



"WHAT CAN YOU DO IN AN EXAM ROOM, ASIDE FROM ACTUALLY WRITING YOUR EXAM?"

Well, it's that time of year again. People are arguing about whether it's too early to put up Christmas decorations, while others are yelling at those people to shut up, cause they have 8 finals in 2 days. And perhaps the most tragic event, among all the other doom this frozen season brings, is the fact that this is the final **mathNEWS** issue of what's been one of the best terms for the paper in a while.

But weep not my good mathies, for while the final nail in volume 138's coffin shall be long past struck by the time you read this, v138 shall nevertheless go out with a blaze of glory. In this issue we've got quite a variety of articles, a full 25 pages of them in fact. Ryan Trelford, our featured instructor for the issue, gives us some much needed advice, albeit unsolicited. Many **mathNEWS** writers tried their best to amuse us and lift our spirits despite the dreary weather, while others wrote "informative" articles that, well, they exist too though I might wish otherwise.

Fitting in tradition for this term, we've got over three full pages of **profQUOTES**, and yet another amazing comic from Cix. They're on pages 4 through 7 and page 17, respectively. Seeing as most people probably care about those, I figured I may as well point you on your way.

I don't feel like writing much more, so I'm just going to say that wraps it up for the term. Best of luck on exams!

swindLED
Editor, **mathNEWS**



- BEYOND META** | I am an alum. I am free from exams. Free free FREE!
- PERMANENT PSEUDONYM** | Cry. It's good for you, after all...
- ALEX LEE (MATHFOC 2019)** | Stress about O-Week 2019 (only 274 days away!).
- ZETHAR** | Inscribe a summoning sigil onto the desk in which you are writing your exam. Invoke an eldritch horror to aid you on the exam by offering a blood sacrifice. Get the exam invalidated because it's a biohazard.
- LOQUATIUS** | Have a "yell PENIS the loudest" contest.
- FRUITBOY** | Start counting the lights. Find the prime factorization. What's the GCD of the light count and your age? What about the room number? What room is this? Where am I?
- CC** | Be a snake by distracting other students through annoying sounds so they get lower marks and you are curved higher.
- WHYOS** | Just don't write the exam (and pray for the curve).
- ME** | Write down my ID, name and exam number on the card they provide for me.
- NULL** | Imagine the exam out of existence.
- XAVENTOIS** | Finals are during Destroy Dick December, so just nut really hard and write the exam in invisible ink ;)
- VARIOUS PSEUDONYMS** | Fold origami with your exam - you're going to fail anyways!
- OVER-ENGINEERED** | Try to get the proctor to write the exam for you.
- SWINDLED** | Initiate a snowball fight with exam papers.
- YCLEPED** | Recruit the geese outside the window and lead a rebellion.
- CONFUSED** | Pray to Mr. Goose.
- STAPLED** | Flirt with proctors with smouldering eye contact.

ARTICLE OF THE ISSUE

The final article of the issue award for the term goes to Epsilon Screwn & The42ndRhombiDodecahedron for their joint article [N Sequences to try out on the CS 135 A9 Bonus Question](#). Come by the **mathNEWS** office to pick up your prize! I'll leave it up to the pair of you to decide how to split it.

swindLED
Editor, **mathNEWS**

So long, and thanks for all the memes

ANUJ OPAL, **mathNEWS** EDITOR FOR FALL 2018
ALONG WITH NOSHERWAN AHMED, ESTHER AHN, JAMIE ANDERSON AND CLYDE BROWN

mathASKS 138.6

FEATURING RYAN TRELFOED

BIGGEST BROTHER: HOW DO YOU FEEL ABOUT THE REACH OF AMAZON? IS IT GOOD FOR OUR SOCIETY?

I don't really think about these things to be honest. This reminds me though, I have a book order from Amazon that will arrive by (... checks Amazon...) December 14 - January 17. Ugh.

CODY THE QUEER: HAVE YOU EVER MET A NICE "TIM"?

I assume you mean people named Tim - the quotation marks you used are making me second guess this though. Anyway, I had not met a nice Tim before University... the only one I knew was a bit of a jerk. I haven't met many in life actually, but I know there are a couple people named Tim who are TAs for my course and they both seem like pretty awesome people!

YOUR DAD: HOW ARE YOU, SON?

Stop smothering me Dad.

WHYOS: WHAT'S YOUR FAVOURITE mathNEWS ISSUE?

I wouldn't say I have a favourite one... I like all of them and flip through them when I see them. My favourite part is the **profQUOTES**, but I do enjoy reading the insightful articles my fellow colleagues have written in the past.

PERMANENT PSEUDONYM: WHAT'S YOUR WORST SKILL?

Cooking - hands down. I'm awful at it. My wife cringes at the thought of me being in the kitchen alone.

THE EUROBEAT-'EM-UP: THE HELL IS A POLYTOPE? AND WHY 'D' DIMENSIONS AND NOT 'N' DIMENSIONS?

A polytope is the higher dimensional analogue of polygons (triangles, squares, etc) in two-dimensions and polyhedra (tetrahedron, cubes, octahedron, etc) in three-dimensions. Often in calculus, linear algebra and analysis, we use 'n' for the dimension, but when we study polytopes, we use 'd' for the dimension (which makes sense given that 'd' is the first letter in dimension). We use 'n' to represent the number of vertices the polytope has, that is, we study d-dimensional polytopes with n vertices. On a side note, I didn't really know what I wanted to do with mathematics until I discovered polytopes during my Masters Degree. Wanting to know more about them is one of the reasons I did my PhD (where I studied a freakish* class of polytopes known as neighbourly polytopes). The book "An Introduction to Convex Polytopes" by Arne Brøndsted is an extremely accessible introduction to these objects for anyone interested.

Branko Grünbaum, whose book "Convex Polytopes" revitalized this branch of mathematics was the one who referred to neighbourly polytopes as "freakish".

VARIOUS PSEUDONYMS: WHAT'S THE COOLEST PLACE YOU'VE TRAVELED TO?

Tokyo. This city was unlike anything I had ever seen before and no other city I have seen since has come close to the awesomeness of Tokyo. The city is both enormous and beautiful, the food is amazing, and you can buy literally anything from a vending machine (yes, I mean literally and not figuratively). I was there in 2006, and have tried to go back on several occasions, but things keep coming up and I have yet to return. It's still on my to-do list though. Watching "Lost in Translation" will have to do until then.

SWINDLED: WHAT'S AN INTERESTING MATHEMATICAL FACT THAT NOT MANY PEOPLE KNOW ABOUT?

That the content (d-dimensional volume) of a d-dimensional ball of radius r goes to zero as d goes to infinity. This just blew my mind when I first learned it.

JPEG>SVG: DO YOU SEE PICTURES OR LARGE MATRICES?

Pictures of large matrices.

OVER-ENGINEERED: WHAT IS THE MOST INTERESTING PROOF THAT YOU HAVE SEEN A STUDENT WRITE ON AN EXAM?

One student used "Proof by T-Rex". It was just a (well-drawn) picture of a T-Rex saying that the statement to be proved was indeed true. I wish I had taken a picture of it.

Ever wonder how much filler is in a given issue of mathNEWS?

Just count the number of items in all the "N Things" articles.

Oh, and these little blackBOXED quotes.

A mathNEWS EDITOR WHO JUST WANTS TO FINISH LAYOUT AND GO HOME

SOME RANDOM UNSOLICITED ADVICE FOR UNDERGRADUATE MATH STUDENTS (AND REALLY FOR ANY UNDERGRADUATE STUDENT)

profTHOUGHTS 138.6

I have been an Instructor in the Faculty of Mathematics for just over three years, and an academic advisor over two years. I have additionally had the opportunity to travel to China to meet with some incoming first-year students and help give them advice aimed at preparing them for their upcoming time at University. Drawing from these experiences, I have created this very short list of advice that I would like to offer to anyone who might be reading. This advice might be new to you, or maybe it will serve as a gentle reminder of some advice you had received before but have since forgotten.

You learn more by being wrong than you do by being right: I, like many math majors, didn't struggle too much with high school math and even my first-year math courses weren't very difficult for me. However, starting in second year, I noticed quite an increase in the difficulty of my courses. I struggled more to understand the material, and both my homework and exam grades began to decline a bit. I was forced to reflect on my graded work and try to understand where I had gone wrong – an exercise that changed how I would learn for the rest of my academic program (and the rest of my life). I realized that I wasn't fully understanding the material from my first year, but rather just memorizing it and simply doing what I was taught to do on assignments and exams without any real thought of my own. Struggling in subsequent courses forced me to pause and really understand why my incorrect work wasn't correct. By understanding why my method of solving a problem didn't work, I gained a better understanding of why the correct method actually worked and I found that I didn't have to memorize as much: the correct method was just the obvious thing to do! I gained a better appreciation for mathematics and more confidence in my abilities as a student. Simply put being wrong (and dealing with it appropriately), made me a better mathematician.

Take advantage of your electives: I cannot stress this enough. You have the great opportunity in most mathematics plans to take at least ten non-math courses to round out your degree. Choose them wisely. I see a never-ending stream of Reddit posts where students ask what the easiest course to take is. I understand the need (and the pressure) to have a higher average, but students sometimes struggle in these "easy" courses simply because they have no interest in them. My recommendation is to take something that you actually like – students typically do well in courses they are passionate about. Interested in learning a language? Do it. Want to know more about Russian history? Take a course on it. In fact, take a few courses in your non-math area of interest and you could possibly earn yourself a minor that could make your degree in mathematics stand out from the rest.

Start studying for finals early! Most of the exams in first-year math courses are worth about 60% of your final

grade. Such a heavy weight deserves more of your time than "the night before" for studying. Know when your final exams are and begin making a schedule of when you will study for each exam. Ideally this preparation should begin at least a week before the final exam period begins – the sooner the better! At this point in your courses you should already have an idea of which areas you are strong in and which areas you need to work on. Begin to review your assignments and exams and make sure you are learning from your mistakes. Most instructors post solutions to their assessments – look at those and make sure you understand them. Attempt any practice problems that have been posted and do any exercises left by your instructors in class. Attend your professor's office hours and ask questions when you have them. Make plans to study with your friends – you will be surprised at what they can teach you, what you can teach them, and what you can figure out together! If your instructor posts a sample final exam, then treat it as a real exam: don't attempt it until you think you are ready. Don't allow yourself to look at the solutions or use any aids and write the practice exam in the allowed time. This will give you a good idea of what you still need to work on, and give you a good idea of what a real final exam will feel like. Simply reading over the solutions to a sample final exam robs you of a valuable learning experience, so resist the temptation (many instructors delay posting solutions for this very reason).

Ask for help when you need it: Your instructors (who love math) are more than happy to talk to you about the course content should you have any questions. Take advantage of this as it is important to quickly deal with any confusion or misunderstandings you are having so that you are able to stay on top of the material. Not understanding something early on and doing nothing about it will only lead to more issues later in the course, and it is far easier to address small problems now than try to deal with large problems later on. One of the most memorable students I had was one who clearly struggled with mathematics due to a very weak background. Although this student was overwhelmed by the material, they visited my office hours regularly and tried their best to stay on top of the content. This student was not afraid to address the "holes" in their education and put in the time and effort needed to master the course material. They wound up getting one of the highest marks in my course simply because they weren't afraid to ask for help.

Look up from your phone once in a while: I debated adding this as I run the risk of sounding old, but I'll do so anyway. Your entire life is happening right in front of you, and some of you are missing it because you can't get off of social media! I particularly notice this when I drive along ring road and a student unexpectedly steps out on a crosswalk without even looking up from their phone, or when I walk around campus

and a student almost walks into me, completely oblivious to their surroundings. Put your phone down once in a while, life is better without it! Also, students who play on their phone all class typically achieve lower marks in that class. Just sayin.

Thank you to Dan Wolczuk for proofreading my first draft of this note and giving some great suggestions on improving it.

Ryan Trelford

100 YEARS SINCE WORLD WAR ONE

WWI ended in November of 1918. Where 70 million people died in the war. This war was called the great war. It was thought to be the war to end all wars. Little did they know what will going to happen afterward.

The thing that bothers me the most about this war is how meaningless this war was, yet so many people died in vain; For the sake of a family feud between European monarchs. I am surprised there wasn't a major peace movement against the war, I guess people were blinded by nationalism and romanticism of wars.

Personally I think this war marks the beginning of the modern industrial age. Mostly due to the insane amount of technological advancement as result of the war. Some people say warfare is a necessary evil for technological jumps, but I count that as a sliver lining of shitty poo. The largest revolution from WWI was battle tactics and technology. No more solders in flamboyant uniforms marching and shooting muskets at each other by the beats of a drum. Now you have to taking cover in some muddy hole shooting and shelling at the opponents trench. WWI give introduction of weapons of mass destruction (chemical). It pioneered tanks, radar, air fighters, many more classes of weapons and logistical tools we still use today. Another great advancement is the maturity of massive production manufacturing process due to the demand of war. The factories that were able to make thousands of tanks during the war can make thousands of tools, automobiles and other goods after the war to fulfill the demands of the roaring 20s. Transportation got a great bonus with introduction of flight. However, the new access to travel means diseases were able to travel faster too, the pandemic right after the war also resulted in millions of additional deaths. Very bad.

This rapid industrialization and infrastructure building due to the war effort paved ways to the largest economic boom in the world, which lasted for a decade. There was some major social change due to the war too. With the tech and economic improvement, people could now afford to have many appliances in their homes. The culture of sports, radio stations, film industry and fashion took off. Another shift of culture created by the shortage of men that went to the war. Woman start to be employed in a massive scale for the first time to fill

the spots left behind by men. This lead to a major civil right movement that pushed through woman's suffrage.

One very interesting fact that relates to Math and Computer science is that women were hired en mass to help the military with solving math problems such as logistics and ballistics during world war one (and more so the next one). They were the first computers - human computers - that later became a backbone in many research projects. When they were replaced by machines, these women would become world's first programmers and the pioneer of computer science. Computers were once made up by lovely wives helping with war effort. And now computers with advanced AI are trying to substitute human relationships by posing as virtual waifus. We have come a full circle.

In Canada people were forced fighting the war via conscription, I feel bad to the people force to fight a meaningless war. This is almost slavery. This fueled the political divide between Canada and the UK, due that fact UK seem to pretty entitled for young Canadians to die for their war without any compensation. Later it resulted in Canada's independence from UK. Another political impact from the Great War was Quebec's opposition to conscription. This created long lasting conflict and resentment between French Canadians and the rest of Canada.

In the end, WWI was bad. People died in this war, millions of them. 100 years has passed, yet you can still see it's scar left behind. The half filled trenches, the grass covered craters still scattered all over Europe. Its legacy of war still looms over people that remember their grandparents' story. Let my favorite fictional character Niko Belic from GTA4 remind everyone: "War is when the young and stupid are tricked by the old and bitter into killing each other"

me

THE END OF 2018

This poem to end all poems
 Winter is coming, snowy and cold.
 Finals are closing in, slowly unfold
 Night become longer as day light retreats
 Ice rain lingers on, washing away the traces of trick or treats.
 Geese flying home, to somewhere warm
 Light rail and slc expansion, probably delayed again.
 2018 - 100 years from the great war.
 Hopefully next year, no more tuition pain.
 Winter, when old life dies
 And meme life begins.

me

profQUOTES 138.6

CO 330: DAVID WAGNER

- “ Here’s an university professor’s favourite method: Proof by example, which is greatly appreciated in the Engineering Faculty.
- “ Bless you, get your [flu] shot.
- “ I’m not sure I want to do this anymore.
- “ No guessing!
- “ [When student didn’t recognize a identity] I’m gonna finish this half hour, go back to my office, close my door, and cry.
- “ Student: We weren’t taught this in MATH^{137/138}.
Wagner: Shame on your instructors.

CO 342: BRUCE RICHTER

- “ How many of you know know the TA’s names?
- “ I will erase the board and then I will disappear.

CS 135: ADRIAN REETZ

- “ We evaluate you all the time. It’s called exams and assignments. Now it’s your turn to retaliate.
- “ Just like everyone else I like to forget else and empty statements.
- “ It’s hard to count, folks!
- “ Coding’s difficult in front of a live audience.
- “ We’ve got trees! Not the ones that produce oxygen unfortunately.

CS 135: ROB HACKMAN

- “ What string should we input here? ... *types "You guys are boring"* There! That looks good.
- “ You bastard! I’m talking about myself, I’m the bastard.
- “ Just because we can do something, doesn’t mean we should. Look at Jurassic park.
- “ That wasn’t the function’s fault, I just can’t type.

CS 840: IAN MUNRO

- “ What’s wrong with this algorithm? It sucks! That’s the technical term, by the way.

- “ She used to work here, but now she’s fallen off the wagon... and works at U of T. Our condolences.
- “ This is something I did with my first PhD students, back in the 17th century.
- “ Okay, so the naive algorithm was a bad idea. No surprise. Let’s try another bad idea! I’m full of bad ideas today.
- “ Anyway, that’s another piece of useless information.
- “ We should have a test at the end of term made up of all the irrelevant things I’ve said
- “ He asked if it would be better done by anglophones or non-anglophones. To tease him, I said the problem remains open since it was done by Americans.
- “ It’s debated who did this first, because it happened on the web, so it has the veracity you might expect of things you find on the web.
- “ I will comment on that later. “Later.” And I will comment on that later.
- “ And here’s more extraneous information!
- “ Since it’s Oktoberfest, we’ll call these sections ein... svei... zumpfa. Some people pronounce the third one differently.
- “ Any results of collaboration between researchers at the University of Pisa and the university of Chile should obviously be called Chili Pizza.
- “ ... but I never remember my own results anyway.
- “ I’m unrealistically hoping to read [your assignments] while I’m away, but you know how hopes are.
- “ You have an excuse for not coming up with this method first, because you weren’t born yet.
- “ This is a total aside, which has never happened in this course before.
- “ This board is getting to look like my notes, with so many typos in it.
- “ They didn’t do it in ‘88 and call it the ‘77 method. People are devious, but not that devious.
- “ If you’re so inclined, you can sing your presentations in a two-part harmony.
- “ I don’t claim my arithmetic is correct.
- “ *Makes whooshing sound while drawing diagram* My sound effects are amazing!

- “ [looks at notes] It's a problem when you can't read your own writing.
- “ Well-known means at least 3 people know it.
- “ David Wheeler was a computer science professor at Cambridge. Not the one in Ontario, the real one. So not Massachussetts either.
- “ A feature is just a documented glitch.
- “ The Mississippi is a small river outside of Ottawa. It's also a big river in the US, but we don't care about that.
- “ Hmm, well let's pretend this is right.
- “ Let me know if you're having trouble sleeping; I can recommend some CS research papers to help with that.
- “ There are ways to improve the run time to $O(n \log n)$, not that I'd want to implement any of them.
- “ It's a well-known text that's been around forever, or maybe even longer.
- “ Let me tell you two ways of doing it, neither of which I'm going to use.
- “ It's $4+1!$ Otherwise known as 5.
- “ We haven't done anything particularly brilliant, but we haven't done anything particularly stupid either.
- “ This works, assuming I haven't made a mistake. And if I have made a mistake, oh well, it doesn't matter.
- “ 3's an integer; you may have noticed that before.

GER 211: MICHAEL BOERINGER

- “ You just cut yourself open. Nicely done.
- “ There's a huge difference between being kidnapped and kidnapping someone.

MATH 114: CONRAD HEWITT

- “ Come to my office. I'll show you an even bigger determinant. [Editor's note: He is happily married to Francine Vnette.]

MATH 137: BARRY FERGUSON

- “ Why would I accept an abbreviation of 'Virginia' as a vertical asymptote?
- “ "Two letter abbreviations are almost as bad as three letter ones.

MATH 135: JORN VAN DER POL

- “ Have you guys heard of hubris? It's very common in Greek tragedies, and it's also what I displayed yesterday when I tried to prove this without preparing it first.

MATH 145: DAVID JAO

- “ This is not a subject where you have to content with dead mathematicians like Gauss.
- “ Two is an odd prime.
- “ I suggest reading it in Latin. You get more of a sense of Gauss's sense of humour that way.
- “ [While teaching about fields] This is taking us a little too far afield.
- “ Imagine you're living in a universe where 41 is the smallest prime.
- “ You know what moonshine is, right?

MATH 147: DAVID MCKINNON

- “ What I said is true, and when I put a $t/2$, it's still true.
- “ If you have to write a closed interval from $-\infty$ to $+\infty$, you're doing something at least a little freaky.
- “ Student: Choose the closed interval $[\epsilon, \delta]$.
McKinnon: *spins around* A world of no.
- “ A half is at least a half – no.
- “ Agh, what letter have I not used yet?
- “ What the heck does this mean?
- “ When someone puts a theorem on the board, or casually mentions it to you in conversation – like that happens all the time – your first question should be, why is this worth my time?
- “ Also, it looks horizontal but that's an accident.
- “ This is sarcasm.
- “ We made Flett proud. Embarrassed ourselves a little bit, but made Flett proud.
- “ Once you show a function is differentiable, next thing you do is differentiate it, right?
- “ We simplify this sucker.
- “ Set $c = \frac{1}{x}$ and plan the parade.

- “ It's always awkward talking about midnight Sunday – is it Sunday or is it Monday? What does that mean?
- “ I don't really want to talk about that. I want to talk about, of course, the MVT.
- “ Maybe I'll tell you when you're older.
- “ That's totally not true, but it is when I know the next step is Cauchy's MVT.
- “ I promise the recursion stops at step 2.
- “ I'm getting a lot of echo, so I'm going to go back there and stand right next to you.
- “ [Writes immediate proof] Are there any questions about this proof? It's rather brief.
- “ Let's actually do this all the way over at the intuition board.
- “ And that says the graph is always on top – no, it says the graph is always below.
- “ Despite popular perception, lemmas do not gather themselves in the Great North and throw themselves off of cliffs.
- “ This is the same thing as a ... a gargantuan double-decker limit.
- “ For the first time all term, I've had to rub off a blackboard to get more space. That's how wasteful I am today.
- “ Then, there's a bloodbath.
- “ Because if you got an A on every quiz, it doesn't matter how it's weighted, you still get an A!
- “ Oh, wouldn't you know! That's just what we wanted to prove. What a happy coincidence!
- “ [On factorials] Simply enough, it's a way for small children to generate large numbers very quickly.
- “ Taking powers of 1 is something I hope you all can do.
- “ This thing is hard, this thing is easy, and we hope this thing isn't too bad.
- “ This part is the part where you just have to cross your fingers and hope it works out...and I'll leave it to you to prove on the homework.
- “ This is the last one I'll do before I say the rest are similar.
- “ My capital F's degenerated into lowercase f's on this side. That's terrible. We have higher moral standards than that.
- “ [on Taylor's Theorem] Cauchy's Mean Value Theorem is Taylor-made for this.
- “ Cauchy's Mean Value Theorem is just Mean Value Theorem with a backpack on.
- “ I got another tool in by box which is Cauchy's Mean Value Theorem.
- “ Luckily, I have a third tool...okay, I might've used that joke too many times.
- “ Extreme left hand and extreme right hand...this is political science.
- “ Aww, that takes all the dramatic sting out of my revelation!
- “ This isn't magic, this is math! Subtle but crucial difference.
- “ This thing in the lumpy box...
- “ I think this pen is finally too crappy to be able to use.
- “ By now, since you've been through the flaming gauntlets of Homework 6 and 7...
- “ Trust me.
- “ It's amazing how much number theory comes down to 'there are no integers between 0 and 1.'
- “ I will hazard a journey back to the proof section of the whiteboard.
- “ Now the last step is really, really hard...you divide both sides by x .
- “ That's—that's irony.
- “ Student: Shouldn't the inequality be the other way?
McKinnon: Ah, yes, I'm a horrible person.
- “ And apart from that pesky k , this looks awfully similar to that homework problem I assigned for some reason.
- “ Un-frickin-believable.
- “ If k is 0, just let it be 3.
- “ People sitting right there –be thankful I took down the sculpture.
- “ About time we finish 3 or 4 minutes early.
- “ I don't know about you, but when I see that, I think, 'why the heck is δ like that?'
- “ *Holds up hot pink whiteboard marker* That's probably the best one for me.

“ Any questions about our beautifully pink theorem?

“ I think I might have to retire Mr. Pink, unfortunately.

PSYCH 101:STEPHANIE DENISON

“ Only dumb people go to the University of Waterloo.

STAT 231: MICHAEL WALLACE

“ I won't call this a lovely equation, I don't like this one. It's not very pretty.

MAN VS DISH: A JOURNAL IN N PARTS

The following a tragic recollection of the past few weeks in my apartment an unnamed university student's apartment, retold through mental journal entries.

Day 1: Wow, all done the dishes. There's my turn done, so I won't have to do them for a couple days.

Day 4: Gosh, has nobody else done the dishes?? Wow, their schools must be getting pretty difficult. Alright, I'll do everyone a favor and do them again, but it won't be my problem next time!

Day 7: Fuck.

Day 8: More dishes already? Jeez. Ok, I'll do every dish now, because I'm leaving for a few days. Someone will HAVE to do them while I'm gone.

Day 14: NOBODY DID DISHES WHILE I WAS GONE WHAT THE HELL

Day 17: I've done the dishes for half a month now... I'm going to refuse to do the dishes for the next week.

Day 18: I got asked to do the dishes today, and I'm a coward so of course I did as many dishes as I could. Everyone else in this apartment makes more dishes than what fits on our drying rack. I can't remember what our counter looks like, I can only see dishes. The flies are starting to move in. I'm suffering.=

...

Day N: Mold begins growing in the sink. Smells become unidentifiable. The suffering. The PAIN. I have actually tried keeping up with the dishes, but people make more. I haven't felt the light of day in a long time.

A TEST OF YOUR NAVIGATIONAL SKILLS

It has come to my attention that there are some people out there (I'm looking at you, specific family member I'm thinking about) who are completely abysmal at navigation, and are blissfully unaware of this fact. To fix this, I have prepared several questions for navigation on campus/in KW to test your navigation ability. Feel free to try and do these to gauge your ability; for experts, try doing this without actually physically following the directions. In recognition of different navigational strategies, there will be different styles of directions.

- Start from the **mathNEWS** office, and turn left. Head down the double black doors in front of you, and exit the building. Turn left, and after the egg fountain head under the bridge and continue onto the left sidewalk at the road there. Continue forward, cross the road, head up the steps and cross the railway, and instead of walking up the second set of stairs, then head forward, past the light post, and when you get to the end you veer left, and it's the door by the fire hydrant.
- Start at the **mathNEWS** office and turn left. Take the first right, then walk to the end and enter the double doors. Turn left, go through the double doors and head to the end. Turn left, go through the second door on the right, and head to the end (going through two sets of doors) turn right, go and head to the end and go through the glass doors, then take the first door on the left, and head to the end of the hallway and go through the doors at the end. Turn left, and head to the end, going through all doors until you get to a T junction. Turn right, go through the double doors and follow the path until you get to another T intersection. Take the left path, go into the the elevator and go to the first floor. Turn right, then left, then right, and through the door on the left.

Assuming my memory isn't faulty, they should get you to recognizable locations. Specifically, Sweet Dreams, and the dinosaur room in EIT.

In the event that you didn't get there, please consider yourself informed. In the event that my memory of Waterloo is shoddy or a tornado has ruined campus geography while I'm not around, I guess I'm sorry for wasting your time.

Rather annoyed,

Zethar

SNOW VS SNEW: WHO WOULD WIN?

It's a well known fact that snow to Canadians is like water to the Dutch. Unlike water, although it inconveniences us greatly, we've never quite managed to conquer it for the most part. Despite our best inventions of snowmobiles, snow blowers, rotary snow plows, and giant flamethrowers with which we attempted to defeat our natural sworn nemesis, snow has always prevailed. There is no doubt that snow is a formidable force of nature.

On the other hand, Professor Stephen New (henceforth referred to as "Snew") is a true force of algebra. Best known for being the beauty that is in mathematics, his intellect is truly astounding. It is trivial to prove that there does not exist a theorem in mathematics that does not fall apart under his astonishingly critical eye. As he himself would say, "We have not yet defined what an eye is."

So now, as bored **mathNEWS** writers, we deliver to you a question that we have spent way too much time pondering, discussing, arguing, and fighting over: of these two great forces, snow and Snew, which would triumph over the other?

Unable to organize a real-life experiment, we dragged the **mathNEWS** Battle Simulator 9000 (TM) (R) (C) from its hiding place in the office dungeon and fired it up to investigate what would happen if snow and Snew were pitted against each other in a fight to the death. Here are the results:

It is a cold, snowy November morning. There exists a University of Waterloo parking lot L such that Snew pulls into L sporting his beautiful silver 2008 Toyota Corolla CE with 4-speed automatic transmission and power windows. There also exists a parking space such that Snew sidles into into this particular space, in the process also trampling a bunch of snow.

The snow is immediately insulted, and goes to slide under Snew's beautiful silver 2008 Toyota Corolla CE with 4-speed automatic transmission and power windows. For all wheels on Snew's beautiful silver 2008 Toyota Corolla CE with 4-speed automatic transmission and power windows, there is a small bank of snow under them. As Snew steps out of his beautiful

silver 2008 Toyota Corolla CE with 4-speed automatic transmission and power windows, the snow shifts, the beautiful silver 2008 Toyota Corolla CE with 4-speed automatic transmission and power windows suddenly slides up and Snew trips, falling onto the pavement next to his beautiful silver 2008 Toyota Corolla CE with 4-speed automatic transmission and power windows.

Confused, Snew inspects his car and finds the suspicious piles of snow under his beautiful silver 2008 Toyota Corolla CE with 4-speed automatic transmission and power windows. Satisfied at finding the culprit, Snew dusts himself off, kicks at the snow, and turns to walk to his morning lecture.

The snow is indignant at Snew's casual cruelty. "How dare you defile me, human!" it screeches as it manifests into a vaguely humanoid form. "I came down to do one thing, and that was [redacted]!"

Snew, bewildered, can only think to reply, "So if there was another thing you came down to do, it would also be [redacted]?"

"FOOOOOOOOL" bellows the snow. "HOW DARE YOU INSULT MY INTELLIGENCE. I WILL LET YOU KNOW THAT I AM THE BEAUTY OF NATURE. WE WILL FIGHT TO THE DEATH."

The snow rises into the air and morphs into a gigantic blob before crashing down on Snew. "Trick question – my position is vague!" he exclaims as he deftly avoids the blow. Realizing that the snow forms an integral domain, he invokes the Unique Factorization Theorem, causing the mass of snow to split into many small bits of ice. Riding on the momentum of his success, he picks up a glob of snow nearby and applies Bézout's identity on it and the aggressor, finding the two coefficients that solve the linear Diophantine equation before he realizes that his efforts are useless. Seeing a break, the snow regroups and begins to envelop Snew, causing him to scream in agony: "Math! How could you have failed your beauty?!"

As the snow tightens its suffocating grasp around Snew, a brilliant flash of inspiration comes to the struggling mathematician. Newly invigorated, Snew pulls apart the ice around his mouth just enough to shout his plans to redefine snow. Confused, the mass of snow relaxes its grip for a brief second. Immediately, Snew seizes the opportunity to invent a series of amazing axioms, and pulls out his list of validity rules to construct a derivation concluding that snow does not exist! The snow tries its best to find a hole in the proof, but its efforts are futile against the unstoppable rigour of a well-written derivation. Disproven, the pile of snow suddenly vanishes, leaving behind an exhausted, embattled Snew as the victor, the true beauty of mathematics, and his snowed-in but unharmed beautiful silver 2008 Toyota Corolla CE with 4-speed automatic transmission and power windows.

For the record, although I did once say "there is beauty in mathematics", I did not then add "and it is me".

STEPHEN NEW

THE CONCERNS OF STUDYING TOO MUCH

Professors and Asian parents alike have high expectations for you to spend much of your time studying your material instead of using your free time to play games and hang out with friends. However, after spending much of my own time on schoolwork, I've begun to develop poor habits in my everyday life, habits from which overstudying is purely to blame. I come here not as comedy, but as a warning. Show this to your professors, TAs, Asian parents, whoever pressures you to continue to study. The school environment has begun damaging my personal life, and I worry the rest of you are next.

COMPSCI HABITS

- Starting to count things at 0 instead of 1
- Forgetting I did that and recording n-1 items
- Referring to the second of a group of items as the 'first of the rest'
- Hearing the word 'Racket' in conversation and begin sobbing
- ;:Writing messages starting with a double colon

MATH HABITS

- Seeing a function and absentmindedly finding it's derivative
- Making math jokes to your non-math friends and receiving blank stares in response
- Hearing about 'pie' over thanksgiving and envisioning circles before dessert
- "Is the twin prime conjecture really that unsolvable?"
- Studying an ages-old unsolved math property and realizing you don't even know how much you don't know about math

LANGUAGE HABITS

- Absentmindedly repeating introductory phrases
- Wir bist manner und wir essen brot [*Editor's note: Schreiben Sie den Satz noch mal, bitte.*]
- Scheiße, I did it again didn't I?
- Accidentally introducing yourself to strangers in the wrong language
- Wanting to tell people you can speak the language but knowing if they ask you to say something in that language, you'd freeze up

HISTORY HABITS

- Not being phased by horrific crimes after comparing them to historical genocides
- Genuinely feeling bad for Germany after the Versailles Treaty
- Thinking that "____ could've done so much better if they'd just changed that one thing!"
- Realizing that previous point is you accidentally encouraging a warmonger
- Regretting that entire line of thinking, but still thinking it

Be warned, these are just some of the numerous concerns with spending all your spare time studying, so please remember to take lots of breaks, perhaps even stop altogether. Go play some video games and hang out with your friends.

Fruitboy

CLASSIFYING THINGS

It is a universally acknowledged fact that any person in want of a spectacle need merely approach a gathering of nerds asking them to clearly define what a sandwich is. After that, all you need is popcorn and a chair to enjoy the mayhem that ensues. However, the complete disagreement on how to classify things extends to wide array of topics like chairs or genders or Christmas movies. Everyone has strong opinions on how to classify these things but there is zero consensus.

We can agree that sandwiches, chairs, genders and Christmas movies actually exist. These categories are useful to have, but to find a definitive description is asking for the impossible.

I believe that part of the problem lies in the fact that people are trying to prescribe universal rules to cultural concepts that contain all the diversity and chaos of human society when the more sensible approach would be to take a descriptivist

approach. I am not so naive to believe that I can persuade anyone to my classifications system.

I would merely advocate for tolerance for different classifying beliefs. As what someone else believes to be a sandwich is unlikely to have a major impact on your life but can be helpful to them having a lunch they consider to be delicious. We might not agree on how to define sandwiches or women but we can agree that if you ask a woman to make you a sandwich, you are undeniably an asshole.

Beyond Meta

TLDR: LAYING DOWN ON THE CARPET IN THE COMPUTER LAB WRITING THIS ARTICLE TRYING TO FIND THE WILLPOWER TO GET UP

It's eerily similar to trying to get up for those morning classes.

Maybe you slept at 5am the night before... because you were scrolling through social media or playing video games or watching useless YouTube videos or scrolling through social media or finishing the assignment due too soon that you should've started too long ago or drinking with friends or watching useless YouTube videos...

Or maybe you slept on time... By the time you had to get up, you've gotten well over 8 hours of sleep, but you already missed all the classes last week. If you go today, you probably won't understand anything anyway. Anyway, that class has notes online and even if it doesn't, you'll just ask someone else in class for your notes. Might as well go back to sleep, or just lay down staring at the ceiling or the marks on the wall.

Like right now, you're looking up, focusing in and out on those annoying eye floaters. Some of them are zooming by, others are taking their time, like the snaking raindrops on your room's window, but with no sense of gravity. It doesn't have to be a morning class. After all, it's 8:50 pm right now.

It doesn't have to be a class. You're not delaying going to class right now. You're delaying writing this very article. Writing is supposed to be a fun experience for you, an enjoyable experience. But even it can be procrastinated. Or maybe you don't like to write. You can still procrastinate something you enjoy doing, but why would you do that? Does that mean you don't enjoy it?

Oh look, it's time to go eat some pizza. You already ate dinner, but might as well have a slice or two. You're also using this time to take a break from everything else... at least, that's what you tell yourself. What is the maximal amount of time you can spend outside of doing assignments that can still be considered a break?

Who knows. You've gotten up. You're sitting now. Typing all this up. Going to eat that pizza. After you finish, there's still so much to do. You're physically sitting up, but even now... Willpower eludes you. Why are you writing this anyway? Is anyone reading right now? Who cares. You're writing for yourself.

Will there be any catharsis after you're done writing?

Maybe. After you finish those assignments, then you'll be free. You'll be able to get up. You'll find that willpower. No, that's not true. What about after you finish those exams? No, it still isn't over. There's gonna be co-op to worry about. Or another school term. Or you're going into the workforce full time. There'll still be so much to do. After it's all over, then there'll be peace. But then what's the point of getting up when there's nothing left to do?

Is this some kind of attempt at being edgy? Seeking attention? No, it's not. Nobody knows your name here. No, this is for you. (But don't you hope somebody will know?) What is this though? How many keystrokes will it take to find the courage to get up? How much ink needs to be spilled to convince you to go study for those exams, finish those assignments, prepare for the future? How many meaningless symbols need to be writ for you to try to go enjoy yourself? How much cheesy motivation is required to lift your spirits?

You're done eating now, but you're still not up. You realize you were never awake in the first place. You've been asleep for too long. You pull the blanket closer as the winds of winter overpower your heater, ice cold tendrils finding their way to your skin through the tiny gaps between skin and cloth. Tonight it's cold, but maybe tomorrow it won't be. Winter can only last for so long.. How long do you have to wait for spring?

You've been asleep for too long. Maybe you should get up now and weather the darkness. The tune of the universe is lacking its laments because it's lacking you. You're thinking I've written all this about myself, but I wanted it to be about you all along. I'm writing for you. (Am I delusional?)

(I have to end this eventually).

*The song has sorely missed your voice; make it heard again.
Open your eyes and wake up; you'll reach winter's end
After summer, dark and cold will creep up once more
Will my voice be enough to quench your soul?
"Strike the beat harder when the taste for music is lacking
Sing the song louder when the weight becomes overbearing"*

**Once, we got pizza with
a charcoal-infused crust
for Production Night.**

Just the once, though.

A mathNEWS PIZZA CONNOISSEUR

Eventually

HOW TO OPTIMIZE YOUR D&D DAMAGE: MATHEMATICALLY!

Have you played a game which involved rolling dice? In that case, you likely know some basic probability tricks. For example, if you have a 20-sided die, you have a $\frac{1}{20}$ chance of rolling a 20. You will roll a 10 or higher 55% of the time. Simple enough.

What we're mostly concerned about as Dungeons and Dragons optimizers are attacks. Here's how it works: you roll a 20-sided die, add an integer A to the result, and if the total is higher than another integer AC, the attack hits and a certain amount of damage is dealt. The damage is usually determined by a die roll. For our purposes, we'll refer to any die roll as $x dy$, where x is the number of dice we roll and y is the number of sides on each die. For example, $2d8$ is the summation of the result of rolling two 8-sided dice.

For this article, we'll compare two first level, simple, fifth-edition D&D characters to get a feel for this works.

Let Bob be a first-level fighter. By default, his attack modifier, $A = 5$. He has a choice: choose the Archery feature, increasing A to 7 and resulting in his damage being $1d8 + 3$, or the Dueling feature, which causes A to stay the same, at 5, but increase damage to $1d8 + 5$.

CASE 1: ARCHERY

If Bob chooses Archery, then his probability to hit is given by:

$$1d20 + A \geq AC$$

$$\text{OR } 1d20 \geq AC - 7, \text{ since } A = 7.$$

since the roll is between 1 and 20, his probability to hit is equal to:

$$\frac{[21 - (AC - 7)]}{20}$$

$$= \frac{[28 - AC]}{20}$$

Next, we can take a look at the damage he does, $1d8 + 3$. $1d8$ has an average roll of 4.5, so $1d8 + 3$ has an average damage of 7.5 on a hit.

Putting all this together by multiplying average damage with probability to hit, we can graph Bob's average damage, D in an attack against an enemy with armor class AC as:

$$D = 7.5 * \frac{[28 - AC]}{20}$$

$$D = 10.5 - 0.375 AC$$

Note: The actual graph D has a range $[0, 7.5]$ due to the maximum and minimum average damage actually possible. Our representation goes out of bounds due to probability being greater than 100% or less than 0%.

CASE 2: DUELING

Similarly, Bob's new build with $A = 5$ and $1d8 + 5$ as the damage results in a graph of

$$D = 9.5 * \frac{[26 - AC]}{20}$$

$$D = 12.35 - 0.475 AC$$

CONCLUSION

If we graph both of these functions, we'll find an intersection at $AC = 18.5$, with Archery being better at higher AC's, and Dueling superior at lower AC's. Now, at level 1, most foes will have AC lower than 18.5, so with all other factors equal, Dueling is likely a superior choice.

This is only a beginning to the probability analysis world of D&D and other dice-based games. What happens when you take critical hits into account, or, say, rolling twice and only taking the higher/lower result? Most of these parameters can be taken into account for more accurate metrics. If you're ever in doubt about the correct choices for your character, consider math!

CC

LIVING WITH A MATH-BLIND GIRLFRIEND

The following accounts, although seemingly fraudulent or satire, are 100% real and have actually happened to me. Proceed with caution.

- "36 plus 5, that's... 42"
You mean 41?
"No, it's 42."
- "Hey look, I won blackjack! I got 10+7, he got 9+9!"
- "Here's the groceries receipt, figure out how much you owe me." [I toss out a number \$20 too low.]
"Oh, that sounds right."
- "3+8... 11! I did it! I did math!"
- "How many of these could I buy with \$35?"
I'll teach you, first you have to divide...
"You lost me at teach."
- I have to find a prime that divides these 2 values, any ideas? "...12"

Fruitboy

DDD: DON'T DIE DURING DDD

First of all, I would like to thank the editors for naming my piece on No-Nut November the article of the last issue. All I can say is that it came from the heart, but I hope that none of you came at all. No Nut November is a noble challenge and few are able to make it through the month without wrangling their ripe rod. For those of you that have made it this far though, the true challenge has yet to begin.

Once you have completed the holy month of restraint without succumbing to your base desires, you qualify to participate in the unholy reward: Destroy Dick December. Aptly named, this challenge is the polar opposite of its chaste brother. Instead of trial testing your self-control and restraint, Destroy Dick December is a test of your endurance and ability of your prostate to produce semen at an inhuman rate. If you are not yet aware, the rules for Destroy Dick December are as follows (not rigorous):

Let δ be a natural number equal to the current day of the month.

Let $N(x)$ be a predicate representing the statement: "You are required to ejaculate x separate times on this day."

If the current month is December, $N(\delta)$ holds.

If for every day of December, you nut the required number of times, you succeed. If there is a day where you do not nut the required number of times or if you die before the end of the month, you fail the challenge.

If you are curious as to how many total nuts a successful Dick Destroyer will have completed by the end of the month, you may use the following formula which gives the n^{th} triangular number:

$$\sum_{k=1}^n k = \frac{n(n+1)}{2}$$

By plugging in 31 as the value for n , we get a total of 496 sperm puddles over the course of the month. It's a shame that December has a finite number of days. If it had an infinite number of days, one would only ejaculate a total of $-\frac{1}{12}$ times. That's even less than during No Nut November!

Now that you understand the rules for the month, you might feel like the barrier to entry is too difficult to overcome. However, let me assure you that overcoming is the whole point. The following are a few suggestions to improve your chances of survival during this fap-fest of a month.

1. BE GENTLE

Have you ever noticed that sweet soreness after a good hard wank? Well, let me tell you that after the hundredth time in a month, it is something that becomes nearly unbearable. Go lightly at first. You will regret not doing so if you neglect this bit of advice. Something to invest in which helps to prevent bruising and chafing would be a good quality lubricant. I would personally recommend a nice silicone-based lube, though water-based products are cheapest. Additionally, stay away from liquids and try to use gels. Not only are they less messy, but it is much easier to monitor and control your usage so as not to waste.

2. FINISH QUICKLY

The refractory period of the average university-aged male ranges from five to fifteen minutes. Once you get up to the end of the month, it becomes difficult to fit over 20 ejaculations into one day. Also, maximizing the amount of time between nuts will make the process significantly easier.

3. DRINK LOTS OF FLUIDS

The prostate and seminal vesicles work extremely hard all day to produce the white love juice that you shoot out repeatedly over the course of December. Have you ever tried to cum while dehydrated? Not as much comes out and it might even hurt. Also, at a certain point, your glands won't have the material to make the ejaculate you need. In order to make it through the month, you need to keep your machine well oiled and fueled up.

4. AVOID MASTURBATION AIDS

As the month progresses, it becomes more difficult to become aroused and finish what needs to be done. If you can manage, try to make it as long as possible without using sexually explicit material. As the days go on, you will start to become desensitized to the constant stimulation. It is at this point that you will want to introduce the help of some porn or big-tiddy anime girls.

5. GIVE UP BEFORE YOU DIE

If you reach the point where masturbating makes you pass out or you start cumming blood, STOP! Refrain from continuing the challenge! You are going to die. If you die before the 31st nut on New Year's Eve, you lose. Do not risk this. There is always the option to try again next year.

While this challenge is less ubiquitous as No Nut November, Destroy Dick December is the ultimate challenge for anyone looking to surpass their nut-free November achievements. Should you elect to attempt this deadly feat, be warned that spilling your seed is a sin in many faith traditions. Dying during this challenge is not advisable. To quote a great man:

"Don't let your dreams be dreams" – I'm dreaming of a white Christmas.

Xaventois

MATHFOC SEZ

MOD APPLICATIONS NOW OPEN!

With only 274 days until the start of Orientation Week 2019, Math Orientation is looking for creative individuals to join as Math Orientation Directors (MODs) to help with planning and running orientation week!

Here's a quick rundown of the positions available:

Devisor: Work in teams of four to design unforgettable activities (e.g. Earn Your Tie, Scavenger Hunt)

Teamster: The events can't run without them. The saviour of us all when something is missing. Plus, they get to drive cool cars.

Tie Guard: Act as the central communications hub, answer any questions first-years might have, and most importantly, guard the 40-ft pink tie!

Food/Sponsorship: Look for sponsors, write sponsorship proposals, and coordinate food.

Media - Choreographer: Select a song and create the 2019 Math Dance!

Media - Design: Create illustrations and videos based on the 2019 orientation week theme (e.g. team logos and theme introduction video), as well as design posters for advertising!

Media - Social Media/Website: Post weekly on social media to keep first-years and leaders engaged with orientation!

To learn more or apply for these positions, visit tinyurl.com/mod-2019. Applications close on January 6th at 7:59pm ET!

Questions? Send us an email at mathorientation@uwaterloo.ca, visit our Facebook page (Waterloo Orientation - Math) or tweet us ([@MathOrientation](https://twitter.com/MathOrientation))!

(And if you're wondering - applications for Pink Tie, Head Pink Tie, and Black Tie open very soon! Stay tuned to our Facebook page.)

Alex L, Alex R, Judy, Hyla
Federation Orientation Committee 2019
Faculty of Mathematics

N WAYS TO COOK TURKEY FOR CHRISTMAS

- Roast the turkey
- Bake the turkey
- Broil the turkey
- Steam the turkey
- Parboil the turkey
- Fry the turkey
- Deep fry the turkey
- Reverse sear the turkey
- Sous-vide the turkey
- Hire Gordon Ramsey to yell insults at the turkey until it cooks itself
- Burn the turkey
- Throw the turkey into a volcano and hope for the best
- Shoot the turkey into the sun
- Just eat the turkey raw with a side of romaine lettuce. It's not like it's gonna kill you.

a mathNEWS writer who doesn't know how to cook turkey

Applications close
January 6th
@ 8pm!

MATH ORIENTATION 2019!

We want you to be:

- * **Devisors**
- * **Tie Guard**
- * **Teamsters**
- * **Food & Sponsorship**
- * **Media**

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THE SQUARE-SUM PROBLEM

Wassaaaaaaaaaaaaaaaaaaaaaaaaaaaaap?? Hey mathNEWSies, I'm back. Today, we get to discover another fun puzzle in the world of math. We're going to be reverting back to the format of my first puzzle (Josephus Problem, i4) in which I simply teach you a method of solving the problem for a given number n .

Today's problem is the Square-Sum problem, a fun game you can play with any natural number. The proposal is simple. Start by picking a natural number. (For our example, we'll choose 15.) Write out each number from 1 up to your chosen number. The puzzle: is it possible to write each of these numbers from 1 to n in a specific order, such that each 2 consecutive numbers result in a perfect square? Here's a few examples:

For the number 1, it is possible vacuously because 1 squared is 1.

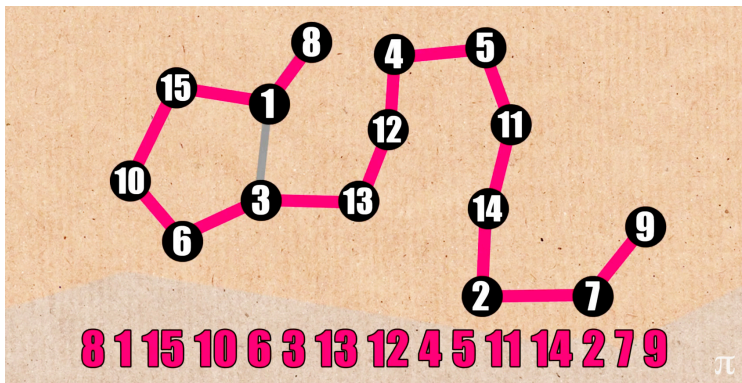
For 2, it is impossible because the only orders (1+2, 2+1) result in 3 which is not a perfect square.

For 3, (123 132 312) are the only unique (to order) solutions and 1+2 nor 2+3 cannot form a perfect square. Each of these combinations exist in one of these sets, so it's not possible.

But, how are you supposed to find a streamline solution for number n ? You aren't going to sit there and count each possible combination, right? There has to be a streamlined solution. Try some strategies for $n=15$ and report back when you're done.

Welcome back! Did you find a good/decent/"it works" tactic? Did you trial-and-error your way through? Well, let me help you out.

An easy way to solve this is to take each number from the collection and figure out which of the other numbers can be added to it to create a perfect square. The idea is to create a map. For example, here's the map for us choosing $n=15$:



So now that you have a map, the answer to your question should become a bit clearer. You've transferred the question into a much easier question: is there a path from one endpoint to the other hitting each number only once and including every number? From this image, you can see the answer is yes, quite easily. So, for $n=15$ the answer is as follows:

(8-1-15-10-6-3-13-12-4-5-11-14-2-7-9)

Each number from 1 to 15 is included exactly once, and every 2 consecutive numbers sums to a prime! Neat. To expand on this, if you hit a scenario where such a chain is impossible (Try $n=18$ to see!), then that means there is no solution to the problem.

So, hope you all had fun with this one. Exams are happening, so good luck! Make sure you keep an eye out next term to catch back up with us here at **mathNEWS!** We'll miss you...

Fruitboy

A CONVERSATION BETWEEN CYBER MONDAY AND BEHAVIOURAL ECONOMICS

CYBER MONDAY: DEALS, DEALS, DEALS

Richie T: Most of the time sales feel good because of transaction utility. This means if you think the price is \$10 dollars and you're getting it for \$5 then it's a good deal. Ultimately the market value of an item is what you pay for it, so if you paid \$5 for an item that item is worth \$5 (at least to you), regardless of the previous price. This doesn't mean that good deals don't exist since an item might actually be worth \$10 to you, so if you get it for \$5 dollars you experience acquisition utility. Think of it as relevant gain vs absolute gain.

CYBER MONDAY: BUY, BUY, BUY

Danny K: Much of happiness is in the stories we tell ourselves, so if you find that you've already made an irrational purchase this past Cyber Monday you're better off pretending that you're really happy with your decision than grumbling about your decision. There's also no shame in returning your purchase if possible, since you already got the enjoyment of buying the item/getting a deal and if you return the item, that happiness only cost you a bit of your time.

CYBER MONDAY: CHEAP, SALE, FUN, BEST, AWESOME, SUPER, MEGA

Me: Hehe, me like shiny things.

Richie T: We might need more psychology.

Yaboi

HOW TO (PROBABLY)¹ PISS OFF MEMBERS OF EACH FACULTY

Every faculty has pet peeves or something that bugs them. Think of that one person who does that one thing that just... Ugh! You know the one. It's like that, but as a faculty. After talking to literally no one from other faculties, I've compiled a list of what I imagine three pet peeves of each faculty are.

MATH

- Use π as a variable. It's sacred and meant ONLY for circles and shit.
- Tell them they have to take communications courses.
- > stat231 is STILL a degree requirement.

ENGINEERING

- Claim you have any amount of work which you find to be stressful.
- Engineering as a field is flooding with so many people going into it and they won't have it good forever.
- "Aren't all the engineering programs just the same?"

SCIENCE

- Give the funding that should very well go into a science building (looking at you PHYS or CHEM buildings) to the E10 megaplex.
- Disrespect Science C&D.
- Put random classes like RM in the massive lecture halls. Why did you build such a nice building and then not use it for science?

ARTS

- Be passive-aggressive and insinuate they don't do real work.²
- Every other thing basically reduces to just "haha Arts isn't a real faculty"

ENVIRONMENT

- Take a supportive stance on forestry and the other industries that are BLATANTLY DESTROYING OUR PLANET
- "Climate change isn't real."
[Author's note: I know there's a whole bunch of random programs in Environment, but IDK how to piss 'em off.]

AHS

- Pronounce "AHS" like "ass."
- Remind them about the odds of getting into med school.
- Joke about them just ending up as PE teachers.

In conclusion, I hope everyone could find something in this list that just made them real angry. May you have a wonderful remainder of your day, and remember, π is NOT a variable.

permanentpseudonym

¹ IDK what bugs people, I'm not them.

² Essay-writing is hard, dude.

THE APEX OF MUSIC

What is the pinnacle of music? Is it the compositions of the old masters? The hymns of the church? Modern pop? No. It is the masterfully made collection of Yugoslav War songs.

Overlooked by all but the most sophisticated of musical connoisseurs, the tasteful and subdued songs of the Yugoslav war show us the finest of musical composition and lyrical genius, with such hits as "The Pope Hates the Serbs" and "Serbia Strong".

With brilliant lines of absolute poetry such as "Small are your borders" and "There are no more Turkish pies made from Posavina's Golden Wheat" from the hit "Oj Alija, Aljo!", it can simply not be denied that the poetry and artistry of such lyrical music is unmatched.

Those are just the Serbian compositions. The masterpiece of the Croatian band "Thompson", a spirited song named

"Bojna Čavoglave", contains inspired lyrics such as "Fire Thomson, Kalashnikov, and Zbrojovka".

The Bosniaks do not lose out either in this lot of musical genius. In fact, the major participants in the Yugoslav war seems to not have only competed in the contest of genocide, but also in the contest of war songs. Furthermore, it seemed that the only ones who lost out in this influx of musical creativity were those that had insufficient genocide.

Seeing this link, I suspect there will again be a period of great musical creation very soon.

[Editor's note: Tenk ju juesej, ju ar maj best frend, ju ar di piskiper, ju ar di ledend]

Thanks,

N SEQUENCES TO TRY OUT ON THE CS 135 A9 BONUS QUESTION

So, you're looking at the CS 135 assignment, and you see the last question. How many sequences do you know? You scramble your mind, thinking of all of the crazy possibilities that you can imagine (and code), but you've run out of ideas. At this moment, you turn to **mathNEWS** for help. Well, you've come to the right place! Here are some sequences that you enterprising CS 135 students can try out to hopefully snag some of those gigantic bonus marks. Be warned, however - you (hopefully) won't be the only one reading this article, which means that you're in direct competition with anyone else who sees these sequences. Good luck, and may the odds be ever in your favour!

1. PRIME NUMBERS

A classic. If you need a refresher, a prime number is defined as a number which has exactly two distinct positive divisors: 1 and itself. (This is technically the definition for an irreducible, not a prime, but same difference.) The first few primes are 2, 3, 5, 7, 11, 13, etc... There's a lot of ways to detect primes, but most of them turn out to be pretty slow. There's theoretically a fast way to do it, though. All you have to do is prove a million-dollar question called the Riemann Hypothesis, a 159-year old unsolved mathematics problem. Good luck.

2. FACTORIALS

Just as there's a sequence of natural numbers (not a bad thing to try, by the way), there too is a sequence of factorials. The n^{th} factorial is the number given by $n * (n - 1) * \dots * 2 * 1$: that is, multiplying n by all of the integers less than it. (Again, there's a little more to it than that - you can look up the "gamma function" for more information.) The first few factorials are 1, 1, 2, 6, 24, 120, 720, etc.

3. SHAPE NUMBERS

You've probably heard of square numbers - numbers that can be formed by squaring natural numbers. You may have heard of triangular numbers - adding up all of the numbers up to a natural number; i.e. the 5th triangle number is $1 + 2 + 3 + 4 = 10$. But did you know that there are actually numbers for every possible n -gon? Pentagonal numbers, octagonal numbers, ennecontahexagonal numbers, you name it, it exists. There's a countably infinite number of these sequences - have fun!

4. PERFECT NUMBERS

"There's no such thing as perfection" is a phrase that you might have heard before. Well, you heard wrong. There is such a thing as perfection, and it is embodied in these numbers. Perfect numbers satisfy the perfectly perfect perfection of having the sum of all their divisors equal to the perfectly perfect sum of perfectly twice as much as their value. As an example, the divisors of 6 are 1, 2, 3 and 6, which, if you add them all up, you might notice that you get the perfectly perfect number 12, which is perfectly equal to twice 6. Perfect! The first few perfect numbers are 6, 28, 496, 8128, and 33550336.

5. DECIMAL EXPANSION OF π

3, 1, 4, 1, 5, 9, 2, 6, 5, 3, 5, 8, 9, 7, 9, 3, 2, 3, 8, 4, 6, 2, 6, 4, 3, 3, 4, 3, 2, 7, 9, 5, 0, 2, 8, 8, 4, 1, 9, 7, 1, 6, 9, 3, 9, 9, 3, 7, 5, 1, 0, 5, 8, 2, 0, 9, 7, 4, 9, 4, 4, 5, 9, 2, 3, 0, 7, 8, 1, 6, 4, 0, 6, 2, 8, 6, 2, 0, 8, 9, 9... you get the point.

6. DECIMAL EXPANSION OF e

6, 2, 8, 3, 1, 8, 5, 3, 0, 7, 1, 7, 9, 5, 8, 6, 4, 7, 6, 9, 2, 5, 2, 8, 6, 7, 6, 6, 5, 5, 9, 0, 0, 5, 7, 6, 8, 3, 9, 4, 3, 3, 8, 7, 9, 8, 7, 5, 0, 2, 1, 1, 6, 4, 1, 9, 4, 9, 8, 8, 9, 1, 8, 4, 6, 1, 5, 6, 3, 2, 8, 1, 2, 5, 7, 2, 4, 1, 7, 9, 9... the lesser known bigger brother, taking his revenge.

7. LUCKY NUMBERS

If you've taken MATH 145, you might recall something called the Sieve of Eratosthenes. If you haven't, well... hopefully this still makes sense. A lucky number is a number which survives a sort of numerical culling process known as a sieve. Take a list of natural numbers, however long you want, and remove every second number from the list. Then remove every third number. Then remove every seventh number. The numbers that remain are the lucky numbers, of which the first few are 1, 3, 7, 9, 13, 15, 21, 25, 31, 33...

8. FORTUNATE NUMBERS

Not to be confused with Lucky Numbers. Fortunate numbers, named after social anthropologist Reo Franklin Fortune, are, well, confusing. Some terminology: A primorial number $p_n\#$

Have something you want to publish in **mathNEWS**? Drop it off in the **mathNEWS blackBOX** by the Math C&D or send it to **mathNEWS@gmail.com!**

A **mathNEWS** EDITOR WHO WANTS MORE WORK FOR THEMSELVES

is the product of the first n prime numbers. With this in mind, a Fortunate number is the smallest natural number $m > 1$ such that, for a given positive integer n , $pn\# + m$ is a prime number. Fun side exercise: are there any composite Fortunate numbers? If you find any, let us know - it's an unsolved problem. The first few Fortunate numbers are 3, 5, 7, 13, 23, 17, etc...

9. DECIMAL EXPANSION OF e

You know what? I'm not writing this one out. If you'd like, $(1 + 1/n)^n$ is waiting for you. Have fun!

10. PRIMORIALS

I almost forgot - the primorials constitute a sequence by themselves! The first few terms are 1, 2, 6, 30, 210, 2310...

11. SUPERPERFECT NUMBERS

So, there's this function called the divisor summatory function that I probably should have introduced back with the regular perfect numbers, but eh whatever. The divisor summatory function of n , or the divisor sum of n , is the sum of all of the divisors of n , and is denoted by $\sigma(n)$. Knowing this, we define a superperfect number as any number that satisfies $\sigma^2(n) = \sigma(\sigma(n)) = 2n$. In other words, just because you're perfect, you can actually still be more perfect. Just perfect. The first few superperfect numbers are 2, 4, 16, 64, 4096, 65536, etc. (You might notice that they're all a power of a certain number...)

12. HYPERPERFECT NUMBERS, AND BEYOND

Ever played Pokémon, and found how they had regular Potions, Super Potions, Hyper Potions, and Max Potions? Well, I'm sorry to say that there aren't any Max-Perfect Numbers - at least not yet. But there ARE Hyperperfect Numbers; in fact, there are infinitely many different sequences of Hyperperfect Numbers, each of which is defined as follows: Pick an integer k . Then a k -hyperperfect number is a natural number n for which we have $n = 1 + k(\sigma(n) - n - 1)$, given the summatory divisor function from above. Perfect numbers are actually a subset of hyperperfect numbers, as they're 1-hyperperfect numbers. A list of some k -hyperperfect numbers can be found on Wikipedia, as I'm too lazy to list them here.

13. QUADRATIC RESIDUES MODULO $10300 + 7$

Because you know you want to.

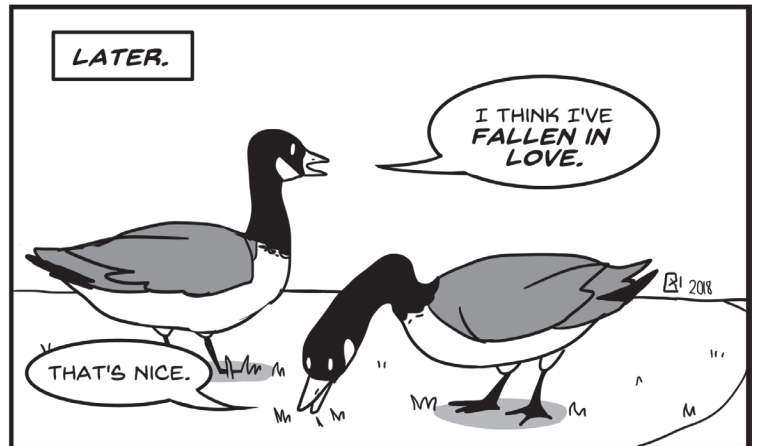
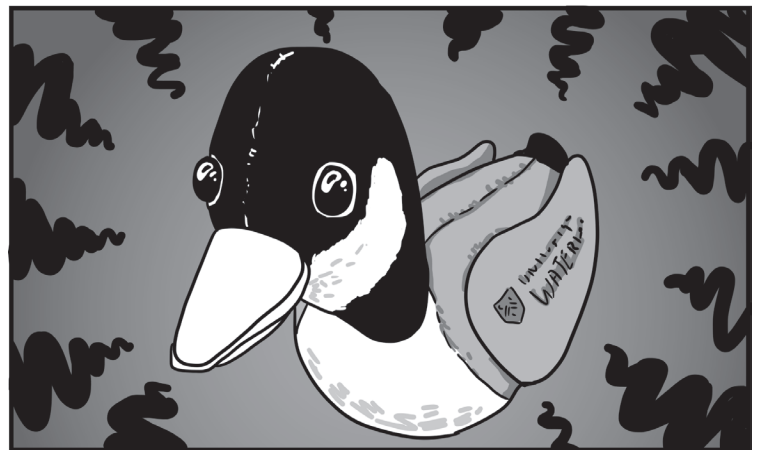
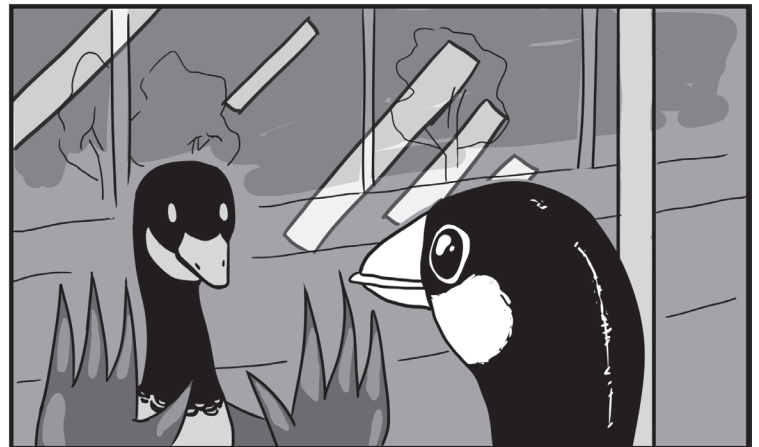
14. COMPLETELY RANDOM NUMBERS

If all else fails, you can always consider the Hail Mary option, which is to construct a sequence of completely random, or even just pseudorandom, numbers. Random-Epsilon, anyone?

Epsilon Screwn &
The42ndRhombiDodecahedron

STAR-CROSSED

BY CIX



(25.5±0.5)N INTERESTING THINGS YOU PROBABLY DIDN'T KNOW ABOUT THE DAYS BETWEEN NOW AND CHRISTMAS

It's that time of year again, when the tinsel comes out and Christmas songs fill the air. Oh, what a joyous time! To commemorate the 25-ish days we have until Christmas, we've decided to compile a list of historical events that happened between now and then on each remaining day.

November 30: In 1954, a meteorite crashes into a house and strikes a woman taking a nap. Lesson: don't take naps without anti-meteorite shielding.

December 1: In 1824, the tenth ever U.S. presidential election ends in a stalemate when no single candidate wins a majority of the electoral college votes, forcing the decision into the hands of the House of Representatives for the first (and only) time in history. John Quincy Adams emerges victorious, but not without incurring a huge cost: the fallout of the election marks the end of the Democratic-Republican party's political monopoly, as it begins to split into the Democratic, National Republican, and Whig parties. And you thought 2016 was bad.

December 2: The world's first nuclear reactor, Chicago Pile-1, reaches criticality underneath the bleachers of Soldier Field in 1942, ushering in both the Nuclear Age and the age of people saying nu-cu-lear.

December 3: An engineer sends the first ever text message to a colleague in 1992. One can only imagine what it said.

December 4: Michael Jackson is born in 1973. He goes on to play for a multitude of English football teams, including Preston North End, Blackpool F.C., and Tranmere Rovers, before retiring into coaching for Shrewsbury Town.

December 5: 1910: The Montreal Canadiens play their first ever game, winning 7-6 in overtime over the Cobalt Silver Kings. One wonders if having Carey Price back then might've helped limit that score.

December 6: During the 1956 Summer Olympics, a match between the Hungarian and Soviet water polo teams turns ugly after the two delegations literally start fighting in the pool, resulting in blood being drawn and a near riot in the audience.

December 7: The Republic of China moves its government from mainland China to Taipei in 1949. Taiwan #1?

December 8: Pope Pius IX proclaims that the Virgin Mary was conceived free of original sin in the 1854 Apostolic constitution *Ineffabilis Deus*, which I have to imagine really pissed off the Protestants.

December 9: The first North American YMCA opens its doors in 1851 in Montreal, albeit without the Village People performing at the opening ceremony.

December 10: London, 1907: The Brown Dog riots reach their height, when 1000 angry medical students waving effigies are joined by a busker with bagpipes as they march towards Trafalgar Square to protest against...a statue of a brown dog. (It's really complicated.)

December 11: Arthur Lucas and Ronald Turpin are the subjects of Canada's last capital execution in 1962, in a rather gruesome double hanging.

December 12: In 1936, Chiang Kai-shek is kidnapped and detained by two of his subordinates, in an attempt to cease fighting between the Chinese Nationalist Party and the Communist Party of China. It somehow works.

December 13: Eugene Cernan and Harrison Schmidt are the last humans to set foot on the Moon, as they set out on the final moonwalk of Apollo 17 in 1972.

December 14: Exactly ten years ago, George W. Bush is assaulted by a pair of flying shoes. It's probably safe to say the assailant got booted after that.

December 15: American Prohibition is repealed in 1933, just in time for drinking eggnog to be legal at Christmas parties.

December 16: John T. Graves announces his discovery of the octonions in 1843 by sending a letter to his dear friend and discoverer of the quaternions William Hamilton, in perhaps the weirdest mathematical flex ever.

December 17: The Finnish Security Police is founded in 1948, in order to remove communist leadership from its predecessor, the State Police. Coincidentally, almost 30 years later, Imprint would replace The Chevron as the University of Waterloo's official student newspaper due to concerns over the latter's increasingly communist stance.

December 18: American Prohibition passes Congress in 1917. One wonders how the Army managed to function between then and the end of the Great War.

December 19: In the Great Swamp Fight of 1675, New England colonists and the Narragansett tribe battle it out on a cold, frozen swamp, with the former burning down the latter's fort. Sadly, the fort did not then sink into the swamp.

December 20: Queen Elizabeth II becomes the oldest monarch of the United Kingdom, surpassing Queen Victoria

and making Prince Charles wonder if he'll ever take the throne.

December 21: The world was supposed to end on this day in 2012, if anyone remembers. (I certainly didn't.)

December 22: Srinivasa Ramunajan was born in 1887, a number which also happens to be a twin prime.

December 23: The transistor is demonstrated for the first time in 1947, marking the beginning of modern computing and parents yelling at their kids to stop playing League.

December 24: The Eggnog Riot starts at West Point in 1826, because of course the one place where an alcohol-fuelled party-turned-riot would occur is the army.

December 25: The Eggnog Riot concludes.

whyOS

THE TERM IS ALMOST OVER!

And that means it's time to treat yourself. Start by sitting down and budgeting your time. How much studying time does each course require, and how much do you have? Done? Good. You probably have at least one day you can afford to live it up. Use it! Organize a party with the three best things there are this time of year: friends, rum, and eggnog. No friends? Well, that's okay too! You can have a party all on your own. Maybe invite friendly-looking strangers from your classes - who would say no to a fun winter party? Not into parties? Just throw on a "yule log" youtube video, make yourself a hot chocolate, and watch your favourite holiday classic. My cheesy movie of choice is "Elf." Feeling a little dark this time of year? Lick a candy cane into a shiv and [REDACTED].

All that said, the holidays are not a pleasant time for everybody. In fact, it probably carries mixed emotions for most people. If you find yourself feeling down as the (in) famous season approaches, reach out. There are plenty of good resources discussed elsewhere, but that's not really the point of this article. For those of you to whom the holidays bring nothing but joy, celebrate, but if people you love start acting strange, keep them in mind. They could probably use a friend.

permanent pseudonym

CHARACTER ANALYSIS OF NARUTO

I finally got myself to watch Naruto as this is an essential anime of the weeb passage. After 30 episodes I have some grasp of the three main characters so far. Currently I've watched to the second stage of the Chunin exam.

Naruto was the first scope. He seems very loud and makes irrational decisions. For example, he would verbally attack his enemies or announce his attacks. He claims his ultimate goal is to become Hokage which is the highest tier of ninja. He believes his entire village will recognize and respect him after he becomes Hokage. On the surface, he seems immature but Kakashi sees his infinite potential as he contains the nine tailed fox.

Sasuke is Naruto's rival for Sakura. His goal is to kill his brother that killed his family in order to avenge his family and rebuild his clan. He seems to be very reserved and mature compared to Naruto. Kakashi also believes his chakra is insane but needs to learn how to use it fully.

Sakura is Naruto's ultimate girl crush. He would do anything to date Sakura but she likes Sasuke. Sakura seems to not have any bravery as she always depends on Naruto or Sasuke to protect her. She would typically be the follower of the group and encourage the other two to fight off their enemies and keep her protected.

Kakashi is the three students' teacher. He typically uses minimum effort and can notice any little detail. For example, a puddle when it hasn't rained. Turns out the puddle was a disguised enemy ninja. I personally really like this character since he seems stoned ^{24%}.

Welp I was very late to watch Naruto but I finally got to it.

Teemo

You should write be an editor for mathNEWS.

(I swear it's not as bad as I make it sound.)

A mathNEWS EDITOR WHO WANTS TO GET THE HELL OUT OF THIS MADHOUSE AND RUN DEFINITELY SECURE THE FUTURE OF THE PAPER

ONE WORD: PLANTS

BECAUSE THE MC IS AWFUL, AND THAT NEEDS TO CHANGE

I'd like to begin this with a quick anthropology lesson: while early humans **did indeed live in caves, they only did so out of necessity**. Today, however, we are better than that, and shouldn't continue to live in them *just because* we're able to build them out of concrete. It's just not good for you; the human body *does* benefit from even minimal connection to both nature, and the world outdoors — two things that the MC *most certainly* does not well provide.

Now, in the interest of bias disclosure, I'd like to make one fact clear: I fucking **hate** the MC, and I say this after having had eight school years of classes within its walls, *and* having lived — *literally lived*¹ — in the **mathNEWS** office for a term. I've spent more time in MC than most students ever will, and I'd have **zero** qualms about seeing the concrete bastard disappear. None. I consider the building such a disgusting blight on the history of the architectural practice that when I hear the letters "MC", I think "Monolith Chambers". And then retch.

I don't think I'm alone in that, either; in fact, I'd wager that if given the opportunity to decide the MC's fate, many of you would start pouring gasoline yourselves. At the *very least*, I know that almost all of you would love to see it suck less, even if it were only *slightly* so.

Now, unfortunately, we can't — *and absolutely shouldn't* — just make the MC disappear. Since it was built in the '60s, its walls are stuffed with asbestos, so **burning tearing** it down would almost certainly loose a cloud of a poorly thought out, cancer-causing, bullshit-excuse-for-insulation snow substitute upon the Waterloo campus, and its surrounding area. This, in turn, would cause a noticeable increase in cancer rates in both Waterloo residents *and* students for years to come, and while I stand staunchly by my opinion that the MC is **fucking awful**, I'm *mostly* sure that it doesn't currently cause **actual cancer**.² So, taking the *euphoric satisfaction* I'd get out of its complete and utter destruction off the table, I'd like, instead, to propose a plan to *improve* the MC, as it exists currently:

Plants, motherfucker. 🍃

Plants fucking *everywhere*. I'm talking Japanese peace lilies at every corner, on every floor, and in most of the lecture halls. I'm talking giant hydrangeas and climbing ivies encircling the outer walls. **And I'm talking a living goddamn wall in the third floor concourse, named after yours truly.**³

Placing plants around the interior of the MC would serve *not only* to liven the place up a bit, but also drastically increase its noticeably sub-par air quality, which in turn would lead to healthier students, *better* students, easier times studying, and — if miracles are real, which I highly doubt, but hey — **a better smelling MC**.⁴ Wall-climbing exterior plants, on the other hand, would add some much needed curb appeal to the building's grim and foreboding facade, which I think many would describe as being... **rather visually unpleasant**, to say the very least.⁵

I'm not just spouting conjecture here, either: NASA did a study on this a while back, and they found several indoor, low-light plants that (along with activated carbon filters) make very effective air purifiers. I won't go into much detail here, but the most generally effective plants seem to be **gerbera daisies, chrysanthemums, Janet Craigs, English ivy, and peace lilies**. You can find the study at <https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19930073077.pdf>.

And lastly, to the obvious caveat that real plants⁶ need regular maintenance, I think I have a rather elegant solution. Aside from their aforementioned health benefits, tending to plants can also be *immensely* psychologically rewarding, and there's a *very* simple way to exploit that fact to produce green-thumbed volunteers: **name the plants**. Names would make them more than just scenery — they'd become fully-fledged *mascots* of the MC, and **students simply wouldn't allow them to die**. Just make sure that there's a watering can or two for students to borrow in the MathSoc Office, and I'm sure they'll do the rest.

If you're still on the garden fence about this, I ask that you go for a walk outside, and think about it. And while you're *on* that walk, take a nice, deep breath. You feel that? That refreshing coolness filling in your lungs? That extra brain power starting to energize your term-weary mind? Feels good, right? Well, that's what fresh air *does* to a person. **And with only a small fuckton of plants, you could have that in the MC too.**

You're welcome.

The Eurobeat-'Em-Up

1. I'm not exaggerating at all. Someone actually had to have a talk with me about zoning laws that term, and one of my roommates in the place I actually *rented* genuinely forgot that I lived with them. You'd *think* they'd let me off, being editor at the time, but *nooooo*...
2. I really hope it doesn't, because I *was not kidding* about the "lived at mathNEWS" thing; I used to keep my T-shirts in the file cabinets.
3. W'sup, members of Math Faculty Administration and the Dean's Office who just figured out who I am? How y'all doin'? 🤔 🤔 🤔
4. Thus succeeding where the showers in M3 **failed**.
5. To say a bit more, the MC is what happens when brutalist architecture, utilitarianism, and a French monastery (seriously, look up "Corbusier monastery") conceive a baby in **the most horrifying orgy you can fucking imagine**, and *then* give that baby a shiny new supercomputer to shield from an **all-but-impending nuclear fucking holocaust**. And that's *still* putting it pretty succinctly.
6. I specify "real plants" because we could theoretically go the *fake* plants route, which... I mean, come on. Really? That'd be like sticking decals on your car in response to the check engine light coming on: expensive, gaudy, and **completely pointless**.

REMINDER – CO-OP 101 INFO SESSION

If you're like most of the math freshman this year, you probably woke to this title in your email. That is, if you ever remember to check your uwaterloo account. If you're one of the few people who actually checked, then you probably decided to skip the session anyways. Thus, leaving a very small selection of people who decided to actually go.

Well, if you did, you really didn't miss much. The highlight was being forced to take PD1 next term. You might have felt left out from all those FuckPD posts on reddit, but don't worry. You'll be able to complain along with the rest of them as you suffer though the soul crushing dullness of PD1.

After doing so, you have the fun job of trying to stand out of the over 1 million applications. A third of all applications are thrown into the bin without even an interview. And even if you get a job, it's probably not going to be what you want. 30% of people end up taking a job in finance. Did you go to waterloo wanting to be an accountant? Probably not.

If you don't manage to get a job, don't fear. The deadlines are all lies (think of it as bendy diamond) and you actually have another month to find a job. Take all 150 resumes and try again in continuous. CECA reminds you that as a freshman, you might need to lower your location preferences (Antarctica), find a different job description (coffee maker and scapegoat) and don't be too picky with salary (\$0.02 per an hour rounded to the nearest million). Also don't forget write your work report and sell your soul when accepting the terms and conditions of waterloo works. On the other hand, CECA promises to let people advertise to you, take your employer out to dinner and complain when you don't follow their deadlines. All this for a low, low fee of \$730 a term. Remember, if you can't find a job, it's your fault. If 90% can

get placed, then you're clearly an outlier and need to improve your marketability by learning web dev and finding your own experience.

If you think that this is great, then you can remember that you need to take a PD course every work term and write reports. In return, you'll be able to get an underinflated performance review, fight for a basic salary and zero guidance on even where the washrooms are. Remember to write about how you can apply your university knowledge to real life problem like rewriting your company's website in racket, using first order logic to determine the meaning of the daily memo and pretend you're in SPCOM when you need to explain why you didn't get anything done.

However, beyond all the requirements and responsibilities for a job, remember that you still need to pay attention to school. You need to make sure to have a job for almost every work term, still take at least 8 terms of school and always write work reports. However, don't worry, you have Wat(TheFuck) PD where you can be concerned about basic social skills such as teamwork, communication and the moral responsibilities of starting the next robot uprising (PD10).

In conclusion, remember to lower your expectation below none, accept that your time will be filled with useless work reports and time sink PD courses. In addition, you have the stress of trying to stand out against a million other applications. Also remember to clean up your social media. Your future boss recognizing everyone in a party picture will never end well, especially if they're in there too.

ACEC

MATHEMATICAL TERMS MODELED AS EVERYDAY TASKS

Integral: Spending all your lifetime adding up a bunch of numbers and still not finishing it by the time you are dead

Limits: On a chilly morning, stretching on a yoga mat until you start to scream because you tore a ligament

Algebra: Remember the first time when you practiced cursive handwriting. All those hours spent writing the same symbols over and over again. Exactly that

Imaginary Numbers: The monster in the closet

Negative Numbers: Spending money

Sets: Throwing laundry into various compartments based on an arbitrary criteria

Logic: Arguing with your mother

Cryptography: Hiding that one folder on your laptop from your parents [editor's note: MadThad0890, is that you?]

Probability: Asking your crush out (doesn't work out really well most of the time)

Approximation: Guessing what you got on that quiz that you didn't study for

Random Number: Number of times you can ignore the call from parents on a night out

I will finish the list some N time later while N tends to Infinity

over-engineerED

WHAT IF EVERYONE BURPED AT ONCE?

IS THAT AN ERUCTION OR ARE YOU JUST HAPPY TO SEE ME?

Hey! **mathNEWS!** Loquatius here. Everyone does it. When you swallow gases while eating and drinking, your body will likely let it out as a burp. Otherwise, it will pass through your digestive system and become... a fart.

[🎧] *Jake Chudnow — Moon Men*

Let's assume that every single human alive today got together and burped all at once. To make this question more exciting, let's say everyone burped as loud as Paul Hunn, who earned the Guinness World Record for the loudest burp in 2009, at 109.9 decibels¹. That's louder than a jackhammer and would cause hearing damage within 90 seconds if you're exposed to it without proper hearing protection. Let's also assume that everyone can burp continuously for as long as Michele Forgione, whose Guinness World Record attempt in 2009 clocked in at 73.57 seconds².

Okay, so everyone simultaneously burps at the loudest intensity for the longest time, all in one place. With 7.55 billion people burping at world record loudness, the resulting sound's loudness would be around 208.7 dB. To put that in perspective:

- Sounds start to be physically painful at 130 dB³.
- Eardrums burst at 160 dB⁴.
- The third blast in the 1883 eruption of Krakatoa was 180 dB³ from 160 km away.
- The loudest undistorted sound possible at 1 atm of pressure is 194 dB³. At this point, it's more useful to consider these explosions, not sounds. They're shockwaves now.
- Lungs rupture at 200 dB³. This is likely lethal.

This zettaburp is 7.4 times louder than a blast that can rupture your lungs and probably kill you. It's over 740 times louder than the third explosion of Krakatoa. That eruption was so powerful, its strongest pressure wave went around the world several times. The eruption destroyed much of the volcano's island and adversely affected the global climate for years.

Getting over seven and a half billion people in one place to burp together is probably difficult.^[citation needed] If you packed QNC's 285 000 square feet of space⁶ as densely as a mosh pit, you could fit 114 000 people. It would take over 66 200 copies of QNC to fit everyone, with QNCs lined up side by side like an Eastern Bloc housing district. This is probably also as fire-safe as one.

Despite having a mosh pit many thousands of times larger than QNC can fit, the only notable smell would be the natural odours of several billion disgusting humans. The burps themselves, as powerful and long-lasting as they are, are basically just loud exhalations. They're mainly made of nitrogen and oxygen⁷, in proportions similar to the atmosphere's composition.

However, given that the zettaburp will kill literally every person, the resulting mass of bodies will probably stink. That is, assuming that the dead people and the land they were standing on remain intact. Since the sheer power of the zettaburp makes it a literal explosion, everyone will probably be too dead to burp for the entire intended duration of 73.57 seconds. There won't be much intact of the people, nor of the land they were on.

The blast that the zettaburp creates would release about 4 gigajoules of energy, which is about as violent as detonating an imperial ton of TNT⁸. The resulting earthquake would register as a 2 on the Richter scale, which would be slightly noticeable to survivors (there are none).

Ultimately, the zettaburp will be strong enough to kill everyone and damage the ground that QNC is on. It would definitely be very loud if anyone had intact eardrums and was also alive. It's only a matter of time until the crows and the geese have a war to determine which of them gets to be the dominant species after humans. Since birds' intestines don't have the kinds of bacteria that produce gases like mammals do⁹, they'll never bother burping and inadvertently wiping out their species.

(Fun fact: in researching information for this article, I ended up adding a missing citation to a Wikipedia article. I'm contributing to the advancement of human knowledge!)

Loquatius

1. <http://www.guinnessworldrecords.com/world-records/80129-loudest-burp-male>
2. <http://www.guinnessworldrecords.com/world-records/77315-longest-burp>
3. <https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20110002902.pdf>
4. "Great Formulas Explained - Physics, Mathematics, Economics" by Metin Bektas
5. <http://www.straightdope.com/columns/read/2298/can-a-noise-be-loud-enough-to-kill-you/>
6. https://uwaterloo.ca/alumni/sites/ca.alumni/files/uploads/files/907173_magFall2012lowresNov29.pdf
7. Cormier RE. Abdominal Gas. In: Walker HK, Hall WD, Hurst JW, editors. *Clinical Methods: The History, Physical, and Laboratory Examinations*. 3rd edition. Boston: Butterworths; 1990. Chapter 90. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK417/>
8. <http://www.makeitlouder.com/Decibel%20Level%20Chart.txt>
9. <https://www.popsci.com/environment/article/2009-05/it-true-birds-cant-fart>

THE HABITUAL HORRORS

So I'm pretty well known in some circles for my interactions with the paranormal. Ghosts, vampires, demons, I've investigated them all. Armed with my only my wits and a fully charged cell phone, I brave the darkest of nights to document these disturbances in nature.

My hordes of female admirers often ask me why I do this.

I have no easy answer for them. I'm a complex person.

Some have tried to answer this question for me. Some say it is my troubled youth of excess, others say it is my lust for fame and fortune. My greatest haters say it's simply an effort to create a captivating resume point to 'cali or bust'.

Regardless, I am here now.

Inside the great corridors of the mausoleum so passionately dubbed 'MC'. Investigating the disturbed spirits of the insane.

As legend has it, this building housed 92 of the most clinically untreatable patients from the Kitchener community back in the 50s. Or something like that. Listen, I do investigations; not research. Do I look like an Arts student? Bah

As the clock struck midnight, I forced my way into this ancient grey slab. Shadows encompassed me as I struggled to open the large wooden doors. They slammed shut after I entered, sounding very much like the lid of my great-aunt Nellie's great oak coffin after she kicked the can at the ripe old age of 98.

Amazingly, the city of Waterloo had not yet shown the competence to cut the power to this building. Here's an inefficiency that Ford should really tackle.

In front of me, the yellowish corridor stretched out in front of me, beckoning me to go forth deeper into its abyss of other-worldly terror. But I knew better. The best path is the one less took, I thought with a smirk, as I turned into the main atrium. Spirits are no match for my chronically underestimated intelligence.

My face went white and I let out an audible yelp of fear as I looked down the atrium.

The atrium had several badly-lit grey tables. Probably remnants of when they let the patients have their daily hour of socialization with each other. Perched on one was the distinct silhouette of a female human staring into a box of white light.

Staring at the silhouette, it suddenly moved her head to the side slightly. I dropped my phone. It landed with an audible crash on the floor. The sound broke my stare, and also my heart – my beautiful Samsung could not have survived that intact.

I scrambled to pick it up. In retrospect, that was my flaw. I should have ditched it and ran for the exit. Mind you it was not my honour or life I was scared for – I happened to be wearing my new AirMax97s, and those are the last thing I would tolerate a ghost getting their hands on.

My phone was luckily fairly fine, only one new crack. I let out a sigh of relief.

"You okay there?" A small distinctly feminine voice called out. It sounded much too close to comfort. I raised my head slowly, reaching to my back pocket for my Taser. Feeling only air, I realized I must have left it on the bedside table of my Thursday night girl.

"Hey? You good?" The voice sounded even closer now.

"Be gone, evil Spirit!" I shouted. The silhouette had risen from her position and was making her way over to me. Black hair flowed around her acute face; a baggy sweater hung around her body. "Go back to your eternal slumber!"

Partly a reflex reaction, my hands had formed a cross I was aiming at her as if I were warding off a vampire. What can I say, I've had some close calls in the past.

Holding this signal, I moved back towards where I entered this wretched place, speeding up with each step. The silhouette seemed taken aback and stunned by my actions, which was exactly what I had hoped for. The last words I heard it murmur was something like: "I'm just studying here, I have an exam tomorrow..."

As I escaped back into the freedom and safety of the cold November night, I felt more like a human than I ever had since my encounter with the RIM Park Poltergeist. Can a human achieve actuality without confronting the fears that crippled others? Definitely no, I told myself. MC had been conquered. We will see what is next.

Descartesito



I WISH COURSES WERE FREE/CHEAPER

There are so many courses I'd like to attend to enrich my education and sometimes I hate my program but due to the sunk cost fallacy keeping me going, also I do not have the funding to take courses that I am interested in but not part of my plan. Germany is one of the most prosperous nations within the EU, thanks to social welfare created from a very developed education system. Education is a investment of human capital. People want know why their tax money was used to educate other people. Well, John Green once said that tax money spent on educating people means more saving and income later. Well, educated people would be less likely to join a gang and damage society. Less people would rely on handouts because more higher paying skilled job would be filled. Better education leads to earning more income, turns into more productivity and tax revenue. With higher supply of doctors and researchers, the high price of medical treatment will go down too (re: econ101). Therefore, even people who didn't attend college would be indirectly benefit from improving education. My English would also be marginally better.

People rightly have many concerns regarding more more funding for education. The largest one has being the freeloader problem. Germany's way to deal with it is making course and prerequisites difficult enough that you really have to exert effort if you want to earn the degree. There are some cheap or free online courses offered by large universities, but to earn the certificate you have to earn 85% or above. Why do the degrees that are too crowded like STEM get more demand yet less prestigious careers like the trades get no love? I feel this can be solved by marketing since people chose STEM because they thought of job opportunities, and the prestige that come with it. Well, if both the trades and college were accessible, with proper promotion I think this issue is something that can be solved. Another concern is "useless" degrees like nano engineering, art history, or memes. If you think a subject is too niche then I am ok with a mixed system where many niche subjects can be taught at private charter schools/academies as long as they pass government regulations. The usefulness of a skill can be subjective.

Finally if I haven't convince you enough yet. I have this case study about how Allies (include Canada) lost the fifth meme war. We once had an advantage on memes, Canadians alone were 30 million memers strong, with superior technology, infrastructure, the backing of /r/uwaterloo and the most expensive internet and mobile plan in the world. Countries like India, a third world country living in complete darkness until recently shouldn't stand a chance against us. But under the leadership of Maharaja Modi, India finally begun to electrify like Pikachu. A few years ago, rumor has it, some part of India managed to obtain dial up technology. Suddenly in early 2018, we saw a shape jump of facebook memes from India. Out of nowhere, India's main meme ship T-series overpowered the largest memer on YouTube- Pewdiepie - "king of 9 year olds" in less than 6 months. India's rise to becoming a meme superpower of 1.5 billion memers taught us a valuable lesson: We were not skilled enough in the art of

memeing, we were blindsided. They were posting flesh lasagna memes while we still beating the dead harambe memes from 2016. We never stand a chance in the meme war (weeps :() from that tragic loss we now understand...knowledge is power.

tldr: I want free stuff.

me

N REASONS WHY WE'RE BETTER THAN UOFT AT THE PUTNAM

With the seventy-ninth William Lowell Putnam Mathematical Competition taking place this Saturday December 1, we thought we'd take a look at how the University of Waterloo compares against its archnemesis in blue. Since it was founded in 1956, here's a compelling list of reasons why Waterloo beats UofT:

- UofT has never won the Putnam, while Waterloo has won twice;
- Waterloo has appeared in the top 5 teams 19 times. UofT has appeared only 10 times;
- Waterloo's top-5 Putnam streak sits at 5 consecutive contests, from 1988-1992. UofT's streak is a measly 3 consecutive contests, from 1958 (Spring)-1959;
- We have Stephen New.

whyOS

HAPPY BIRTHDAY, BONAVENTURA CAVALIERI!

Today, November 30th, marks the birthday of Italian mathematician Bonaventura Cavalieri. He developed the modern version of the method of indivisibles, called Cavalieri's principle. It states that two shapes have the same area if it's possible to make parallel slices of both objects such that each of the first object's slices has an identical counterpart from the second object.

Cavalieri later used his principle to find the area under the curve of exponential functions, an early attempt at integrals.


The integral of his rate of aging from 1647 to 2018 is 371.

Loquatus

THIS WEEK'S haltingSOLUTIONS

YOU DON'T KNOW MATH: NUMBERWANG EDITION

 5	<i>The ISO 3166-1 country code for Antigua and Barbuda</i> 28	$2^{12} \times 8191$ 33 550 336	Legendre's Constant 1
2↑↑↑↑↑12 4	 2	8128	<i>Mathematician Friedrich Julius Richelot's age</i> 210
<i>L'autoroute qui relie Saint-Bernard-de-Lacolle à Sainte-Agathe-des-Monts</i> 15	<i>How to call the police if you're in Madagascar</i> 117	 496	 56
 6	 (See footnote)	<i>What most cards in Blackjack are worth</i> 10	<i>Smallest # w/ 5 ways to be expressed as a sum of 3 diff. primes</i> 35

 = 191,561,942,608,236,107,294,793,378, 084,303,638,130,997,321,548,169,216

Numbers whose English words have three letters: 1, 2, 6, 10

Pentagonal numbers: 5, 35, 210, 117

Numbers whose English words begin with F: 4, 15, 56, 496

Perfect numbers: 28, 8128, 33 550 336, [floppy disk]

Loquatius

IMPORTANT UPDATE ON SLC CONSTRUCTION

Shit's still broken.

Fruitboy

THANK YOU.

This is in response to "Getting Out of My Head" by A CS 135 instructor in the previous issue (Volume 138, Issue 5), which I highly recommend for reading if you've ever had thoughts. Thoughts that force you into a sort of limbo where you are just the right kind of 'unable' to do any work but very able to criticize yourself for not being able to do it. Please do read it. To the author:

Thank you so much for putting those words into print. For pushing through the judge telling you that the article is a big waste of time because it is not. I—and I'm sure countless others—really appreciated it. I read it a couple of times when I was feeling anxious about the impending workload and just knowing that someone else took the time to write down a calming algorithm was priceless. My personal favourite line was the last one in the last paragraph, and I swear on Math that if there exists a paragraph that deserves to be reprinted in mathNEWS, it is this:

The next time you are feeling anxious or depressed, pause for sixty seconds and observe the thoughts that are spinning in your head. Are they all about you? Maybe it is worth trying to get out of your head too. And if you cannot manage to do so, then I hope you can be kind to yourself about that.

A CS 135 student



FROM THE TOP OF MC TO THE TOP OF FED HALL, NOW DASH AWAY, DASH AWAY, DASH AWAY ALL!

gridCOMMENT 138.6

Another term of Gridword is complete. Thanks guys for a great term! With five courses this term, my time was limited and the puzzle construction suffered a bit, but you guys still came through with a ton of submissions! Next term I'm only taking ONE course (cue sound: chorus of Hallelujah!), and I'm looking forward to using some of my extra time to stretch my puzzle building muscles. You might even see a cryptic crossword in January!

This week we had eight submissions. Two were correct, so we turn to the Gridquestion for a tiebreaker. Last issue's Gridquestion was "What's the weirdest thing a prof has ever said to you?". The runner-up this time around is also this semester's Gridword MVP Ethan Zhang. Ethan writes "How do you solve this problem? The answer is... it's difficult" - Anonymous Prof.

The winner of the final Gridword of 2018 is ACONE, who writes: "You know, I have some very strong religious beliefs.

I believe that in the beginning, the Lord said 'Let $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$ ' and from there things proceeded spontaneously." - A Chemistry Prof. Congratulations, ACONE you can come by the **mathNEWS** office MC3030 to claim your prize.

There's no prize for this Gridword, but feel free to submit your solutions if you want, just for kicks. If you feel like answering a Gridquestion too, you can answer this one: "What should the **mathNEWS** editors do to make the holidays extra special this year?"

This is an ordinally-themed puzzle. Identifying the precise theme is left as an exercise for the reader.

Happy puzzling!

yclePED

ACROSS

1. 2 OF 8
7. 3 OF 8
14. Cooling-off period
15. 9 OF 8 (and the most famous of them all)
16. _____ beef (2 wds.)
17. Friendliness, to Francois
18. 6 OF 8
19. A small village in Slovenia that Santa and his reindeer will visit
20. Australian golf tourney
22. "Bright outlook" term coined by Napoleon Hill
25. Les Etats-_____
26. Spring sound
31. A crime, with abetted
34. Pennywise was one incarnation
35. 7 OF 8
36. NHLer who played in 55-Down
38. Follower
39. All _____
40. The Twelve Days ___ Christmas
41. Acrobat from Avatar: TLA
42. 4 OF 8
43. Order of St John, for short
45. Form of transportation that might operate in Waterloo someday, someday...
46. Surrounded by a hedge
49. Swedish death metal band
54. 5 OF 8
58. "Trim more fat off", Make _____ (2 wds.)
59. Eagle, to Erastus
60. 8 OF 8
61. A small village in Romania that Santa and his reindeer will visit
62. But _____ Cold Outside! (2 wds.)
63. 1 OF 8

DOWN

1. 45, e.g.
2. Censorship-fighting org.
3. _____ tide
4. Log home
5. Entertainment industry grand slams
6. Call, as a game
7. What InSight does on Mars now
8. Altercation
9. Inattentiveness diagnosis, for short
10. "High" time
11. 100, 50, 1000, 1
12. "Beowulf," e.g.
13. Perlman of "Cheers"
17. Highly suggestive workout device
19. Rogue samurai
21. Shangahi Chinese
22. Cable for money
23. A small city in China that Santa and his reindeer will visit
24. Folie _____ (2 wds, appropriately)
26. Sack
27. The "O" in S.R.O.
28. Tennyson poem
29. An Egyptian God
30. Receive
32. Archaic word for "yearn" or "feel sad"
33. In CS, a type of butterfly network
35. Campus building, or comics label
37. The "a" in "af".
38. Behind
40. Basket material

43. A small town in Switzerland that Santa and his reindeer will visit
44. The "J" in "JBC" at Wendy's
46. IQ test inventor
47. "Would any woman?", to Cicero
48. A non-alcoholic beer, with "O"
49. A non-alcoholic soft drink, with "Mr."
50. Ga. city
51. Pat
52. Literally a nonsense word I invented to make this puzzle work. Anagram of YATE
53. WWII bad guy
55. Detr. State
56. "... or ___!"
57. Persian stringed instrument
59. Make sense, with "up"

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	53						54		55	56	57
58										59				
60										61				
62										63				

YOU DON'T KNOW MATH: NUMBERWANG EDITION

haltingCOMMENT 138.6

Hey! mathNEWS! Loquatius here! But where is... here?

♪♪♪♪ [Jake Chudnow – Moon Men]

“Here” could refer to a physical position or a time, but also the page of this issue of mathNEWS where you found this. In that case, you could say I’m back here. Hi. But also, I am actually back, as in back back, as in “I have returned.” Forward in time I come forward with a new type of puzzle for you to solve.

Back in time, check the previous page of this issue to see the solutions.

So in a way...

I’m always here.

And as always, thanks for watching.

Loquatius

HOW TO PLAY

Separate this grid of sixteen values into four stacks of four, such that every value in a stack shares a property. Watch out, though, because although some values may belong in multiple stacks, there’s only one valid way to make four stacks. The traits they share in common aren’t always mathematical relationships.

SIMPLE EXAMPLE

36	9
16	37

ANSWER

(Note how 36 is also a square number, but has to go in the other stack to solve the grid.)





9	16
---	----


square numbers

36	37
----	----

numbers whose English words begin with "th"

THAT’S NUMBERWANG!

	The ISO 3166-1 country code for Antigua and Barbuda	$2^{12} \times 8191$	Legendre’s Constant
$2 \uparrow \uparrow \uparrow \uparrow 2$	II	8128	Mathematician Friedrich Julius Richelot’s age
L’autoroute qui relie Saint-Benoît-de-Lacolle à Sainte-Agathe-des-Monts	How to call the police if you’re in Madagascar		(8) (5)
	 (See footnote)	What most cards in BlackJack are worth	Smallest # w/ 5 ways to be expressed as a sum of 3 diff. primes

 = 191,561,942,608,236,107,294,793,378,084,303,638,130,997,321,548,169,216

HINTS:

Some things to try if you’re stuck.

- Numbers n such that OEIS sequence A_n contains n
- Numbers ≥ 496
- Numbers whose English words begin with F
- Triangular numbers
- Every digit in the number is different
- Hypotenuse lengths of Pythagorean triples
- They rhyme in English
- Perfect numbers
- Numbers whose English words are three letters long
- Fibonacci numbers
- Pentagonal numbers
- Odd numbers

lookAHEAD

SUN DEC 2

MON DEC 3

Last day of classes! 🎉

TUE DEC 4

Pre-exam study day

Drop penalty 2 period ends (WF assigned, grade of 32 received)

WED DEC 5

Pre-exam study day

THU DEC 6

First day of Final exams

FRI DEC 7

Online course final exam day 1

SAT DEC 8

Online course final exam day 2

SUN DEC 9

MON DEC 10

TUE DEC 11

WED DEC 12

THU DEC 13

FRI DEC 14

SAT DEC 15

Due date for Winter 2019 fees.

Late fees for Winter 2019 begin.

LAST WEEK'S gridSOLUTION

S	T	O	M	P		O	A	S	T		J	A	M	B		
E	R	O	R			U	G	L	I		O	L	E	O		
N	U	C	L	E	A	R	E	A	C	T	O	R	S			
T	E	S	T	E	R		A	W	R	Y		H	I	C		
						O	N	C	E		S	A	B	A	T	H
I	M	P				S	T	U	D		S	O	L			
S	E	A	S			I	R	I	S		R	A	T	E	R	
I	N	T	E	R	C	O	L	L	E	G	I	A	T	E		
S	U	E	D	E		S	L	O	E		N	E	A	T		
						A	V	E		Y	O	R	E	L	S	D
P	H	O	N	E	M	E				P	I	P	S			
R	E	P				R	E	A	P		L	I	P	A	S	E
A	L	I	M	E	N	T	A	R	Y	C	A	N	A	L		
T	O	N	E			D	U	P	E		A	T	O	L	L	
S	T	E	T			S	P	A	T		L	E	A	K	S	

THIS WEEK'S gridSOLUTION

D	A	N	C	E	R					P	R	A	N	C	E	R				
I	C	E	A	G	E					R	U	D	O	L	P	H				
S	L	A	B	O	F					B	O	N	H	O	M	I	E			
C	U	P	I	T						R	O	B	I	D	N	I	C	A		
						N	S	W	O	P	E	N								
P	M	A								U	N	I	S		B	O	I	N	G	
A	I	D	E	D						I	T			D	O	N	D	E	R	
Y	Z	E	R	M	A	N				A	C	O	L	Y	T	E				
T	H	U	M	B	S					O	F			T	Y	L	E	E		
V	I	X	E	N						O	S	T	J		L	R	T			
P	A	G	A	N	I	Z	E	R		B	R	I	E	R	E	D				
I	T	L	E	A	N	E	R								A	Q	U	I	L	A
B	L	I	T	Z	E	N									D	U	L	C	S	A
B	A	B	Y	I	T	S									D	A	S	H	E	R

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