

# Giving Women a Second Chance: Center for Women in Mathematics at Smith College

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# Goals

- help women make the transition from casual mathematics student to beginning PhD student in the mathematical sciences.
- provide an opportunity for students who decide they are serious about mathematics too late to apply directly to graduate programs
- create an environment that encourages undergraduate women to continue in the mathematical sciences.

# Why a Center for Women in Mathematics?

- Still not that many women in mathematics.
- At every stage women drop down or drop out.

## data



K-12 ▾

UNDERGRAD ▾

GRAD ▾

EDUCATORS

DATA &amp; RESEARCH

## DATA AND RESEARCH

Search ...



The [2015 Annual Survey of the Mathematical Sciences in the U.S.](#) paints a picture of women's representation in mathematics.

## As of 2015, women are...

41% of undergraduate math majors

28% of new PhDs in the US

25% of current postdocs in math

24% of tenured/tenure-stream math faculty

11% of full professors at PhD-granting institutions

## Why so few?

[SEE THE FULL REPORT](#)

This 2010 report from the American Association of University Women (AAUW) presents "profiles of eight key research findings that point to environmental and social barriers — including stereotypes, gender bias, and the climate of science and engineering departments in colleges and universities — that continue to block women's progress in STEM".

# Why do what *we* do

- Disconnect between taking math classes and doing mathematics.
- Social aspect of mathematics is hidden.
- The mathematician stereotype.
- Women get serious about math later.
- Women underestimate their abilities in mathematics.

# Perception: What is mathematics?

Disconnect between taking math classes and doing mathematics.

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Disconnect between taking math classes and doing mathematics.

## Solutions to Section 5.4

1. (i)  $P_2(x) = 2 + \frac{x}{4} - \frac{x^2}{64}$ , (ii)  $P_2(1) = 2 + \frac{1}{4} - \frac{1}{64} = 2 + \frac{15}{64}$

3.

$$\begin{aligned} P_8(x) &= 0 + (x-1) + \frac{(-1)(x-1)^2}{2!} + \frac{(2)(x-1)^3}{3!} + \frac{(-3)(x-1)^4}{4!} + \cdots + \frac{(-7)(x-1)^8}{8!} \\ &= (x-1) - \frac{(x-1)^2}{2} + \frac{(x-1)^3}{3} - \frac{(x-1)^4}{4} + \frac{(x-1)^5}{5} - \frac{(x-1)^6}{6} + \frac{(x-1)^7}{7} - \frac{(x-1)^8}{8} \\ &= \sum_{i=0}^8 (-1)^{(i+1)} \frac{(x-1)^i}{i} \quad (\text{could start at } i=1). \end{aligned}$$

5.(a)  $\sum_{i=0}^{\infty} \left( \left( \frac{2}{3} \right)^3 \right)^i = \frac{1}{1-8/125} = \frac{125}{117}$       (b)  $\frac{2}{5} \sum_{i=0}^{\infty} \left( \frac{1}{5} \right)^i = \frac{2}{5} \cdot \frac{1}{1-1/5} = \frac{1}{2}$

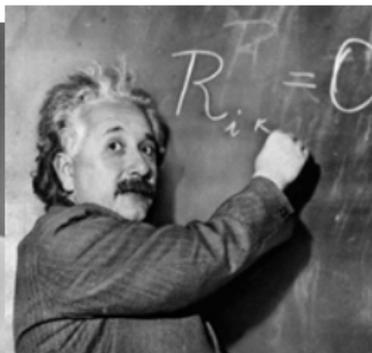
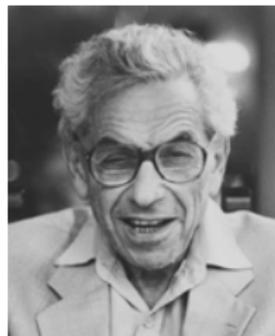
(c)  $2.2222\dots = 2 \sum_{i=0}^{\infty} \left( \frac{1}{10} \right)^i = 2 \cdot \frac{1}{1-1/10} = \frac{20}{9}$

(d)  $1 + 2x + 3x^2 + 4x^3 + 5x^4 + \cdots = \frac{d}{dx} \sum_{i=0}^{\infty} x^i = \frac{d}{dx} \frac{1}{1-x} = \frac{1}{(1-x)^2}$  converges if  $|x| < 1$

(e) does not converge since  $|-2.2| > 1$ .

# Perception: What does a mathematician look like?

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# Perception: What does a mathematician do?

# Perception: What does a mathematician do?



# Reality



Mathematics is open ended, creative, social.

## Who goes to grad school in mathematics and why?

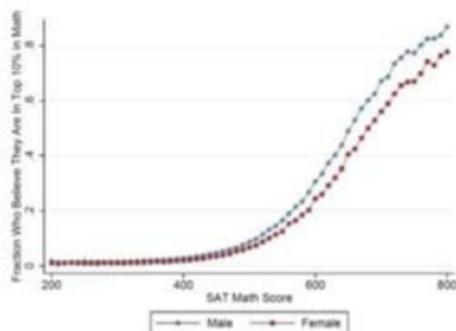
- People who are “good at math.”
- People who can imagine themselves as mathematicians.

## Who goes to grad school in mathematics and why?

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Women who are elite mathematicians are less likely than men to believe they're elite mathematicians

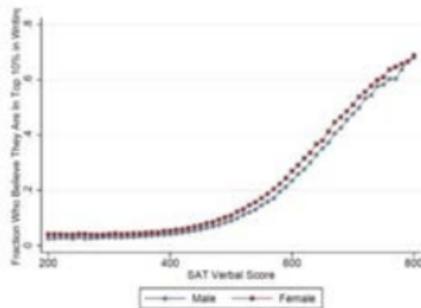
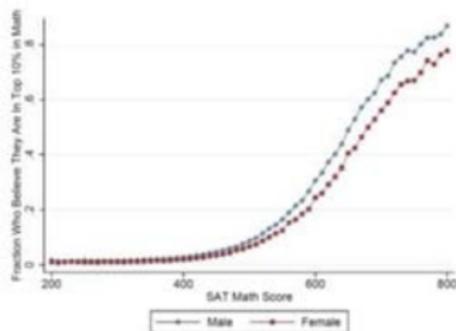


## Who goes to grad school in mathematics and why?

- People who are “good at math.”
- People who can imagine themselves as mathematicians.



Working • © 2013  
**Women who are elite mathematicians are less likely than men to believe they're elite mathematicians**



- Women and those from under-represented groups don't see themselves as potential mathematicians.
- Don't commit to mathematics until later. May have less extensive course work.
- May be quicker to drop out.
- Missing motivation/encouragement.
- Most mathematicians are not stereotypical math nerds.

# The Post-baccalaureate Program at Smith College:

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## Center for Women in Mathematics

### POST-BACCALAUREATE PROGRAM

[How to Apply](#)[FAQs](#)[Brochure](#)

Downloads require  
Adobe Reader (free)

[Download Adobe Reader](#) >

The Postbaccalaureate Program is for women with bachelor's degrees who did not major in mathematics or whose mathematics major was light. This program is open to all women with a serious interest in pursuing a higher degree in the mathematical sciences. Successful applicants will have completed at least Linear Algebra and Vector Calculus before enrolling in our program.

# Post-Baccalaureate Program in Mathematics at Smith College

- help women make the transition from casual mathematics student to beginning PhD student in the mathematical sciences.
- provide an opportunity for students who decide they are serious about mathematics too late to apply directly to graduate programs.
- create an environment that encourages women to continue in the mathematical sciences.

# What we do.

First, an opportunity.







## Megan Sawyer

Assistant Professor

Dr. Megan Sawyer joined the mathematics department as an assistant professor in 2013. Courses taught include: Heart of Mathematics, Applied Statistics, Calculus, Cryptology, Applied Linear Algebra, and Differential Equations.

Sawyer received their Bachelor of Science in Mathematics Education from University of Colorado Denver, a Certificate of Post-Baccalaureate Studies in Mathematics from Smith College, and their Master of Science in Mathematics and Doctor of Philosophy in Applied Mathematics from North Carolina State University. Sawyer was nominated for SNHU's Excellence in Teaching award in 2015, as well as several teaching awards from North Carolina State University.

Sawyer has served or serves as a member of the School of Arts and Sciences Curriculum Committee, Undergraduate Research Committee, and the President's Commission on LGBTQ Advocacy. In addition, they serve on the Great Bay Community College Mathematics Department Advisory Board, have participated in several symposia for Diversity, Equity and Inclusion in Higher Education, and serve as an advisor to Generation Equality, an advocacy group on campus.

Research interests include physiologically based pharmacokinetic (PBPK) modeling including applications to Vitamin D as well as dermal models. Multiple conference presentations and publications, including articles submitted to Toxicology Letters and Journal of Pharmacokinetics and Pharmacodynamics, center around these topics. Research awards include the US Environmental Protection Agency 2013 Level III Scientific and Technological Achievement Awards (STAA) for work conducted with undergraduate students. Other publications include "Modeling Dynamic Biological Systems" by Hannon and Ruth, Mathematical Association of America Book Reviews, October 2015.





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## Samantha Oestreicher

General Info    Alumni Info

**PhD Awarded:** 2014  
**Masters Awarded:** 2011  
**Advisors:** McGehee, Richard  
**PhD Thesis:** Forced Oscillators with Dynamic Hopf Bifurcations and applications to Paleoclimate.  
**Last Known Institution:** Target, Minneapolis, MN

**Remarks:** Lead Product Owner, Data & Analytics (Supply Chain), Target, Minneapolis, MN, 2017-present  
 Lead Data Scientist, Target, Minneapolis, MN, 2016-2017  
 Senior Supply Chain Analyst, Distribution Planning, Target, Minneapolis, MN, 2014-2016

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## School of Mathematics

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### Samantha Oestreicher

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## sustainable operations

We're committed to achieving milestones in our business by creating efficient buildings and spaces, using resources responsibly, eliminating waste and minimizing our carbon footprint.



explore  
sustainability



“Because you can’t take Real Analysis in Night School.”

## Our students were previously:

High school/middle school math teachers

Med school drop outs,

Information Technology Specialist

Lawyers

Architects

Bio majors, theater majors, French majors, Econ majors, Women Studies majors, Poorly prepared math majors

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# Leona Sparaco



Dr. Sparaco, of Tallahassee, Florida, was named visiting instructor in the Mathematics Department. She earned a bachelor's degree in mathematics from Siena College and a doctorate in mathematics from Florida State University. Since 2012, she has taught

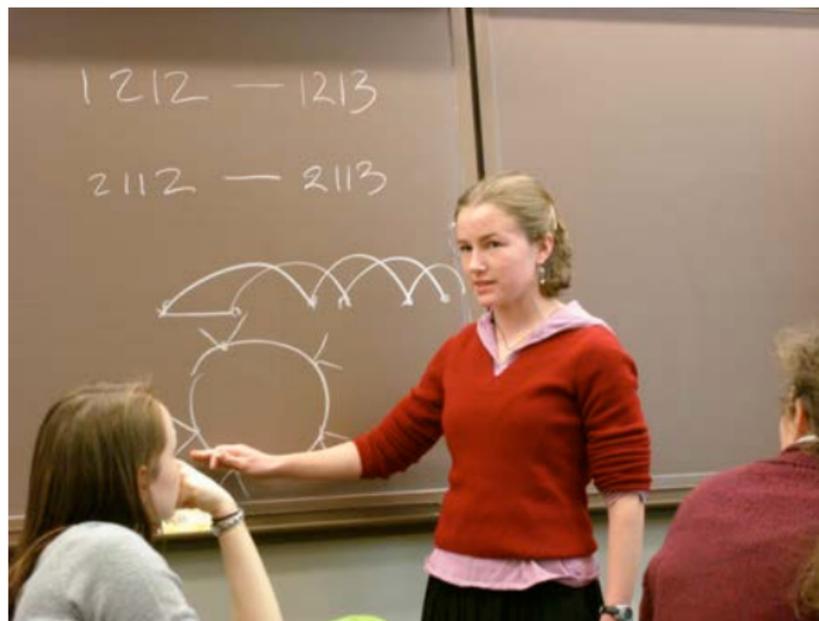
a variety of calculus, trigonometry, college algebra and other math classes at Florida State.

# Courses

- Real Analysis (Modified Moore Method)
- Algebra
- Topology
- Complex Analysis
- Other things: Combinatorics, Graph Theory, Number Theory, Differential Equations, Probability, Statistics, etc.
- Graduate Courses at U Mass. (Often several students together.)
- Dialogues in Math/ Research course

– Tailor the program to the student.

# Research Experience.



Experience open ended research. Work as a team.  
–creativity, set backs, conjectures, results....

# Research Experience.

The poster is titled "Convexity and Minimum Distance" and is presented by Steven Naylor, South College, Northampton, MA 01063, and Aron D. Edvardsson, Department of Mathematics, California State University, San Bernardino, CA 92407, Summer 2007.

**Abstract:**  
We look at the problem of reducing the minimum distance energy of a polygon by an appropriate perturbation. Building on work of previous authors, we show that a regular  $n$ -gon minimizes energy for a given perimeter, but we have been able to prove that convex polygons minimize the minimum distance energy for all polygons in  $\mathbb{R}^2$ . We hope that this will be a helpful step towards showing the regular  $n$ -gon has the least minimum distance energy for all polygons, and give suggestions for appropriate problems arising from this that could be used to further explore the problem.

**Definitions and Theorem:**  
"Steven's Minimum Distance Energy" is defined for a pair of non-overlapping edges,  $E$  and  $F$ , of an origin, as  $E_{SD}(E, F) = \frac{1}{|E||F|} \sum_{x \in E} \sum_{y \in F} |x - y|$ . Here  $|E|$  gives the length of the segment  $E$  and  $\sum_{x \in E} \sum_{y \in F} |x - y|$  gives the minimum distance between edges  $E$  and  $F$ . Steven's energy extends to the Minimum Distance Energy of a polygon,  $P$ , as given by

$$E_{SD}(P) = \sum_{\substack{E, F \text{ edges of } P \\ E < F}} E_{SD}(E, F)$$

$\mathbb{R}^2$ .  
Convex hull of an origin  $P$ , is the smallest convex set containing all vertices of  $P$ . It is denoted  $CH(P)$  and  $CH(P)$  gives the convex hull of  $P$ .

A perturbation of a polygon  $P$  is a set of points  $\{x_1, \dots, x_n\}$  in  $\mathbb{R}^2$  such that  $CH(P) \cap CH(\{x_1, \dots, x_n\}) = \emptyset$ . A perturbation  $\{x_1, \dots, x_n\}$  of a polygon  $P$  is a set of points  $\{x_1, \dots, x_n\}$  in  $\mathbb{R}^2$  such that  $CH(P) \cap CH(\{x_1, \dots, x_n\}) = \emptyset$  and  $\{x_1, \dots, x_n\}$  is a convex set.

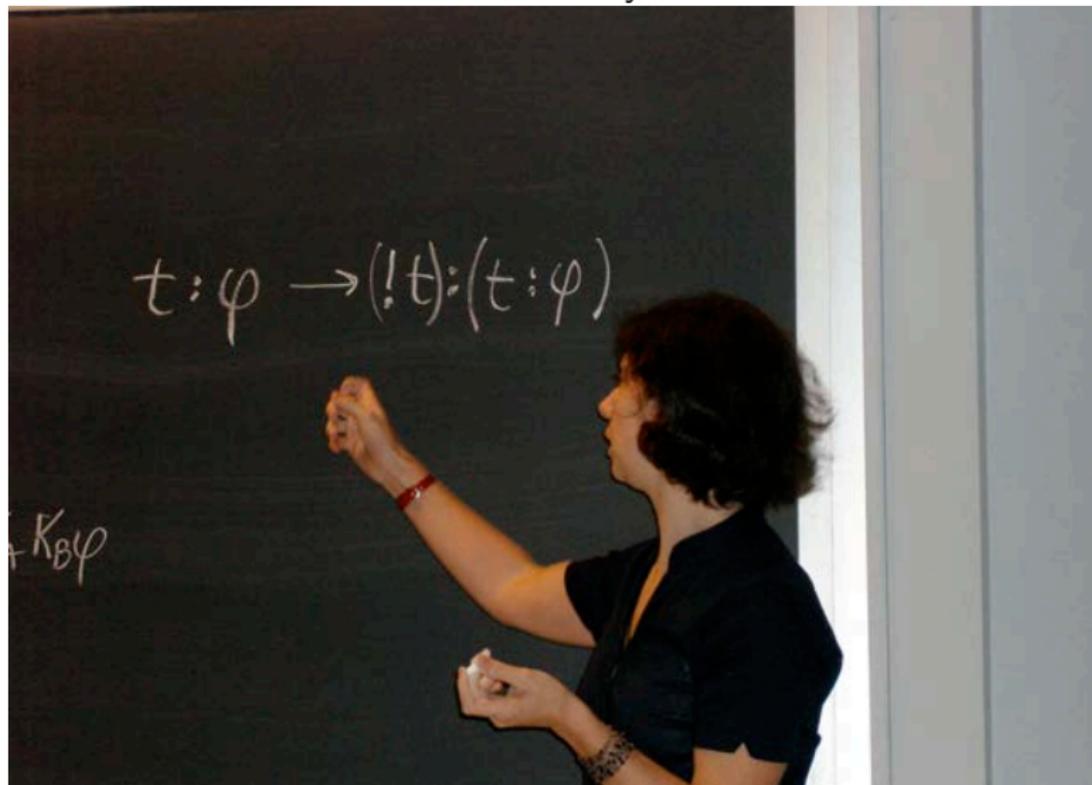
Theorem. If  $P$  is a convex polygon in  $\mathbb{R}^2$ , then there exists a perturbation  $\{x_1, \dots, x_n\}$  of  $P$  such that  $E_{SD}(P) > E_{SD}(\{x_1, \dots, x_n\})$ .

Figure 1: A Convex Polygon  
Figure 2: The Convex Hull  
Figure 3: Finding a Perturbation  
Figure 4: A Perturbation, the Perturbation Polygon and the Convex Hull of the Perturbation

-presentations, posters, talks, write ups,

# On being a mathematician....

Hear lots of mathematics from many mathematicians.



# On being a mathematician....

Meet lots of mathematicians at many stages.  
Hear their stories.



# Conferences:



Make them a community.  
Do hard math together.



Make them a community.  
Have fun together.



# Results

- In the past 9 years 90 postbacs completed program.
- 80 of these went to graduate programs in the mathematical sciences. (Mostly PhD programs) Minnesota, U. Illinois, U. Illinois Chicago, UC Davis, UMass, NC State, Wesleyan, Georgia, Brown, Santa Cruz, Columbia, Utah, Duke, Oregon, Cornell, N. Texas, Vermont, Georgetown, Nebraska, U. Iowa, Iowa State, U. Conn., Tufts, U Md, Columbia, Harvard, UNC, Indiana, London School of Economics.
- This is  $> 1\%$  first year women grad students.
- 80% of these student continue to make good progress (or have finished).

# How do grad schools react to our students?

- They ALL want more women students.

# How do grad schools react to our students?

- They ALL want more women students.
- In practice, many are wary of the meandering paths and lower GREs of these students.
- Most grad schools do not help students feel truly part of the math community early on. (several years of courses and exams before any research, competitive environment)
- We give our students a community to which they stay connected. (And point them to grad schools that suit them better.)

# Our experience

Women need to hear the stories of women mathematicians!

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Women need to hear the stories of women mathematicians!

Especially stories of bumps in the road and persistence.

# Our experience

Women need to hear the stories of women mathematicians!

Especially stories of bumps in the road and persistence.

And stories of those of us who are just “average” mathematicians.