

Mathematical Breakthroughs

- Mathematics research is like genealogical research—answers why
- Chose geometry because it is the most rewarding even though visualization does not come easily for me
- Count on my fingers

ALL YOU NEED IS

$$y = \frac{1}{x}$$



$$x^2 + y^2 = 9$$



$$y = |-2x|$$



$$x = -3|\sin y|$$



A Rough Beginning to my Career: Freshman Year




- Our mother instilled the beliefs: try things at least once, work hard

Freshman Year:

- Failed first test in college but improved to B+
- Guardian of my brother
- *Simpsons* on Sundays

Diversity Issues

- Physics and computer science high school teacher
- “You don’t look like a mathematician”



"The formality of the language of mathematics gives us a precision that eludes common courtesy in the articulation of ideas."

IMAGINE ALL THE POSSIBLE WAYS WE CAN USE GEOMETRY TO DESCRIBE SPATIAL REALITIES.

I am a Mathematician.

Small text at the bottom of the page, partially obscured by the vertical title, includes a photo of a group of people and a quote: "I am a mathematician of several kinds... I am a mathematician of several kinds... I am a mathematician of several kinds..."

Representations of Spaces and Mathematics in Society

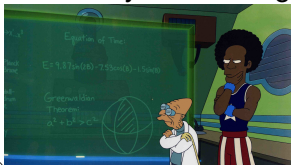
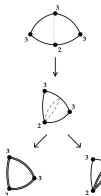
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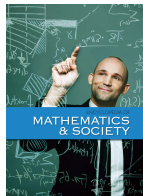
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- Representations of Spaces, Mathematicians, and Mathematics in Society & Teaching



THANKS FOR ALL YOUR MATHEMATICAL HELP, SARAH! WE NEED IT! FOR... PLEASE DON'T FORGET US

$a^n + b^n =$ (DAVID X. COHEN'S)

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PRESIDENT'S REPORT

The January-February AWM Newsletter is dedicated to the memory of Alice Tatum Schuler, one of the founders of AWM and its second president, who died September 27, 2009 at the age of 94.

As early as her high school years, Alice Tatum demonstrated a deep love of mathematics and teaching. She then attended the University of Wisconsin, where back in the early 1930s, the men and women's colleges stood on opposite sides of Washington Lane and women were not allowed in the campus library. Female students had never studied in advanced mathematics classes there until a public mathematics program at the heart of the late '30s "New

$$\left(\frac{\text{SurfaceArea}(\mathcal{O})}{4\pi}\right)\frac{1}{t} + \left(\frac{1}{64\sqrt{\pi}} \int \text{MirrorLocus}(\mathcal{O}) \tau\right)\sqrt{t} + \frac{\chi(\mathcal{O})}{6} + \dots$$

Working with Others

Erdős-Bacon number: 7 or ∞

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Six degrees of Kevin Bacon:

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Erdős-Bacon number: 7 or ∞

Six degrees of Kevin Bacon: 3 or ∞

Futurama: Bite My Shiny Metal X (documentary short) $\xrightarrow{\text{David X Cohen}}$ /
Know that Voice (documentary) $\xrightarrow{\text{Ed Asner}}$ *JFK* (1991) $\xleftarrow{\text{Kevin Bacon}}$

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Paul Erdős number: 4

Asymptotic expansion of the heat kernel for orbifolds $\xrightarrow{\text{Carolyn S. Gordon}}$
Boundary volume and length spectra of Riemannian manifolds: what the middle degree Hodge spectrum doesn't reveal $\xrightarrow{\text{Jaun Pablo Rossetti}}$
Hearing the platycosms $\xrightarrow{\text{John Conway}}$ *On the distribution of values of angles determined by coplanar points* $\xleftarrow{\text{Paul Erdős}}$

Research on Representations of Mathematics in Society

Research on Representations of Mathematics in Society

Apu insists that he has an excellent memory:
In fact I can recite π to 40,000 places. The last digit is one!
[Marge in Chains]

How many digits of π do you know? What is the probability that Apu is correct if he randomly guessed?

Hideaki Tomoyori: World Record 1987-1995



For example, the number sequence three-nine in Japanese is pronounced san-kyu, and that sounds very like the word sa-kyu, which means “sand dune”. If I picture a sand dune, I easily remember the numbers three and nine. And if I add in other elements, like my wife standing in front of the sand dune by the bright sea, then those words in Japanese can remind me of a whole string of ten numbers.

Hideaki Tomoyori: World Record 1987-1995



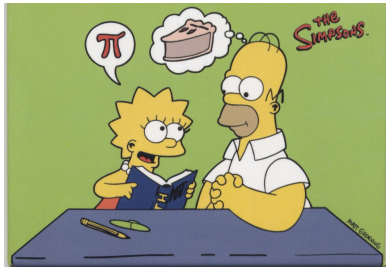
I feel that human abilities really have no limits. It's often said that we use just about five percent of our brain cells, so I think we have much greater potential - and I want to pursue that potential. So I want to go on with the challenge of memorizing π , for just the same reason that people climb high mountains. I think it's a wonderful thing to challenge the limits of what we can do... the more one memorizes of it, the closer one comes to the real value of the circle - closer to perfection.

Research on Hideaki Tomoyori: World Record 1987-1995



Researchers compared his cognitive abilities with a control group and concluded that they were not superior; they attributed his achievement to extensive practice.

Apu is Correct



- The 40,000th digit of π is one if he is counting digits following the decimal point

3.141592653589793238462643383279502884197169399375105820974944592307816406286208998628034825342117
0679821480865132823066470938446095505822317253594081284811174502841027019385211055596446229489549
3038196442881097566593344612847564823378678316527120190914564856692346034861045432664821339360726
0249141273724587006606315588174881520920962829254091715364367892590360011330530548820466521384146
9519415116094330572703657595919530921861173819326117931051185480744623799627495673518...

1507814685262133252473837651...

Researching 1 Billion Digits of π

$$\frac{1}{\pi} = 12 \sum_{k=0}^{\infty} \frac{(-1)^k (6k)! (545140134k + 13591409)}{(3k)! (k!)^3 (640320)^{3k + \frac{3}{2}}}$$



David and Gregory Chudnovsky (1989).
Their algorithm is used by computer algebra software.

- **David:** *Maybe in the eyes of God π looks perfect... π is the best stress test for a supercomputer*
- **Gregory:** *π is a damned good fake of a random number... It cannot be that π is truly random? Actually, a truly random sequence of numbers has not yet been discovered.*
- **David:** *Exploring π is like exploring the universe.*
- **Gregory:** *It's more like exploring underwater. You are in the mud, and everything looks the same... Our computer is the flashlight*

Marge in Chains: The Simpsons



Al Jean

The 40,000th digit of π is 1



TO: DAVID BAILEY
FROM: JACQUELINE ATKINS
DATE: 10/9/92
NUMBER OF PAGES: 1

FAX (310) [REDACTED]

PHONE (310) [REDACTED]

A Professor at UCLA told me that you might be able to give me the answer to: What is the 40,000th digit of π ?

We would like to use the answer in our show. Can you help?

The 40,000th digit of π is 1

Bailey, Borwein and Plouffe, 1996

$$\pi = \sum_{i=0}^{\infty} \frac{1}{16^i} \left(\frac{4}{8i+1} - \frac{2}{8i+4} - \frac{1}{8i+5} - \frac{1}{8i+6} \right)$$

The 40,000th digit of π is 1

Bailey, Borwein and Plouffe, 1996

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The Simpsons: 22 Short Films About Springfield

Outside Interests



- Hiking
- Music
- Travel

Jeff Westbrook: *Nothing trains you better and gives you more analytical skills than mathematics. That skill is useful in the craziest places you might imagine: writing a TV show, writing a cartoon, and lawyering perhaps.*



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