

"HOW WILL YOU TAKE REVENGE ON THE VARIOUS FORCES THAT HAVE CONSPIRED TO CAUSE THE GRT STRIKE?"

Hello again,

It's a new issue, and with this new issue comes some new issues. Specifically, the GRT strike, the death of Kobe and his daughter, and the coronavirus. Life is pretty terrifying, huh?

Fear not, however... **mathNEWS** is doing its best to act as a beacon of light in these dark, troubling times. How so? Well...

mathNEWS merch!!!

That's right, **mathNEWS** is finally getting merch!!! We just put in a bulk order for hats, and those should be coming in within the next month if y'all want to pop by the office and purchase one at-cost (we make no money from this) for a little over \$20. **mathNEWS** writers can contact the editors directly for a small **cough* discount *cough**.

Otherwise, we have stickers, t-shirts, hoodies, tank tops, and even a beanbag chair (though that's a lot more expensive). See designs at store.aopal.dev/collections/all. We are quite open to suggestions, so send in your ideas and designs, and we just might make merch out of it!

Some notable designs currently on the store are:

- a mathematical parody of the iconic t-shirt bearing the cover art of Joy Division *Unknown Pleasures* (this was the cover of v139i6, thanks Cix!)
- a tank top bearing a **mathNEWS** production night pizza receipt (v140i5, also thanks Cix)
- a beanbag chair. It says **mathNEWS** on it. Multiple times.
- a dad hat with a toilet on the front and **mathNEWS** on the back, available in a variety of colours. This harkens back to earlier in **mathNEWS** history, W2017 to be specific. (v133i2 had a great cover, thanks extrovertED!)

Well, that's everything. Enjoy the next two weeks!

itorED
Editor, **mathNEWS**

swindLED
Editor, **mathNEWS**

OLDA	Sponsor socialist fifth columnists who will better fund public transportation.
OCTOPODES	Promote solidarity strikes in the rest of the transport industry.
XX_420SONICFAN69_XX	Reincarnate Mahmud Sevket Pasha and assassinate him again to motivate the movement into all-out civil war.
JEFF	With great difficulty.
WATER	Throwing them under the bus.
SANDWICH EXPERT	By eating the rich.
DERIVING FOR DICK	Gently.
WHILD	Curse their souls.
ALYSSNYA	Curse their soles (then have them walk everywhere for the rest of eternity).
YEE	IDK, but I'll probably take an Uber there.
WALDO@<3.LE-GASP.CA	Do nothing unless back to work legislation is involved. Then I will summon my disapproving letter writing powers and mail things straight to the ON parliament.
PIKACHU.EXE	Pull an UNO Reverse Card™ and strike them when they come back online.
SWINDLED	Abolish currency.
ITORED	Rob the politicians and give the money to the bus drivers.
TERRIFIED	Rob the bus drivers and give the money to the politicians.
CONFUSED	Make them wait to use the GRT after services resume for the same amount of time as the strike.

ARTICLE OF THE ISSUE

This week's article of the issue award goes to Bass Case for *Introduction to Harmonic Analysis*. It's a fantastic explanation of one of the many cross-disciplinary uses of mathematics that everyone reading this should also read.

Don't forget to swing by the **mathNEWS** office in MC 3030 to pick up your prize!

Please buy our hats. We worked very hard on them.

MIN ZHU, **mathNEWS** EDITOR FOR WINTER 2020
ALONG WITH JAMIE ANDERSON, TERRY CHEN AND ANUJ OPAL

mathASKS 142.2

FEATURING PROF. NICHOLAS RAY

PIKACHU.EXE: WHAT MADE YOU PURSUE COGNITIVE SCIENCE? WHAT ABOUT TEACHING?

I came to cognitive science through philosophy. Almost all of my interests in cognitive science have some root in philosophy. My graduate work was on the epistemology of perception—with lots of philosophy of mind in the mix. The people I studied with were always interested in understanding how the mind works, but they were also interested in applying whatever formal tools allowed them to talk more productively about the nature of minds and mental processes. I quickly realized that one needed to have a grasp of the way minds actually worked if one wanted to model how minds can work (e.g. how we might design minds that differed in critically important ways from our own). Philosophy is a good complement to empirical studies of the mind because it encourages us to stretch and bend our concepts to see what resulting shifts in theory might occur. New theories allow us to see the world in new ways. Philosophically-minded cognitive scientists and scientifically-minded philosophers always manage to produce stimulating work.

Teaching has been my favourite part of being an academic. I got my first teaching position in 2004 after finishing my MA. Up until that point, I thought I would be more of a researcher than a teacher. And then I got up in front of a classroom full of students for the first time; I knew from that point on that my passion was with teaching, with research coming behind in a distant 2nd place. So, I guess I fell into it. I am happy it with how things fell into place.

TURING GUY: CAN YOU PROVE TO ME YOU'RE NOT AN AI AGENT?

Nope. Absolutely not. I can't do it. But, more importantly, I wouldn't want to try to convince you I'm not an AI! But that's because I have a rather quirky view of myself. When you are the kind of functionalist I am, you tend to adopt the rather peculiar belief that you are a computer. You are maybe not a simple serial processing, digital computer. But you're a computer. I think of myself as a very complex robot made up of a bunch of smaller robots. In this peculiar belief, I follow folks like Dan Dennett. To think I am special because I am the product of natural design as opposed to an artifact would be to make a mistake. I don't care primarily about what minds are made out of; I care primarily about what they do. The "A" in "AI" doesn't really matter. That is a genesis story. Where you come from and what you are made from might be neat biographical facts about you, but they don't make you better than a really smart, equally complex, artificial agent. If there were such an agent, I would happily be accidentally categorized as such!

PIKACHU.EXE: ARE THERE ANY RECENT ADVANCEMENTS IN COGNITIVE SCIENCE THAT YOU ARE EXCITED ABOUT?

Yes! It takes very little to pique my interest, though, so this category is rather large. I am interested in a lot of recent developments in "4E" cognition (as it is sometimes called). The four "E"s are embodied, embedded (or situated), enactive, and extended cognition. 4E frameworks challenge our traditional conception of computational processing being a wholly internal affair. We get inputs in the form of symbols, and cognition (on a computational model) is a matter of symbol manipulation using rules. But this picture gets upset when we look at how cognition can be embodied and situated, and intimately connected to agent behaviour in a dynamically changing environment.

In the past few years, I have also become quite interested in generative adversarial networks as machine learning systems. This kind of neural network architecture produces really cool results that people have long thought beyond the ken of computer minds. A GAN is really two neural networks in one. A generative network generates candidate outputs that are similar to its training data set. A discriminator network then assesses the generator outputs against the training data set. The generator is trying to fool or trick the discriminator (i.e. trying to increase its error rate). These networks can produce novel artwork, for instance. Human art specialists, looking at the products of adversarial networks, think they are looking at art produced by contemporary human artists. The art that is being produced by adversarial networks is astonishingly novel. Google it!

SANDWICH EXPERT: HOW OFTEN DO YOU READ mathNEWS?

I teach a lot of math students, and they tell me to look at specific things once in a while. I think I have logged on a few times in the past. Now that I know **mathNEWS** interviews only the Very Best People, I will have to read it more frequently! ;)

CONCERNED CITIZEN™: WHEN WILL THE MACHINES TAKE OVER?

I am going to put on my philosopher's hat, and answer your question with another question: Why are you assuming they haven't already? Now, let me unpack that a bit. We tend to think of "the machines" and their eventual "takeover" in terms of science-fiction and other apocalyptic tales. The problem with these stories (as entertaining as they are) is this: they presuppose the menace of machine technology comes in the form of an autonomous machine intelligence. They presuppose a singularity—what philosophers call strong AI. But that is not the kind of AI that is likely to take us over. Domain-specific AI is already displacing human labour, aiding in the surveillance and control of citizens, and channeling the flow of information on social media in ways that are having a deleterious effect on the way we interact with one another.

CHALK VICTIM: CAN YOU ADDRESS THE ALLEGATIONS THAT YOU FREQUENTLY THROW CHALK AND FLEX CHAIRS IN FRONT OF STUDENTS AS A PEDAGOGICAL TOOL?

I have never thrown chalk at students. I have sometimes thrown chalk near students. I assure you that it is always a pedagogical expedient, and in some cases a necessity. I will sometimes use chairs to make a point. I have been known to kick them rather aggressively when talking about pain sensation. I believe folks nowadays call this “experiential learning”. And that chair had it coming... you can ask anybody!

But, seriously, chalk victim: if a piece of chalk ever got too close to you, I apologize.

TRANSITIVITY: WHAT'S SOMETHING PEOPLE GET WRONG ABOUT PHILOSOPHY?

Some people tend to think that philosophy isn't concerned with science. They think that we do everything from the “arm-chair”, or that we try to figure out everything from first principles, etc. In reality, almost all philosophers interact with scientific work pertinent to their field. I don't know any philosophers of mind who don't know about the relevant psychology or neuroscience. I don't know a single philosopher of physics who doesn't know a lot about physics. And many philosophers have a background in a scientific field. There are lots of philosophers of biology who did their undergraduate degrees in biology, philosophers of math who are trained mathematicians. Like many philosophers, I like to think of my teaching and research as informed by and continuous with scientific research.

The days when you could do Philosophy of X and know nothing about X are, I hope, long gone!

TLLLOW PRINCESS: WHAT IS YOUR PREFERRED WASHROOM ON CAMPUS?

I teach a lot in the Physics building. Those bathrooms (at least the men's rooms) have those old-fashioned fountain sinks—the round ones where you turn them on with a foot pedal, and the water comes out from the top. Do you know what I'm talking about?

What a waste of water... but, so much fun!

I disagree strongly with whatever work this quote is attached to.

RANDALL MUNROE

BEYOND META: WHAT'S AN ETHICAL IMPLICATION ABOUT ADVANCED TECHNOLOGY THAT MORE PEOPLE SHOULD BE AWARE OF?

As I said in my response to concerned citizen™ above, I think people should be aware of the capacity for technology to displace human beings. Our moral theories, political policies, and laws aren't even remotely ready for the rapid pace of this displacement. We can't even figure out who should be at fault if an autonomous vehicle screws up and causes an accident! Is it the programmer? The manufacturer? The owner of the car? And much more pressing concerns are on the immediate horizon. With increased use of prenatal testing, preimplantation genetic diagnosis, and gene editing technology like CRISPR, we are going to be able to design persons. If we continue to make advancements in general AI, we might be able to design artificial persons, too. Our ethics and our law are based on persons being subjects (largely the product of chance), not objects. We have to be prepared for how things might change when we design persons. Right now, we design things. Persons are not things; they are not objects. To objectify a person is to wrong them in perhaps the most fundamental way a moral being could be wronged. We have to make sure that the design of persons, if it is to be allowed, doesn't promote the objectification of persons. I think we can do this, but we have to try to be ahead of the technological curve. Because of the way that we fund humanities research, we are (I am afraid to say) woefully behind the curve in thinking about the ethics and politics of the design of persons. If this doesn't change, I foresee calamity.

BEYOND META: IF A TROLLEY IS HEADING TOWARDS A FORK WITH ONE GOOSE ON ONE SIDE, AND FIVE GEESE ON THE OTHER, WHICH PATH DO YOU SEND IT ON?

I send it toward the 5 geese. This is your thought experiment, so you're in charge, but am I allowed to then go and kill the other goose?

(I am assuming this is a question about Canadian geese, and, perhaps more specifically, Canadian geese on the uWaterloo campus. If you are referring to other kinds of geese, I would kill 1 to save 5. I ain't got no problems with other geese. Canadian geese, on the other hand...)

FORTISSIMO: CAN YOU DEBUNK A MYTH ABOUT AI IN POPULAR CULTURE?

Simply reading up on actual research in AI will dispel the idea that researchers are all trying to play god. They usually have more limited concerns. Trying to get a neural network to finish a puzzle poses great difficulty and takes a lot of “training”. The idea that we are close to producing strong AI is, I think, a consequence of popular culture. Still, I think popular culture is telling the right kind of stories. Science-fiction films like Her or Ex Machina aren't trying to tell us where AI will be in 5 years. They are trying to tell us something about how we might deal with a future that is defined by transhumanism. Thinking about a world in which human beings are de-centred is a worthy pursuit, and art is leading the way.

WHILD: IF WE HAD AI THAT LOOKED AND FUNCTIONED LIKE HUMANS, WOULD THEY DESERVE HUMAN RIGHTS?

Yes. Human rights supervene primarily on our cognitive capacities. If an entity, of whatever sort, has the requisite underlying cognitive capacities, then it should receive human rights. Social relations can also play a role in how we attribute human rights, but I assume the AI you are talking about would be capable of making close social ties with other people.

I actually think that human rights should be extended to all sorts of non-humans. For this reason, the name “human rights” is a misleading one. What we need to do is figure out the class of entities worthy of protection and develop a spate of rights for those entities that help protect them from the arbitrary behaviour of others. Some AI might eventually make it on the list of protected entities. Lots of animals should already be there as rights-bearers.

In general, I think I agree with two principles outlined by philosopher Nick Bostrom. The first, he calls the Principle of Substrate Non-Discrimination. The second is the Principle of Ontogeny Non-discrimination. We should base moral status, including who has which rights, on function, not what an entity is made of or where it came from. If you found out tomorrow that you were an artificial being, designed by a very smart robotics team working with the very best computer engineers, would you think you lost your moral status? If not, then what you are made out of, and where you came from, just don't matter to morality and shouldn't matter to the law.

CIX: HOW LONG DO WE HAVE LEFT TO LIVE BEFORE THE SINGULARITY COMES?

A while yet. Most AI research is governed by the profitability of possible products. Right now, the real money is in domain-specific AI. Developing strong AI is still a thing, but it is hard to get the funding for it, especially from private interests. Amazon wants to make Alexa quicker so she can sell you stuff. She doesn't need to be conscious to do that.

YOGO: IN THE TROLLEY PROBLEM WHO WOULD YOU CHOOSE TO SAVE, SOMEONE YOU KNOW OR 5 RANDOM PEOPLE?

Should I assume the someone I know is someone I like? ;)

I honestly don't know how I would react in contrived scenarios like the trolley problem. I have some intuitions, but I don't really know how I would react. I actually think ethical theorizing would be in a better place if we used less of these contrived cases (thought experiments) and more concrete cases. When I teach my students ethics, we spend a bit of time talking about trolley problems. But we spend much more time talking about real-world cases.

XX_420SONICFAN69_XX: WHAT DO WE GAIN IN THE PURSUIT OF KNOWLEDGE IN THE SCIENCES AND MATH WHEN OUR ANSWERS COULD ALL BE WRONG, AND WE CAN DOUBT EVERYTHING WE'VE LEARNED AT ANY MOMENT?

It depends on how our answers are wrong. Newton was wrong. His theories of motion and gravity are false. But they were false in a very useful way. They were excellent approximations of the truth, and where Newtonian physics broke down shed light on what the successor theory should look like. Newton really did pave the way for Einstein.

I am enough of a pragmatist to think that theories that work are at least approximating the truth. To think that tools as complex as physical theory, chemistry, biology, or psychology are not only false, but globally dubious and useless for further inquiry, seems like a stretch. We are involved in a project of epistemic progress in the sciences. It is fallible and revisable, but that's a good thing. Science, even formal sciences like mathematics, shouldn't give us certainty. They should give us a better handle on the world.

WHACK: WHO'S YOUR FAVOURITE PHILOSOPHER AND WHY?

I think my favorite philosophers are Gottlob Frege and Bertrand Russell. They invented the first real predicate calculus, and then used it to answer long-standing philosophical questions. I still think my two favourite writings in all of the history of philosophy are Frege's *Grundlagen der Arithmetik* and Russell's essay “On denoting”. Frege showed us that you better have a really intricate theory if you want to make proposals about number theory, and what numbers are. Russell showed us that many of the problems of philosophy arise because we aren't using the right formal tools for analysis. Developing those formal tools brings precision to our thought. I think this is still the right way to do philosophy, the right way to do science, and the right way to conduct human affairs.

EX-PHIL 255 STUDENT: DO YOUR CHILDREN STILL MAKE YOU SICK?

Haha! Yes!!! Children are tiny disease vectors that you welcome into your home. Once there, they touch, cough upon, and even lick your precious belongings.

It is worth it though. They are very cute, and very funny.

SWINDLED: IF YOU HAD THE OPPORTUNITY TO TEACH A COURSE OF YOUR CHOOSING OUTSIDE OF YOUR NORMAL REALM OF EXPERTISE (ONE THAT CURRENTLY EXISTS OR A HYPOTHETICAL NEW ONE), WHAT WOULD YOU TEACH?

A class on great works of autobiographical fiction. We would start with *Slaughterhouse-Five*, and end with *Slaughterhouse-Five*. I think I am going to go re-read *Slaughterhouse-Five*.

ITSH: WHAT IS THE LEAST PHILOSOPHICAL ARGUMENT FOR CARING ABOUT PEOPLE?

Good! The “least” philosophical argument. I like that. Look, I am not sure if there is a philosophical argument that can convince someone they should care about others. I think Aristotle probably got the picture right: caring about others isn't something you do because an argument tells you that you ought to. You care about people (or don't) because that is how you were raised.

But here's a decent first approximation of a not-very-philosophical-argument for caring: “Care about others... you'll like it!”

WALDO@<3LE-GASP.CA: HOW OFTEN DO YOU DO MATH IN YOUR RESEARCH? DO YOU FIND THAT PEOPLE REACT DIFFERENTLY TO YOU BECAUSE YOU'RE IN THE ARTS?

I use lots of math and lots of logic in my research, but I present my research differently depending on the audience. Some philosophers are fine with formalism. Others aren't as familiar. It is always a good idea to explain what the formalism means, and why using it matters. So, for example, some of my recent research uses Markov blankets. I always make sure to explain what they are, and why they apply to the work I am doing on predictive processing.

In general, I don't feel like I get treated differently because I'm in the Arts. It's my experience that people are really interested in one another's work. I like it when we get excited about one another's research, regardless of disciplinary and faculty boundaries. These divisions are relatively new, and sometimes boundaries are best ignored.

TERRIFIED: WHAT IS YOUR FAVOURITE STAR WARS MOVIE AND WHY IS IT THE RETURN OF THE JEDI?

It is Return of the Jedi... because: Ewoks!

A FORMAL INQUIRY TO DRAGONICKHAOS

You wrote an article called “Thoughts of a first timer at mathNEWS” in the last mathNEWS. In it, you called me out for not knowing your name after our interaction in the V1 Cafeteria in the winter of first year after our math 136 quiz, wherein we discussed courses and the fact that I took genetics. Well, I have but one thing to say to you:

I still don't know your name. Could you please tell me again at the next prod night? Thanks, and sorry lmao

Guy whose first name starts with L and ends with h

AN UPDATE ON THE SMASH BROS ROSTER!

Well, just about everyone is talking about it. I'm sure many of you already know anyway, but it's worthwhile to report this momentous occasion for the records.

The Nintendo direct that came around the other week marked the biggest reveal in the video game industry, that being the reveal of the roster expansion for Super Smash Brothers Ultimate. After weeks of waiting, pondering, hoping and praying, they finally unveiled the character added to the series. And boy, were we celebrating hard this week. A character that has long been requested to be added to the roster, one that truly shines as a unique and noteworthy character. One that truly deserves the praise and honor of being added to such a series as Smash Brothers, and one that will for sure fill in the awfully large shoes left for it by other fighters.

That's right folks. The Direct on the 16th finally revealed to us all the character most truly deserving and anticipated for Smash.

Cuphead.

Although only being a Mii Fighter skin currently, the acknowledgement and representation of the franchise from which it hails is a huge step forwards in the community. Similarly to how K.Rool was but a Fighter costume during Smash4, this too could potentially lead to more independent roles in future games. This, in addition to the release of the 'Sans' fighter skin in a previous direct, is a massive step forward in the indie development community as well, seeing that smaller 'cult classic' series are beginning to see a lot more large-scale representation within these kinds of games, and across the gaming community as a whole.

So we thank you, Sakurai, for your dedication to the indie community, and for listening to the input of the Smash community, who can sometimes be difficult to deal with.

Fruitboy

MEF PROPOSALS

MEF is now receiving proposals! You need some money for your club or idea. We can give it to you! You would get it on O(1) time. Oh, much efficiency such money very wow. To apply, go to our website (<https://uwaterloo.ca/math-endowment-fund/>) under

“Funding Grants!” Applications close on March 4th at 12 pm ET.

MEF execs

GBDA STUDENT ANSWERS MATH QUESTIONS

[Editor's Note: Originally, this article was published in v142i1; however, due to an editing mistake, a portion of the article was omitted. As a result, we are republishing it in its entirety for you to enjoy.]

Q: WHAT DOES $e^{i\pi}$ EQUAL?

A: Well if i pi would be equal to a simple sentence, i indeed eat pi. Like I eat pie. Then $e^{i\pi}$ would exclaim that not only do i eat pi, everyday i pi. It is a constant activity, there is not a day where i do not pi, e is a constant.

Q: WHAT IS THE DEFINITION OF A LIMIT?

A: Look, people often say "limits are meant to be broken", but limits are more so about how you react when you hit them. You're not there to break the limit, limits are there to break you. If you can resist them, if you can persevere, if you can keep moving forward, then you've discovered not what a limit is, but what your limits are.

Q: WHAT IS AN ISOMORPHISM?

A: There is a lot of discourse in the scientific community about what qualifies as morphism. Some say any form of transmogrification or shape-shifting, even just a wardrobe change, could be a human morphism. Isomorphism on the other hand, is specifically defined as a morphism in which one is alone. Hence the combination of isolation and morphism. No matter what category of polymorph we're discussing, if it's alone, has no friends, has no family, or any decent purpose, it is an isomorph, and we can laugh at it, and that's why it's a math term.

Whild

MEF COUNCIL

MEF Council nominations are open! If you want to determine the fate of over \$150k, join the council. We only have 2 meetings in the term and give you fancy food. SUPER RELAXED! LOW TIME COMMITMENT...and free food.

To apply, go to our website (<https://uwaterloo.ca/math-endowment-fund/>) under "Funding Council" and submit your application. Applications close on February 13th at 11:59 PM

MEF execs

THE DRAGON SOARS TO NEW HEIGHTS!

After many a year of resting upon the great treasure trove of knowledge and board games that is the cavernous MC, this dragon has finally spread it's wings in a quest to acquire a hoard of it's own. Leaving behind many mysteries for new adventurers to unravel should they choose to examine the puzzle of the chair of man. He additionally leaves behind an apprentice, a young drake known only as Solar Flare, for the matrices of letters that is beloved by the readership of mathNEWS.

Fare thee well Zethar!

May we soar in the same skies soon...

Sincerely,
The Mythical Badgers

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THE CASE FOR COMPASSIONATE POLITICS IN CANADA

PART 1: ELECTORAL POLITICS

Last election night I allowed myself to be happier than I really should've been. Of course, the conservatives lost, and the PPC didn't gain a single seat, and that was admittedly a sigh of relief. But in an election with so much at stake, I woke up with a heavy heart. This was not my first day-after electing Mr. Trudeau, last time I was truly celebrating. After over a decade of Harper's rule, and I was salivating for a change. After starving the Canadian economy from billions of tax income that could be used on social programs, he gave yet even more billions to the oil tzars that buy and sell Canadian politicians like Yu-Gi-Oh cards. The conservative plan was to not just stop social spending they disliked, they tried, often successfully, to starve these programs slowly, ensuring that future governments' first task will be rebuilding these programs before the people get to see the benefits again.

The NDP would not like to admit this, but Trudeau ran to the left of Mulcair in 2015. Now, many factions of the NDP are quick to distance themselves from Mulcair and his cringe-worthy focus on the deficit, falling right into right wing gotchas created by people who do not understand what it means to invest in the people. These talking points are shoved down our throats by people who don't mind giving billions to the dying fossil fuel companies while telling us we don't have the money to invest in education, healthcare, infrastructure, transit and housing. Despite the millions spent on propaganda, here's the truth: countries who invest in their people have the healthiest, happiest, most productive workforces. They have the longest life expectancy. They have the lowest rates of violence and mental illness. Every dollar we put into the people is a thousand dollar return we will see. A healthy, secure society is a society at it's strongest.

Trudeau's platform in 2015 included indigenous reconciliation, ending fossil fuel subsidies, legalizing marijuana, fighting climate change, and making the rich pay their fair share. The liberals wore leftist clothing and they wore it well. They explicitly said they would run a deficit, and they offered people a decent amount of respite from Harper's Canada. And they won. The NDP wavered on their supposed for-the-people status, and their polling results showed it.

Trudeau ran on indigenous reconciliation and has in his 4 years attacked indigenous youth to their faces, and bought a 4 billion dollar pipeline while his RCMP go to protests ready to shoot indigenous people defending their own land. Fossil fuel subsidies are alive and well until 2024, 9 years after his promise to end them. As for fighting climate change, Trudeau was caught telling a private function that any country would be a fool to leave the oil sands in the ground. Burning the fuel from the oil sands alone will raise earths temperature 0.5%, 25% of the way towards the point of no return. Trudeau is fine letting Canada's 1% of the global population be responsible for a quarter of earth's destruction. Our healthcare system is one of the worst of all nations with universal healthcare, despite Canada spending the second most. We have the highest infant

mortality rate, long wait times, a shortage of physicians and nurses, a severe lack of hospital beds & MRI machines, and hospitals are going broke. It's been 4 years since Trudeau took office and what exactly has gotten better? We still choose between meals, gas and medication. We cannot see mental health professionals when we are hurting. We can not afford dental, hearing or vision care. Here's a radical idea: healthcare is a human right, and dental, hearing, vision, long term care, pharmacare, mental health care and physical therapy are all integral parts of healthcare. A truly universal system is needed which provides us holistic healthcare for all, something the Liberals have scoffed at in their years despite the dire need. It turned out that Harper's sabotage of our social programs was less consequential than we expect in hampering progress, because the Liberals were happy to continue as much as the status quo as possible. The one promise truly kept was legalized weed, the one with the most immediate returns to the government. The rich keep getting richer, their offshore accounts are secure, and an egregious number of our people live on the streets or live in poverty. In 2019, The NDP under Singh seemed to pull themselves back from the grip of the neoliberal consensus. He ran on ending homelessness over ten years, no more pipelines, radical climate action, making the wealthy pay and expanding healthcare to a truly universal model. Do not be fooled by their seat count, Mulcair's damage to the party was much vaster than the 2015 election, and it will take time to regain the trust of the people and for Singh himself to gain our trust for the first time. In the short campaign season, Singh saw himself rocket from the least possible to the most possible federal leader, despite much adversity. This is yet another proof that the Canadian people want true populism, not platitudes and compromising on behalf of big businesses.

As much as I can defend the showing of the NDP this election (and the importance of having a minority government), I still cannot pretend like I am okay with what is happening. Jack Layton would have become Canada's first NDP Prime Minister. He made historic gains in Quebec and the east coast, and brought the NDP to official opposition status for the first time. His death was tragic, and he surely would be horrified to see how the NDP moved from a focus on compassion and human lives over profit to a focus on capitulating to the worst aspects of the Canadian right in a desperate attempt to play both sides. What Mulcair did instead was set back Canadian leftist politics back potentially decades by firebombing the progressive multi racial coalition that Layton built. He let the Liberals co-opt our movement in 2015, and the results of 2019 shows us that the liberal grift is still alive and well. With the Liberals' record, this should have been an easy election. The only promises they kept were the ones that benefited them most (we still remember their electoral reform promise, even if I didn't highlight it here). However, the conservatives posed such a big threat that sadly many Canadian either stayed home defeated or voted Liberal out of fear of Scheer. Conveniently, Trudeau's decision to keep first past the post helped Trudeau

win; it's what scared enough voters who truly care about climate change to vote for the lesser of two evils. This is a sign of things to come, and election after election the Liberals will continue to scare you into a vote rather than earnestly fight for it. One day we must say that enough is enough, and vote for who you want and not who you can deal with.

Indigenous communities are being poisoned and I do not trust Trudeau to stop it. Kids are sleeping in the street and mothers are skipping meals while our GDP approaches 2 trillion annually, and I do not trust Trudeau to spread out the wealth. This is not out of partisanship, this is based on his actions during his four year majority. Although not without its flaws, the NDP more than any other mainstream party is taking steps towards truly making Canada a progressive nation. It is our responsibility to push all parties here to prioritize the people and not the corporations that hold too much power over us. It is our responsibility to make the argument for investing in our people. It is our responsibility to fight for a Canada where our people live the longest, stress the least and make the most. Imagine a Canada where being born poor is not a death sentence. Where one accident doesn't leave you bankrupt.

Homelessness, hunger, addiction and poverty are policy failures. For every homeless person there are 6 empty homes. For every hungry person there are hundreds of pounds of food thrown away every year. For every person addicted there are compassionate methods of rehabilitation and structural changes that can be implemented to address the root causes of addiction. For every citizen in poverty there are billions siphoned off to big oil. It is not radical to feed everyone when we have enough food to do so. It is not radical to house everyone when we have enough houses to do so. It is the moral thing to do, and it's the fiscally conservative thing to do too. Watch crime plummet, jails close, profits rise, productivity soar, mental illness rates drop, and lifespans increase. We cannot fall victim to propaganda. We cannot let our citizens continue to suffer from preventable causes. 2015 is long gone, and 2019 is becoming a memory. We must remain political. I cannot tell you how the next election will go, but I can tell you the same bad actors will be pushing the same scare tactics. The truth is the people agree with progressive policies. The economics agree with progressive policies. And most importantly, compassion agrees with progressive policies. The rich and powerful are fighting day and night to keep their hold on power. We must stop them.

ITSH

EDITORS PLS HELP

my engineering friends keep laughing at me when I tell them I wrote an article in "that anime newspaper"

a sad writer

N THINGS OVERHEARD AT mathNEWS

- Editor: What demands would you make as part of the **mathNEWS** union?
Editor: Have better **mastHEAD** questions
- Writer: We should have a **mathNEWS** pizza catalogue
Editor: We can just photocopy our itemized receipts
- Editor: Vegetarians collaborate on what pizza you want. Lactose...I don't know your name so your name is "Lactose" now.
- Editor: **mathNEWS** is getting merchandise!
giant applause and cheering ensues
Writer: FINALLY!
- Writer: We can get **mathNEWS** bikinis but not ties?
- Writer: How much is the **mathNEWS** bean bag chair?
Editors: \$100
Writer: How much do we have to pay?
Editors: \$100
- Writer: [referring to talkingmoose.com (view at your own risk)] Do you think this is a creepy experiment where some guy's daughter died and he tried to bring her back as a digital moose
- Writer: I don't understand why the worst programmers I've ever met all have PhDs
- Writer: I wish to be cremated alive along with all the back issues of **mathNEWS**
- Editor: What are you gonna draw us today?
Writer: I don't know, probably garbage

swindlED & waldo@<3.LE-GASP.ca

Disclaimer: The opinions expressed in mathNEWS articles belong to their authors, and do not necessarily reflect those of mathNEWS. Please keep this in mind as you read the issue.

THE mathNEWS EDITORIAL TEAM

2020 WATCH

EPISODE II: ATTACKS IN THE CORN

Welcome back, everyone. The debates have stopped. The beginning of the middle of the election has begun. Iowa is upon us.

BERNARD SANDERS

This last two weeks have been what we in the politics business call “good” for Sanders. Clearly, something is happening, both nationally and in the early states. Sanders is posting leads up to nine percent in Iowa polls, making your Twitter timeline ninety nine percent more insufferable. If you were ever going to surge, this is the time to do it. Enough time to make an impact, but not enough time for everyone to notice, granting an advantage in the all important game of expectation. A win in Iowa will cement Sanders's newly found front runner status and clear the way for him to be nominated. It turns out they were right: Bernie can still win.

JOSEPH ROBINETTE BIDEN JR.

Biden entered this race in first. He has been the presumptive frontrunner this whole time. Despite a history of gaffes and mistakes, his stalwart aheadness has made writing sections about him rather boring. Not anymore. Biden is behind in the first three states, and is now coming second in some national polls. Like someone planning to save their course mark in the final, Biden's campaign has claimed all along that the mostly white early states were not his strong points and that a victory in the later, more diverse South Carolina would more accurately reflect his strength. But as Sanders continues to get stronger, he might realize he should have been studying this whole time. A win in Iowa would go a long way into bringing those marks up.

ELIZABETH ANN WARREN

Well, it was worth a shot. After watching her grip loosen on the left wing of the party, Warren decided to go in on Sanders in hope of taking the initiative and the lead. Instead, Sanders is on the way up, and Warren is on the way down to fifteen percent, the point where you are considered non viable and your supporters have to awkwardly shuffle around looking for another candidate to support. Could Warren claw her way back to being the left's chosen one and banish Bernie to the shadow realm? If she will, it'll start with a win in Iowa.

PETER PAUL MONTGOMERY BUTTIGIEG (YES THIS IS HIS REAL NAME)

There was a time when Buttigieg was the center of the race. The young, intelligent, gay, progressive but not *too* progressive mayor seemed like the future of the Democratic Party (and the being white part helped, let's not lie about that). While Buttigieg might still be the future, he certainly ain't the present anymore. Now solidly lodged in fourth, both in Iowa and nationally, Buttigieg needs a win to get back in the game. Can he get it? Iowa polls can vary a lot from the result, and Buttigieg is in range for an upset, but there's a lot riding on the coming weeks. If he comes up short, he'll be exiled back to the third level of government.

You might notice a common theme here: Iowa is important, something which, now said, will never be said again for four years. Nothing helps you win like winning, and nothing makes a loser more than losing. See you in two weeks, one week after Iowa. The salt will surely be legendary.

UW Unprint

NEW NAFTA AND CONSEQUENCES

The new trade agreement in North America, the CUSMA, or the new NAFTA, has been passed by every party with the exception of Canada. This late into the talks, at which time hardly any changes can be made before ratification, is the perfect time to understand what this agreement is all about.

The main idea behind any trade agreement is to standardize regulations, improve clarity, and provide predictability for traders. For countries, it exists to provide legal pretext to protect weak and strategic sectors, preventing foreign countries from having leverage over the economy.

So what parts of industry is Canada getting to protect out of this agreement, and more importantly, what sectors remain unprotected?

The most discussed protected system is the supply management system, while milk classes 6 and 7 had to be

killed and greater access to the Canadian milk market had to be provided, the system remains in place under the agreement. Labour laws have been made more stringent to prevent Mexico from undercutting the US, and this will have marginal benefits for Canada. Protections for steel and aluminum remain for automotive parts, but Quebec seems unsatisfied with the protections on aluminum. As the tariffs were applied using the national security measures in the US, there were commitments and exceptions secured against this sequence of events in the future.

All in all, decent protections while maintaining the facade of our commitment to free trade.

quiz

N FUN THINGS TO DO BETWEEN CLASSES

Hey everyone! Whenever I can't find the motivation to do any work between classes, I often find myself wondering what to do with all the time! Here's a list of fun things to try out between classes that I've compiled over the course of my time here at Waterloo:

- Hang out for a while in MC Comfy!
- Sit on a chair in MC Comfy!
- Sit in the chair in MC Comfy.
- Sink into the chair in MC Comfy.
- Sink a little too much into the chair in MC Comfy.
- ...You should probably get up now, it's been a few h-
- Consider becoming one with the chair in MC Comfy.
- It is pretty comfy after all. What if you could be this comfy?
- No, that's ridiculous. Unless...?
- Go get a snack.
- ...But no, to do that you would need to get up.
- Your legs numb, the chair draws you in further.
- Another chair may have entered the fray; not that you could tell.
- Hours go by. Or has it been days? Decades? It's all the same.
- Dear God, you can't get up. But are you really trying?

- ...You really need to get to cla-
- Agency is lost; the tan of your skin likens itself more closely to the beige of the Chair.
- The Chair's worn fabric resonates somewhere deeply inside you.
- Your sense of identity slips through your fingers like fine sand.
- The memories of the chair overcome you.
- What cruel secrets hath this lone Chair bore?
- Oh God. Unspeakable things.
- Actually, it's not that bad after hearing an admittedly convincing argument from the Chair.
- You can kind of see where the Chair was coming from.
- Your mind is like putty to the Chair.
- Were the chairs really that comfy? You can't remember. For that matter, you can't even think.
- Cognition seems a relic, lost to the sands of time.
- Cease metabolic activity after a while.
- Become the chair in MC Comfy.

...

- Try going for a walk!

jeff

SOME WHILD ADVICE: SLUTSHAMING

Hello! It's me! Whild! Today I had one of my lovely readers approach me with a question. For all y'all who don't know my real identity, please email whildadvice@gmail.com if you would like some advice. Back to my friend. They have recently discovered that they are known as a "slut", and they would like to change that perception.

I would like to preface this article by stating that being perceived as a slut is NOT A BAD THING. If you wanna have lots of sex, we support, if you do not wanna have lots of sex, we also support. This particular person, enjoys having sex but does not like the label of slut, and as described above, would like to change this.

Here are some potential ways to do that. First, you could stop telling people about all the amazing sex that you are having. Or the terrible sex. Either way, stop talking about the sex you are having. This will trick people into thinking that you are not having sex and then they will be less envious of you *and* stop calling you a slut. Yay! Unless you want them to be envious, that's where advice number two comes in. My second suggestion is to either find a relationship, or tell people you are in a relationship. In this case, you can tell everyone about the sex you are having, without being considered a slut, because for some reason our society only accepts a lot of sex if it's all with the same person. Hopefully one of these things

helps you! Or you can make a weird mix and match of them both. You do you friend! You're awesome!

Finally, a reminder that it is okay to be a slut, enjoy the name, not enjoy the name, want lots of sex, no sex, any amount of sex. We support you in your choices, your opinions, and your sex life.

Lots of love,

Whild

**The mathNEWS Twitter:
in case this issue
doesn't fill your weekly
nonsense quota.**

THE SENTIENT BEING THAT IS
@UWmathNEWS ON TWITTER

DECRYPTING CRYPTIC CROSSWORDS

Howdy math and puzzle aficionados!

I have some theorems for you:

1. Crosswords are awesome! Proof: the GridWord
2. Wordplay is awesome! Proof: puns!

From these it follows that crosswords involving wordplay must be awesome! As it turns out, that's basically what a cryptic crossword is. They're a fun twist on crosswords where each clue is also a word puzzle that points to the answer in two different ways.

For example, a clue might read "*Mountains in the paintings.*" The answer to this clue is URALS:

- The URALS are a mountain range
- "in the" tells us to look for a substring
- URALS is a substring of MURALS, which are paintings

If you're anything like me when I first saw that, you'll be thinking "what the !@#\$ is that nonsense?" But with some practice the clues become less opaque, and even fun! Cryptics also have the nice feature that when you get the right answer, you can usually be pretty confident in it since the clue will point at it in two different ways.

This term we're going to aim to teach you how to do cryptic crosswords. There are about nine common types that clues can take, so in the first half of the term we'll introduce three types each edition followed by a mini-format crossword to demonstrate. In the second half of the term things will start getting trickier!

This week we'll be covering hidden words, anagrams, and acrostics.

BASIC STRUCTURE

Most cryptic clues you encounter will have three components:

- The definition: this is the literal meaning of the clue. Most clues in normal crosswords will only have this part.
- The wordplay: this will be a different way to get to the same answer, usually involving doing something with the letters of the answer.
- An hint showing the shape of the answer: e.g. (7) for a seven-letter word like CRYPTIC or (3,3) for a phrase of two three-letter words like HOT DOG.

There may also be a word or two to connect the pieces together. The wordplay itself will usually contain both an *indicator* and some *ingredients*. The *indicator* will tell you what type of clue it is, and from that you'll know what sort of operation to perform on the *ingredients* to get the answer.

For example, a clue for the word VET in a normal crossword might be something like "dog doctor." A cryptic clue for the same word might be "*riveting center for dog doctor (3).*" Let's break it down:

- "Dog doctor" is the definition, just as in the first clue.
- "Riveting center" is the wordplay:
- "Center" is an indicator meaning we're going to remove some letters from either side of the ingredients, leaving us with just the center of the word
- "Riveting" is our ingredient, and sure enough when you remove the RI from the start and the ING from the end you're left with VET, the same answer from the definition portion!
- "For" is just a connector to make the clue flow more smoothly.

Hopefully that made sense, let's get on to this week's clue types!

HIDDEN WORDS

In a hidden word clue, the answer will be a substring of the ingredients. For example, in the clue "*Oscar Fantenberg holds accessory,*" the answer SCARF is a substring of the ingredients **Oscar** Fantenberg, and the word *holds* indicates a hidden word clue.

Some indicators for hidden word clues might be *concealed*, *buried in*, *partly*, *smuggling*, or *containing*.

ANAGRAMS

In an anagram clue, the answer will be an anagram of the ingredients. In the clue "*teach about swindler (5),*" the word *teach* is an anagram of the answer, CHEAT. The word *about* in this case indicates an anagram.

Some other anagram indicators could be *agitated*, *chopped up*, *improper*, *becomes*, or *upset*.

ACROSTICS

Acrostics involve taking the letters in a given position from a sequence of words. For example in "*Planes joined extra training sorties, initially (4)*" the answer JETS can be obtained by taking the *initial* letters of *Joined Extra Training Sorties*.

Indicators like *initially*, *sources*, or *beginners* could mean an acrostic taking the first letters of a sequence of words, whereas *terminally*, *finally*, or *at last* may indicate taking the last letters.

SAMPLE CROSSWORD

Alright, let's give these clue types a shot!

1	2	3	4	5
6				
7				
8				
9				

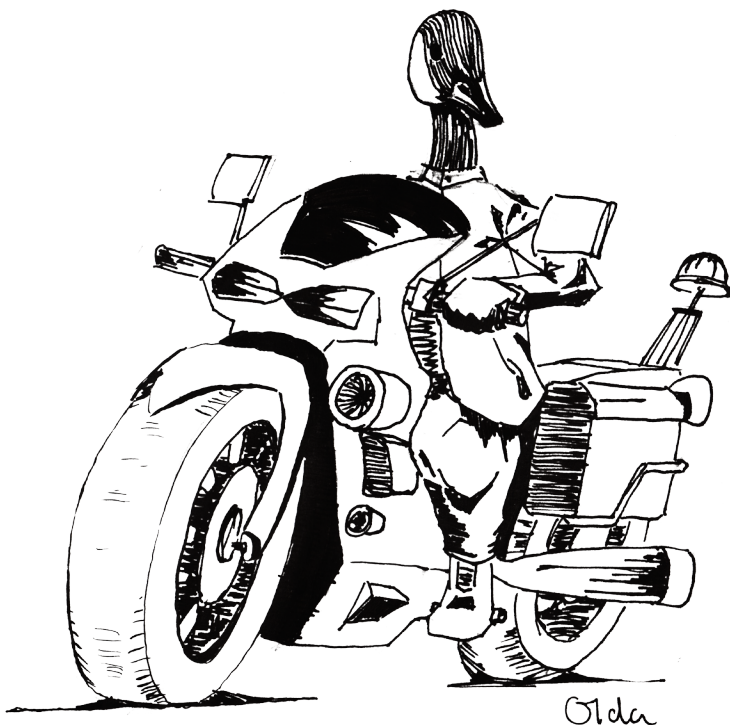
ACROSS

- 1. Zany tales of a fine-grained rock (5)
- 6. Separator in protocol on internet (5)
- 7. Ottawa gentleman concealing spy (5)
- 8. This ream I xeroxed shows a party (5)
- 9. Leaders of some can articulate repulsive yelps, spooky (5)

DOWN

- 1. Initially Scott came across my strung racket (5)
- 2. I clog excitedly for deduction (5)
- 3. Assistant hiding in canal? Exactly (5)
- 4. Upset tenor fills printer (5)
- 5. In the end, everyone can wait or pay for admission (5)

Grace Speaker and 7777777



MATH GRAD BALL 2020

If you are:

- graduating
- single
- a math student
- somewhat intrigued by the concept of “fun”
- not graduating
- just fiending for that aesthetic
- a magnificent vampire cheetah that won’t be bound to society’s standards of what an acceptable way to live your one finite life on this glorious dying planet is
- alive
- none of those things
- all of those things

then YOU should mark down the Math Grad Ball on your calendar for March 21st! Featuring a full three-course meal, mathematically engineered art, a live DJ, and shuttle service to the venue from campus, you’re guaranteed an unforgettable night.

Get your tickets here: tinyurl.com/uwmathgrad

Latest and greatest updates here: facebook.com/UWMathGrad

Math Grad ~~Club~~ Committee

STUDENT MISSING AFTER FOUR DAYS IDLE IN MATH LOUNGE

WATERLOO – An undergraduate student attending the University of Waterloo is reportedly missing after allegedly spending four entire, consecutive days in the University’s lounge for math students, “MC Comfy.” One of the student’s friends comments on the disappearance:

“I didn’t really think anything of it. I figured he just spent a lot of time in there, but looking back now, something definitely felt wrong.”

Another one of the student’s colleagues admitted it took her at least a day to notice he was gone. “The guy just started to blend in after a few days I guess,” she told reporters. “We just realized he was gone after a few hours.”

Security footage revealed that the student in question indeed spent four days sitting uninterrupted in the lounge, before “disappearing” from footage, as a University official put it.

A thorough investigation is underway.

FACULTIES AS GRAMMYS OUTFITS

MATH: LIL NAS X



ARTS: CHRISSEY TEIGEN



ENGINEERING: JAMEELA JAMIL



SCIENCE: BILLIE EILISH



ENVIRONMENT: H.E.R.



AHS: BILLY PORTER



If the editors don't post the pictures I've inserted, please look them up. They are really good outfits. Also look them up anyways because the colours are beautiful!

Whild

mathNEWS ENDORSES "TAKE THE TOOL" FOR WUSA'S MATH STUDENT COUNCIL SEATS

Serves the Engineers right for stealing our Natural Log last term...

In all seriousness though, anyone from the "Take the Tool" roster would be an amazing representative for Math students on WUSA's Student Council. Hell, the fact that there are 8 students running for the seats in general shows you how dedicated and passionate these students are about representing and advocating issues facing all Math students.

Get to know your candidates for not only the Math Student Council Seats, but for the other WUSA Exec positions and student representation on the University Senate (one of the highest governing bodies of UWaterloo as a whole). Full info should be available soon at vote.wusa.ca and on WUSA's website here: <https://wusa.ca/governance/elections-and-referendums/elections#doc-candidates>

Good luck candidates, and do the best job you're able to should you be successfully elected! As for everyone else, GO OUT AND VOTE DAMMIT!!!

→ VOTE.WUSA.CA ←

Narf Dert

N CARELESS MISTAKES I'VE MADE IN FIRST YEAR

- Dropped a coefficient
- Calculated the derivative instead of the antiderivative
- Mistook addition for multiplication
- Mistook multiplication for addition
- $2 \times 0 = 1$
- That one time I somehow rewrote a 15 as a 3 and just rolled with it
- Handling multiple variables in a proof and substituted one for the other

bullies wildlife

Send more profQUOTES.

THE ENTIRE mathNEWS READERSHIP

TURNABOUT INTRODUCTIONS

Alright. Here we go. First **mathNEWS** article. I was inspired by a particularly AMAZING article by DragonicKhaos last week, so here I am, ready to become a published writer. Woot.

Worst-case scenario I'll just write this until I think of a better thing to write. To be completely honest, I'm just here to play Mao. What is Mao, you ask? Well, that's classified. I'm not very good at Mao, but that's kinda the point. I've already said too much. But yeah, Mao and free pizza sounds like a pretty good deal to me, and if I have to pretend to be literate for a few hours to get those things, so be it.

Since this is my first time writing, maybe I should introduce myself? My username is Psykarp. My favourite colour is cyan, my favourite book series is The Dark Tower, and my favourite Crystal Gem is Lapis. That sums me up pretty well. To answer the natural follow-up questions: cyan means #00FFFF, I read the ending to The Dark Tower a few days ago and don't regret a thing, and I do not ship Lapidot. Lapis is her own independent gem, dammit, and don't need no green dorito.

OH! I just remembered my idea for an article that I had a week ago! Get ready for the most useful Public Service Announcement you've ever heard! Did you know that Club Penguin is still around? "No, Psykarp," I hear you thinking, "it died long ago and I cried for three days, don't you dare give me hope." Well too bad! Hope has arrived! CPRewritten and other fan-made websites have revived it!

"WAIT!" you rudely interrupt, "That's just a fan-made game! That's not the official Club Penguin I know and love!" Don't be so quick to judge! You're right, this isn't the official Club Penguin, because the official Club Penguin is lying in a cold coffin six feet under. CPRewritten is the phoenix born from the flames of a passionate community, outfit with the exact same graphics and island layout & games, weekly updates and cool events, and an active player base that cares about keeping the game alive.

Go! Go now! Play the game of your childhood, and rejoice! But seriously, it's pretty great. They've got everything that you missed, from EPF missions to Card-Jitsu. After your penguin is 30 days old, you can even apply to the PSA and do the old point-and-click adventures. [Note: I haven't been able to confirm this myself, but I've seen penguins waddling around with the black puffle wearing the welding mask, which I'm pretty sure you can only get from the PSA missions? Don't trust me, just go and check it out yourself.]

Upon my re-discovery of Club Penguin, I did nothing but throw virtual snowballs for a few days. However, I found something I never expected to find on my good Christian iceberg: cults. Battle-cults, to be specific. However, this seems like something deserving of its own article. So look forward to my next article: BATTLE-CULTS OF CULB PENGUIN! Maybe. Like I said, I'm just here for Mao.

Psykarp

THOUGHTS THAT GIVE ME AN EXISTENTIAL CRISIS

What colour is a mirror?

Do we really all see colour the same way?

Are we really doomed to a life of constantly coming home and making dinner and washing dishes and repeating that forever and ever?

Why did we breed dogs in such a way that gave us pugs, who suffer by merely existing?

We are always the oldest we've ever been in the present time.

Every passing second is a second closer to our deaths =D

How did language begin and how did it develop to the point it's at today?

Why the hell did we allow the word Kranch to exist? Why does Kranch exist? Why?

Why is there a convention for literally everything? Vacuum conventions???? Bean conventions???? Hello????

Will students of the future have to study the memes of today? Will they understand them? Will they understand loss.jpg? Will ok boomer only be a thing of the past?

History as a subject only gets harder to study as time passes.

We never get the time we waste back. I know that's pretty obvious but man. It sure does put how much time I waste on TikTok and Twitter into perspective.

We will never be able to see the entire electromagnetic spectrum.

We let society get to a point where we celebrate people who do absolutely nothing but are ridiculously rich and famous. And people make gofundmes to make them more rich and famous.

Herbie

N REASONS WHY YOU WANT TO GO TO HELL

- the gays
- everyone else is doing it
- its more fun
- constantly warm
- your favs are prolly there
- stan twitter and tiktok
- no clothing required
- sinners
- sex demons
- deep dark fantasies
- spicy food
- less boring than heaven
- easier to get into than heaven

banh mami

COLLECTIVE NOUNS FOR MATH MAJORS

In order to comply with Policy 71, I would like to thank Beyond Meta for this article idea. I would also like to thank the various people who gave their input.

What is the word for a group of majors?

- A group of ActSci majors is called an accident
- A group of Applied Math majors is called an engineering
- A group of Combinatorics and Optimization majors is called a counting
- A group of Computational Mathematics majors is called a CS rejection
- A group of Computer Science majors is called a stench
- A group of Computing and Financial Management majors is called a chain of blocks
- A group of Mathematics/Business majors is called a Golden Hawk
- A group of Mathematical Studies majors is called a default
- A group of Mathematics/Teaching majors is called a backup
- A group of Pure Mathematics majors is called a ring
- A group of Statistics majors is called a distribution

Sandwich Expert

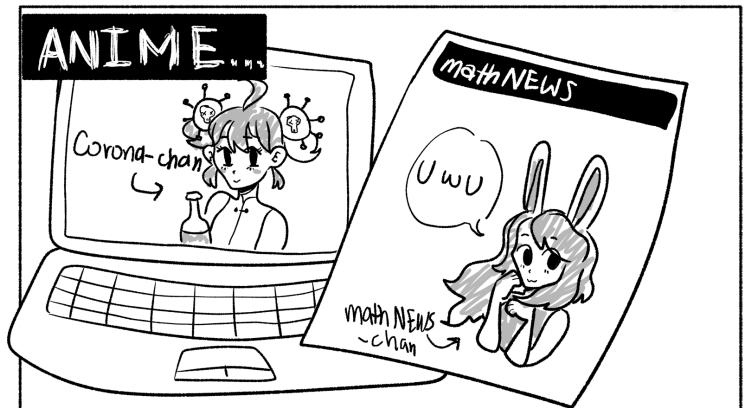
U OF T BEATS WATERLOO AT ASNA CASE COMPETITION

NIAGARA ON—After coming second place to the University of Waterloo team at the Actuarial Students National Association Case Competition for 3 years in a row, the University of Toronto team emerged victorious in the 2020 ASNA Case Competition earlier this January.

Waterloo actuaries, you better win next year!

sillycone

[INSERT YEAR HERE] ID: @alyssnyah



3 THINGS UWATERLOO STUDENTS SHOULD DO IN THE FACE OF THE CORONA VIRUS OUTBREAK

Thanks to /u/weallfalldown123 on /r/uwaterloo for this guest feature.

Are you worried about the Corona Virus? Well you shouldn't be, you should be terrified of it. But if you follow these 3 things and remain paranoid you can help contribute to a counter productive climate of fear and uncertainty that will make things harder for everyone!

1. WEAR A SURGICAL MASK, IF YOU'RE HEALTHY

Doctors speaking on behalf of the Canadian government, the U.S. Centre for Disease Control (CDC), and the World Health Organization (WHO) have all clarified on multiple occasions that wearing a mask does not protect healthy people from becoming sick. It only reduces the chances of those who are already sick from spreading the disease further. In fact, it can actually increase a healthy person's risk of falling sick as it can accumulate bacteria and encourage you to unknowingly touch your face, nose, mouth, and eyes even more frequently than normal.

But who gives a shit what the quack doctors at Health Canada, the CDC, and WHO say? Your mom already bought 10,000 masks of Amazon. So wear them anyway.

See links in footnotes for further reading including guidance from Canada's Chief Medical Officer at a Corona Virus Briefing

2. BLAME CHINESE PEOPLE

The Corona Virus began from animal to human transition, and since humans and animals interact literally everywhere the new diseases could start from anywhere.

But the Corona Virus began in China, which means every single Chinese person is at fault for some reason. Please be sure to leave racist anti-Chinese comments on any news stories you read about the Corona virus, and suspiciously eye any East/Southeast Asian looking person on the bus while hoping the next disease outbreak doesn't start in a country where your ethnicity is the majority. Just like how every single Canadian is personally responsible for the cross-contamination and cannibalism that created Mad Cow Disease, every Chinese is responsible for the cross contamination in Wuhan butcher shops.

3. TRUST NO ONE, BUT BELIEVE EVERYTHING

All authorities are out to mislead you, and media is fake news. The only people you can trust are dubious LiveLeaks videos, anonymous internet posters, and the barely coherent conspiracy theory that your totally unqualified uncle came up with while driving home from work. Be sure to tell as many people as possible to help confuse and mislead as many people as possible.

(but UW Unprint, did you have legal permission to repost this in this most honorable publication?)

 weallfalldown123 3 points · 5 hours ago

if this is legit. then i give consent to publish this or a modified version of this.


 Reply  Give Award  Share  Report  Save

Take that, lawyers.


weallfalldown123
(with the support of UW Unprint)

- <https://www.ctvnews.ca/canada/feds-roll-out-education-call-for-self-reporting-to-prevent-coronavirus-outbreak-1.4780101>
- <https://www.foxnews.com/health/do-surgical-masks-protect-against-coronavirus>

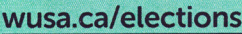
get to know your candidates



popcorn & politics: the executive debate
hosted with imprint
feb 3 @ 5 pm // SLC atrium




reddit AMA: all candidates
ask your questions all day on r/uwaterloo
jan 29 @ 10 am - midnight




wusa.ca/elections
to check out your full candidate listing
(and all election info)


and the positions they're running for



WUSA execs
Four roles: President, Vice President Operations & Finance, Vice President Student Life, and Vice President Education.
Elected Execs are the faces of WUSA and advocates for all UWaterloo undergrads.
These are full-time paid, executive-level positions



WUSA students' council
Elected student leaders who represent a faculty, college or campus.
Elected Councilors oversee the WUSA Executives, Board of Directors, determine priorities for our fees (and approval of the fees), and decide what we advocate for and how we run.
Council meets once a month.



uwaterloo senate
Consists of University admin, faculty and elected student leaders.
Senate is responsible for all issues relating to academic quality, including the granting of degrees, setting program requirements and approving academic regulations. Elected Senators make important decisions on issues that matter to undergrads, like Fall Reading Break and program requirements.
Senate meets once a month.

N GENIUS WAYS TO END THE GRT STRIKE

[Editor's note: Originally posted to r/uwaterloo, re-published here with u/shizzledog's approval]

As you all know, GRT bus drivers have been on strike the last two weeks. What does that mean? Waterloo's roads are devoid of GRT buses as the drivers are home doing whatever bus drivers do in their free time (for example, they could be teaching their children how to shovel the driveway or learning how to cook ratatouille) while the rest of us are wondering why we have been forsaken to walk along the un-shoveled sidewalks of Columbia and University.

All in all, it's pandemonium.

Still, GRT can do better. Inspired by the Japanese bus drivers who continued their normal routes but refused fares while striking, here are some ways the GRT union can spice up the strike a little. After all, what good are strikes if they don't have some dramatic flair?

BUS DRIVERS CREATE THEIR OWN BUS ROUTES

If you're a suburban PTA member living in your Kiwanis Park McMansion, the bus strike probably doesn't affect your life very much. Now imagine you can't back your Honda Pilot out of the driveway because there's 6 oncoming GRT buses free-styling into your cul-de-sac. The GRT hath no fury like a mom late for pilates.

PARK THE BUSES OUTSIDE GRT'S OFFICES BUMPER TO BUMPER SO THAT MANAGEMENT CAN'T LEAVE THE BUILDING

If we're looking for a quick end to the strike, there's no better way than to cut the supply lines of the enemy by blocking them in. When the GRT office snacks start running low, they'll have a new deal inked in no time.

DRIVE ALONG THE NORMAL ROUTES, STOPPING AT ALL STOPS, BUT NOT OPENING THE DOORS

This is a bad PR look but it wins bonus points for shock value. It's unclear how this would actually help with the strike, but it does show that the union is not to be messed with.

HAVE DRIVERS INVITE 20 OF THEIR DEAREST FRIENDS ABOARD, TURNING THE HUMDRUM GRT BUSES INTO RAGING PARTY BUSES

The number one draw of a party bus is getting to drunkenly wave at the peasants who didn't get an invite. Having belligerent KW folk unleashed upon the unsuspecting pedestrian is a surefire way to spark unrest amongst the masses. Plus, the GRT execs will feel left out, allowing the union to use party bus invites as a potential bargaining chip.

STAGE BUS DRAG RACING ALONG THE 85 HIGHWAY (HIGH STAKES)

Everyone loves a good show, and having two GRT buses screaming down the highway is guaranteed to draw a crowd. Onlookers can watch from the University Ave. Bridge and union-sponsored bookies can take bets to pad the union purse.

Obviously there are many other options that weren't covered here; feel free to share your own. I know it may seem like we're powerless, but if we can get these ideas in the hands of the union, we'll be doing our part to help end the strike.

N. Lemoing and L. Rock

WHAT COULD GO RIGHT?

A GUIDE TO THE MAGIC OF INVITATIONS

"What could go wrong" is a phrase that has the power to alter reality. It is an invitations to tempt fate. Whenever someone utters it in a story you know that things are going to get crazy.

What I want to consider instead is asking fate "what could go right?", focusing on the possible positive. By voicing an idea you make it more real. And maybe it won't happen but if you send out enough invitations it might happen.

I have a personal philosophy of only joking about things I want to happen. So, for example, I will let everyone know that I would really love a surprise party. And this probably won't happen but by voicing it you now know that I would love a surprise party and maybe someone will read it and file it away and decide to actually implement it. At which I will be surprised as I don't expect you random **mathNEWS** reader to throw me a surprise party but now that you know it becomes just a little more likely.

Don't joke about things you don't want to happen. Trump as president is only funny when it's not real. Now it's horrifying. %10 joke do not recommend.

Be sincere about expressing your desires and the world might deliver. As what you express changes how you see the world. If you focus on what could go right you are more likely to notice and seize opportunities than if you are constantly imagining scenarios of negativity.

Send out the invitations for the things you want for you never know what will answer but if you don't you will never find out.

Beyond Meta

YOUR LEAP MONTH horrorSCOPES, JUST IN THE NICK OF TIME

IN BRIEF: MC 4021'S GONNA GET STUFFY

Your quadrennial leap month **horrorSCOPES** are here and without a day to spare! Assuming you're reading this the day the issue comes out, that is. If not, I hate you and you can suck my dick. Just kidding. I'll never hate you, *mio caro*. But you can still suck my dick though; alternatively, Venmo me 2929 Swiss francs.

ActSci: As Valentine's Day nears, you'll consider getting yourself or a special someone something nice for the day. You'll decide to get chocolate. After a thorough analysis of historical price data for ten different chocolate stores in the region, you end up buying a box of chocolate from the Lindt store in Conestoga Mall a few days before the 14th. As the weekend arrives, however, you'll feel a strange, ineffable feeling of buyer's remorse. Should you have waited? Your unlucky number: 29 grams of sugar per truffle.

AHS: The gym will become less busy as the leap month progresses, which is good news for you, as you've started to think about trying Olympic lifting. Your unlucky number: 29 clean and jerks before you faint.

AMATH: One of your close friends will become more aloof and cold after reading week. You won't be able to think of an explanation for their sudden change in behaviour towards you. You'll spend a lot of time sulking, until one day you see your friend on the corner of Phillip and Columbia handing out Illuminati pamphlets. Your unlucky number: 29 minutes of conversation about government mind control.

Arts: Sometime within the next two weeks, you will slip on some ice between AL and ML, but thanks to your grippy winter boots and your strong sense of balance, you won't fall. However, the sonic waves in the ice caused by your misstep will travel eastward across the ice towards RCH and cause another student to suddenly lose their balance and fall. Your unlucky number: 29 steps to Hagey Hall.

C&O: You'll find yourself antsy and itching to get off of campus during reading week. Strange events will have happened to your friends and they'll have acted in ways they normally wouldn't—you won't be able to shake off the feeling of a curse having being laid over the university. You'll develop paranoia and become more distant from your friends; over reading week you'll become particularly interested in reading blog posts about New World Order conspiracy theories. Your unlucky number: 29—you start seeing it everywhere.

CS: One of your friends will suddenly develop a frenzied taste for the vegetable chili in the CnD. At some point, they will buy you a small bowl of it and ask you to try some. You'll take it with you to your class: you'll sit at the back corner as to avoid disturbing people while you eat. Twenty minutes into the lecture, you will raise your hand to ask the prof a question, in the process knocking over your bowl of chili

onto somebody sitting on the floor to your left. Your unlucky number: 29 awkward apologies.

Double Degree: This term's been a challenge for you academically. You think it might have to do with one of your profs for one of your classes. You will try sitting in on another prof's lecture for that class. Unfortunately, other students will have had the same idea, and eventually the prof will start to check WatCards at the door. You attend your old section to find that your prof is now covering material in a different order to the other prof. Your unlucky number: 29% on your next assignment.

Engineering: Due to unforeseen freak ice storms, you'll hole up indoors the entire reading week. Staying indoors all the time makes you restless, as you will find out, and you'll make a resolution to work out more often once reading week ends. The slippery conditions outside will do a lot to put a damper on that, however. Your unlucky number: 29°F.

Environment: Sometime within the next two weeks, you will slip and fall on a stretch of ice between DP and RCH. It will be in between classes and there will be lots of people around. No one will help you. Your ass will be sore for an hour. Your unlucky number: 29 pairs of onlooking eyes.

PMATH: You will grow to really like the vegetable chili in the CnD. I mean really, *really*, like it. After the leap month ends, your taste for it will fade away as quickly and incomprehensibly as it came, and even the sight of it will fill you with a sense of floating ennui and frustration. Your unlucky number: \$29/week spent on chili alone.

Science: You will start your own science-related blog, both for the fun of writing and for resume padding. At first, you will write about topical science news in your field of study, but you don't get very many views. After writing about an article that referred briefly to the anti-vax movement, however, your hits shoot way up. You learn that this kind of content sells, and channel your blog's focus into documenting extravagant conspiracy theories. Your unlucky number: 29 unique hits an hour.

Stats: Your favourite weekend of the year is soon to come. You have already started to subconsciously prepare for it, by saving up your money here and there. You can't wait—last year's stash has nearly run out. You can already taste the heavily discounted candy and chocolate if you focus hard enough. Your unlucky number: 29 pounds of cinnamon hearts.

Teaching: You will start hanging out in the TSA office more than you're used to. The hours will creep up on you day by day until you basically only leave the office to use the washroom and buy food from the CnD. The wall between the **mathNEWS** and TSA offices is thin; you'll file a complaint to the Dean

against the **mathNEWS** editors, citing inability to sleep from their noise. Your unlucky number: 29 consecutive hours in the TSA office.

Undeclared: Sometime within the next two weeks, you will see a student slip on ice between DP and RCH. You'll contemplate going over to help them, while also knowing that you're already running late to your lecture in MC 4021 and you'll have trouble finding a seat if you don't hurry. Your indecision will paralyze you and you have to sit on the floor during your lecture anyway. Your unlucky number: 29 people in MC 4021 who aren't enrolled in your section.

Finchey

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Beyond Meta

DOES $\backslash(\backslash$ **MATHRM{mathNEWS}\)** **REALLY SUPPORT $\backslash(\backslash$** **LATEX\)?**

[Editor's note: we theoretically fixed the LaTeX script, so this article is being re-published in all its glory]

In this article I will try to break the **mathNEWS** $\backslash(\backslash$ LaTeX) scripts.

Editors, please do not try to fix any broken output.

$$e^{i\tau} = 0$$

$$\text{mathNEWS} \left(\frac{a}{b} \right)$$

$$\text{TRUE} \wedge \text{FALSE} = \text{FALSE}$$

$$\int_b^{\int^{\int^{\int^{\int}}}}$$

$$\frac{\text{mathNEWS}}{\text{profQUOTES}} = \emptyset = \varnothing$$

Is **mathNEWS** Turing complete? If the next line says “2”, then **mathNEWS** is capable of calculating 1 + 1.

2

How well does **mathNEWS** support bad $\backslash(\backslash$ LaTeX) code? The next two lines use wrong/horrendous syntax.

$\backslash[\text{int}\{\{\{\{a}\}\}\}]$

$\backslash[\text{frac}\{a\}bb\}\backslash]$

Testing Expert

I CHASED A GOOSE AROUND THE UWP PARKING LOT

Only partially by accident—it started running from me first.

:)

TRUE FACTS ABOUT THE WUHAN CORONAVIRUS

The rise of the Wuhan Coronavirus, also known as 2019-nCoV, has brought about much fear and worry. Accounts of stores running out of masks and hand sanitizer are accompanied by frantic hoaxes shared on social media about prospective cases, as reporters speak of the impending collapse of society and the apocalyptic future that humanity faces. Lost among the soundbites, however, is the truth about the coronavirus. How is it different from the common cold? How easily does it get transmitted? Do masks help? How bad is it really?

WHAT ARE CORONAVIRUSES?

Coronaviruses are a family of viruses responsible for a variety of diseases in birds and mammals, including humans. We encounter coronaviruses most commonly when we experience the common cold, an ailment that is familiar to most — if not all — of us. Coronaviruses are also the cause of SARS and MERS, two illnesses that have caused concern in the past. Most coronaviruses cause respiratory illness, resulting in the all-too-familiar symptoms of coughing, sore throat, and difficulty breathing.

WHAT DO WE KNOW ABOUT THE WUHAN CORONAVIRUS SO FAR?

We know that the symptoms of the Wuhan Coronavirus mirror those of other coronaviruses such as the common cold, with fever being near-universal and coughs, muscle pain, and fatigue as common symptoms¹. We also know that the incubation period — the time between acquiring the virus and showing symptoms — is between one and fourteen days². Early reports suggest that the method of transmission for the Wuhan Coronavirus mirrors those of other coronaviruses³; namely, primarily through respiratory droplets released through coughing and sneezing. Unlike SARS, it seems that the Wuhan Coronavirus is not transmitted through bathroom activities⁴, which makes SARS a lot scarier in hindsight.

However, as with all emerging diseases, there is still much to learn. We don't know the exact details of the Wuhan Coronavirus's infectivity, mutability, and seriousness. Much of what we do know about the virus is preliminary, and is liable to change as we collect more and more data.

HOW LIKELY AM I TO CONTACT THE CORONAVIRUS?

At time of writing, the risks for Canadians remains low⁵. Despite there being one confirmed and one presumptive case and eleven more persons under investigation in Ontario⁶, and one presumptive case in B.C.⁷, the public health systems in China and Canada are nowhere near as underprepared and overwhelmed when it comes to handling infectious diseases as they were during the SARS outbreak in 2003. In the decade-plus since, China has improved in its preparedness and systematic capabilities for responding to such outbreaks³. Progress has also been made domestically, with improved policies and procedures based on the lessons learned from handling the SARS outbreak⁸.

Although the National Health Commission in China has stated that those without symptoms are able to spread the coronavirus⁹, Dr. Danny Chen, an Infectious Disease Specialist at Mackenzie Richmond Hill Hospital, notes that local experts as well as experts from the Centers for Disease Control and Prevention have stated that they are unaware of data which supports such a claim. "While some viral illnesses can spread before a patient becomes symptomatic, others such as SARS and MERS do not," he said.

The ability for the coronavirus to spread should be recognized; preliminary numbers suggest that every infected person could infect anywhere from 1.5 to 3.5 people⁹. This number, called R_0 (reproduction number), can be compared to SARS's R_0 of 2-5 and MERS's R_0 of less than one¹⁰. Thus, it appears that the Wuhan Coronavirus does not spread as easily as SARS.

WHAT'S THE PROGNOSIS?

The majority of cases caused by the Wuhan Coronavirus exhibit viral pneumonia¹. Currently, 106 persons have passed away out of a total of 4515 confirmed cases in China¹¹, a death percentage of roughly 2.3%. This is much lower than SARS, in which 9.6% of cases resulted in death¹⁰.

All but the most severe coronavirus infections clear up after a period of time, and the Wuhan Coronavirus is no different; of 41 patients tracked at the start of the outbreak, 28 (68%) were discharged from hospital, the standard for which was a lack of fever for at least ten days and a noticeable improvement in condition¹. Although it is not yet known how to best treat patients who are severely affected with the coronavirus, treatment based on experience from the SARS outbreak is currently being evaluated¹. This brings hope that the same medications that showed promise then may also work now, so although it would be inadvisable to do so, getting infected with the coronavirus might not be a deathly experience.

Despite their shared heritage, initial data suggests that the Wuhan Coronavirus may be less capable of causing harm than SARS and MERS^{10,12}. However, this may change as more data is collected and analyzed.

WHAT CAN I DO TO PROTECT MYSELF? HOW ABOUT PROTECTING OTHERS?

As with most respiratory diseases, basic hygiene offers a reasonable level of protection.

"You can protect yourself and others by washing your hands often, avoiding contact with people who are sick, and practising proper cough and sneeze etiquette (into the elbow)," says Dr. Chen.

DO MASKS HELP? WHAT KIND OF MASKS SHOULD I GET?

Somewhat counterintuitively, masks may cause more problems than they prevent. "For the general public with casual passing contact with others, masks are unnecessary and may lead to more hand-face contact potentially increasing the risk of getting sick," says Dr. Chen.

That being said, there are various sources online claiming the effectiveness of masks certified against the N95 standard against transmission of the virus. For the general public, however, N95 masks are unnecessary, and as above, may potentially increase the risk of infection. Though N95 masks are part of the protective equipment worn by healthcare workers in such cases, they are worn only in circumstances requiring direct contact with affected patients, and are worn in conjunction with more intrusive equipment such as facemasks and gloves. Furthermore, such masks only guarantee N95 protection if they have been tested to form a reasonable seal for each individual user, a certification process that must be performed by specialized equipment¹³. While it is possible to achieve N95 protection without undergoing such testing, wearing an N95 mask is basically overkill if you're not going to be in direct contact with someone who's already sick, and even then there are much more cost-effective ways to prevent infection.

I'M FEELING A LITTLE SICK. HOW DO I KNOW IF IT'S JUST THE COMMON COLD, OR IF IT'S THE WUHAN CORONAVIRUS? WHEN SHOULD I GO TO A HOSPITAL?

Since the Wuhan Coronavirus is a coronavirus just like the common cold, much of the symptoms overlap, such as fever, coughing, and difficulty breathing. What distinguishes the Wuhan Coronavirus is mainly travel history to Wuhan, or close contact with an affected person or sick persons who have been to Wuhan in the past fourteen days.

"If you have the travel history or close contact history and are sick, then seek medical attention," advises Dr. Chen. He suggests to call Telehealth Ontario, the local Public Health Unit, or the local hospital to inform them and to request specific directions on how to proceed.

The onset of severe symptoms, however, should be grounds to seek immediate medical attention. "Go to the hospital if you are having trouble breathing, feel like fainting, confused, having trouble keeping fluids down, or getting dehydrated."

Anon

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**THAT FEELING YOU GET,
WHEN YOU MEAN TO TAG
AN ARTICLE AS V142I1,
BUT DO SO AS V142I2
INSTEAD.**

Feels bad man. Sorry editors for the silent unwarranted rage. Like this if you cry evertim.

Narf Dert

STAIRWAY CONSTANTS, PART [1,2)

FOREWORD AND CORRECTION

Thanks to the editors for fixing almost all of the $\backslash(\backslash\text{LaTeX})$ [Editor's note: sic.] compilation errors from the previous issue! *Almost*, because a single error did make it through. The exercise from the Liouville's constant section is supposed to say:

Exercise: find a rational number $\frac{p}{q}$ which is within $\frac{1}{q^{42}}$ of L .

If you're tuning in for the first time, the last issue of **mathNEWS** contains the first instalment of a 6-part series dedicated to the number line that decorates the north-north-east stairwell of MC. Titled *Stairway Constants, part [0,1)*, we left off at the first floor landing, where we pick back up now.

FLOOR 1

One. The successor of zero. 0.999... The multiplicative identity. $e^{i\tau}$. Depending on how you define things, it's the first or second natural number. Meanwhile, it's the first *and* second Fibonacci number. One is unity, but it is not the only unit (in the integers). It's neither prime nor composite. One is unique, and unique is one.

"Wau!" you exclaim¹. A big pink 1 stares you in the face. Above, the number line runs on by. Up the stairs you follow it.

S_1

First Smarandache constant

1.09317...

(For more digits, see OEIS A048799.) If you've been keeping track, it seems as though whoever designed these plaques didn't care about having a consistent number of decimal places on each one.

We cannot discuss the "First Smarandache constant" without acknowledging how many there are. From the Wolfram MathWorld page, Florentin Smarandache has at least 14 things named after him:

- The Smarandache-Wellin numbers, which come up on Wikipedia when you Google him.
- The Smarandache constant (OEIS A038458), which is the first exponent x such that we get $q^x - p^x = 1$ for two consecutive primes p and q .
- The Smarandache function $\mu(n)$, on which the subsequent things in the list are based (more on this later). If you look for this function on Wikipedia you will see it called the Kempner function, named after the mathematician who first described an algorithm to compute $\mu(n)$ (62 years before Smarandache rediscovered it).
- The First Smarandache constant S_1 .
- The Second Smarandache constant S_2 (OEIS A048834).
- The Third Smarandache constant S_3 .

- The Fourth Smarandache "constant" $S_4(\alpha)$ is really a series parameterized by α , which converges for $\alpha \geq 1$.
- S_5 through S_{11} , some of which have parameters like S_4 does.

Florentin Smarandache is now teaching mathematics at the University of New Mexico, so he still has a chance to get even more things named after him. Still, he's nowhere close to Euler. Moreover, Smarandache's things don't have nearly the same usefulness as Euler's. S_1 through S_{11} are pretty damn arbitrary. They come from papers by 6 different authors written between 1995 and 1996. The formulas for the eleven series get increasingly esoteric with no apparent mathematical significance to their ordering. If all this sounds sketchy to you, there is a whole discussion on the r/math subreddit about whether or not Florentin Smarandache is legit.

Nonetheless, let's see what we can learn from the First Smarandache constant. To begin, the Smarandache function $\mu(n)$ is defined as the least positive integer k such that $k!$ is divisible by n . For example, $\mu(9) = 6$, since $6! = 720$ is divisible by 9 (and $1!, 2!, 3!, 4!$, and $5!$ aren't).

Meanwhile, the First Smarandache constant is defined by:

$$S_1 = \sum_{n=2}^{\infty} \frac{1}{(\mu(n))!} = \sum_{n=2}^{\infty} \frac{1}{\text{the first factorial } k! \text{ divisible by } n}$$

It doesn't really matter what the value of S_1 is; the significance of S_1 (if any) is that it exists. Paraphrasing David Jao, a good way to see how an integer sequence grows is to check the "sum of reciprocals" of its terms. In this case, the terms in question are $(\mu(2))!$, $(\mu(3))!$, $(\mu(4))!$, ... Since the series converges, we know this sequence grows pretty fast.

Exercise: prove the easier theorem that the sum of reciprocals of $2!, 3!, 4!, \dots$ converges.

σ_1

Smallest known Salem number

(Root of Lehmer's polynomial)

1.1762808183...

(For more digits, see OEIS A073011.) This plaque is a bit misleading. I interpreted it as "the Salem numbers are the

Give us a bigger office,
and the rag lives.

A POSTER ON THE WALL IN
THE mathNEWS OFFICE THAT I
DON'T KNOW THE ORIGIN OF

roots of some mystical polynomial, and σ_1 is the smallest of them." I was very wrong.

In actuality, Lehmer's polynomial has just 10 roots, and σ_1 is the "largest" among them. (The other roots are not Salem numbers.) The infinitely many other Salem numbers (named after the 20th century Greek mathematician Raphaël Salem) have nothing to do with Lehmer's polynomial, but we don't know any that are smaller than σ_1 . The legendary late number theorist Derrick Henry Lehmer (after whom the polynomial is named) conjectured that σ_1 is the smallest, but nobody has proven it yet. Meanwhile, there's nothing particularly mystical about Lehmer's polynomial. We can actually write it out in full:

$$x^{10} + x^9 - x^7 - x^6 - x^5 - x^4 - x^3 + x + 1$$

That's it. So what's this constant doing in the stairwell?

The Salem numbers have to do with polynomials satisfying a very strict set of conditions:

1. The polynomial is monic (its leading coefficient is 1).
2. The polynomial's coefficients are integers.
3. The polynomial has a real root greater than 1.
4. No other polynomial of smaller degree has the same root from condition #3.
5. The polynomial has a complex root with modulus exactly 1.
6. The other (complex) roots of the polynomial have modulus 1 or smaller.

Iff the polynomial fits all of the above, then the root mentioned in condition #3 is a Salem number. Thanks to these conditions, Salem numbers are useful in all sorts of math, even beyond number theory. Chris Smyth has written a nice paper listing some of the uses.

At the moment, the next largest known Salem number is 1.1883681475..., which exceeds σ_1 by less than 0.013. The next one after that is very close to 1.2. This is part of why σ_1 is interesting: after it, there's a ton of Salem numbers. But before it, there's an empty sea of nothing².

Exercise: are any of the other numbers in this stairwell Salem numbers?

FLOOR 1.5

After 11 steps, you reach the next landing, with a big pink 1.5. There's an alcove for a door leading to the outside world, but we're heading to the second floor. There's more constants to see.

However, the alcove brings up an interesting question. This landing seems to have a larger perimeter than the others. Is the physical length of the number line varying between floors? That would be a grave travesty. I'll have an answer for you by the next installment, after I check using a ruler.

P

Plastic number

1.324717957...

(For more digits, see OEIS A060006.) Hey, we've seen *P* before. It's the same symbol for the prime constant, but it's definitely not the same number. This brings up an important point in mathematics: a symbol means exactly the meaning you give it here and now, and it means nothing else. The same goes for names. A plastic number by any other name is just as cool, if not cooler. Other people might know it as:

- The plastic ratio
- The radiant number
- The silver number
- The smallest Pisot-Vijayaraghavan number, as conjectured by Raphaël Salem (after whom Salem numbers are named!) and proven by Carl Ludwig Siegel
- (hence the name) Siegel's number

"Plastic" might sound degrading in our modern day and age, but it is meant to be flattering, in the same way that someone might say that the human brain is plastic.

The plastic number has one of the simplest definitions out of the constants so far, as the positive real solution to the equation $x^3 = x + 1$. That is, cubing the plastic number is the same as adding one. You might recall a famous number with a similar property: squaring the golden ratio is the same as adding one.

However, like plastic, the plastic ratio is much less abundant in the natural world than its golden counterpart, and has only appeared in relatively recent times through the influence of mankind. Most notably it appears in the work of the 20th century Dutch monk and architect Dom Hans van der Laan, one of the first people to recognize the geometric properties of the plastic ratio and relate it to the human ability to tell sizes apart in 3 dimensions.

Exercise: use the cubic formula to find the exact value of P.

$\sqrt{2}$

Square root of 2

1.4142135623...

(For more digits, see OEIS A002193.) After a slew of 20th century constants, here's one for the ancients. Legend has it that someone was drowned as a result of their discovery of $\sqrt{2}$ as the first irrational number... You yourself may have had to come up with one of the many proofs that $\sqrt{2}$ is irrational. As testament to the progress of society, you were almost certainly not thrown into the sea for doing so.

Probably as common as $\sqrt{2}$ is its reciprocal $\frac{\sqrt{2}}{2}$, which happens to be the sine (and cosine) of a certain special angle. Or do you prefer to write it as $\frac{\sqrt{2}}{2}$? I'll make a case for the latter:

$$\begin{aligned}\sin 0 &= 0 = \frac{\sqrt{0}}{2} \\ \sin \frac{\pi}{6} &= \frac{1}{2} = \frac{\sqrt{1}}{2} \\ \sin \frac{\pi}{4} &= \frac{\sqrt{2}}{2} \\ \sin \frac{\pi}{3} &= \frac{\sqrt{3}}{2} \\ \sin \frac{\pi}{2} &= 1 = \frac{\sqrt{4}}{2}\end{aligned}$$

It makes it so much easier to memorize special angle trig ratios if you rationalize the denominators.

Better than the OEIS, you can find even more digits of $\sqrt{2}$ at this ancient NASA webpage <https://apod.nasa.gov/htmltest/gifcity/sqrt2.10mil>. Why would anyone want to know so many decimal places of a number? It's mostly for the glory. Even for NASA, beyond the 100th digit, you already have more precision than you need for any sort of astronomical computation. The current record for $\sqrt{2}$ is 10 trillion digits, set by Ron Watkins³. If you're thinking of trying to beat him, you should be warned that it took his two Intel Xeon X5690 processors a month and a half to compute and verify the digits. *Exercise: compute $\sqrt{2}$ to 14,142,135,623,731 digits. (Good luck!)*

ϕ

Golden Ratio 1.6180339887...

(For more digits, see OEIS A001622.) Here's another one for the ancients: the most overrated ratio in mathematics. A certain author (who I will not name, to avoid promoting him) has even cooked up a \$120 wellness guide consisting of various things in golden proportions to help its readers harness the magical power of the placebo effect golden ratio⁴.

In all seriousness, the exact value of the golden ratio is $\frac{1+\sqrt{5}}{2}$, and it does have serious mathematical applications. These properties stem from the fact that the golden ratio is the positive solution to the quadratic relation “squaring is the same as adding one”:

$$\phi^2 = \phi + 1$$

That relation is the source of the golden ratio's “unexplained” powers. For example, we can divide both sides by ϕ to get the continued fraction

$$\phi = 1 + \frac{1}{\phi} = 1 + \frac{1}{1 + \frac{1}{\phi}} = \dots = 1 + \frac{1}{1 + \frac{1}{1 + \dots}}$$

At any point, we can cut off the continued fraction to get an approximation of ϕ . Cutting it off immediately gives $1 = 1/1$. Cutting it off after one term gives $1 + \frac{1}{1} = 2/1$. Cutting it off after two terms gives $1 + \frac{1}{1 + \frac{1}{1}} = 1 + \frac{1}{2} = 3/2$. And then $5/3$, $8/5$, $13/8$... the appearance of the Fibonacci numbers in this sequence is no coincidence. For the same reason, the rational approximations converge really slowly to ϕ ; slower than they do for any other number between 1 and 2. Thus, ϕ is also known as “the most irrational number” (you can find a lot of YouTube videos on this topic). This is ultimately why it occurs famously in the centres of so many flowers: you can fit more seeds that way.

See? Nothing magical about ϕ . Nothing magical about the golden spiral. In fact, there is a whole sequence of ratios that come up when you generalize the defining property of the golden ratio. Consider “squaring it is the same as adding n ” for any integer n .

$$x^2 = x + n$$

$n = 1$ gives us the beloved golden ratio. For $n = 2$ you get the aptly named silver ratio. For $n = 3$ you get the bronze ratio⁵. Each of these has their own spiral, their own fractals, and falls short perhaps only in fame and recognition.

Exercise: can you find examples of the golden ratio in the architecture on campus?

FLOOR 2

Hey look, we made it. After climbing another 11 steps, a big pink 2 greets us. If you've been keeping track, that makes a total of 42 steps from the very bottom. (Coincidence? Probably.) The editors are getting a bit scared by the length of this article, which means the next floor of constants will have to wait until the next issue. See you then!

water

Exercise: don't take the elevator.

1. The mathematician Vihart made a great YouTube video about the properties of the underappreciated constant wau. You can find wau in this stairwell if you look closely.
2. A sudden empty sea of nothing bounded above by σ_1 also comes up in Mahler measure, which I don't have room to explain in this article.
3. You can find the full list of records at <http://www.numberworld.org/y-cruncher/records.html>, which features many of the constants from this stairwell. You might recognize the Euler-Mascheroni constant, which we've already covered. Undoubtedly, this page will come up again in the near future.
4. As I write this, the editors are having a blast while they ridicule this book. If you really want to laugh along, it's called *The Golden Ratio Lifestyle Diet*.
5. The aforementioned plastic ratio does not appear in this sequence. We're dealing with metals only here.

profQUOTES 142.2

CS 146: BRAD LUSHMAN

- “ If you speak COBOL, you really are speaking.
- “ There's these things called mistakes. They're horrible.
- “ Just remember that this is in the lecture summaries, which I sometimes update.
- “ At this point you could say to your C compiler: "come on, Racket can do this, why can't you?"
- “ Is the numeric value [of the character 0] also 0? No, that would make too much sense.
- “ That is correct! My second question: did you Google that?
- “ I've successfully failed to find my name. That's good.

CS 146: ROB HACKMAN

- “ If you don't play video games, all you use the internet for is taxes.
- “ I didn't know I had to put in \$300 for my annual income until I read the tax form.
- “ Student: does that say "myth?"
- “ Prof: No, it's mrl-h, for my-read-line helper.

CS 690B/CO 499: DAVID JAO

- “ Crap do I actually have to do calculus.
- “ Velu is dumb.
- “ Do you know how to divide a power series, cause I don't.
- “ The strategy is to think really hard, write down some magic equation and prove it.

STAT 241: YINGLI QIN

- “ It's n times f U.
- “ [in reference to sample bias on a survey to legalize marijuana] College students, uhh, more or less have this, uhh, preference for...
- “ Please skip this step.
- “ I might cough too much, that is not because I caught the cold. It is because I talk too much.

MATH 249: DAVID WAGNER

- “ [stumbles over table] Whoa, that was fun!

PHIL 259: NICHOLAS RAY

- “ Not like that crazy theory you all have called "gravity", I don't think that's a word.
- “ Look, dirt likes dirt: [drops marker on the floor]
- “ Why don't you kill me and give yourself an A+?
- “ Philosophers are never romantic.
- “ Who else has a newest-gen MacBook air in dark silver? Not normal silver you plebs.
- “ You got shitty shit, I want good shit.
- “ They were trying to one up each other with beards, and Engels clearly won. Marx is all shaggy.
- “ Do you guys know about those "women liking yogurt too much" memes?
- “ Oh my god this yogurt, I had like 4 orgasms!



INTRODUCTION TO HARMONIC ANALYSIS

Hello **mathNEWS** readers,

Oftentimes interesting mathematics crops up at the intersection of multiple disciplines. (Timothy Gowers's *Symmetric Structures in Banach Spaces* and the realisation that complex analysis can power number theory are fine examples). However, these connections don't even have to be between fields of math. Physicists use math to unravel the mysteries of the natural world. Computer scientists leverage math to craft things that the mathematicians of old could only dream of. Engineers (*shudder*) ... build stuff?

And for the most part these relations are symbiotic¹.

Today I'd like to take a walk down a different path. Let's take a step into the world of *music theory*. Euler himself considered music theory to be a valid branch of mathematics, publishing hundreds of pages on the subject². Thelonious Monk was known to say that "all musicians are subconsciously mathematicians." So at least two people think that this is a connection of some substance. If you're not hip to the basics of music theory, that's OK because it's not too crazy. Here's the quick low-down.

On a piano, you'll see a bunch of keys, after a while you might notice that there's a pattern between how the black keys and the white keys are laid out. You might observe that this pattern repeats every twelve keys. This period is what musicians call an octave. For our purposes, we can label the notes in one octave with numbers. We'll only consider one octave worth of notes (and hence no compound intervals) because that's where all the interesting stuff happens. When two notes are played together we hear an *interval*. The size of these intervals is determined by the distance between notes.

Think of each note as an element of \mathbb{Z}_{12} . The *intervals* between two notes, say 0 and 3 (feel free to think of them as *C* and *E^b* if you wish) is: $\pm(0 - 3) = 3, 9 \pmod{12}$ OR *m3* and *M6* if you're a musician. Now in general, for two notes $a, b \in \mathbb{Z}_{12}$ the *interval* between them is $f(a, b) = \pm(a - b) \pmod{12}$. Note that

each pair of notes defines two intervals; this is understood as the interval from a to b and the interval from b to a .

I've laid out some problems concerning intervals below. (The non-musician may have to do some googling) The intention of these problems is to have fun and stir your musical creativity. I don't guarantee accuracy, well defined problems, mathematical consistency, or correctness.

- How many intervals are there?
- Does the major scale contain all intervals? (i.e. for any interval I can two notes a and b be chosen so that they define I)?
- What about the melodic minor scale?
- For the melodic minor scale calculate $P(I)$, the probability that a uniformly random selection of notes defines the interval I .
- What is the smallest number of notes required to make a scale containing all intervals?
- Let T_n be the temperament in which the octave is divided into n equal parts. (Western music works in T_{12} for the most part). In T_n , what is the cardinality of any minimal scale S for which $f : S \times S \rightarrow \mathbb{I}$ is surjective? Here, \mathbb{I} is the set of all intervals of T_n and f is the expected extension of f from above.
- What is the least number of notes required to make a scale containing all the intervals in T_n ?
- Bonus: What is the probability that a randomly chosen chord with n notes contains the interval I ? (Hopefully you do this in T_{12}).

Bass Case

1. If you're interested in more about how physics gives back to math, I'd like to recommend *The Mathematical Mechanic* by Mark Levi. It's quite short, and well-presented too!
2. This is quite impressive by any non-Eulerian standard of publication.

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UW'S BASTION OF ERUDITE THOUGHT SINCE 1973

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SMALLER GRIDWORDS CORRESPOND TO A STATISTICALLY SIGNIFICANT INCREASE IN SUBMISSIONS

gridCOMMENT 142.2

Ah, yes, the **mathNEWS** office. A place of scum and villainy and the **blackBOX** key's resting place. Let's see how many submissions the tiny **gridWORD** from v142i1 got...

...wait... what is this monstrous stack...

Oh well, 9 submissions. I don't think **mathNEWS** ever had this many submissions at once, and this is the first time I personally witnessed terrified gasp in pure horror. Oh, and 8 of 9 submissions were 100% correct too. Here goes, in no particular order, moniker or real name followed by their answer to v142i1's **gridQUESTION**, "How would you prank a **mathNEWS** editor?"

- Joe: make a fake letter from WUSA promising funding
- braeden: Put fucking airbags in their chairs. That's the epicest prank
- Honkadoodle: I would intercept the pizza delivery for the production night and hold it hostage in return for something :))
- JanDark: I would pair up a wireless bluetooth keyboard to their station and whenever I walk by their office, type "uwu"
- Clayton Halim: "" (Author's Note: Sometimes the best pranks are not doing any at all, but pretend you did, and watching the editors paranoid trying to figure out what the prank is)
- axiom: Fill the office with geese! But more realistically, change the system font to Comic Sans

- copperium: Ctrl+F replace every backslash with the "reverse slides operator" (U+29F5) and watch as every LaTeX toy in Stairwell Constants (et al.) fails
- Ashley, Nunu, Duran: Make them complete this crossword.
- lokiNeverDie: Write an article with no space and lowercase/uppercase all random

I think of all these, the most diabolical yet somewhat harmless and funny prank has to be copperium's backslash shenanigans, so congratulations! Come bug the **mathNEWS** editors (and while doing so, silently switch the backslashes) at MC 3030 for your prize.

Anyways, boilerplate? Boilerplate. The **gridWORD** is a feature column of **mathNEWS** wherein a tiny and edible crossword can be solved in your leisure. You may choose to submit it either via the **blackBOX** mounted next to the Math C&D's neon sign, or electronically to mathnews@gmail.com. Please include your name, optionally a moniker, and a **gridWORD** with your solution attempt on it. Also optionally your answer to this issue's **gridQUESTION**, "If you could teach a course of your own, what would it be on and why?"

Since I had to painstakingly sift through 9 submissions, I decided to ramp up the difficulty of this one so I don't get as many submissions this time >:)

Oh well, have fun!

Solar Flare

LAST WEEK'S gridSOLUTION

	T	H	I	S		D	A	T	A	
M		I	N	N		E	X	I	T	S
U	P		R	O	T	C		L	E	E
C	E	L	E	B	R	A	T	E		M
H	E	A	T		I	D	O		P	I
	L	O	U	N	G	E	B	A	R	
I	S		R	A	G		A	R	E	A
T		I	N	T	E	R	C	E	P	T
E	O	N		U	R	I	C		S	O
M	O	T	O	R		G	O	O		M
	H	O	N	E		A	S	K	S	



gridCLUES

THIS SUBTITLE ISN'T JUST TO FILL SPACE, NO SIRREE

ACROSS

- 1. A faculty here
- 7. Plants with intoxicating leaves
- 12. Soft singing
- 13. Respond
- 14. Banned supplement
- 16. 404
- 17. Opposite of retro
- 18. ___ von Bismarck
- 20. Vader's childhood nickname
- 21. Brief
- 24. Investigative branch of the British Police force
- 25. Edible tuber usually found in same areas as 7-Across
- 26. Explodes after a while when hot
- 28. 26-Across and 32-Across, etc.
- 31. Shock weapon
- 32. Starchy vegetable
- 34. Edible mushroom
- 35. 34-Across, e.g.
- 36. To be able to be placed side by side

- 41. US presidents, so far
- 42. Recipe direction
- 43. Clothing scrap
- 44. Kenyan tribesman
- 46. Speaking
- 49. Cast out
- 50. Bulb on electrically charged particle
- 51. Many laptops
- 52. Concluding segment [2]

- 10. Poisonous cone
- 11. Windpipe obstruction vibration noise
- 15. Capital of Portland?
- 19. Tablespoon
- 22. *Pop!*
- 23. Intoxications
- 27. Spanish appetizer
- 28. Sent unwanted emails
- 29. Ancient chopper
- 30. Kitchen gadget
- 33. Choose
- 34. Alcohol brand
- 37. Torque central point
- 38. Strong salty solution
- 39. Networks that used to be associated with parties
- 40. Urged on
- 45. 100%
- 47. Sundial's rightmost number
- 48. Officer rank (abbr)

DOWN

- 1. Pine, e.g.
- 2. "divine blood"
- 3. Before, before
- 4. Quiet affirmation
- 5. A virus that has currently infected over two thousand people
- 6. Kin to mom
- 7. Wood preservatives
- 8. Across, in verse
- 9. South American Capital

1		2	3	4	5	6		7	8	9	10	11
		12						13				
14	15							16				
17					18		19			20		
21			22	23						24		
			25				26		27			
28	29	30						31				
32					33		34					
35				36		37				38	39	40
41				42						43		
44			45			46		47	48			
49						50						
51						52						

LookAhead

SUN FEB 2

Groundhog day
Superbowl Sunday

MON FEB 3

Last day to start a Winter
co-op term

TUE FEB 4

P4E Career Fair

WED FEB 5

Last day of Spring 2020
course selection

THU FEB 6

FRI FEB 7

MathSoc Career Fair in
DC 1301 @ 11 AM

SAT FEB 8

SUN FEB 9

mathNEWS 142.3
production night

MON FEB 10

TUE FEB 11

WED FEB 12

THU FEB 13

FRI FEB 14

Valentine's Day <3
mathNEWS 142.3 released
Last day to drop classes
with 50% refund

SAT FEB 15

Singles Awareness day

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vote.wusa.ca
vote.wusa.ca
vote.wusa.ca



Waterloo
Undergraduate
Student
Association

february 4-6
vote.wusa.ca

