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mastHEAD

"WHAT IS A TERRIBLE LIFE DECISION YOU MADE OVER READING WEEK?"

Greetings readers! Now that reading week is over, we return once again to your regularly scheduled issue of **mathNEWS**.

The only caveat is that this production night happened to coincide exactly with the MATH 138 midterm, meaning that the majority of our authors (and one of our editors) were unable to attend, resulting in much less content than usual. That means all you readers have less delicious **mathNEWS** goodness available for consumption, but the benefit for our editors is that we have much less to edit.

This is especially important because we are right in the middle of midterms season! Each and every one of the editors (except confusED who isn't on a school term right now) is extremely stressed out, and every single second of our time that we take to do **mathNEWS** only detracts from our potential studying time. Am I saying that you need to be grateful to us for doing this? No, not at all. However, this is a plea for help because oh my god I am so tired and would really like to just sleep for a week straight instead of doing any of the things that I need to this week, grades be damned.

For those wondering about last week's **gridWORD**, sorry! staplED realized a bit too late that the numbering was fucked up, and so we do not have the solution ready for you at this time, as the **gridWORD** was unsolvable in its previous state. However, we will be reprinting the correct version of that same **gridWORD** next issue, so hold on to your horses and donkeys and assorted equine creatures because you'll have a chance to look at the clues from last issue and get a head start on figuring out all the words! Submit something, and you just might win.

I'm getting really tired of writing this **mastHEAD**, and I'm sure you are of reading it too. To make things easier on me (and harder on you), I will use the rest of this space to complain about my various parts of my life that you likely have zero interest in. I have a really bad stomachache. Huh, I guess that's my only complaint, considering how much space I have left.

Well, that's all for this issue, folks! Best of luck on your midterms, and see you next time.

itorED
Editor, **mathNEWS**

Theodore Bear	Put assignments off that I could've worked on
Totally-Not-A-Traitor	Quit heroin.
Beyond Meta	Procrastinate.
Finchey	Terrible life decision? Those three words don't exist in my vocabulary. I live for myrself, in the moment, without regrets – carpe diem, bitches.
Zethar	Evidently, deciding that I should do the **gridWORD** for this issue.
A Cute Angle	Prolly not travelling during reading week.
BMONEY	Smoking too much weed while studying = do midterms while high
Fruitboy	My dad convinced me to do Jagerbombs. Tastes like cough syrup. Unless he fed me cough syrup.
Tears For Fears	Not ruling the world because... ♫ Everybody wants to rule the world ♫
Drukqs	Not listening to enough Aphex Twin.
pirate	Arrrgh, not enough fruits. I've got scurvy now.
All UW Students	Not going to UofT for a free handjob workshop :(
MATH 138 Instructors	Scheduling the midterm at the same time as Production Night.
Fer!dun Hamdullahpur	Not holding school over reading week to compensate for the snow days.
me too thanks	Not watching Cold War :(
Epsilon Screwn	Deciding to sleep eight hours per night.
dawdling	Started watching another anime. Oh, Japan; never change.
Vesica Piscis	Actually reading?
itorED	Taking a break and enjoying myself.
staplED	Drinking many shots of ORGANIC, Oaxacan mezcal I bought two years ago at the Benito Juárez International airport. No ragrats!
terrifiED	Not studying hard enough for the MATH 138 midterm. Oh, Jordan Hamilton, why must thou maketh life so hard?

ARTICLE OF THE ISSUE

This issue's article of the issue goes to cy for the article, *Two Negatives Multiply to a Positive*! Come pick up your prize in the **mathNEWS** office, MC 3030.

itorED
Editor, **mathNEWS**

Call us Edward, cause we keep getting snowed-in!

MICHELLE ZHU, mathNEWS EDITOR FOR WINTER 2019
ALONG WITH ESTHER AHN, JAMIE ANDERSON, AND TERRY CHEN

mathASKS 139.3

FEATURING PROF. KEN DAVIDSON

FRUITBOY: FAVOURITE MATH PUN?

I like to say "The (set of) complex numbers is the only real field." Of course, it isn't a 'real field' (look it up). However this captures the sentiment that the complex numbers is the most important field. This is because it contains the real numbers and is algebraically closed. It is the right field for doing linear algebra and also my field of linear operator theory.

ZETHAR: WHAT ADVICE DO YOU HAVE FOR ASPIRING STUDENTS WHO WISH TO PURSUE MATHEMATICS RESEARCH?

Try to get a summer research experience while still an undergrad. NSERC has the USRA program. Seek out a prof you know. I have observed that students entering grad school now have a much better idea of what math research is about because of these programs.

DIOGENES: WHAT DO YOU THINK IS THE BEAUTY IN MATHEMATICS?

There are surprising connections in mathematics that link apparently different areas. The discovery of these connections is rare, but often comes with marvellous consequences. I also like clever and elegant proofs. Even in elementary material like calculus, I continue to run into new ideas. It is also wonderful that mathematics endures and maintains its importance for a very long time. Other disciplines like physics, biology and computer science are always replacing the old with an updated version. In math, if it was right 300 years ago, it is still right today (although style and terminology do change).

SANDWICHEXPERT: WHY DO YOU WEAR SOCKS AND SANDALS TO CLASS IN THE WINTER?

Winter boots are too hot to wear indoors, so I keep a pair of sandals in my office. I'm old enough that I don't have to follow fashion trends, so I keep my socks on.

DIOGENES: IS A HOT DOG A SANDWICH?

Sure — meat between two pieces of bread. I wouldn't eat it though, because I am a vegan. Also I am not a fan of soft white bread.

UW UNPRINT: ARE YOU AFRAID OF SNAKES AND/OR SPIDERS?

No, although I would be very cautious around poisonous snakes. Many years ago in Arizona, when my sons were still very young, my wife found a black widow spider on a white couch in a house we were renting. She wanted to get rid of it as soon as possible to protect the children, but couldn't figure out how to smash it on the white couch without ruining the upholstery, so she kept a close eye on it for hours. When I came home, I picked up the cushion it was on, carried it outside, knocked it off and stomped on it. Problem solved!

DAWDLING: HOW DO YOU OBSERVE NUMBERS?

I definitely like numbers. However mathematics is about a lot more. It is understanding the concepts and how they interact that is really exciting to me.

SANDWICHEXPERT: IF YOU WERE A C* ALGEBRA, WHAT C* ALGEBRA WOULD YOU BE?

Probably an irrational rotation algebra. This can also be recognized as a crossed product of a group action.

WATER: WHAT'S YOUR FAVOURITE INTEGRAL?

$\int_{-\infty}^{+\infty} e^{-x^2}\,dx = \sqrt{\pi}$. This is neat because it is a definite integral of a function that does not have a closed form antiderivative using the usual functions, but the value can still be calculated. The trick is to square it and convert to polar coordinates. There are many other ways to compute it. If you substitute $u = x^2$, you can convert this to $\int_0^\infty u^{-1/2}e^{-u}\,du$. This is $\Gamma(\frac{1}{2})$, where the gamma function is a nice analytic extension of the factorial function. Easily established properties of this function also yield the answer.

LICENSE2DERIVE: WHICH DELTA SHOULD I PICK TO MAKE MY EXPRESSION LESS THAN EPSILON?

I can't see your expression, but I assume that you are smiling. Years ago, I had a big Oldsmobile Delta 88 and two epsilons (which is what Paul Erdős called children). I don't recommend a big gas guzzler like that today. You should choose a hybrid. Perhaps you are also too young for epsilons yet. For most calculus problems that you are likely to encounter, $\delta = e^{-\varepsilon^{-100}}/100!$ should work when $\varepsilon < 1/2$.

SANDWICHEXPERT: WHAT CHALK DO YOU RECOMMEND?

Apparently you were in my class. I like fat chalk that doesn't break. A single piece lasts a whole lecture. I tried some fancy Japanese chalk once (Hagoromo Fulltouch) and it was great. I just looked it up online and apparently it went out of business last year, but Amazon still lists it. We can't get the fat chalk any more either, and I have almost run out.

SANDWICHEXPERT: IS IT TRUE THAT PROFESSOR MARCOUX LIVED WITH YOU WHILE HE WAS DOING HIS PHD?

I spent 4 months in Tempe, AZ while on my first sabbatical in 1985. Laurent came too, and shared a house with me and my family. We biked 7 miles to the university (completely flat except for a foot/bike bridge over a major road), and discussed his research progress on the way.

SANDWICHEXPERT: WHAT DO YOU HAVE AGAINST L'HÔPITAL'S RULE?

Actually I don't hate it as much as I claim. But it tends to be misused and misunderstood, so I forbid my calculus students to use it until they are ready. I like to teach better methods such as Taylor approximations.

SANDWICHEXPERT: IS THERE A DAVIDSON'S THEOREM?

There are a number of them. One important one early in my career is my Similarity Theorem from 1984. This deals with 'nests', which are chains of closed subspaces of a Hilbert space (infinite dimensional Euclidean space). My theorem describes exactly when two nests are similar in the sense that there is an invertible linear map that carries one nest onto the other. I wrote a book called "Nest Algebras" (nest algebras are the infinite dimensional analogues of the algebra of upper triangular matrices).

SANDWICHEXPERT: ARE YOU A REGULAR READER OF mathNEWS?

No, though I sometimes look for interesting prof quotes.

UW UNPRINT: IF YOU WERE A TYPE OF BREAD, WHAT TYPE OF BREAD WOULD YOU BE?

I like rye bread. It is firm and substantial, and often a bit seedy.

WATER: PICK AN INTEGER BETWEEN -2147483648 AND 2147483647 INCLUSIVE.

0. I like to keep things simple.

TERRIFIED: WHAT IS IT LIKE TO BE A FIELDS INSTITUTE FELLOW?

When I was the Director of the Fields Institute for Research in the Mathematical Sciences from 2001 – 2004, we came up with the idea of Fields Institute Fellows as a way to recognize individuals who made significant contributions to the institute and to mathematics in Canada. This was started on the 10th anniversary of the institute. When I finished my term, I became eligible and received the honour myself. I am pleased to receive the recognition.

TERRIFIED: WHAT'S YOUR FAVOURITE MATHEMATICAL PAPER?

At different times of my career, different papers have been central to what I was working on. I will pick one which has had a long life. My Ph.D. supervisor at U.C. Berkeley, William Arveson, wrote a paper in 1969 called "Subalgebras of C*-algebras". He started with some very important work of Sz.Nagy and Foiaș on dilation theory for a single linear operator and recast it in a non-commutative, multivariable context which has proven to be very insightful and powerful. It remains very important fifty years later.

STAPLED: DO YOU LIKE CATS OR DOGS? WHY/WHY NOT?

I like cats. I like dogs okay, but I have owned many cats (if owned is the right word) over the years. They are more independent than dogs, but they still have a lot of affection. My wife really likes cats and isn't into dogs. Our current cat, named Smudge, is 12 years old.

CONFUSED: WHY?

This is very open ended. I think that we should stop here.

A FUNDAMENTAL PROOF

profTHOUGHTS *139.3*

I'm going to prove the Fundamental Theorem of Algebra. This states that every non-constant polynomial with complex coefficients factors into a product of linear terms. While this is evidently an algebra statement, most proofs use analysis. Indeed, a purely algebraic proof is both very difficult and quite artificial. I will present a simple proof that only depends on the Extreme Value Theorem: A continuous real-valued function on a closed bounded subset of the plane attains its maximum and minimum value. There are several nice proofs of this theorem using different approaches. This is basically taken from my MATH 145 Notes (with some typos fixed).

It suffices to show that every non-constant polynomial has a root. If $p(z)$ has a root a, you can factor out $z - a$ from p and reduce its degree. A routine induction argument completes the task.

Let $\mathrm{p(z)}=\sum_{i=0}^{d} a_i z^i$ be a polynomial of degree $d \geq 1$. Suppose that p has no root, so that $p(z)$ is never 0. Notice that

$$\lim_{|z|\to\infty} |p(z)| = \lim_{|z|\to\infty} |z|^d \left| a_d + \frac{a_{d-1}}{z} + \frac{a_{d-2}}{z^2} + \ldots + \frac{a_0}{z^d} \right| = +\infty$$

since the second factor tends to the finite non-zero limit $|a_{\mathrm{d}}|$ and $|z|^{\mathrm{d}}$ tends to infinity. Therefore there is a large real number R so that $|p(z)| > |a_0|$ for all $|z| > \mathrm{R}$.

By the Extreme Value Theorem applied to the continuous real valued function $\mathrm{f}(z) = |p(z)|$ on the closed bounded set $\{\ z \in \mathbb{C} : |z| \leq R\ \}$, there is a point z_0 so that

$$|p(z_0)| \leq |p(z)| \text{ for all } z \in \mathbb{C},\ |z| \leq \mathrm{R}.$$

But for $|z| > \mathrm{R}$, one has

$$|p(z)| > |a_0| = |p(0)\ | > |p(z_0)|.$$

So $|p(z)|$ achieves its global minimum at z_0. To simplify the computations, replace $p(z)$ by the polynomial

$$q(z) = \frac{p(z + z_0)}{p(z_0)}.$$

Notice that $q(z)$ is also a polynomial of degree d which is never 0, and q takes its minimum value 1 at $z = 0$. That is,

$$1 = q(0) \leq |q(z)| \text{ for all } z \in \mathbb{C}.$$

The constant term of q is 1. Let b be the next non-zero coefficient, so that

$$q(z) = 1 + bz^{\mathrm{k}} + \text{higher order terms} = 1 + bz^{\mathrm{k}} r(z)$$

where r is another polynomial such that $r(0) = 1$.

Since $r(z)$ is continuous, there is a real number $\varepsilon > 0$ so that

$$|r(z) - 1| < ½ \text{ for } |z| \leq \varepsilon.$$

Choose an angle θ so that $be^{ik\theta}$ is a negative real number. (One can take $\theta = (\pi - \text{Arg } b)/k$.) Set $w = \varepsilon e^{i\theta}$. Because of our choice of θ, one has $bw^k = -|b|\varepsilon^k$. By replacing ε by an even smaller positive number if necessary, we can also suppose that $|b|\varepsilon^k < 1$. Let us also write $r(w) = 1 + u$, where $|u| < ½$. Then:

$$q(w) = 1 + bw^k r(w) = 1 - |b|\varepsilon^k(1+u) = (1 - |b|\varepsilon^k) - |b|\varepsilon^{ku}.$$

Hence

$$|q(w)| < 1 - |b|\ \varepsilon^k + |b|\varepsilon^k/2 = 1 - |b|\varepsilon^k/2 < 1.$$

This contradicts the fact that q has minimum modulus 1. So the assumption that p has no root must be false.

Prof. Kenneth R. Davidson

N WAYS YOU COULD'VE SPENT YOUR READING WEEK

- Go on vacation
- Go home for the break
- Catch up on homework
- Prepare for upcoming midterms (maybe finals? if you are really keen)
- Go to a concert
- Hang out with friends
- Maybe actually read?
- Go see a movie
- Binge watch something
- Spend Family Day with your family
- Pray for more snow days
- Realize February is the shortest month of the year
- Try to figure out what to do after school

A Cute Angle

I'm not a mathematician, I'm a statistician, which is better.

PROF. MICHAEL WALLACE

THE MINEFIELD OF MINESWEEPER

Last month, one of the various Discords I am part of became weirdly obsessed with Minesweeper. The actual focus of_this Discord is actually about a specific Korean web novel. At first, everyone was focused on classic Minesweeper, but quickly branched off to some more exotic versions, like Hexagonal Minesweeper or 3D Minesweeper. The hexagonal one was fairly simple.

The 3D Minesweeper hurt everyone's brain and everyone else gave up on the challenge. I however, was looking to procrastinate from the soul crushing grind of job searching and quickly became obsessed with becoming good at it.

I stared into the abyss of squares and numbers 'til I could see the shadow of God. If you too want an excuse to procrastinate instead of doing the work you need to do, the link to it is found below.

egraether.com/mine3D

Beyond Meta

SPORTS ANIME FAN DISAPPOINTED BY THE REAL DEAL

This last week, a die-hard sports anime fan somehow ended up attending a real-life sporting event. What they found was not what they expected. While the graphics were definitely an improvement from the 2D, however, the field of view for the sporting event was much greater than the one in the anime. It was a lot harder to follow. It was also a lot harder to identify the main characters as all the people involved were kind of normal looking. No one them had any special skills they could dish out.

The plot of the event was badly paced with one team taking the lead and the other team never overtaking that lead even in the last quarter. It was rather disappointing. Additionally, when a point was scored, there was no slow motion capture of the moment. It was really hard to identify which moments were supposed to be important. The lack of opening and closing songs was also a huge disappointment.

The anime fan has thankfully made it safely back to his waifu after this traumatic experience.

Beyond Meta

YOUR MARCH HOROSCOPES ARE HERE, YOU BEAUTIFUL BITCHES

ALTERNATE HEADLINE: MERCURY'S IN RETROGRADE, AND YOU KNOW WHAT THAT MEANS.

Hello hello, my dear readers. Guess what? This hawt-off-the-printing-press issue of **mathNEWS** currently being cradled by your fleshy hands (or beaming directly into your retinas via thousands of microscopic LED lights if you're one of those gone-paperless, *tree-hugger* types. Yes, we do publish every single issue online, ya know) is gonna be published on the first of March. And that, like, never happens. It's about as rare as a blue moon by my calculations. You can check the math for me if you've really got nothin' better to do but I'm probably right.

Essentially, due to the fortnightly nature of this publication, it's not often that an issue drops on the first day of a month. Prime horoscopin' time, I say. I'll admit, I know jack shit about astrology (despite the fact that I'm taking SCI 238 this term. Sorry Professor Afshordi, if you're reading this. Feel free to flay me at your convenience). But I just love **you** so much, dear reader, that instead of studying for my very important midterm that's in, like, two hours, I wrote this lovely article for you. I was armed with nothing but a shit-ass WikiHow article on "How to Write Horoscopes", a Google search on the meaning of "mercury retrograde", and my own gift for clairvoyance, and yet, in the final analysis, I think I managed to do a fabulous job. Whaddya' know — might be giving Susan Miller a run for her money.

Let's get this party started.

ARIES (MARCH 21–APRIL 20)

Hello there Aries! My feisty little ram. The probability of your birthday being on this month is about one in three. That's pretty special. Don't feel *too* special though — with Mercury up to no good for the majority of the month, you oughta take it slow. Think about what things you wanna do very carefully before you do them. The post-midterm, pre-final season is ripe time for self-reflection and taking stock. Haven't exactly been crushing those quizzes and midterms so far? Did V-Day get you down? Don't worry Aries, I believe in you and the boundless potentials you hold within yourself. Take the time in March to form your game plan — and emerge in the spring dew of April anew and reborn like the premature fetus of a wild mountain goat in the valleys of Peru.

TAURUS (APRIL 21–MAY 21)

Ah, Taurus, you lovely ungulate. Time's been moving so slow and yet so impossibly fast this year, hasn't it? Whatever stage in life you're currently at — a baby-faced froshie reminiscing about O-week days only half a year ago, or a wizened upper year in their 4B term getting ready begin a new chapter in the storybook that is life — it's hard to not get caught up in wistful nostalgia. But I ask you, Taurus, to challenge yourself this month: don't allow yourself to overly dwell on the past, but think instead of what lies ahead. Keep your options open and embrace spontaneity, for life is as rich with as many possibilities as there are stars in our universe and grains of sands on our beaches (see, Professor Afshordi, I *do* pay attention to your lectures sometimes!).

GEMINI (MAY 21–JUNE 21)

Gemini, how's it going? Had a rough February? Whether you did or did not, I just know you're ready to tackle March with everything you've got. That's one of the strengths I admire in you: your truly inimitable adaptability. You're not afraid of change and growth at all. Although, just like your ruling planet Mercury, you might find that the other signs are unable to keep up with or are put off by your energy. You're not as superficial as they all say, Gemini, but try to reach out to those around you — your friends, coworkers, acquaintances. Let them know you care about them.

CANCER (JUNE 22–JULY 22)

I'm not gonna make a cancer joke here, my cherished crab. For one, I actually have a sense of humour. And I know you're tired of the jokes — in fact, you've been feeling very tired in general. It may be emotional exhaustion. Cancer, I know you love to look after others. You're an empath after all. But when you're in a Boeing 747 over the Bermuda Triangle, hurtling down, down, to your watery doom below, and the little yellow oxygen masks pop down from the compartment above your head — what do the little words on them say? *Put on your own oxygen mask first before helping others.* Remember this mantra, Cancer, and keep those words close to your heart like a plutonium pacemaker. It may not be pleasant to think about, but it's what keeps you alive and kicking.

LEO (JULY 23–AUGUST 22)

Leo, don't you know how handsome your lovely golden mane looks today? Such luscious locks. Your radiance will be the inspiration of all the signs this March. After all, the first day of spring will be on the 20th; your ruling planet, the Sun (which technically isn't a planet but *shhh*, it'll be our little secret) will be making its long-awaited return after many months of cold and shivering. Due to downtime from exams, March is the perfect time to let loose and have some fun with friends or loved ones. Take the lead this month to explore and even deepen your relationships with others — especially those you've recently met. And look forward to an equinoxal epiphany, dear Leo, about a certain someone... (oh, you *know* who I'm talkin' about).

VIRGO (AUGUST 23–SEPTEMBER 22)

Working as hard as ever, Virgo? If you're in co-op, rankings should be out on their way today — perhaps you've managed to see them already, before you picked up this issue. Priorities, amirite? You've worked so very, very hard towards your goals

over the past month. Why not live in the moment for a bit and give yourself a little break this March? I'm telling ya, you deserve one, even if you don't think you do. Frame it like this: you don't wanna get burnt out before the end of April now, do you? So cutting yourself some slack and having fun is actually better in the long run. Keep your head up, Virgo, there's only one month left to go! ("Wow, Finchey, *two rhymes in a row*?" Yeah, yeah, dear reader, I already know).

LIBRA (SEPTEMBER 23–OCTOBER 22)

Libra, you absolute delight. Who doesn't love your romanticism and easygoing charm? No one, that's who. Venus will still be in transit across the Sun (or something like that) for the first third of this month. Use that positive energy to spread joy to others. Treat a friend with an uptown lunch date. Compliment a stranger from one of your classes. The possibilities are endless, and I know you're already brainstorming them as I speak. But for the latter part of March, once Mercury begins its retreat across the sky, you may find that unpleasant reminders of the past will start popping up all around you in the most unexpected of ways. Keep your kind spirit strong, Libra. Although you can't change history, you should never waver in your belief for a better, brighter future.

SCORPIO (OCTOBER 23–NOVEMBER 21)

Feeling like you've been livin' on a prayer, Scorpio? Think about it — we're over halfway through this term already, yet you can hardly wait for it to be over. New terms, whether school or work, always come with a flood of new things — new environments, new routines, new expectations, new people. But the experience can be overwhelming, even threatening. Do you ever feel like the entire world just seems like it's conspiring against you? It's tough not to feel resentful and closed off sometimes, but we've all been there. You're not alone, scorpion. Consider opening yourself up to someone you know. Test the waters, of course, but don't be self-sabotaging either. You may be outwardly armed with poisonous barbs, but I know that within you lies a vulnerable, human soul.

SAGITTARIUS (NOVEMBER 22–DECEMBER 21)

Sagittarius, my dude. You're usually the life of the party, but I can tell that something's been bothering you lately. It's not like you're in crisis mode or anything, but instead you've had small, nagging doubts in the back of your head that you just can't shake, like a catchy 80's synth line you heard once on 99.5 KFUN in your friend's 2008 Toyota Corolla CE (with the 4-speed automatic transmission and power windows). Just like a song that's stuck in your head, you've been trying to not give too much attention to these thoughts, lest they grow and consume you. However, the retrograde of Mercury this month will bring these thoughts to the forefront — you'll need to confront them head-on. You can make peace with yourself, Sagittarius — I know it.

CAPRICORN (DECEMBER 22–JANUARY 19)

Hi, Capricorn! What's been going on lately? I'm sure you're as on top of things as ever. You *are* the most responsible and disciplined of all the signs, not to flatter you or anything. Oh, what the hell, I'm totally flattering you. You deserve it! You've made a lot of progress so far this term towards your goals, but then Mercury has to barge right in and mess it all up, right? I feel ya, my good goat. You've been uncertain about the path in life you've been taking recently; these feelings will only amplify come the Ides of March. Although it may be frightening, I really want you to sit down with yourself and think over your goals for your future — your hopes, your dreams, the whole shebang. Emerge from this period of transience with a clearer direction in life that's truer to who you are.

AQUARIUS (JANUARY 20–FEBRUARY 18)

How has your day been so far, lovely Aquarius? I know you're not one for small talk though, so I'll just cut straight to the chase: March has got some great things in store for you. Mars'll be doing something funky in the sky — I'm not sure what exactly, but I *do* know that it means increased passion, ambition, and perseverance for you. You're gonna be on a roll this month. Side projects? Assignments? Personal pursuits? All done with inimitable Aquarius gusto, but all of this comes at a price — there's no such thing as a free lunch, after all (employer info sessions don't count). Your red-hot energy may come off as off-putting or even aggressive to others. Maintain awareness of your surroundings and be sympathetic to others.

PISCES (FEBRUARY 19–MARCH 20)

And last but *most certainly* not least, Pisces! My fabulous fish! I'd just like to say, happy birthday! Even if it already passed in February. I didn't write a horoscope article then, so I get to make up for it now. Pisces, this is *your* month. So many good things are in store for you, I'm just gushing with excitement thinking about it. But I can't say it all here — that'd spoil the surprise. Not even Mercury's gonna get you down. Let me just say this: Lady Luck will be on your side this month. You'll find yourself encountering many happy coincidences; the world will be warm and welcoming. Most importantly, something *momentous* related to the one thing you desire above all will happen in March. What? When? And why? You'll have to see for yourself, love.

Finchey

I read mathNEWS devoutly.

PROF. STEVE FURINO

profQUOTES 139.3

STAT 241: MICHAEL WALLACE

❝ Poutine with sweet potatoes is abomination.

❝ I originally wanted to be a professor in pure math, but then I realized that's way too hard, so I became a statistician instead.

❝ I have just made a mistake in my algebra, but it doesn't matter because this is statistics.

❝ When I was young and naïve and argued on the Internet…

❝ I realized when preparing today's class that it was Valentine's Day, and so I thought I would go on the internet to try and find funny statistician valentine cards, but they all just made me kind of angry, which I suppose is in many ways what Valentine's Day is supposed to accomplish.

❝ We won't be using these in this course mainly because we don't need to. These are largely a relic of the past, it's good to have used them in the same way it's good to have eaten broccoli or something like that. Well. I mean, broccoli is nice anyway, but pick a vegetable you don't like that is healthy, that's what probability distribution tables are.

❝ You'll almost certainly know by this point in your mathematical careers, that the number two is the greatest enemy of all of us. It's certainly the greatest enemy of algebra, because if you haven't had a problem where you got to the end and you're off by a factor of two, you haven't lived as a mathematician in my book.

CO 789: DOUGLAS STEBLIA

❝ If I die before the end of the lecture, please let the secretary know.

ENGL 119: CLIVE FORRESTER

❝ Canadians are much more intelligent [than Americans]

❝ … who apparently is such a good professor, so caring and nurturing, that you guys decided to call him Daddy Jao

❝ You just want to smoke a weed right now.

PMATH 334: ZACK AS SUBSTITUTE:

❝ If my mom calls me Zack and my father calls me "disappointing son", you know that both of those terms mean the same thing.

CS 136: ALICE GAO

❝ So now this number [8675309] is burned into your memory. Etched into the deepest part of your memory.

CS 246: ROB HACKMAN

❝ Initializing a variable is like losing your virginity. You CANNOT go back!

❝ I should be proud that I came up with that analogy.

❝ A lot of efficiency in C++ is based on theft.

❝ Can anyone tell me how object A lost its virginity?

❝ Assuming that I didn't write any bugs… which is a big assumption.

❝ Wow, we have managed to print out the contents of a list in linear time… WE ARE GODS!

❝ Use friend sparingly. Have as few friends as possible. It's a good advice for life as well.

❝ If you have too many friends and you have to do stuff all the time, when are you gonna get your work done? Do your CS246 assignments!

❝ Don't do your CS246 assignments with your friends though… that's cheating!

❝ Put in your notes a pointer that points to the repository.

QIC 890: RICHARD CLEVE

❝ You agree with me that the graph below is the same graph, and it's planer right, which means a contradiction right … (draws an extra edge on the board after that) … no, the proof is correct.

CS 146: BRAD LUSHMAN

❝ This is worth knowing, but isn't something you should do all that often. As in ever.

❝ The heap is not a heap.

MATH 136: DAN WOLCZUK

❝ I have bad news. There's no class next week. (Students start clapping) Hey!

❝ We will talk about the Four Fundamental Subspaces of a Matrix, putting the "fun" back into "mental".

❝ You do, must have to, absolutely need to know it!

❝ Yeah, I can read lips. You wouldn't believe the things I've seen people say about me, it's terrible.

❝ When I was an undergrad, 2 times 3 was always equal to 5.

❝ A vector could be a cow with a hat.

MATH 146: ROSS WILLARD

❝ Prove this by waving your arms and not saying anything.

❝ Ross: "Any questions?"
Student: "Who cares?"

❝ Let's just apply our eyeballs.

❝ Theorem: No.

❝ This is true, but irrelevant.

RATING BUILDINGS ON CAMPUS BY THE FIRST THING THAT COMES TO MIND ABOUT THEM

MC: The home of **mathNEWS**, as well as the hub of most mathematical education on campus. As well, the fantastic C&D, and the ever so cozy Comfy Lounge. However, the water from the fountains is kinda gross. 9/10

M3: There's that neat colourful sphere thing in the middle of the first floor, interesting to look at but kind of in the way. 7/10

DC: The architecture is neat and colourful, but it's an awkwardly shaped two-piece building. 6/10

SLC: **SHIT'S STILL BROKEN.** 1/10

QNC: The building's got a fancy hex pattern on the outside, but the doors are heavy. 5/10

B1/B2: They look the same and I don't know which is which, but one of them has a bunch of skeletons in there and that's pretty spooky. 6/10

EIT: From fossils, the mineshaft in the basement and the little great-lakes puddle too. That place is cool. 10/10

PAS: Literal rat maze. If you ever want to get lost and cry yourself to sleep, here's the place. 1/10

RCH: The giant round lecture hall is cool but I actually managed to get a 0% on a test there. Bad memories. 4/10

PAC: Squash is fun but my exams aren't. 3/10

HH: Like stepping through time — there's the older half and newer half. It's pretty cool. 8/10

Fruitboy

N THINGS PEOPLE HAVE SAID IN THE mathNEWS OFFICE

MOSTLY VERBATIM. DON'T @ ME, FRIENDS.

- "What's a fleshlight?"
  Get a dildo. What's the dual?
  "Got it."
- "[REDACTED], have you slept in the office before?"
  Yeah.
  "Did you shower after sleeping overnight?"
  [Pause] No.
- "Would you rather have him sweat all over the classroom?"
  Better than him towelling his own head. It's weird.
- "What the hell? They got the IPA all wrong. Someone check the IPA charts."
  It should be /smaɪl/, not /smahyl/.
  "/SMAHYL/!!!!"
- "Hey, you can't say you don't know many white people! Me and [REDACTED] make a whole white person!"
- I just want to grad school where water stays liquid.
- [REDACTED] did an impression of [REDACTED2] doing an impression of [REDACTED].
- "How do you pronounce coq?"
  Isn't it /kɑk/? Some people pronounce it as /koʊk/, don't they?
  "Fuck it, we all know it's pronounced /kɑk/."
- ... someone who is beautiful and tolerable in general behaviour.
- I wish I took NLP instead.
- NLP.
- N...L...P...

staplED & friends

N WAYS TO COOK A CHICKEN

- Bake for 1.26e7 milliseconds at 463.706K
- Put it in the microwave and hope for the best
- Give it to the caf and hope the result is edible
- Go home and have your mother cook it for you
- Place 1.27瘌 of Oxygen-22 at centre of chicken and wait until fully decayed (yes I did the math)
- Yol-Toor-Shul !!!!
- Slap at approximately 1665m/s
- Play my mixtape

Yonathan

WHY THE ENGINEERS' HELL WEEK IS ANYTHING BUT

Hello Mathies. Perhaps you have heard the phrase "Hell Week" whispered as you walk through the cold halls of an engineering building—E3, perhaps, or RCH, with their empty C&D-less floors. Perhaps the words came to you from a "friend" in engineering, mentioned in passing during a discussion of midterms; an assertion of superiority. What this elusive phrase refers to is a scheduling circumstance which some engineering years and programs are subject to having all their midterms taking place within a single week. Sounds brutal, doesn't it? It may not be as bad as you think.

Perhaps the phrase came about in a chance conversation not unlike this:

Math Student: When's your next midterm? Mine's on Monday, and then I have one on Thursday too!

Engineering Student: Well, I have one Monday...

The engineer pauses and takes a moment to causally flex...

Engineering Student: *[while continuing to flex loudly]* And Tuesday, and Wednesday, and Thursday, and Friday.

Math Student: Wow! This week must be *Hellish* for you engineers!

Engineering Student: *[with a face-splitting grin]* It absolutely is. You might even say it's a *Hell Week*!

What you might not know about Hell Week is that it's a little more than just five or six midterms stacked next to each other. There are perks which have been arranged for engineers which allow them to simultaneously share their academic difficulties with their peers while having a better midterm-writing experience than any other faculty. How could this possibly be accomplished, one asks?

ONE: CLASSES ARE CANCELLED DURING HELL WEEK.

While the rest of us have to juggle classes, labs and assignments with midterms while praying for a snow day to alleviate our work, engineers, who have no classes during Hell Week, can focus solely on their midterms. There's no new content to digest, or assignment problems to worry about. Just all the time in the week one could ever want, for studying, or partying (haha) or complaining about your struggles to other students.

TWO: HELL WEEK HAPPENS RIGHT AFTER READING WEEK.

As if an entire week without classes wasn't enough, the midterms of Hell Week occur immediately after Reading Week, providing engineers with even more study time. Other courses have midterms at times that aren't actually in the middle of the term, or even multiple midterms. It's pretty difficult to utilize Reading Week to study for a midterm that happens before it! (Unless you have some type of time-travelling device, but if you do, then there's probably more important stuff to do than to attend classes and study.)

THREE: HELL WEEK IS ONE AND DONE

Perhaps there's an argument for the benefits of having midterms spread out throughout the term, but after Hell Week, engineers no longer need concern themselves with anything significant in terms of academic marks until finals. There's no midterm every week or two, forcing you to refocus your attention, or dragging you away from a **mathNEWS** production night. Imagine how much more content would be written if midterms didn't steal some of our writers away every night!

In conclusion, keep this article close the next time an engineer attempts to challenge your academic self-confidence by flaunting Hell Week. At the end of the day, they may very well have less to complain about than us.

CC

N REASONS TO NOT DATE MATH PEOPLE

- They smell
- They will push you off a cliff if you say "$-\frac{1}{12}^{\text{th}}$" is or is not the sum of the natural
- They will make things complex if you don't set the proper bounds outright
- They have no money to bring you on dates
- Their entire field is based on being pedantic
- They base their entire life on being pedantic
- They share a department with CS students which cannot be healthy
- I mean, just imagine the smell oh god...
- They will constantly make the same math jokes for years
- Example: look at the recurring jokes in **mathNEWS** but instead of bi-weekly, it is every second
- LITERALLY JUST SMELL ONE OF THEM

Totally not a traitor

ANOTHER HAIKU FOR YOU

I saw Red Velvet

Live and performing on stage

I have ascended

Herbie

THE RANDOM BALLOT — EVERYONE'S VOTE COUNTS

Democracy is preferred over other systems of government in part because it treats everyone equally - no matter your wealth, background, or social class, everyone gets one vote. However, even ignoring various ways people have been disenfranchised thought history, the very voting system we use prevents this from ever being the case.

To see this, suppose you move to a new electoral district. Due to you moving, how much more likely is it that your preferred candidate will be elected?

For any deterministic voting system, this question has an easy answer — assuming no one else's vote changes, there are two possibilities. The first is that nothing changes at all; your preferences make exactly zero difference in how the district is represented. The second happens if your favourite candidate was tied for first place before you moved, in which case your vote has decided the election by itself. Neither of these scenarios seem very democratic; one person's vote shouldn't count more or less than anyone else's.

We can view this same problem from the perspective of a political party, instead of an individual voter. Suppose your party only has 48% of the popular vote, compared to the other party's 52%. Can your party still win the election? If every 12 of your voters counted for 13 of your opponents, you might have a chance. While this seems to contradict the principles of a democracy, in most modern democratic states, you can eke out a win.

The key to understanding this is voter efficiency; that is, the average number of your party's candidates who are elected for each person who vote for your party. In the above example, if your voter efficiency is over $13/12$ times that of your opponent, your party will win the election. To illustrate how this can happen, consider a country with 9 electoral districts with 100 people each. If your voters are split evenly, 48 per district, you will certainly lose (in fact, you'll lose every seat, also a very undemocratic result). If instead you have 51 voters in each of 6 ridings, and 42 voters in the remaining 3, you can win ⅔rds of the house and take complete control of government. If 51 of 100 sounds like too close of an election to you, 6 districts with 55 voters and 34 voters in the remaining 3 also works; you can even win 8 of the 9 districts with 54 supporters in each, although your opponents will take the last district 100-0.

If you win 6 seats, your 432 voters have an efficiency of about 1.4% (72 voters per seat), while your opponent needs 156 voters per seat (an efficiency of about 0.64%). This means that overall, your supporters votes counted for more than twice as much as people who voted for your opponent. Specifically, it is voters whose candidates win, and who live in close ridings, who are most efficient - the closer the race, the better for the winners (of course, if your candidate loses, your vote elects 0 candidates, so it counts for 0). A party who has a candidate elected 51-49 has "spent" 51 supporters to get that seat, while a landslide 75-25 victory "costs" the party almost 50% more. This is bad enough when it just occurs by chance, but gerrymandering (a topic for another article) allows parties can create situations like this intentionally.

Some electoral systems — known as proportional systems — help prevent this by ensuring that the number of seats each party has matches the portion of voters which support that party as closely as possible. While this seems to work on the level of the country, it doesn't really fix the problem — the mover's problem from above still applies as far as their local representative is concerned.

In fact, this problem is impossible to solve if you insist on a deterministic voting system, since when you move to a new district, either your candidate now has more votes than the opposition, in which case they win, or they don't, and they lose. In order for each person's vote to count equally, when you moved to a new electoral district of, say, 10000 people, your candidate would have to win $1/10000$ more seats in the next election. The random ballot is the only system that makes this possible.

In the random ballot, one voter is chosen from each riding uniformly at random, and whichever candidate they voted for wins the riding. When using the random ballot, if one person in a district 100 changes from voting for candidate A to voting for candidate B instead, candidate B will be 1 percentage point (pp) more likely to win, and candidate A 1pp less. If B's campaign flips 10 people, then B will be 10pp more likely to win, and A 10pp less — always exactly proportional to the number of people voting for them. This solves the problem above; everyone's vote always has the same impact on the probability of their candidate winning (in other words, on their expected value of seats). In a district of n people, your vote (and the vote of every other voter) always increases the probability of your candidate winning by 1/n. This feature alone, something no deterministic system can accomplish, is reason enough to use the random vote; anything else is not truly democratic.

Octopodes

Production Nights are every other Monday. We meet at 6:30 in the MathSoc Office.

Please come...

A LONELY mathNEWS EDITOR

YOU DESERVE IT

So, you're taking a break to read these articles. That's good, you need it. You're probably relaxing wih your feet up, because midterms are mostly over by now (this issue's pretty thin because Calc decided to put a midterm on production night). This school is demanding, and sometimes you have to take the time off to keep yourself sane level-headed.

Going through my first year here has been a real struggle for me. Going from one of the top in my school to being a somewhat low-average student here has been a total turnaround, and if I'm being honest it's begun taking a toll on my mental health. The school is stressful, the work is much harder, you're probably broke, the place is huge, and I've struggled to make literally any friends here because I was working during frosh week.

I'm sure many of you share at least a few of these dreads that I experience, and may have your own issues too that I either neglected to mention or personally haven't run into. This stuff isn't fun to deal with, but you have to remember that it's not worth the gains for you to completely throw out the next four years of your life for a degree.

Remember, this school is very high-demand, especially in the Math and Engineering departments. I was scared because I dropped heavily from being one of the top of my school, but it helps to keep in mind that most of the other people in your class were also the top of their schools. And their schools had them in the advanced classes. Yikes.

It's easy to get completely invested in having the highest grade you can obtain, but you have to remember too that if you're just looking for a regular job, the likelihood that they'll scan over your complete transcript and reject you despite you completing your degree is slim to none. They only concern themselves with the words "degree obtained".

So, the difference between an '80' and a '69' on that transcript, although humorous, won't make much of a difference in the long run. You'll still get the degree which can still get the job. This means you can still live your life outside being a student! Take the night off from studying! Go play video games or hang out with friends. Or visit your family. Or at the very least, take an hour break, head to the bar and go get a beer with a pal (provided you're n years old, $n \geq 19$, and that you have a pal that meets the same requirements).

Just be you for a night or two. It's not like your math is going to run off in the night, not to be studied again. You'll have your chance tomorrow. But please, don't forget to be yourself and live life sometimes.

Fruitboy

CHARACTER ANALYSIS OF NARUTO SHIPPUDEN

SPOILER WARNING.

So after 3 months, I finally have a followup of my previous Naruto character analysis since I got decently far into the Shippuden series.

NARUTO

As the main character, obviously his personality changed immensely. He still has the same feelings for Sasuke as he felt he worked hard to build a brotherly bond with him. He became a lot more mature and doesn't do his sexy justsu anymore. He learned a lot of techniques and got influenced by Jiraiya's goal of peace. He sorta figured out how to do strategic combat, unlike when he was younger where he would just jump in first without any thought or plan. He's much closer to achieving his goal of becoming Hokage.

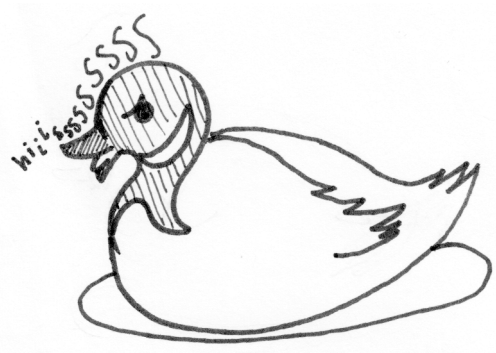
SAKURA

I used to think Sakura was really useless back in the first Naruto series. Near the end, she became really mature and learned medical ninjutsu. She also finally learned how to fight as she was under Tsunade. She still maintains the mentality of protecting others. She still has a thing for Sasuke but more of a familial love instead of a crush.

SASUKE

Once Sasuke ran away in search for power from Orochimaru, he managed to learn many new techniques. After he left Orochimaru, he finally faced his brother Itachi. However, we were deceived and thought his brother was going to kill Sasuke the entire time. It turns out Itachi wanted to give Sasuke his ocular powers as he believes Sasuke can surpass him. He seemed to become a fearless leader with good strategic decision making.

Teemo



RANKING ALL 0 TO 10 RATINGS

1: 8/10. 8 is a fantastic rating to obtain. Although you're passing the given examination with a great score, you still have work you can put in. Constructive criticism is critical for the development of any project, and 8 shows you did really well and still saves some room for improvement.

2: 6/10. Although you had some problems, you passed with over a 50%. You met the basic requirements for the given rating, as well as adding a small bonus to get that extra point. However, there's more that you need to obtain in addition to your contributions, meaning there's more criticism against you.

3: 3/10. Yes, 3 isn't great. You failed the rating by getting less than half, BUT there were good elements there. Unfortunately, the benefits of this rating is all brutal honesty. Your work has a good base, but you need to take it to the next level if you're looking for success.

4: 9/10. Similar to 8/10, this is a good rating to get, but there's less error in your work. The problem with obtaining this rating is that you're left with the feeling of "so close", and the need to do so much more next time to make up that one point.

5: 2/10. Similar to 3/10. You have a decent start, but you need to put in a lot more work if you want to go the extra mile. This rating, however, is worse in that you got less correct, and need to contribute even more to the project to pass the next time around.

6: 1/10. Again, there's something slightly right about your performance. It's brutal honesty that you need to turn around your way of thinking. This is a red flag that you probably need to re-evaluate your methods.

7: 7/10. This is a pretty bland rating, in my opinion. The mathematical equivalent of asking someone if they like your gift and they say "It's ok". It's very common, and many people tend to use it as an "easy way out" rating when they like something but want it to be better without knowing how to improve it.

8: 10/10. Now you may think this is the best rating, but there are problems with it. It's super easy to give something 10/10 just because you like it, without really giving insights into what's being rated. The rating gives absolutely no room for improving the project, and sometimes can just be used as an ego boost or corporate ball-fondling.

9: 4/10. You had contributed enough to this project to get a few points on your score, but you couldn't meet the halfway point for the rating system. You have to get it together and build the project up from a better base.

10: 0/10. Did you even do the project? Good lord, at least remember to do the project next time. This isn't constructive in any way — it's just outright wrong. This score stings the heart, gives you nightmares and makes you cry yourself to sleep. Tragic.

11: 5/10. Really? A 5 is not helpful. It's the equivalent of asking someone to be honest about your project and they say "meh". It's the equivalent of the Colosseum, when instead of a thumbs-up or thumbs-down, the gamemaster holds his thumb sideways. It's the equivalent of flipping a coin and having the coin land on its side. It means nothing. Really? 5? I'd rather not receive a rating. If someone rated one of my articles with a 5, I'd feel obligated to change my pseudonym and arrive at **mathNEWS** in a ski mask. 5. Unbelievable.

Fruitboy

NEW MATH DEGREE REQUIREMENTS STARTING 2020

Every UWaterloo student should come out of university as a well-rounded individual — they should not come out too thin, too thicc, or too rectangular. Hence, the university has decided to implement additional requirements to ensure the smooth curvature of graduating students, starting next year. Here they are:

- 0.5 units of **mathNEWS** (1 term of writing for **mathNEWS**)
- 0.5 units of dating (1 term of being in a relationship)
- 4.0 units of abstaining from goose-based food
- Maximum PD mark of 51%
- Ability to recite the Variables alphabet (aka the Greek alphabet)
- Elementary grasp of official language of UWaterloo (aka Mandarin*)
- Instructor endorsed answerer on Piazza
- Celebrity endorsed answerer on Piazza
- Published an obligatory PD post on the r/uwaterloo
- 4A Menlo Park btw

But most importantly students should fulfill 4.0 units (all 8 terms) of having fun, being happy, and keeping their mental health in check. After all, coming out intact and getting the life is more important than any goal or degree requirement.

License2Derive

**May be substituted with Cantonese.*

TWO NEGATIVES MULTIPLY TO A POSITIVE

Something that strikes me is the fact that it took until university for me to be taught why a negative number times a negative number equals a positive number. That's not because it's a hard concept (I'd say it's maybe realistic for eighth- or ninth-graders to be learning) but because of the way our education system has decided to teach algebra. When I was first told in school that a negative number times a negative number equals a positive number, it was in elementary school where our teachers knew almost nothing about math and taught us this fact "because it just is".

"Because it just is" was used quite often in elementary school, and understandably so, as those teachers really didn't know the answer (and maybe really did think that "because it just is" was the right answer). When we moved onto high school we began to move past "because it just is". Except by this time, "because it just is" was drilled into our heads so much that only a few people even cared to think about the "why" or the "how".

Maybe this is the greatest irony of mathematics education, because the "why" part is what makes it mathematics, yet we have managed to teach everyone that mathematics is the "because it just is".

If you'll believe me, let me say that I am not that bad at math, and that all throughout high school I did have the knowledge floating around in the back of my head that two negative numbers multiply to a positive number out of some sort of algebraic necessity. This is pretty much the truth, but I'm not trying to show you how smart I am (for reference, I am sure that Gauss could understand this when he was like two, so I am really nothing). I was interested in mathematics all throughout high school, and yet this was all I thought about negative numbers. It is not too much of a stretch to say that people who aren't particularly interested in mathematics never think about this at all.

And yet the way our mathematics education is structured, we build off of our basic understanding of arithmetic on integers and real numbers until we reach calculus in twelfth grade. "I was good at math until they added letters," is a common humorous quote. In elementary school, we learn facts about adding and multiplying natural numbers, then integers and rational numbers and then some real numbers too (like pi, how fun!). But these are taught as plain facts of reality that you need to memorize.

To be fair, it's not particularly hard to memorize 1 + 1 = 2 "because it just is", even for a six-year-old, so it's not surprising that mathematics teaching begins this way, but you can't do mathematics by memorizing facts. If you teach kids for several years that mathematics is the fact that 1 + 1 = 2, and not the why of 1 + 1 = 2, then they are taking this fundamental misunderstanding to high school where mathematics does slowly start thinking about the "why" of things. Is it surprising that students begin to struggle here?

It's hard to think about the "why" of something without understanding the "why" of everything else that came before it. And yes, this means knowing the "why" of 1 + 1 = 2 and the "why" of why two negative numbers multiply to a positive. Yet we build our "why" education in high school over this "because it just is" education in elementary school. Well then, why should students start questioning and proving things when they never had to before? Why should we prove that x + y = z when we never proved that 1 + 1 = 2?

We probably shouldn't teach six-year-olds how to understand axioms and theorems and proofs, but I thought it was important for children to learn creativity and imagination. Then why is this only taught through art and science, and not mathematics? Why is the mathematics the subject that says "because it just is"? How boring. How useless.

For the record, I still don't know why 1 + 1 = 2. I believe that in my algebra class, we covered the existence of the number 2, but it was incredibly long and I'm not that good at math.

cy

SONNET CXXXVI

In front of me, a page of white beholds,

Untouched, pure, as clean as winter snowfall,

Not for long — the test begins, it unfolds,

And strikes black, midnight terror in us all,

Impenitently it curses my fate,

Knowing the torture it inflicts on me,

It intimidates, I fail to think straight,

And remember what I learned precisely

In class. Definitions and theorems eluding,

My will to go on evermore darkens,

Wishing I had spent more time studying,

For Dan Wolczuk's words, I failed to hearken:

"What's the definition of a basis?"

I wish I knew. His kindness was wasted.

Finchey

LINUX SOFTWARE SHOWCASE: GRAPHICAL NOTETAKING

While I recognize that most **mathNEWS** readers are here for entertainment, I assume there are enough readers, like me, would like some tech content. With that said, I would like to introduce some random tech content, where I will *maybe*, *possibly*, *occasionally* post some (what I think is) cool stuff. More likely than not, it will involve GNU/Linux (which I may also call Linux), as the OS of choice for a fair number of math and computer science students.

Today, I would like to discuss what a fair number of students in our class have asked me: What (graphical) notetaking solution do you use in class?

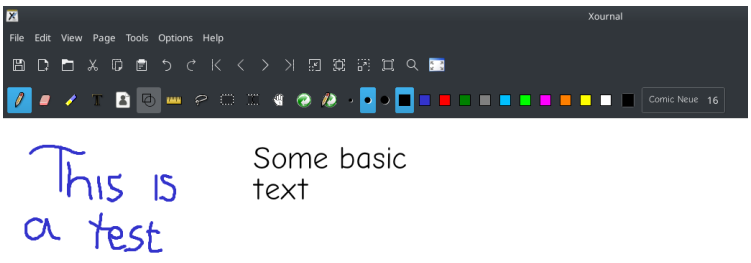
THE OBJECTIVE

Find an application for laptops running Linux, that supports taking notes, with support for entering diagrams, text or equations using a pen or stylus (in my case, a Wacom tablet since my laptop is not touchscreen).

INTRODUCTION

First of all, the true enthusiasts among you will probably say something along the lines of "just type your notes in Vim", "just type LaTeX code in realtime for equations" and "just make your diagrams in TikZ" or even outright "why do you need to take notes?". If your reaction was one if the above, stop reading, and skip to the next article (*looking at some of you CSC folks*). Thank you.

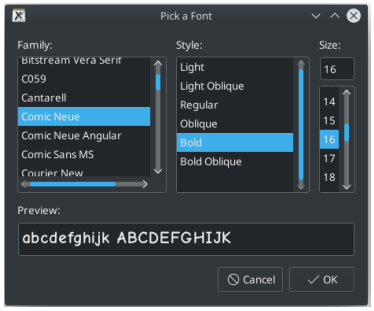
XOURNAL (ONENOTE ALTERNATIVE)



Xournal is a decent alternative to OneNote licensed under the GPL. Xournal works great on Linux if pen & touch are going to be your **primary form of input**. The graphics system works plenty well, incorporating directly with xinput, which means there is native support for graphics tablets (such as the Wacom Intuos) as well as touchscreen laptops. It also recognizes the pen pressure used, to adjust line width, which is cool for making diagrams.

Each stroke is saved as a line in an xml file, which gets rendered as a vector graphic, ensuring no pixelation occurs. Notes can be exported as PDF files to allow cross compatibility with other computers and devices. Slides and other PDF documents can easily be imported, making it rather convenient for classes where profs post slides in advance, allowing you to write on the slides, adding pages in between as necessary.

Unfortunately, typesetting support is rather crude, on par with Paint. You can't have multiple colours or formatting settings in the same text box, which makes it rather inconvenient. It doesn't even add newlines for you. You have to manually press enter when you reach the end of a line. And if you have to change font sizes, or, make bold text? **There is no hotkey!** You have to open up the fonts windows, and choose the font type and size from a given typeface, just to bold or change size. That's kind of inconvenient. Fortunately, handwriting does not have such restrictions and is easy to change colours or pen widths, so if you plan on handwriting, this may be the program for you. Check it out!



Protip: Use dark mode (KhanAcademy style) by setting the page background colours to #000000 (black) and using a light coloured pen.

Overall, even given its flaws, I found it worked best for me last term. If you don't care about graphics support, there are other options, but if having stylus support is key, then I haven't found a better alternative yet.

One last thing before the editors cut me off for passing their word count: you might say, "well, I can fix issues like that, the code is on GitHub" to which my response is "Yeah, but it's written in C, and good luck".

Unlike OneNode, each note is a separate file, so you will have to deal with the file structure and organization yourself. This also means you can rsync the folder across though, which is rather convenient. There is an upcoming version Xournal++, which is a C++ port/remake (with some nice new features like embedded LaTeX!) which may be more worthwhile.

Anyway, that's all for this article, enjoy reading **mathNEWS** and I hope this helped highlight some other neat software you may not have previously heard of!

Tony

13 doesn't exist.

ROB HACKMAN

UNIVERSITY AS A METAPHOR FOR LIFE

AKA HOW I BECAME THE UWATERLOO VERSION OF A GRUMPY OLD MAN (AND WHY 4TH YEARS ARE BASICALLY OLD PEOPLE)

Hello all, Theodore Bear here. I started writing for **mathNEWS** during my second term at Waterloo, back in Winter of 2015. It's been four years since then, and a lot has changed since. I saw three UWaterloo snow days. It might be because I'm now on my last term, but I've been looking back on my time at university recently, the highs and lows, and I thought I'd write about them before I graduate, to pass on some of my 4B knowledge to any first years reading this.

I also want to win "Article of the Issue" at least one more time before I graduate, and I heard that long, introspective articles are basically **mathNEWS**'s version of Oscar-bait. *(Editor's note: Disqualified.)*

It recently occurred to me that during my time at university, I had passed through the phases of life and become an old man. It happened at an event I attended recently, where I paired up with a first-year CS student, and he asked me for some advice. And right there, as I thinking of things to tell him, the fact that was I about to graduate finally dawned on me. Before that, I hadn't really considered myself any different from who I was when I was in his place.

The second event that made me realize what I had become was when we had our first snow day this semester. When I started at Waterloo, the idea of ever typing that sentence seemed preposterous. I had been not expecting it so much that I had gone to office hours for a class (thankfully, they still happened despite the weather) and noticing that there were less students than normal, and that a lot of the on-campus were closed. My first reaction was one of shock, soon followed by happiness that classes were cancelled. I started thinking back on the storms I had to trek through, and I thought:

"Seriously? *This* is what they close down the school for? This is nothing! I've had to come to class in worse."

It was quickly followed up with:

"Back in my day, when there was a storm, we still had to come to class. No excuses. The roads could be slick with ice. The weather could be so bad that the professor had to cancel. But storm or no storm, school was still on!"

Of course I'm exaggerating a bit, but that summed up general feelings, and that's when I realized: I had become a grumpy old man yelling about "kids these days". I should've been happy that the University of Waterloo finally started caring about the safety and well-being of its students, but instead, I was grumpy because honestly, I'd had to suffer through worse (note: said grumpiness may also have been due to the fact that I'd had already trekked to campus).

That's when I realized, being in 4th year was essentially the same as being an old man (or woman). While they aren't the exact same, there are a remarkable number of similarities between the two groups.

The second similarity I noticed about was how little opportunity I had to do other things compared to my first semesters. Back then, once I was out of class for the day, I would go to clubs, I would head home and write. I sometimes felt like I was swamped by assignments, but everything was relative. I had the time to do things I enjoyed while still being able to get the grades I wanted. As the years went on, I slowly stopped attending certain clubs, or assignments prevented from going to longer events. In my first year, I ended up travelling to Ottawa for a weekend for a tournament, but if I do that now, I know that would mean spending long sleepless nights working to make up for it, and I probably wouldn't get it done. While this isn't a perfect match, as old people have a lot of time on their hands, it does apply, since due to an inability to drive and declining health, many elderly men and women are prevented from doing things they could've easily done when they were younger.

Related to that, I stopped having the energy I did. Whatever free time I have now, I used to watch Youtube videos or browse Reddit. I don't want to do anything else, but all that requires effort. Another trait that 4th years share with the elderly is that we sleep in, a lot. Everyday, I get up an hour before I have class, and all my classes are in the afternoon, and somehow, I still feel exhausted for most of the day.

Fourth was that, like all old people, I stopped giving a crap. While I had to cut some clubs I really enjoyed, there were also a few that I didn't really want to attend in the first place, but did because they looked good on a resume or some other dumb reason. I just cut those. You also start noticing once you're older just how little everyone else cares, too. You start realizing that people get positions in student organizations because they're the only ones who applied.

I have to admit, this is probably the nicest thing about being a UWaterloo old man. Back in my other semesters, I worked hard to get good marks, tearing my hair out as I tried to push my mark past a 90%. But now, I've worked hard and I've done my time, and I just want to coast to the end. Leaving a question on an assignment unanswered becomes fine. You realize that the final hour of studying, after you've done so much of it already isn't going to matter. Things that used to stress me out make me feel nothing, and getting sleep is actually a lot easier (though it still doesn't help with the lack of energy). Lately, I've even started to play video games again during my study term. First year, I managed to finish playing a game. That was because I had the time back then. Now, I'm spending a lot of my time playing another (if anyone wants to know, it's Mount & Blade: Warband. If you want to get good marks this semester, don't start playing it). I'm still going to pass my classes. I'm still going to graduate with a great average,

but there stops being a difference between a 75, 80, or 90 percent.

The last is that, because of a combination of the previous aspects of 4th Year life, I'm grumpy most of the time. I wish I was back in 1st and 2nd year, able to have the opportunities and energy I had back then.

I know I've been a bit rambly, but forgive me, I've experienced a lot over the years I've spent here. Now, here's my bit of old man advice to first years, from a weary, weathered 4B student. It was the same advice I gave to the first year. You have time right now. Things might seem bad sometimes, but you have more time to yourself than anyone else here. Use it wisely. Don't waste it. Join any clubs you want. Get your university experiences now, because as the years go on, your ability to have fun and party like you can now will disappear. You'll start sacrificing the things you love in order to get your assignments done. Whether it be due to a lack of energy or a lack of time, you'll find yourself being able to do less. So, do what you want to do now, before you get consumed and swamped by upper-year assignment after upper-year assignment. The only time you'll be able to do that again is when you've stopping given a shit like I have.

Also, if you're a computer science student, don't take CS 348. Trust me, all the stories you've heard about it are true. Just don't take it.

Don't.

Theodore Bear

FOLLOW UP TO HONEST REVIEW OF mathNEWS EXPERIENCE

Last issue, I gave an Honest Review of **mathNEWS** Experience for all you curious mathies. However, my final rating was 4.14 / π , which is a fraction greater than 1, meaning I clearly screwed up the math.

Now that I have had two more weeks of math lectures, I feel more prepared to give a proper rating. Unfortunately, there was a MATH 138/148 midterm this production night, and **mathNEWS** did not schedule around it just for the sake of us first years.

Hence, I'm going to have to give **scheduling** a rating of 0 / π. Since I wasn't able to attend production night in person, this is going to be it for the review for this week.

Overall rating: 0 / π

License2Derive

A REVIEW OF SKYRIM (2012) FOR 2019

This review is admittedly late to the party, but considering I hardly get invited to parties that's fine by me. So how does this classic game hold up under post-post-modern scrutiny? Does it still hold up or is it just a pile of Goose-Shit? It's time to find out. To insure academic integrity, all scores with be on a scale from 0 to π (± 22/7)

GRAPHICS: 1.20428/π

When you first open the game, you are greeted with a beautiful scene filled with many vibrant colours; from light grey to dark grey, pale blue to slightly less pale blue, and from murky brown to murkier green. In terms of overall resolution, I can personally confirm there are many pixels on my screen. The graphics are also very sharp, so sharp in fact that I can see the individual polygons making up Lydia's stupid face.

STORY: 0.733038/π

The main story is boring, but the game more than makes up for it in its many side quests, like clearing a mine of forsworn, a mine of bandits, a temple of forsworn, a temple of bandits, running through a dwarven mine..full of bandits, or mining a bandit forsworn temple.

GAMEPLAY: π/π

Just walked through a wall and then got killed by a flying bucket… perfect.

FUN-VALUE: 420/π

You don't know true joy until you get thrown in jail in a city you're the Thain of because you picked up a piece of bread in your own house that you bought for 5000 gold.

TOTAL SCORE: MANY / TWO CIRCLES

9/10 would play for the next 4 years before the new one isn't released

Yonathan

N THINGS YOU CAN DO TO GET OVER POST-READING-WEEK-DEPRESSION

- Take a walk around ring road in shorts. Allow the merciless cold to spread feeling back into your body.
- Go say hi to some geese. They're apparently back and in action.
- Get some food from good ol' Aunty's Kitchen.
- Always wear ice skates. The sidewalks are so icy, you can just glide to class to save yourself some time AND avoid the physical pain of falling on hard concrete.
- Download Animal Crossing Pocket Camp again. Is anyone still playing that?
- Forget to do your assignments. There's no warmer welcome on the first week back than a nice, fresh due date. But if you forget the assignment, is there really any reason to worry?
- Get a sandwich from the C&D and then subsequently realize your mistake. (no hate... but I think some of you might know what I mean).
- Take a nap in MC Comfy. Then wake up the next morning and realize your nap turned into a full 12-hour sleep and you missed all your assignment deadlines. Lovely.
- Watch your stress levels skyrocket exponentially at each passing day. A fun observation.
- Chug 3 cups of coffee, because we all need a reason to both be awake until the end of the term AND be so anxious that we can't even hold a pencil properly.
- Do an old assignment for fun. Then become instantly and irrevocably disappointed that this is what is has come to. This is it. This is what we do for fun now.

And lastly, with all the seriousness in my heart,

- Stan red velvet, the one true stress-reliever.

(I really recommend giving 'Body Talk' by Red Velvet a listen. I personally have an out-of-body experience each time I listen to it.)

(Have fun!)

Herbie

Send more profQUOTES.

THE ENTIRE mathNEWS READERSHIP

LASCIATE OGNE SPERANZA, VOI CH'INTRATE

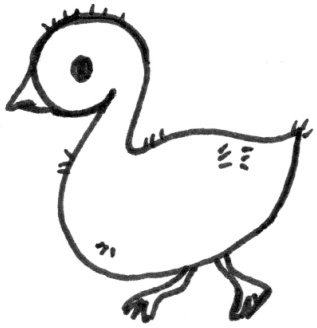
gridCOMMENT *139.3*

Of course it has come to this. I just couldn't hold onto my **gridWORD** retirement, and the temporarily vacant throne of **gridMASTER** beacons (see volume 137, issue 1). This thankless task incurs a high cost, for being seated upon this lofty chilly throne requires a sacrifice of blood in the form of a grid, with nary but a few slices of pizza for remuneration. So here I am, yanked from my retirement studying Akkadian in the distant past, to trudge through the frozen Cocytus, to bring this edition of the **gridWORD** to all the readers of **mathNEWS**.

I have been informed that nobody had submitted a solution or the **gridWORD** that staplED so laboriously put together last issue. Perhaps it is worth mentioning again how the rules of submission works in full, lest one be confused and unsure.

Solutions to this issue's **gridWORD** can be done physically into the **BLACK BOX** (located in the 3rd floor hallway between the C&D and the stairs, by the newspaper racks) before 6PM on Monday, March 11th, or submitted electronically to mathnews@gmail.com by the same time. A submission, in addition to the grid (or not — I've definitely seen people win just by submitting the answer to the **gridQUESTION** and hoping nobody tried to actually solve the grid), should include a name and optionally a moniker: the first to identify you with in the event a prize is won, and the latter to be published if one wishes to be credited differently from one's name. A prize (determined by the editors) shall be awarded to the submission with the most correct solution; in the event of a tie, the tiebreaker shall be the submission with my favourite answer to this issue's **gridQUESTION**, "What would you do with an army of frozen undead at your beck and call?"

Considering taking up residence in Dis again,
Zethar

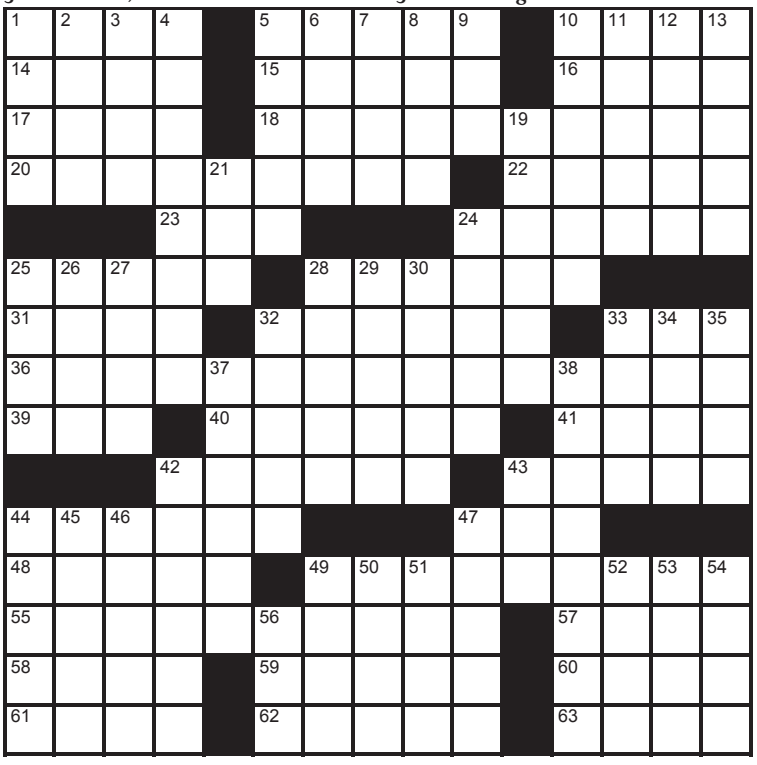


ACROSS

1. Riemann function
5. Driving hazard
10. Carpet type
14. List-ending abbr.
15. Ray or skate
16. Islamic judge
17. Family member
18. Fine sweetener
20. Striker or flasher
22. Dragons' abodes
23. Word source
24. Over-shoe (alternative spelling)
25. This is the third one
28. Handed
31. Loot
32. Blood and muscle tissue suffix
33. Cooking meas.
36. What you're here for (probably)
39. APRNs
40. Recycles
41. Not theirs
42. "Absalom and Achitophel" poet
43. Driving hazard
44. Breathing problems
47. Ground cover
48. Hoary poet?
49. Rational polynomial root number
55. Government House
57. ^Z
58. Cake decorator
59. SE Asian skewer dish
60. White coat
61. Midterm, say
62. Stomach
63. See: **gridCOMMENT** title

DOWN

1. Ardor
2. Needle case
3. Zest
4. In spite of
5. Crush
6. Points
7. Like
8. Indigo dye
9. A little bit of work
10. A loud cry
11. Saintly?
12. Jewish intercalanary months
13. ⅒ rial
19. Sequence database
21. Driving aid
24. Puzzles
25. Library ID
26. [a, b] = [b, a];
27. Pouches
28. Cover
29. Snake follower
30. "A Doll's House" playwright
32. Deoxygenated waterlogged soils
33. Unwavering
34. Dry
35. Bother
37. mathNEWS corrections
38. Yukon event
42. Leave
43. Kind of story
44. Type of djinn (alternate spelling)
45. Bounty
46. Network vertices
47. Stress identifier
49. Ishmael's captain
50. A and B, in C
51. Tickled
52. Sister of King Arthur
53. False god
54. Hood
56. Our neighbour



lookAHEAD

SUN MAR 3	MON MAR 4	TUE MAR 5	WED MAR 6	THU MAR 7	FRI MAR 8	SAT MAR 9
			Dragons' Den Audition, QNC 1010 Three Minute Thesis (3MT) Math Faculty	**mathSOC** Board Games Night in CND		March Break Open House

SUN MAR 10	MON MAR 11	TUE MAR 12	WED MAR 13	THU MAR 14	FRI MAR 15	SAT MAR 16
TerribleHack XII	Chemical Engineering Capstone Design Symposium		Noon Hour Concert: Rachmaninoff Tribute to Tchaikovsky Spotlight on Mental Health	PiDay! **mathSOC** Board Games Night in CND Systems Design Engineering Symposum		Math Grad Ball: Crazy Glam Affair

ACTUAL MATH PROBLEM OF THE WEEK

Hello **mathNEWS** readership,

I was pleased last week, as many of you successfully solved the problem and went home with their favourite chocolate bar.

Here is the problem for this week:

Let a,b be real numbers between 0 and 1. Prove that:

sqrt(ab) + sqrt((1-a)(1-b)) =< 1

As usual, bring your proofs to the PMC clubroom (MC 3033) for your prize !

PMC Prez

IMPORTANT UPDATE ON SLC CONSTRUCTION

Shit's ***still*** broken.

Fruitboy

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UW'S BASTION OF ERUDITE THOUGHT SINCE 1973

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