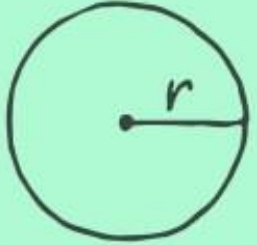
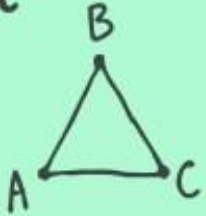
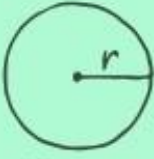
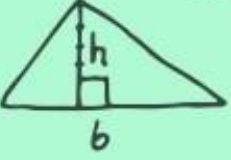
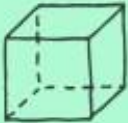

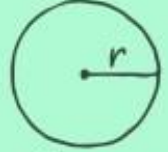
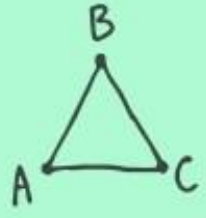

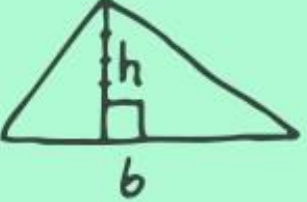


$a^{-n} = \frac{1}{a^n}$
 $(ab)^n = a^n b^n$
 $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$
 $a^{-n} = \frac{1}{a^n}$
 $(ab)^n = a^n b^n$
 $a^m \times a^n = a^{m+n}$

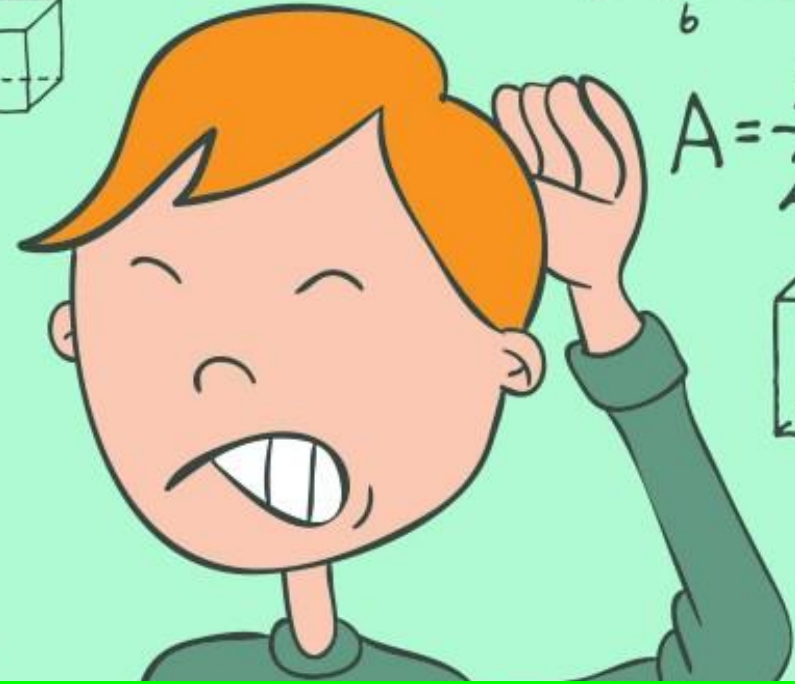







$C = 2\pi r$
 $A = 2\pi r^2$
 $A = \frac{1}{2}bh$
 $C = 2\pi r$
 $A = 2\pi r^2$

$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$
 $a^{-n} = \frac{1}{a^n}$
 $A = \frac{1}{2}bh$
 $C = 2\pi r$
 $A = 2\pi r^2$

$\frac{a^m}{a^n} = a^{m-n}$
 $a^2 - b^2 = (a+b)(a-b)$



What is Math good for?

Math and English skills determine whether you are college ready

- Are Math skills totally arbitrary, or are they really important?
- Think of math as juggling numbers, how important is juggling?
 - If you want to be a circus performer, juggling three balls is critical
 - Does this justify making juggling a prerequisite for other careers
- Andrew Hacker (PhD Princeton) states:
 - Math is a barrier to higher education
 - This contributes to inequity in our society

Mathematics

- What Math is like now
- How other fields changed
- What Math should be

kontrowersyjna.

Warning.
Controversial
content.

警告。論争の的となる
コンテンツ。

What Math is now

- Memorization
- Recitation
- Manual Calculations
- Word Problems

Memorization

“30 days hath September, April, June, and
November;

All the rest have 31, Excepting February alone,

And that has 28 days clear And 29 in each leap year.”

Recitation

➤ 3 times 5 is 15

➤ 4 times 5 is 20

➤ 5 times 5 is 25

➤ Etc.

Manual Calculations

- Say you want to multiply 315×826 to get 260190
- Instead of using technology, Math teaches a manual algorithm:

- First you multiply a bunch of stuff:

$$5 \times 6 + 310 \times 6 + 5 \times 20 + 310 \times 20 + 5 \times 800 + 310 \times 800 =$$

- Then you add up the products:

$$30 + 1860 + 100 + 6200 + 4000 + 248000 = 260190$$

Word Problems?



How about a word problem:

If Johnny has four apples in his hands and Mary gives him five more, what does Johnny have?

Very big hands?

Oops! Not the right answer.

Beautiful Principles

- All great painters are trained in atelier art schools
 - What about house painters? Do they need to learn perspective and novorealism?
- All great mathematicians are trained in the beautiful principles of Algebra and Calculus
 - What about our students? Will they need these principles in other disciplines or on the job?

The State of Knowledge Today

What children today don't know...

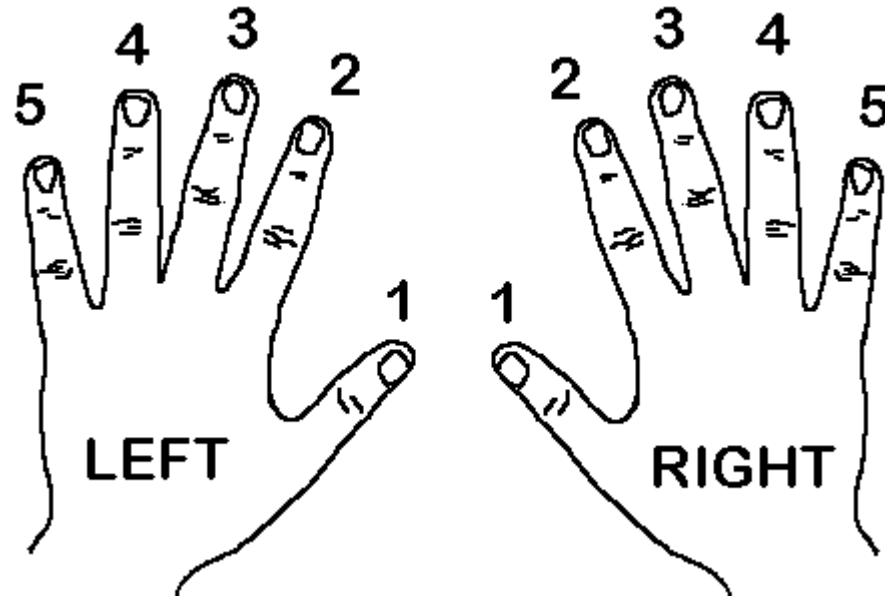
- Reading an analog clock
- Writing cursive
- Buy and use postage stamps
- Sand hourglasses
- Paper maps

But they do know...

- Getting digital time from their phone
- Typing/Keyboarding
- Email and texting
- Electronic timers
- GPS navigation systems

What does it mean to Know Math?

Counting



What does it mean to Know Math?

Adding



$$5 + 3 = 8$$

What does it mean to Know Math?

Multiplying



$$4 \text{ times } 5 = 20$$

TEACHING MATH

- Hasn't changed in hundreds of years.
- Math courses still teach formulas and calculations because they are easy to teach and test, not because they are needed.
- Formulas and manual calculations are not needed any more because calculators and apps are a much better way of getting answers to problems.
- Memorizing a series of steps to solve a problem by hand is not critical thinking.

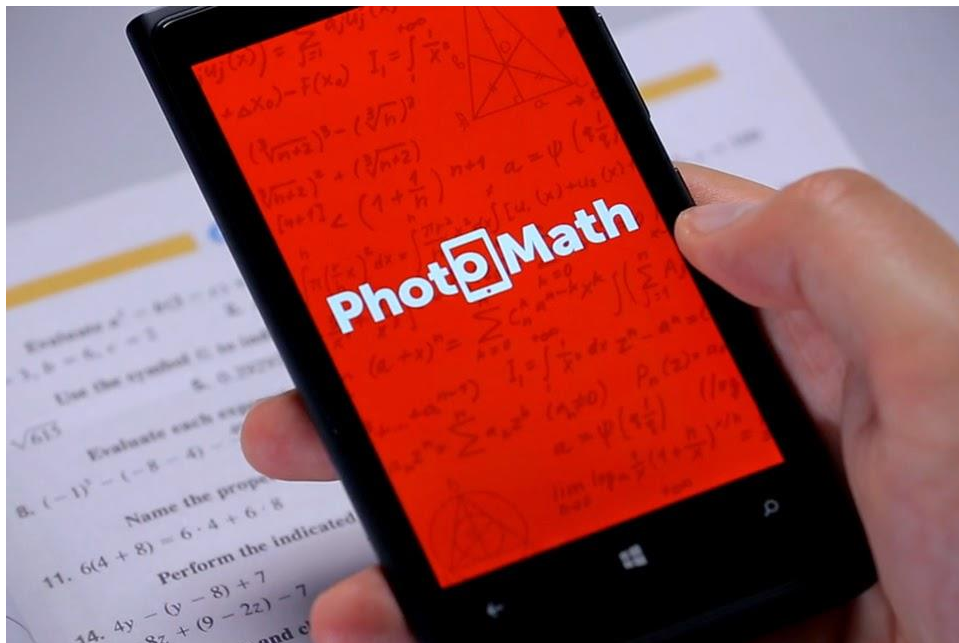
How other fields changed

Other disciplines have all added technology to their teaching:

- Simulated labs in the sciences
- Spreadsheets and databases in Business
- CAD in Architecture
- SolidWorks In Manufacturing Technology
- Online library database research in the Humanities and Social Sciences
- Word Processing and PowerPoint for all students

What Math today should be teaching today:

Smart Phones and Apps!



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WolframAlpha computational knowledge engine

Integral of $x^2 x - 3$ from -3 to 4

Definite integral: $\int_{-3}^4 (x^2 x - 3) dx = \frac{91}{4} \approx 22.75$ [More digits](#)

Visual representation of the integral:

Riemann sums: $\text{left sum} = \frac{7(13n^2 - 182n + 49)}{4n^2} = \frac{91}{4} - \frac{637}{2n} + O\left(\frac{1}{n^2}\right)$ [More cases](#)

Indefinite integral: $\int (x^2 x - 3) dx = \frac{x^4}{4} - 3x + \text{constant}$ [Approximate form](#) [Step-by-step solution](#)

Computed by [Wolfram Mathematica](#) [Download page](#)

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What Do Math students need to do?

- Look at a problem
- Understand the vocabulary of the problem
- Figure out what it is asking for
- Determine the relationship between that and the given information
- Come up with a way to get the answer.

What do Math students need to have?

Every Math student should have at least one of the following:

- a smart phone
- a lap top computer
- a tablet
- a net book
- a calculator

How should today's Math student learn?

- Learn to use their technology
- Get familiar with various existing apps like
 - [PhotoMath](#)
 - [WolframAlpha](#)
 - [Desmos](#)
- Or even learn to write apps like the ones I wrote
 - [WrightCalc](#)

Some examples of apps
solving math problems on
the next slides:

A Very Simple App – Area of a Rectangle

- Without the app, you need a formula
 - $AREA = LENGTH \text{ times } WIDTH$
 - Variables are $A=AREA$, $L=LENGTH$, $W=WIDTH$
- Knowing any two of these allows you to calculate the third value
 - $A = L * W$, $L = A / W$, $W = A / L$
- Now try it with the app
 - <http://faculty.ccc.edu/jnadas/js/arearect.htm>
 - Just enter any two values and click on the third to get the answer
- Got it? Good! Moving on to something more complicated and more useful.



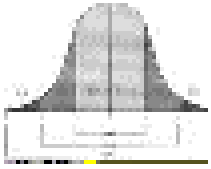
- Financial Calculator

Suppose you deposit \$500 into a savings account that pays 2.5% per year credited on a monthly basis. How much money will you have after 5 years?

[SOLUTION](#)

Suppose you borrow \$500 to be repaid with 4.3% APR over 3 years with monthly payments. How much will you be paying in total interest? [SOLUTION](#)

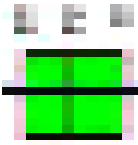
Suppose you deposit \$10.00 at the beginning of every month into an account that pays 1.7% APR at the end of each month. How much will you have after 42 months? [SOLUTION](#)



- Continuous Probability

If the average weight of a watermelon is around twenty pounds with a standard deviation of 1.6 pounds, what is the probability that a random melon will weigh more than 21 pounds? [SOLUTION](#)

Graph the probability distribution showing the probability of a melon weighing between 16 and 19 pounds. [SOLUTION](#)



- 1-Variable Statistics

Using the following data values:

19,26,48,45,50,56,35,10,10,35,67,66,46,35,35,29,10,65,66,35

calculate the values in this poem:

Hey diddle diddle,

the median's the middle;

you add and divide for the mean.

The mode is the one that appears the most,

and the range is the difference between.

[SOLUTION](#)



- Discrete Probability

If every student has a 75% chance of passing a test what is the probability that out of a class of 35 there will be at least 25 passing grades?

What is the probability of rolling less than 6 with two dice?

If six out of ten apples in a bag are ripe, what is the probability of only picking two ripe ones when you pick three randomly?

Real Life – Math will only be a tool

- Different tools for each student
- Examples in Careers
 - Business Analysts use PV/FV
 - Real Estate Agents use Amortization Tables
 - Laboratories and Pharmacies calculate quantities
 - ROI
 - What if analysis
 - Charts for trends
 - Data Analytics

Real Life – Math will only be a tool

- Different tools for each student
- Examples Personal Life
 - Baking
 - Sewing
 - Managing money \$\$\$
 - Balancing the checkbook.
 - Shopping for the best price.
 - Preparing food.
 - Figuring out distance, time and cost for travel.
 - Understanding loans for cars, trucks, homes, schooling or other purposes.
 - Understanding sports (being a player and team statistics)

The teaching of math at secondary and post secondary levels should evolve to explore and understand basic mathematical concepts while providing students an introduction to the application of tools similar to what they might experience in their careers and lives

Thank you for your attention!