* "Numbers for Life" at McMaster University

* Idea: to think with numbers in context

* Numeracy is the "ability to access, use, interpret and communicate quantitative information and ideas, in order to engage in and manage quantitative demands of a range of situations in adult life" [OECD]

* What is the relation between math and numeracy? Why would that be important? Maybe it's not...

WHAT DO
YOU THINK?
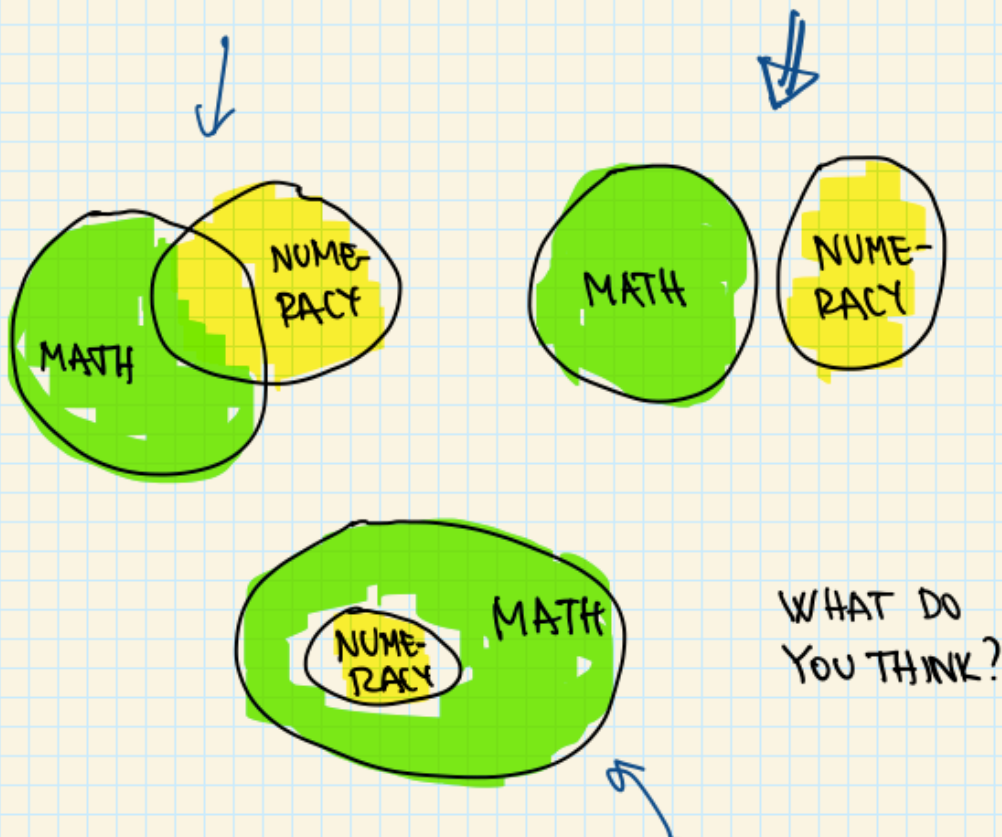
Is numeracy math?

NO — because we do not do functions, etc.

YES — because the content forces students to

MATH "HABITS OF MIND"
[CUOCO, ET AL. 1996]

- THINK
- PROBLEM-SOLVE
- ESTIMATE, APPROXIMATE
- EXPERIMENT
- ANALYZE
- INTERPRET

IMPORTANT
but
not routinely
done in
math

* Numeracy shoud not be viewed as Math. Why?

Needs its own identity so that it does not "drown" in math

QUESTION: Who is a NUMERATE PERSON?
What shoud they know, be able to do?

Fibonacci sequence, golden ratio, chaos, etc....?

$\frac{3.7}{4}$, π , $f(x) = x^2$, ...?

* **NUMBERS FOR LIFE** course at McMaster

* offered once per year

* open to, and taken by, students from all faculties and programs (except math and stats)

* the only course offered by Math Dept which is not restricted to certain populations
(such as "Calc for the Life Sciences")

* ≈ 600 students

* dominant mode: lecture, discussion, and (when in person) class activities

* assessment (limited because of no recources):
tests and exam

* TAs : 30 minutes/student for the entire term
→ so just marking

* free textbook ☺

99 numbers
mathematics of everyday life
part 1

2021

andie burazin and miroslav lovric
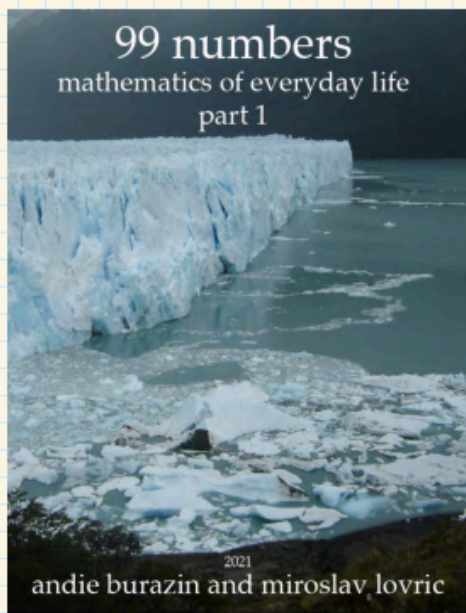
COURSE CONTENT

x examining numbers and reasoning as they appear in
every day situations

99 Numbers: Mathematics of Everyday Life

Gini index

FYMSIC

LOVRIC@MCMASTER.CA

Your turn:

even though we likely don't
agree what _numeracy_ is

==0.1%== $\frac{1}{1000}$ 1 in 1000

FRAME

---

* SAMPLES FROM MY COURSE...

* EXAMPLES OF COMPLEX PROBLEMS...

(A) How much water is wasted in Canada every
day because (some) people do not turn the
tap off while brushing their teeth?

(B) How to measure (quantify) income inequalities
in a given population?

Pop. I : 20, 30, 50, 100
Pop. II : 20, 20, 20, 30, 30

$\longrightarrow$ Gini

$0 \vdash\!\!\!\!\!\longrightarrow\!\!\!\!\!\dashv 1$

(C) If the temperature of all oceans on Earth
increases by 1°C, by how much will their
level increase? ✓

(D) Present world population is about 8 billion.
If, from 2020, every couple has exactly two
children, what is the maximum population
when it stabilizes?

What goes into (A) ?

* identify what data you need, and find it
    how accurate is the data, can I verify?

* survey : how often do you brush teeth / day?
    turn tap off, keep on ?
    bias, how to summarize data so that |||
    it can be used ?

* find an approximation (no formulas given!)
    if you can't approximate, estimate

* analyze: compare with others → accuracy?
    orders of magnitude
    "robustness"

never done in
math!

* present: how to communicate a large number?
  ↳ visualize, present in familiar terms

KEY THING: DAILY LIFE IS A GREAT SOURCE OF PROBLEMS WHICH REQUIRE QUANTITATIVE APPROACHES

Questions? Comments?

SAMPLES:

BMO MASTERCARD®ʳ
CARDHOLDER AGREEMENT

BMO 🔴 B

Read Credit Card Agreements!

13. How we calculate interest

The interest rates we charge are:
- the annual cash advance and purchase interest rates shown on the card carrier or any notice we provide to you; or
- any promotional interest rates that we may provide to you.

Your account statement shows your annual and daily interest rates.

If you do not make a minimum payment by the due date two times in any twelve-month period, your interest rate will increase as shown on the card carrier or any notice we provide to you. The amount of interest we charge you on each account statement is calculated as follows:

- first, we determine your average daily balance by adding the interest-bearing amount you owe each day and dividing that total by the number of days in the statement period.

- next, we determine the daily interest rate by dividing the annual interest rate by the number of days in a year.

Your interest charge is then calculated by multiplying the average daily balance by the daily interest rate by the number of days in a statement period.

This is a summary of credit card balances for one month. How much interest will we pay for the period from 1 October to and including 31 October (31 days)?

Date	Balance
1 October	$ 500
5 October	$ 575
18 October	$ 475
24 October	$ 920
1 November	$ 920

Interest = Average daily balance * number of days in a month * daily interest rate (=APR/365 or APR/366)

CALCULATING YOUR BALANCE

Previous Balance	$2,564.00
Payments & Credits	$2,864.00
Purchases & Other Charges	$3,119.75
Cash Advances	$0.00
Interest	$0.00
Fees	$0.00
Sub-total	$3,119.75
NEW BALANCE	**$2,819.75**

Misleading: it is actually $10 PLUS monthly interest

PAYMENT INFORMATION

Minimum Payment	**$10.00**
Payment Due Date	Feb. 13, 2017
Credit Limit	$16,500
Available Credit	$13,680
Annual Interest Rate: Purchases	8.00%
Cash Advances	8.00%

Estimated Time to Pay
The estimated time to pay your New Balance in full if you pay only the Minimum Payment each month is: 22 year(s) and 5 month(s).

How Effective are Condoms at Preventing Pregnancy?

Using what we have learned, we will answer the following question: What is the probaility that a sexually active woman who regularly uses condoms (and no other protection) during the four years at university, will get pregnant?

TROJAN ARMOR SPERMICIDAL LUBRICANT
ENZ
- Made from Premium Quality Latex – To help reduce the risk
- Nonoxynol-9 Spermicide is on this Condom:
  – For extra protection against pregnancy ONLY
  – NOT for extra protection against AIDS and other STIs
- Special Reservoir End – For extra safety
- Each Condom is Electronically Tested – To help ensure reliability

ALWAYS INSIST ON TROJAN®.
AMERICA'S #1 CONDOM
TRUSTED FOR OVER 90 YEARS

public health agency. • Condoms are highly effective against pregnancy, less than 2 women in 100 get pregnant during one year of typical correct and consistent use. Other contraceptive methods are more or less effective than

98%   *2%*

99%, 100%, 95%

The Government of Canada Health Site https://bit.ly/2SDZdVv states that "Condoms help prevent pregnancy when used as intended by the manufacturer. But condoms sometimes fail because of improper use or the material gets damaged. Pregnancy happens in about 10% of cases." *90%*

On the U.K.'s National Health Services web page https://bit.ly/2Gh7oV0 we read "When used correctly every time you have sex, male condoms are 98% effective. This means 2 out of 100 women will become pregnant in one year when male condoms are used as contraception." *98%*

According to their web page, *Planned Parenthood* is " a trusted health care provider, an informed educator, a passionate advocate, and a global partner helping similar organizations around the world." On https://bit.ly/2TsfkFQ we read "If you use condoms perfectly every single time you have sex, they're 98% effective at preventing pregnancy. But people aren't perfect, so in real life condoms are about 82% effective that means about 18 out of 100 people who use condoms as their only birth control method will get pregnant each year." *82-98%*

Student - Elementary/ Secondary

Person between the ages of 5 and 19 who attends an elementary or secondary school in the City of Hamilton. All secondary students must present their HSR photo ID when using a student fare.
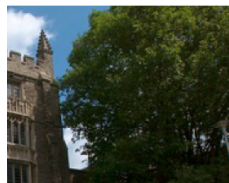Paper Ticket or PRESTO - $2
Monthly Pass or PRESTO - $88

CPI

High school student: (5 <=age<=19) monthly pass:

| 2016 | $ 83.60 | ✓ |
| 2018 | $ 88.00 | ✓ |

Increase - due to inflation?

Salary of a postdoc

at McMaster
(Math and Stats)

$ 33,000 in 1992
$ 45,000-50,000 in 2020

Which postdoc got a better deal?

Combined hormonal contraception (CHC) has side effects: **blood clots are generally rare but sometimes occur in otherwise healthy people, even those not taking CHCs.**

Evidence:

Between 1 and 5 of every 10,000 women (who are not pregnant and not using CHCs) will experience a blood clot in any given year.

Between 3 and 9 of every 10,000 CHC users will experience a blood clot in any given year.

HOW CAN THIS BE INTERPRETED AS DOUBLE THE RATE?

from
1-5 per 10,000 (no CHC, no pregnancy)
to
3-9 per 10,000 (CHC)

Change from 1-5 per 10,000 to 3-9 per 10,000 could be interpreted as double the rate, as the doubles of numbers from 1 to 5 are 2 to 10, which is close to the 3-9 range given.

Or: the average of 1-5 is (3), and the average of 3 -9 is (6), so the average doubles.

Some contraceptive pills said to have DOUBLE the risk of blood clots

But don't start panicking just yet...

by ROSIE MULLENDER   MAY 27, 2015

Big Brothers Big S
Watch life-chang
stories unfold
START SOMETHING

British university 'sorry' after wr ongly giving students 300 coffee cups' worth of caffeine

Study International Staff   ⏰ January 26, 2017

1874
SOCIAL BUZZ

The University of Northumbria has apologised for an experiment on caffeine that went horribly wrong, after they were found to have given two students the equivalent of 300 cups of coffee each.

This Is How Many Calories You Burn While Walking

Kcals burned per minute = (0.035 * body weight in kilograms) + ((Velocity^2)/Height))*(0.029)*(body weight in kilograms)

on the next slide we will write it as a math formula

optional reading:

$$\text{Calories per minute} = 0.035 \cdot B + 0.029 \cdot B \cdot \frac{V^2}{H}$$

B = body mass in kilograms
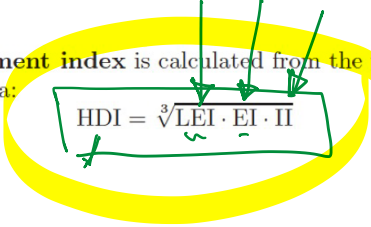V = velocity in metres per second
H = height in metres

"Height essentially economizes walking, so the taller you are, the less energy it takes per pound to walk a mile, or the slower the rate you burn calories while walking at the same speed compared to someone who is shorter," Peter Weyand, co-author of the study, tells RealSimple.com.

the taller you are, less energy it takes … how is it reflected in the formula?

The **human development index** is calculated from the three indices according to the following formula:

$$\text{HDI} = \sqrt[3]{\text{LEI} \cdot \text{EI} \cdot \text{II}}$$

I loved how things that are often overlooked and misinterpreted are finally being slowly explained so we get a better understanding of it. Very beneficial course and I am very happy I took it

The relevance of the material to real life gives me confidence in handling real life problems and breaking down what I need to understand. I feel less intimidated when math/numbers are presented to me in real life. I understand that if I break it down, I will be able to understand it.

I really enjoyed all the practical aspects of this course and how they can be used in our day to day lives. It didn't really feel like a math course but rather a pay-attention-to-this-in-life course and I really enjoyed it. The problem sets were a great way to practice what we have learnt in class and prepare for the tests.

I enjoyed having hands-on experience in this course that I didn't really have in other math classes. I learnt to appreciate math through the many ways we learnt how to apply math. I also found it helpful how the prof would prove math equations when we learnt it. It helped me feel that I wasn't just memorizing math equations.

➡ GOOD THINGS ABOUT THE COURSE....

1. The actual materials are very useful in the daily life. 2. The thinking structure, let students consider things or events in a very logical way.

➡ What will I remember...

I think I will remember that when reading articles and it says something like 'double the risk of a blood clot' to consider the actual numbers and remember a really small number doubled is still a really small number. Read articles for yourself and consider the number.

A Starbucks venti cup of coffee can be claimed to be 99.9% caffeine free

I feel like most of the lessons stuck with me because the concepts are so practical! I specifically enjoyed the Avocado Toast Index because I eat a lot of Avocado toast. I even showed my friends.

➤ contingency table

Something else that stuck with me was the technique of extending the chart when we did statistics. For example, when comparing men and women who received a vaccine or did not receive a vaccine and figuring out the percentages.

That percentages are relative information. You should always know what people are measuring when they throw percentages out there. I'm now more skeptical of certain videos when they throw out random percentage facts.