw, no back ahead (6)
30 . Sing with public relations about the season (6)
31 . Terribly nails a shelled mollusk (5)

DOWN

1 . Bug is a cad in the CIA (6)
2 . Trapping blimp is hip, mischievous (6)
3 . Oddly, peer bubble experiment begins with small stone (6)
4 . Unusually slow ref picks blooms (7)
5 . Stinger heads off, becoming enraged easily (3)
6 . Angry birds, back in these eggs (5)
7 . Bright star by New York (5)
11 . Go around saying to get tickets (2,4)
12 . Supply results from strange pique (5)
13 . Daisy relative is found forward and back in backwards alphabet (6)
15 . Befuddled pupils err (4,2)
16 . Most recent goes North-East before West (6)
17 . Travel by air to lofty catastrophe (3,2)
20 . Broken dams woe fields (7)
22 . Provides sly die, disguised (6)
23 . Recording device became rather essential (6)
24 . Small mammal shows cunning (6)
25 . Strikes mollusks (5)
26 . Competitor back about car (5)



lookAHEAD

SUN MAR 28	MON MAR 29	TUE MAR 30	WED MAR 31	THU APR 1	FRI APR 2	SAT APR 3
		Drop with WD ends	Drop with WF begins Student rankings open at 8PM Vote in the MathSoc general elections (vote.wusa.ca) (until Apr. 1)	Course selection results released Student rankings close at 10AM April Fools' Day	Good Friday	

SUN APR 4	MON APR 5	TUE APR 6	WED APR 7	THU APR 8	FRI APR 9	SAT APR 10
Easter Sunday	**mathNEWS** 145.6 production night Add/drop period begins			Student rankings open at 8PM	**mathNEWS** 145.6 released Student rankings close at 10AM	

NEW REPORT SUGGESTS THAT lookAHEAD WAS LOOKING BACKWARDS ALL THIS TIME

WATERLOO, ON — Avid **mathNEWS** readers will be familiar with the **lookAHEAD**; a staple of every issue, and beloved by its fans across the faculty and campus. However, new information has emerged that puts the **lookAHEAD** in a precarious position.

According to sources "kinda sorta familiar with the matter, like I heard it from someone who heard it from someone who heard it from someone who the second someone swears is legit," the **lookAHEAD** may have been deceiving math students everywhere with its misleading title.

Sources claim that despite the name **lookAHEAD**, this part of the issue is never actually looking "ahead", as in, it never looks out into the front of the issue. Indeed, as a new report has revealed, at least 42% of the **lookAHEADs** published in the past three volumes have actually looked behind, to the back of the issue, printed on the last page.

When editors were questioned about this pressing issue, their responses were evasive at best.

"It's great that people are asking these questions. It's so important that people hold the free press to account, and I welcome this scrutiny," said god ϟ peED, a current editor. When grilled for an actual answer, he pretended to be unable to hear our reporter, complained about bad internet, and walked away from their physical meeting spot.

Ex-editors have even gone so far as to deny the **lookAHEAD**'s existence completely. "The **lookAHEAD** has obviously never existed, of course," said terrifiED, a former editor of the publication.

The truth may be murky right now, but we **lookFORWARD** to bringing you any updates.

R. E. Porter

otherNEWS is made technically possible by club executives of the Math Faculty.

I say "technically" because if they had sent us more news this week, this box wouldn't be here.

THE mathNEWS EDITOR WHO PUTS THE "NEWS" IN mathNEWS