

## 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 beauty of the language of mathematics gives us a precision that allows enormous subtlety in the articulation of ideas."

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

I use generalizations of vectors to study a variety of geometric problems in hyperbolic space. It is a wonderful fact that the solutions of these problems provide insight into the structure of physical theories. An example of such a theory that arose in my research during the context of use of a spinning top. I also study hyperbolic differential equations and structures related to the geometry of objects like branes.

Photo by [Gregory S. Galloway](#), a member of the [American Mathematical Society](#).

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I am a Mathematician.

# Representations of Spaces and Mathematics in Society

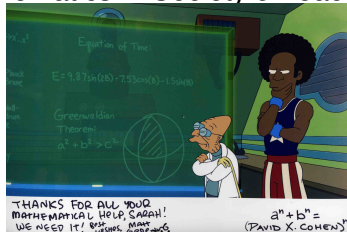
- **Analogy:** How do we know whether two fractions are the

same?  $\frac{14038227}{2351281419} \stackrel{?}{\rightarrow} \frac{3521}{589737}$

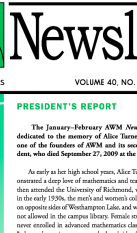
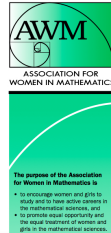
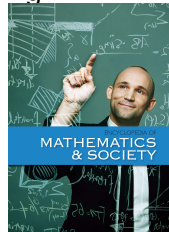


# Representations of Spaces and Mathematics in Society

- **Analogy:** How do we know whether two fractions are the same?  $\frac{14038227}{2351281419} \xrightarrow{?} \frac{3521}{589737}$
- Thesis problem had roots in crystallography and relates to some of the higher dimensional models for our universe, the study of 3-manifolds, string theory, viruses, and even music theory
- Representations of Spaces, Mathematicians, and Mathematics in Society & Teaching



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# Working with Others

Erdős-Bacon number: 7 or  $\infty$

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Six degrees of Kevin Bacon:

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Six degrees of Kevin Bacon: 3 or  $\infty$

*Futurama: Bite My Shiny Metal X* (documentary short)  $\xrightarrow{\text{David X Cohen}}$  *I*  
*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  
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*Hearing the platycosms*  $\xrightarrow{\text{John Conway}}$  *On the distribution of values of  
angles determined by coplanar points*  $\xleftarrow{\text{Paul Erdős}}$

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