



A Decade of MoMath: TEnacity, InTENSity, PoTENTIAL



Cindy Lawrence, Executive Director and CEO National Museum of Mathematics

TEN years



2012 to 2022

How we got here

1. **TENacity**
2. **PreTENse**
3. **ConTENt**
4. **AtTENtion**
5. **InTENsity**
6. **AtTENdance**
7. **CompeTENcy**
8. **PoTENcy**
9. **ExTENsion**
10. **PoTENTial**

What keeps us here

Ongoing challenges

Past

Present

Future

TEN years



2012 to 2022

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TENacity



A Museum of Mathematics??

“Poor business idea.”

“Everyone hates math.”

“Nobody will come.”

“Destined to fail.”

“It just doesn’t add up!”

TENacity

Can we build this
on a circular track
for museum use?



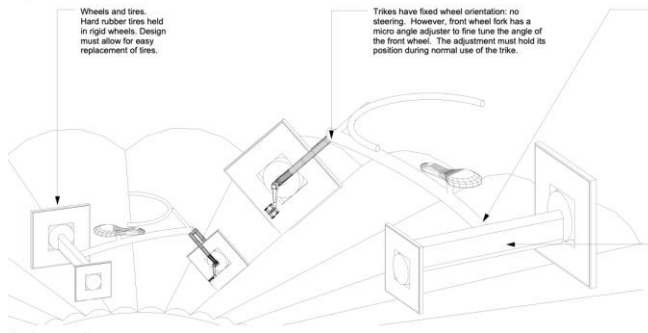
Stan Wagon, 1997

“Impossible!”

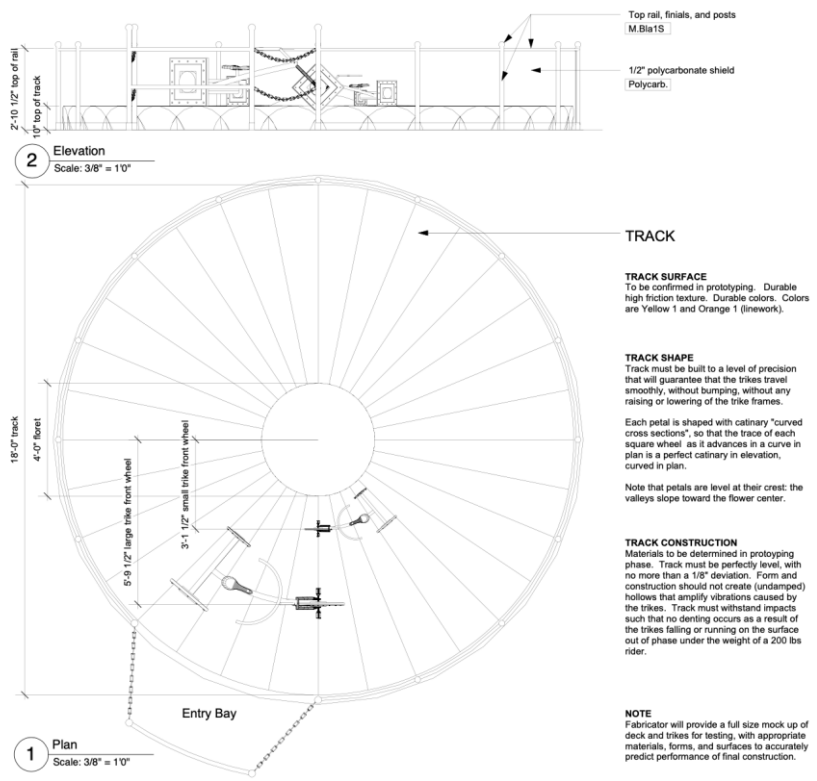
TENacity

Or...

“It’s just an engineering problem.”



TRIKE FINISHES
 Same as Math Midway.
 M.Red1G M.Gm1G
 P.Pur1 P.Bu1



TENacity

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TENacity



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TENacity



People lose money →

Philanthropy slows →

Museums have less money →

Exhibit projects come to a halt →

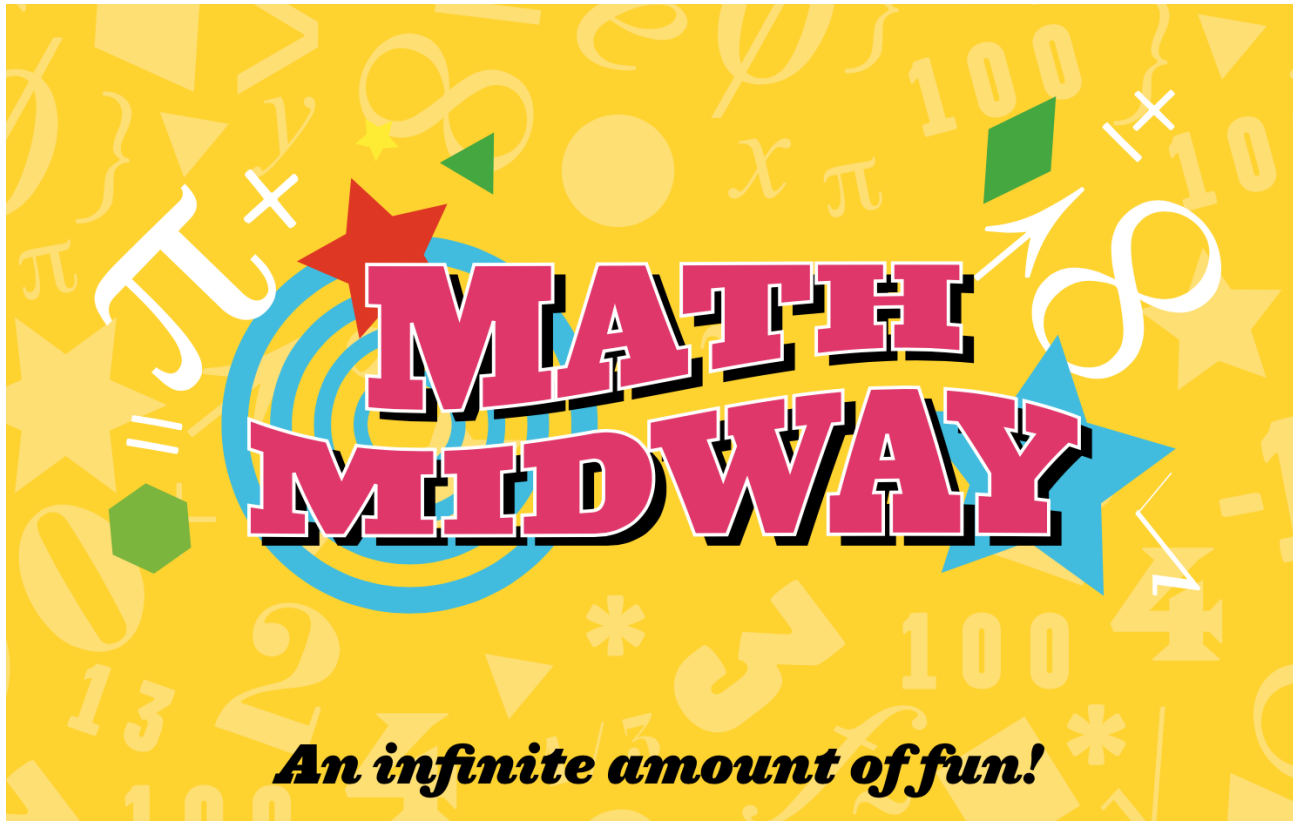
Exhibit fabricators have no work

Build a traveling exhibit of math?

That's usually a two-to-three year project...

TENacity

...completed in 4.5 months!



TENacity

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June 14, 2009



TENacity

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OPENING NYC 2012
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BECOME A MEMBER TODAY!

The banner features the MO MATH logo in the center, with the text 'OPENING NYC 2012' and 'momath.org' below it. To the right, a curved banner says 'BECOME A MEMBER TODAY!'. The background is decorated with various colorful mathematical motifs, including large stylized letters, starburst patterns, and geometric shapes.

TENacity

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TENacity



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MOMATH
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The Newsletter of
The National Museum of Mathematics
January 2012
Volume 6



Whitney, Lawrence, and Nissen count down at the 12-12-12 Opening Ceremony.

Opening Ceremony: Turning on the Museum



MoMath's first visitors on 12-15-12 await entry to the Museum

TEN years



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What keeps us here

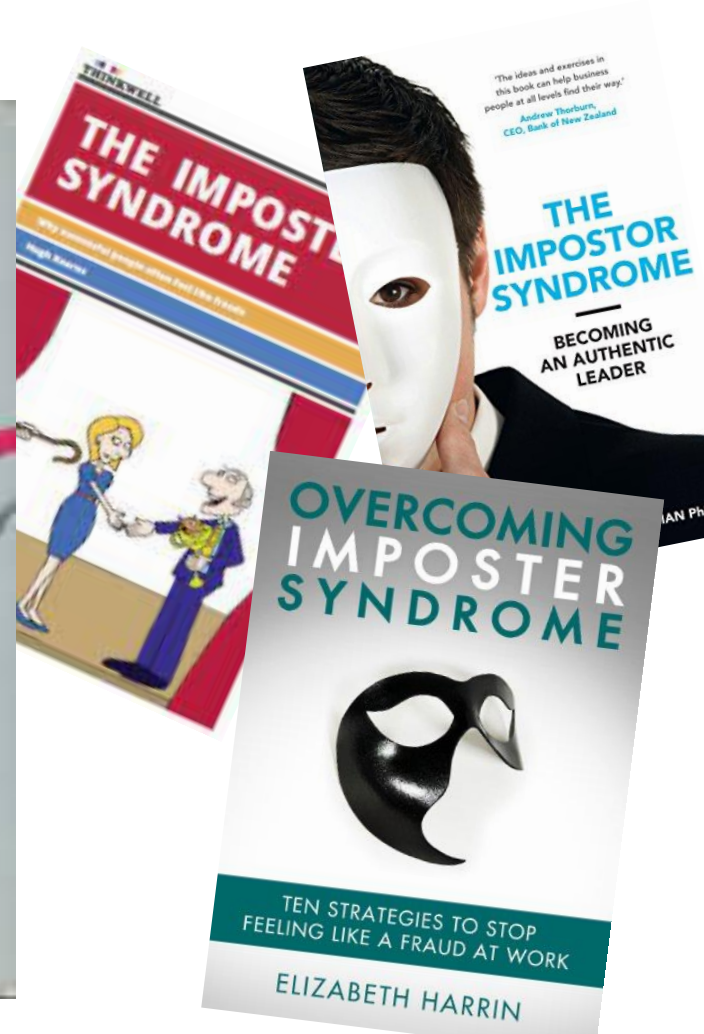
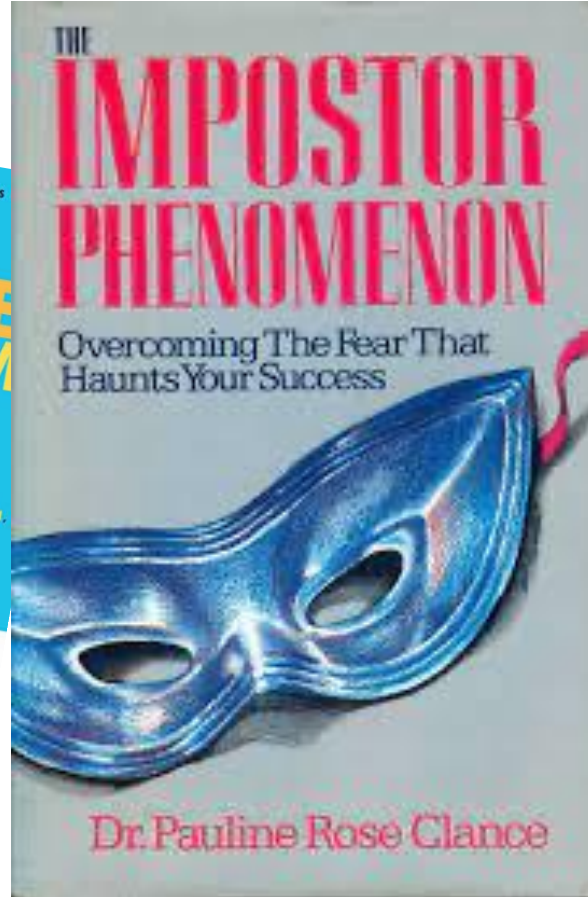
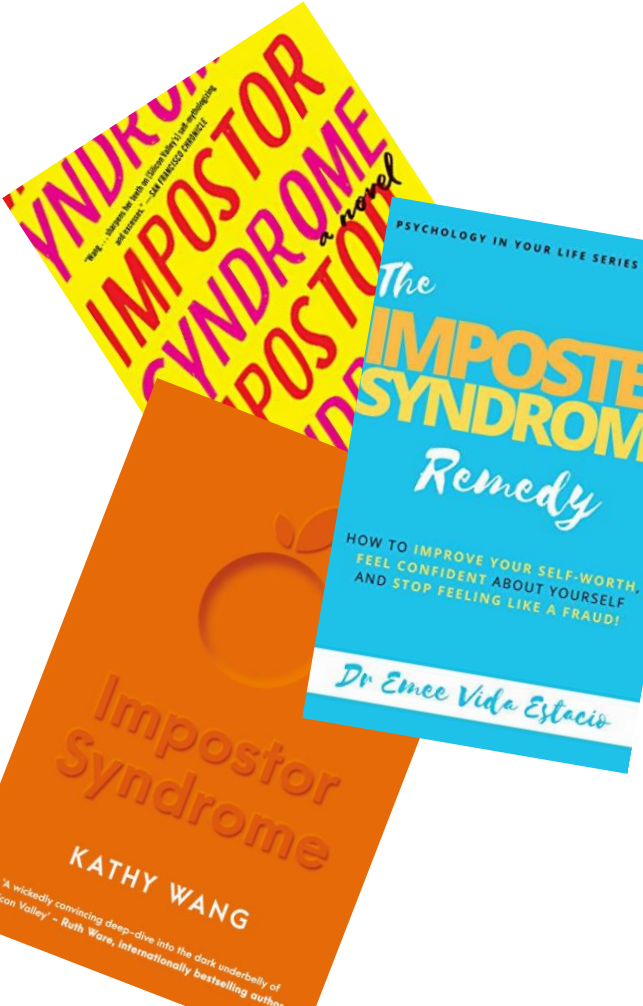
Ongoing challenges

Past

Present

Future

PreTENse

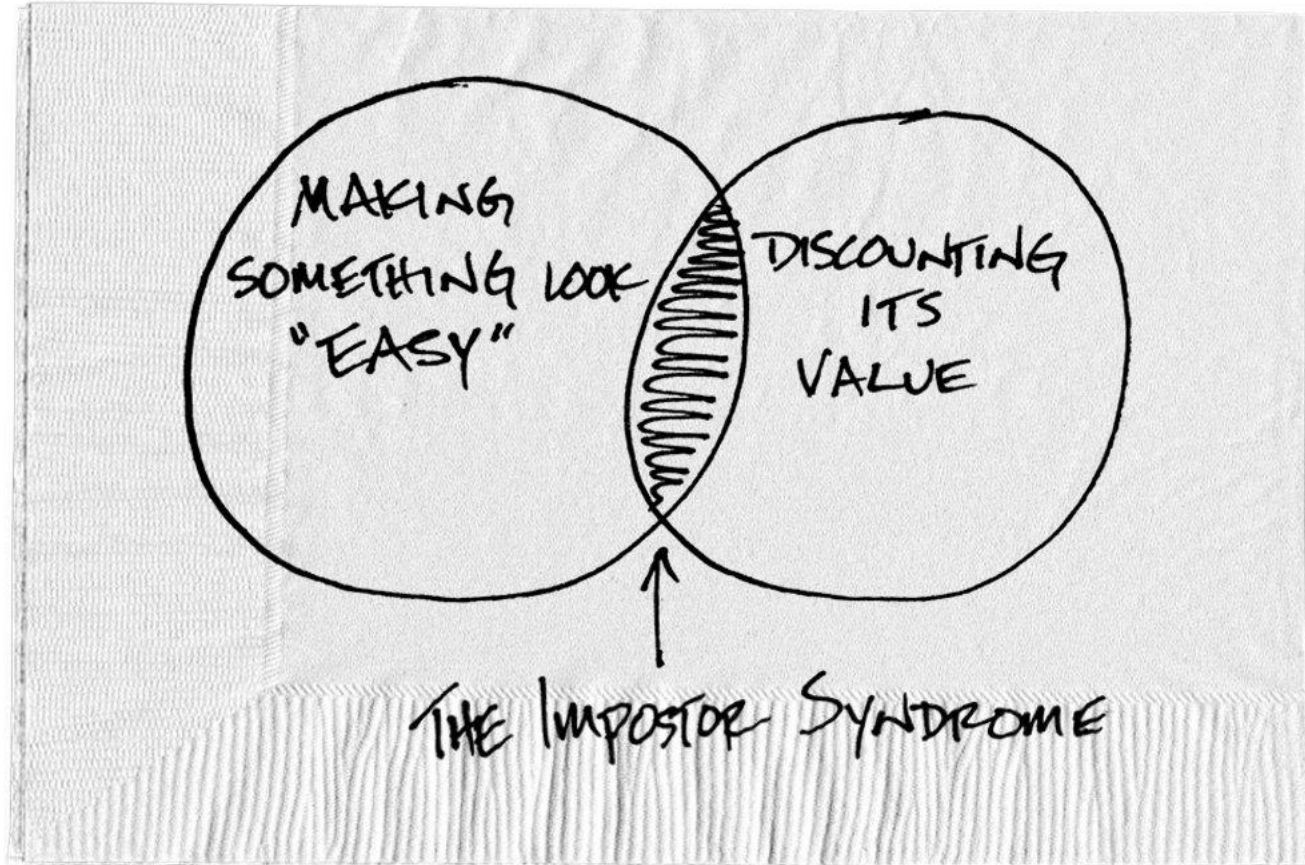


PreTENSE



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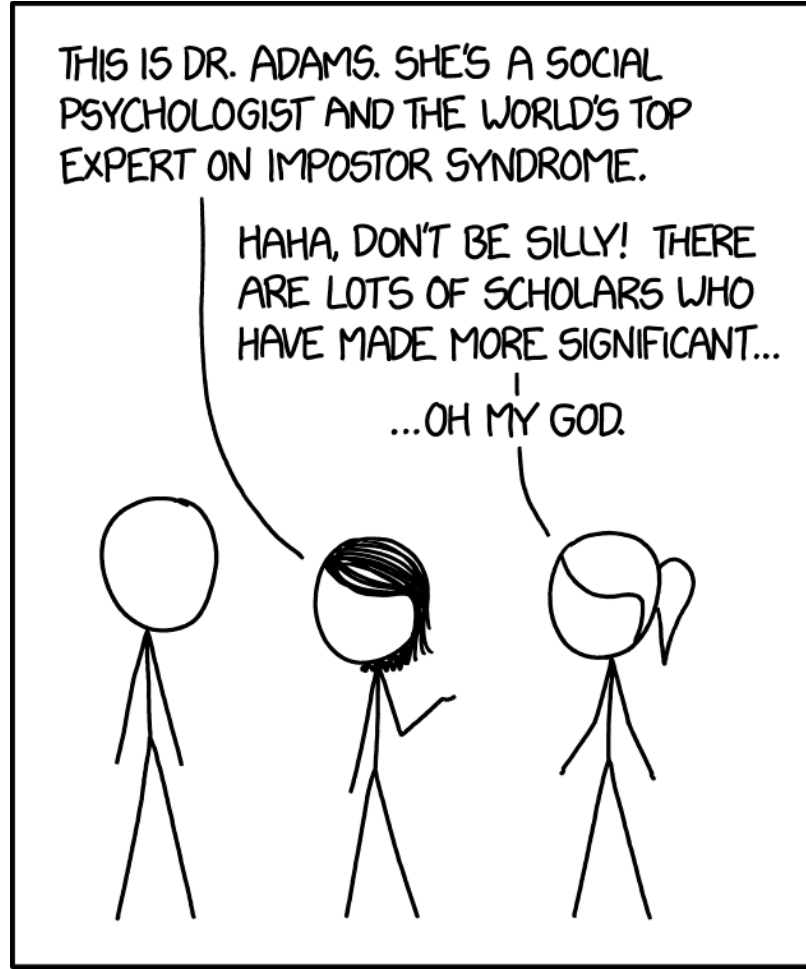


PreTENse



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ConTENT



Theorem

Let the parabola P defined as $y = x^2$ be plotted on the Cartesian plane.

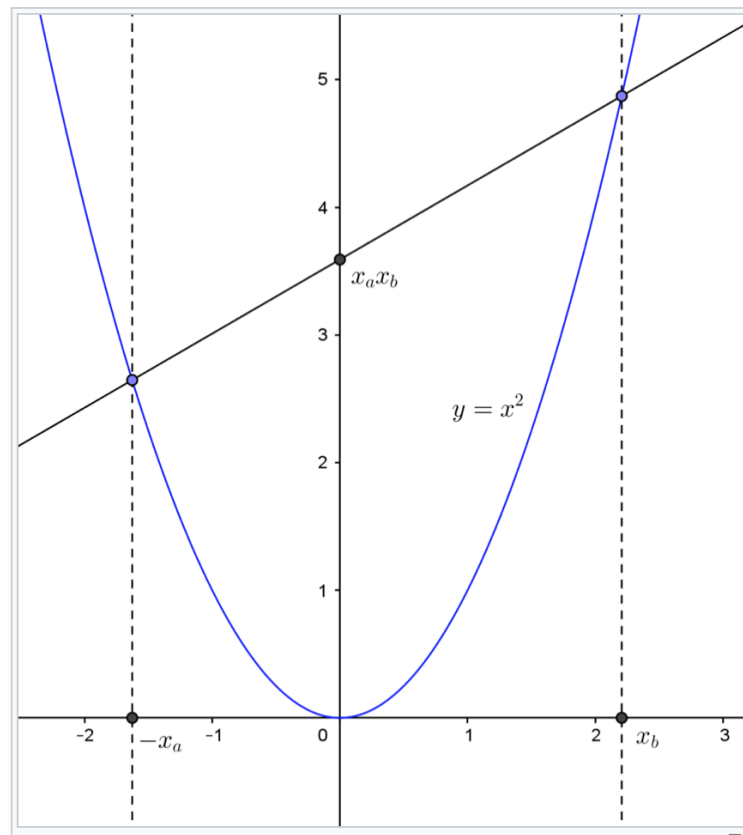
Let $A = (x_a, y_a)$ and $B = (x_b, y_b)$ be points on the curve $f(x)$ so that $x_a < x_b$.

Then the line segment joining AB will cross the y -axis at $-x_a x_b$.

Thus P can be used as a nomogram to calculate the product of two numbers x_a and x_b , as follows:

- (1) Find the points $-x_a$ and x_b on the x -axis.
- (2) Find the points A and B where the lines $x = -x_a$ and $x = x_b$ cut P .
- (3) Lay a straightedge on the straight line joining A and B and locate its y -intercept c .

Then $x_a x_b$ can be read off from the y -axis as the position of c .



ConTENT

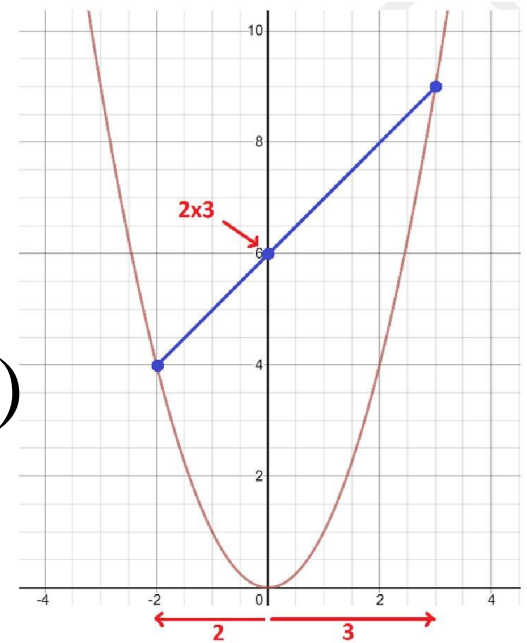


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$$y = mx + b$$

$$y = x^2$$

$$a^2 - b^2 = (a+b)(a-b)$$



$$a = 2$$

$$b = 3$$

ConTENT



$$5 \times 8$$

$$3 \times 4$$

$$9 \times 7$$

1 x	2 x	3 x	4 x
1 x 1 = 1	2 x 1 = 2	3 x 1 = 3	4 x 1 = 4
1 x 2 = 2	2 x 2 = 4	3 x 2 = 6	4 x 2 = 8
1 x 3 = 3	2 x 3 = 6	3 x 3 = 9	4 x 3 = 12
1 x 4 = 4	2 x 4 = 8	3 x 4 = 12	4 x 4 = 16
1 x 5 = 5	2 x 5 = 10	3 x 5 = 15	4 x 5 = 20
1 x 6 = 6	2 x 6 = 12	3 x 6 = 18	4 x 6 = 24
1 x 7 = 7	2 x 7 = 14	3 x 7 = 21	4 x 7 = 28
1 x 8 = 8	2 x 8 = 16	3 x 8 = 24	4 x 8 = 32
1 x 9 = 9	2 x 9 = 18	3 x 9 = 27	4 x 9 = 36
1 x 10 = 10	2 x 10 = 20	3 x 10 = 30	4 x 10 = 40
1 x 11 = 11	2 x 11 = 22	3 x 11 = 33	4 x 11 = 44
1 x 12 = 12	2 x 12 = 24	3 x 12 = 36	4 x 12 = 48
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5 x	6 x	7 x	8 x
5 x 1 = 5	6 x 1 = 6	7 x 1 = 7	8 x 1 = 8
5 x 2 = 10	6 x 2 = 12	7 x 2 = 14	8 x 2 = 16
5 x 3 = 15	6 x 3 = 18	7 x 3 = 21	8 x 3 = 24
5 x 4 = 20	6 x 4 = 24	7 x 4 = 28	8 x 4 = 32
5 x 5 = 25	6 x 5 = 30	7 x 5 = 35	8 x 5 = 40
5 x 6 = 30	6 x 6 = 36	7 x 6 = 42	8 x 6 = 48
5 x 7 = 35	6 x 7 = 42	7 x 7 = 49	8 x 7 = 56
5 x 8 = 40	6 x 8 = 48	7 x 8 = 56	8 x 8 = 64
5 x 9 = 45	6 x 9 = 54	7 x 9 = 63	8 x 9 = 72
5 x 10 = 50	6 x 10 = 60	7 x 10 = 70	8 x 10 = 80
5 x 11 = 55	6 x 11 = 66	7 x 11 = 77	8 x 11 = 88
5 x 12 = 60	6 x 12 = 72	7 x 12 = 84	8 x 12 = 96
©ActiveForKids.com	©ActiveForKids.com	©ActiveForKids.com	©ActiveForKids.com
9 x	10 x	11 x	12 x
9 x 1 = 9	10 x 1 = 10	11 x 1 = 11	12 x 1 = 12
9 x 2 = 18	10 x 2 = 20	11 x 2 = 22	12 x 2 = 24
9 x 3 = 27	10 x 3 = 30	11 x 3 = 33	12 x 3 = 36
9 x 4 = 36	10 x 4 = 40	11 x 4 = 44	12 x 4 = 48
9 x 5 = 45	10 x 5 = 50	11 x 5 = 55	12 x 5 = 60
9 x 6 = 54	10 x 6 = 60	11 x 6 = 66	12 x 6 = 72
9 x 7 = 63	10 x 7 = 70	11 x 7 = 77	12 x 7 = 84
9 x 8 = 72	10 x 8 = 80	11 x 8 = 88	12 x 8 = 96
9 x 9 = 81	10 x 9 = 90	11 x 9 = 99	12 x 9 = 108
9 x 10 = 90	10 x 10 = 100	11 x 10 = 110	12 x 10 = 120
9 x 11 = 99	10 x 11 = 110	11 x 11 = 121	12 x 11 = 132
9 x 12 = 108	10 x 12 = 120	11 x 12 = 132	12 x 12 = 144
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$$2 \times 6$$

$$7 \times 1$$

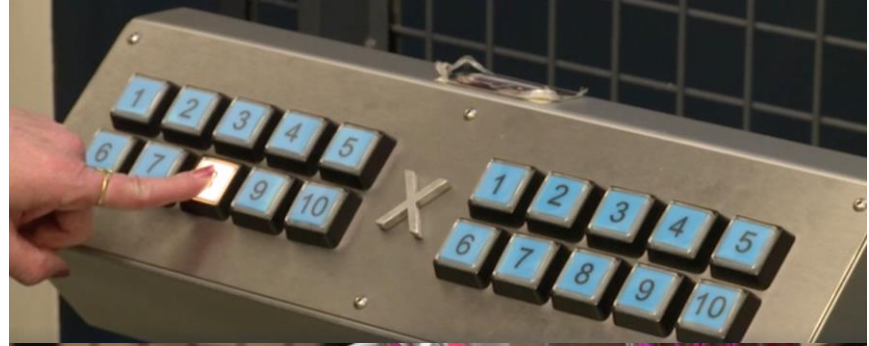
$$4 \times 4$$

ConTENT



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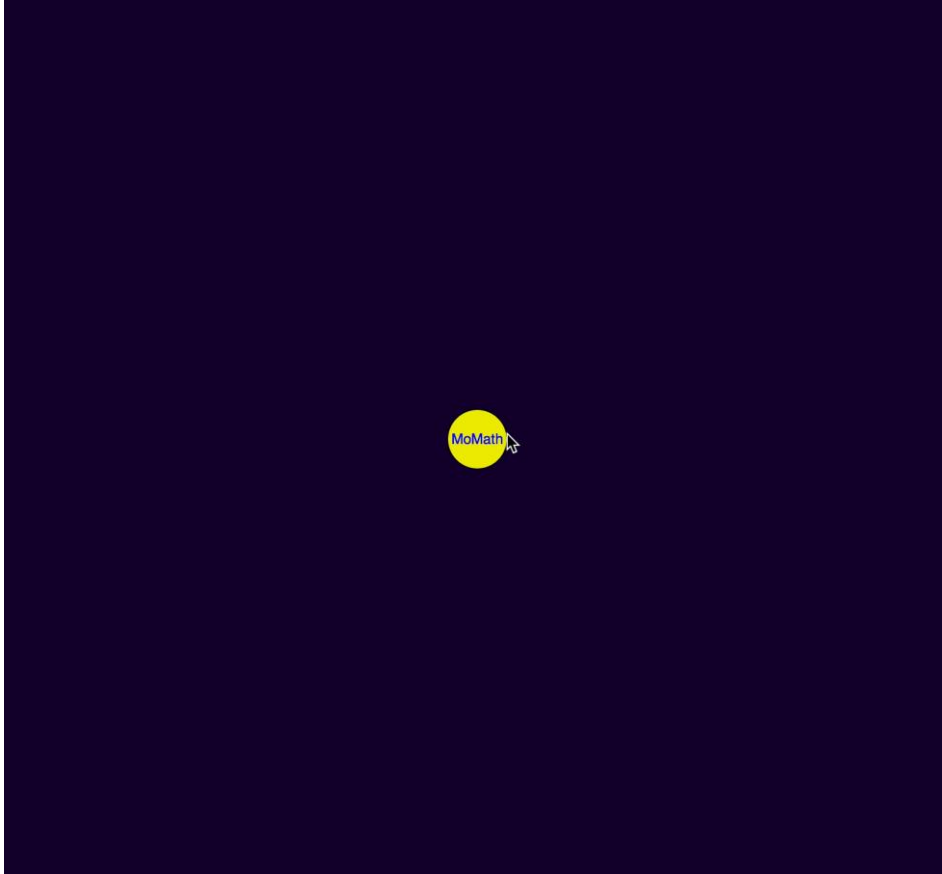


ConTENT

Math Square



ConTENT



venus.momath.org

TEN years



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What keeps us here

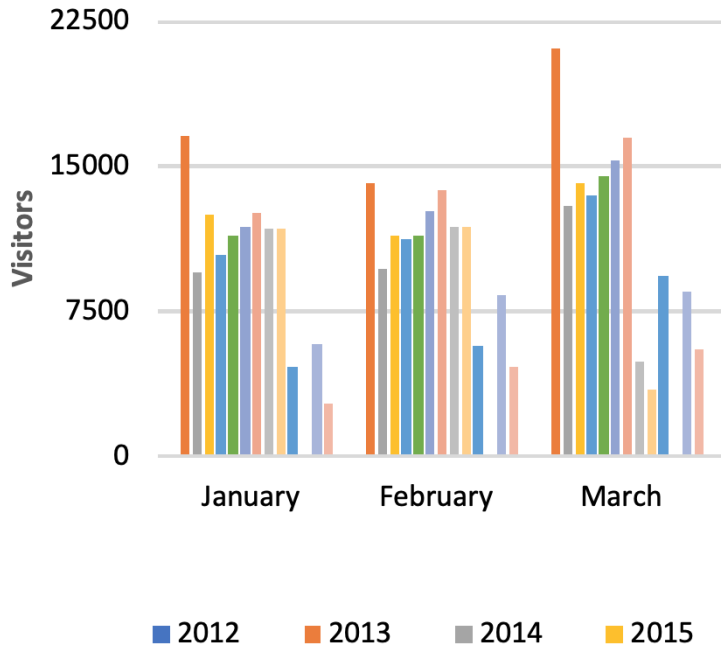
Ongoing challenges

Past

Present

Future

AtTention



What happened in
March of 2013?

AtTENTion



CBS Sunday morning with Mo Rocca
morocca.momath.org



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Present

Future

InTENSity



Hey, December 5, 2013
is coming up...that's a
special date...

InTENSity

The date 5-12-13...

$$5^2 + 12^2 = 13^2$$

Hey...isn't the
Flatiron Building a
right triangle?

InTENsity

Hey! It's not just a
right triangle...
It's a 5-12-13 right
triangle!

InTENSity



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August 17, 2015

pythagorizevideo.momath.org



InTENSity

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InTENsity

Los Angeles Times



New York's Flatiron Building is based on a right triangle. So the National Museum of Mathematics is using it to celebrate its one-year anniversary, on a date that is a Pythagorean triple. (Los Angeles Times)

SCIENCE NOW DISPATCHES FROM FRONT LINES OF SCIENCE,
MEDICINE, HEALTH AND THE ENVIRONMENT

Some squares sum squares to celebrate Pythagoras

By Geoffrey Mohan
December 5, 2013

If you enjoy Pi Day (3/14) and Avogadro's Number Day (10/23), then get this: today is a Pythagorean triple date.

You'd have to be a serious math nerd to recognize that the sum of the squares of 5 and 12 equals the square of 13. Which is exactly what the co-founders of the National Museum of Mathematics (MoMath) noticed.

So, along with some 2,000 fellow math geeks and museum staff, MoMath co-founder Cindy Lawrence will help surround the most well-known right-triangle-based edifice in the country -- New York's Flatiron Building -- and execute a glow-stick proof of the ancient Greek mathematician's famed theorem.

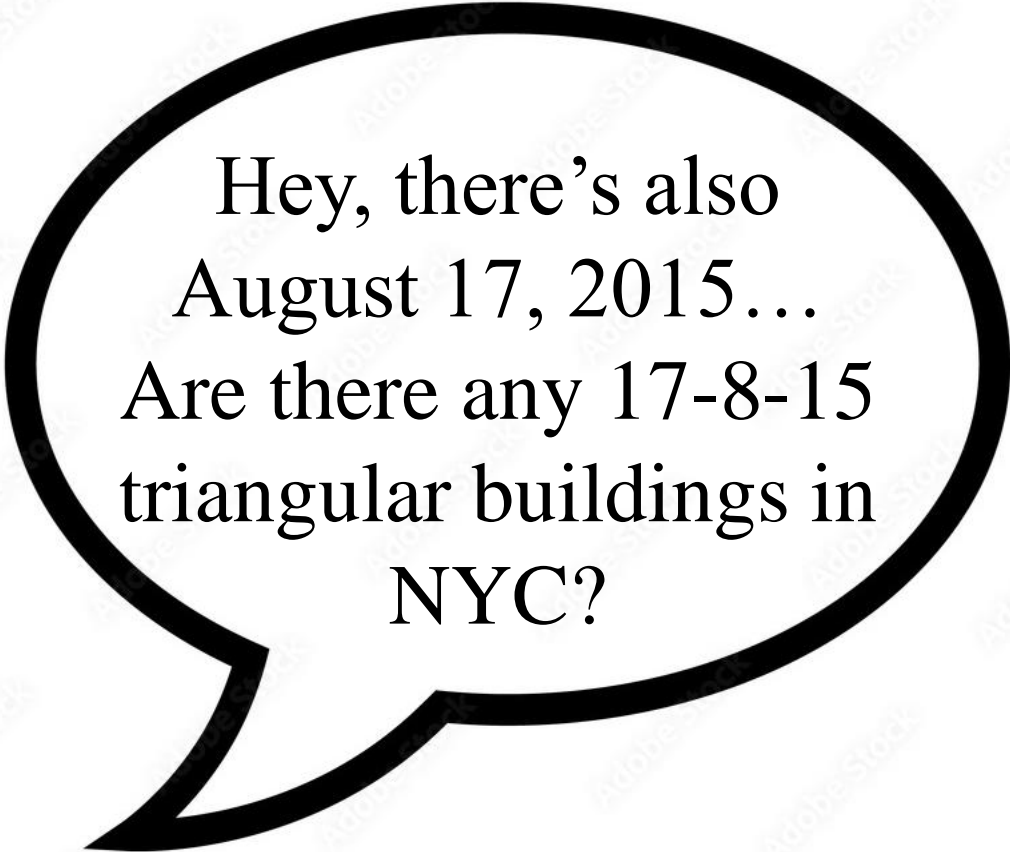
"You know about a 5-12-13 right triangle?" Lawrence asked, hopefully. "So, we decided we would celebrate to-

day as Pythagoras Day, since it's one of the few days in the calendar that works out to be a Pythagorean triple. And then we knew the Flatiron Building was roughly a right triangle, and we thought: well, maybe we should do something with that."

LA Times:

Some squares
sum squares...

InTENsity



Hey, there's also
August 17, 2015...
Are there any 17-8-15
triangular buildings in
NYC?

InTENSity




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Nope.

This is useless
information, but the
Triangle Pub in Seattle is
exactly an 8-15-17 right
triangle...

InTENsity



Hey, we know the
people who run the
Pacific Science Center.
Hmmm...

InTENsity

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August 17, 2015

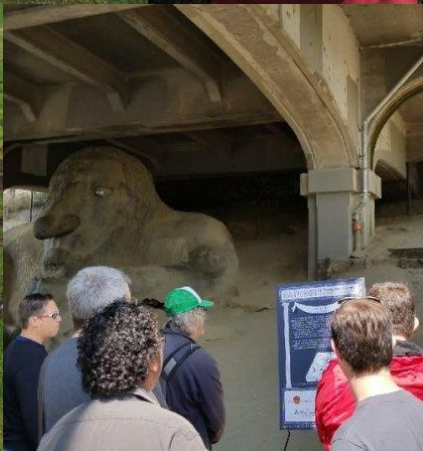


InTENsity

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August 15, 2017



InTENsity

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August 15, 2017



TEN years



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8. **PoTENcy**
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What keeps us here

Ongoing challenges

Past

Present

Future

AtTENDance



August 2018
buzzfeed.momath.org



AtTENDance



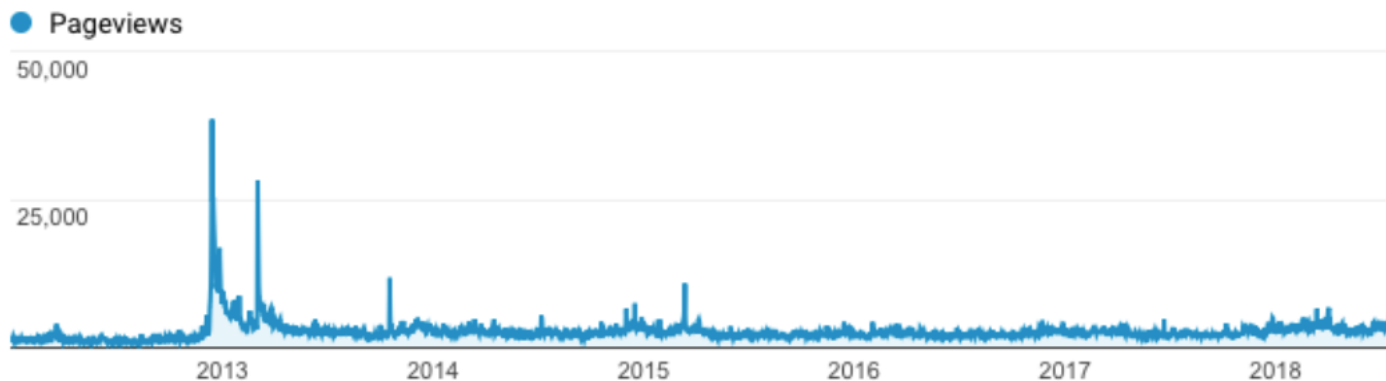
On July 19, MoMath was featured in a video on BuzzFeed that went viral. By August 9, the video had logged over 15 million views. The release of the video had a noticeable effect on both foot traffic and website visitors. In the case of the website, the effect of the BuzzFeed Bounce on page views is clearly visible:



AtTENDance



This is the largest spike in page views since the opening days of the Museum. The highest peak was during opening week (~38k peak), with a secondary spike (~28k peak) in March 2013 when the Museum was featured on CBS Sunday Morning with Mo Rocca. Smaller spikes (~12k and ~11k, respectively) were observable in October 2013 and March 2015, but the BuzzFeed Bounce is by far the largest spike in activity since the earliest days of the Museum.



AtTENDance



MoMath welcomed its one millionth visitor in June 2019.

Date	Cumulative Total	Day Total
6/1/2019	999678	214
6/2/2019	999945	267
6/3/2019	1000397	452
6/4/2019	1000958	561
6/5/2019	1001482	524
6/6/2019	1002083	601

Subject: Evening Report 6/3/19

Date: June 3, 2019 at 5:14:27 PM EDT

Today: 452

Year to date: 76,738

Last year: 72,543

Total visitors: 1,000,397

AtTENDance



June 2019

One million visitors!



AtTENDance

MILLION MILLIMETER MARCH



TEN years



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Ongoing challenges

Past

Present

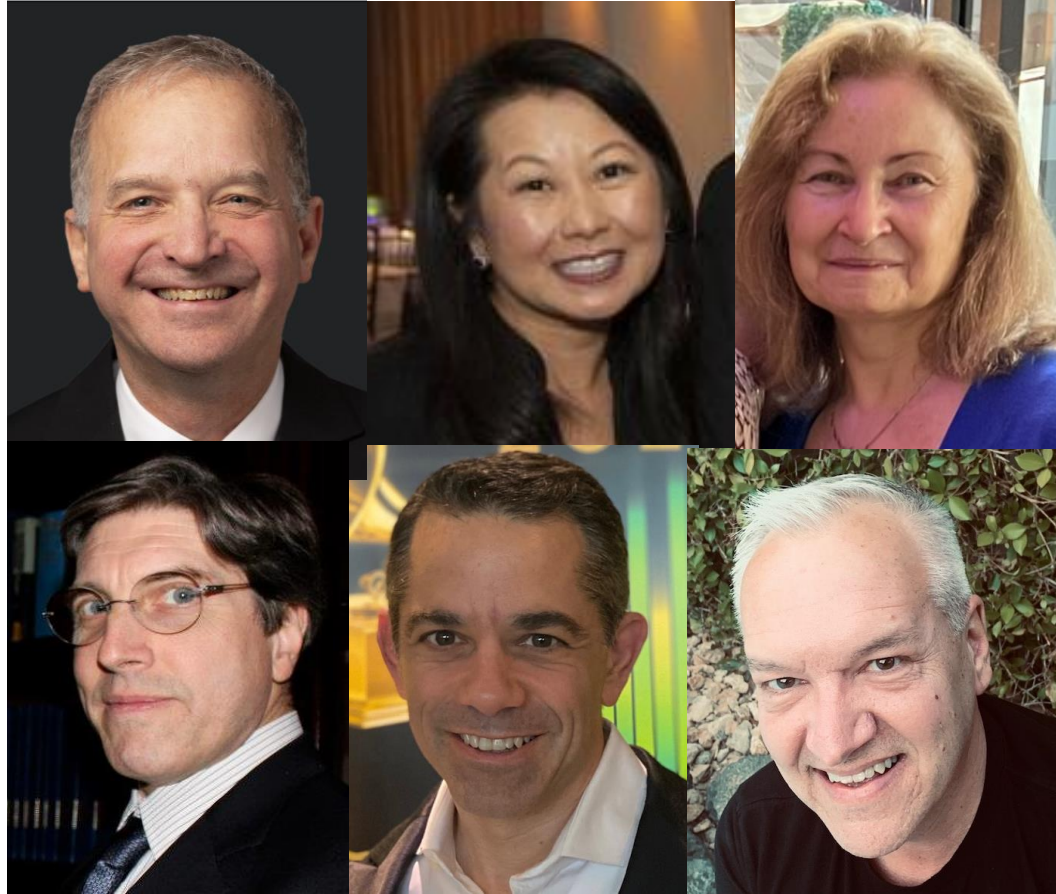
Future

CompeTENcy



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Senior leadership team

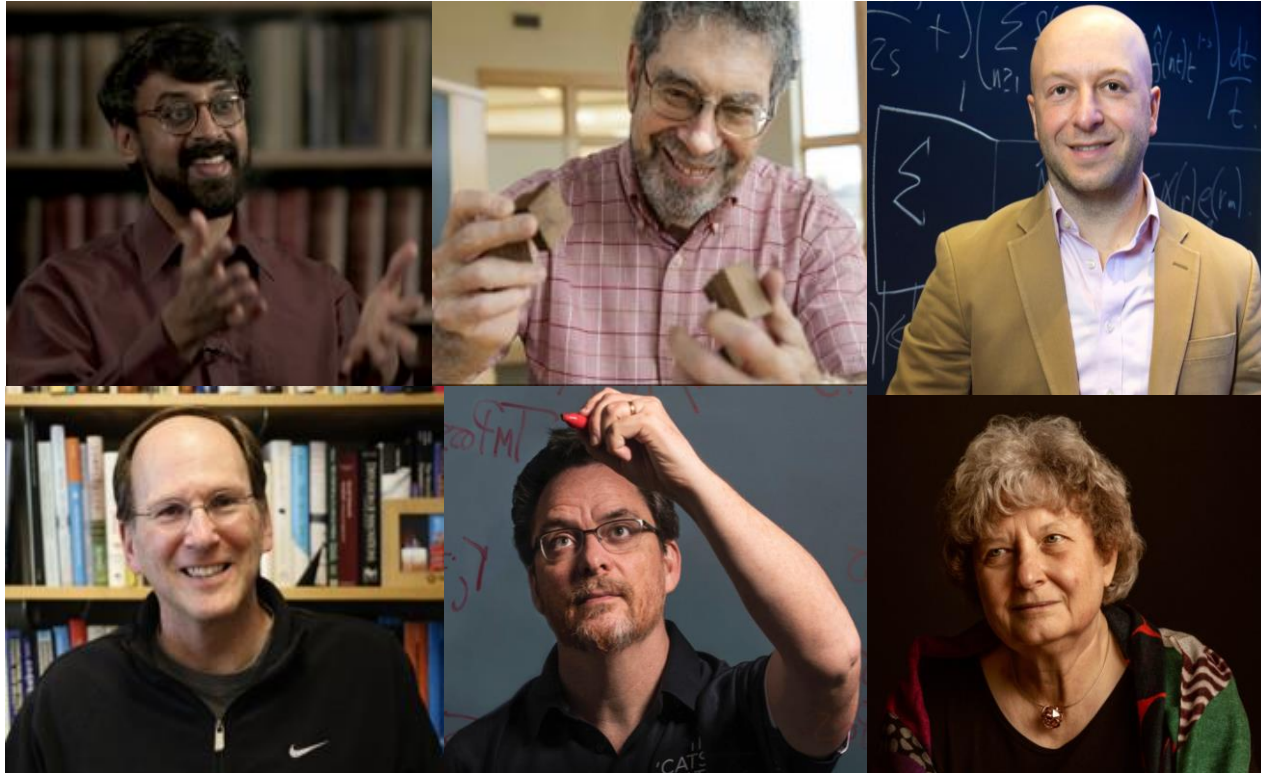


CompeTENcy



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Distinguished Visiting Professor for the Public Dissemination of Mathematics



CompeTENcy



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Student interns



CompeTENcy

Exponent Fellows (and one special guest)



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Ongoing challenges

Past

Present

Future

PoTENcy



March 2014

OUTCOME 1: CHILDREN KNOW THAT MATHEMATICS CAN BE A PROCESS OF DISCOVERY / MORE THAN JUST FINDING THE CORRECT ANSWER.

OUTCOME 2: CHILDREN FEEL POSITIVELY ABOUT MATH AND BELIEVE IT IS FUN, EXCITING, AND INTERESTING.

OUTCOME 3: CHILDREN LEARN ABOUT AT LEAST ONE MATHEMATICAL IDEA OR CONCEPT.

OUTCOME 4: CHILDREN ENGAGE IN AUTHENTIC MATHEMATICAL THINKING, USING LOGIC AND REASONING TO IDENTIFY AND SOLVE A PROBLEM.

OUTCOME 5: CHILDREN EXPRESS INCREASED INTEREST IN MATH BY EXPLORING AT LEAST ONE RELATED CONCEPT AT HOME INSPIRED BY THEIR EXPERIENCES WITH THE EXHIBITS.

January 2018

Key Findings

- Visitor engagement at MoMath is high, indicated by long exhibit dwell times in the Museum, the high number of exhibits with which visitors engage, and high levels of staff interaction with visitors.
- Visitors have overwhelmingly positive changes in their perception of math after even a single visit to the Museum.
- Most visitors emerge from their visit to MoMath with a new understanding about the value of math.
- By introducing cultural references in the visual arts, architecture, and history, the Museum reduces anxiety among visitors who have an uncomfortable relationship with mathematics.
- The high level of physical interactivity at MoMath has been and will continue to be absolutely key to the success of the Museum.
- Almost 50% of weekend visitors to MoMath are adults without children — illustrating that MoMath appeals to all ages.

January 2019

WHAT WAS VISITORS' LEVEL OF ENGAGEMENT WITH EXHIBITS AT THE MUSEUM?

Visitor engagement with MoMath exhibits was high, as indicated by long dwell times in the museum, the high number of exhibits with which visitors engaged, and high levels of staff interaction.

WHAT WERE VISITORS' PERCEPTIONS OF MATH IN THE CONTEXT OF THE EXHIBITS?

Visitors' perceptions of math in the context of their museum experience with exhibits were overwhelmingly positive, as indicated by positive changes in their perception of math upon exiting the museum and their perception of the museum's main messages.

WHAT, IF ANY, NEW LEARNING EMERGED FROM VISITORS' EXPERIENCE?

Most visitors emerged with some new learning from their experience with exhibits, ranging from isolated facts to more detailed descriptions of math.

January 2019

CONCLUSION

Summative evaluation demonstrates that MoMath visitors have engaging, accessible, and relatable exhibit experiences with math that are different from their everyday, more mundane, math experiences at school, work, or home. Evaluation findings also demonstrate the essential role staff play in facilitating these exhibit experiences for visitors as well as the types of exhibits—those with accessible, interactive problems to solve—that support visitors’ engagement and learning. And, in RK&A’s 30-year experience with timing and tracking studies in museums, the higher than normal median dwell times in the museum and with individual exhibits not only indicate high levels of visitor engagement but also suggest that MoMath’s approach to exhibit design paired with skilled staff facilitation is quite successful and worthy of further exploration. Finally, the fact that visitors’ perceptions of math began to shift from negative to positive after a single visit is highly encouraging and serves as a wonderful entry point into new learning about the value of math.

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Ongoing challenges

Past

Present

Future

ExTENSION



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MoMath Exhibits Around the World



March 2020

ExTENSION



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MoMath Programs Around the World



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Ongoing challenges

Past

Present

Future

PoTENTIAL



The Limit Does Not Exist

A Program for Teen and Tween Girls Who Like Math



Join a diverse group of women in mathematics as they share their personal career journeys and experiences and answer your questions. This is your chance to hear from *real* mathematicians, with *real* stories, about what it's *really* like to study math after high school and have a math-focused career — **it's a girls' world after all!**

PoTENTIAL



Bending the Arc

An intimate discussion with accomplished Black mathematicians

Moderator and Host



John Urschel, former NFL (Baltimore Ravens) professional, current MIT Math PhD candidate, and MoMath Trustee

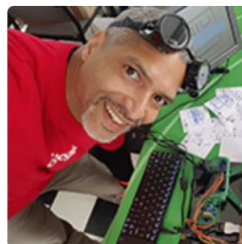
Featured Panelists



Monica C. Jackson
Interim Deputy Provost
& Dean of Faculty,
Mathematics &
Statistics, American
University



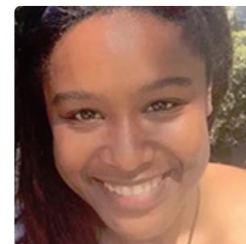
William A. Massey
Edwin S. Wilsey
Professor, Department
of Operations
Research and Financial
Engineering, Princeton
University



James McLurkin
Senior Hardware
Engineer, Google



Jelani Nelson
Professor in the
Department of
Electrical Engineering
and Computer Science,
UC Berkeley
(Photo by Yaphet
Teklu)



Ashia Wilson
Assistant Professor in
Electrical Engineering
and Computer Science,
MIT

TEN years



2012 to 2022

A picture is worth 10^3 words!

Fun

Colorful

1. Exhibits
2. *Additions* Shop
3. *Composite* Gallery
4. Visitors
5. *Math Encounters*
6. *Family Fridays*
7. *MathHappenings*
8. Music and Dance
9. NYC Math Festival
10. Annual Galas

Hands-on

Engaging

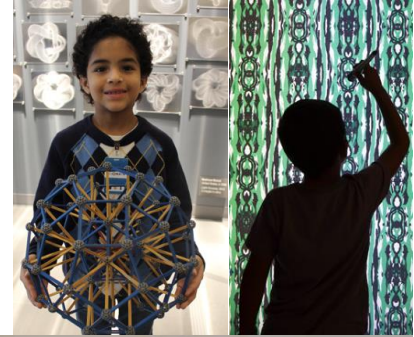
Collaborative

Creative

SHAPES OF SPACE
inspired by David de Weese and Anne Heller

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Exhibits





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*Additions: the
Shop at MoMath*





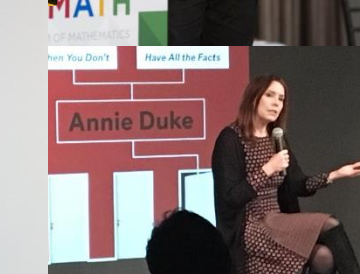
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Composite: the Gallery at MoMath



MOMATH

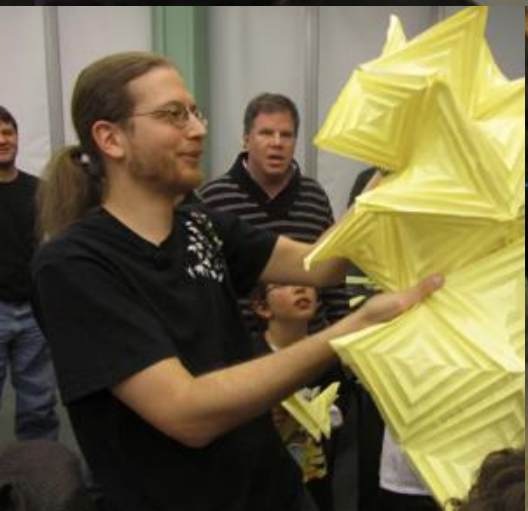
Visitors





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Math Encounters



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Family Fridays





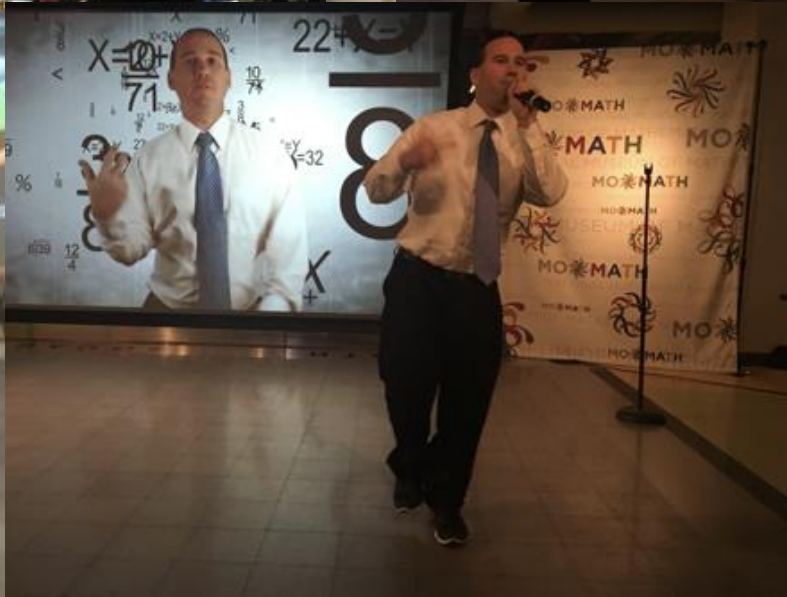
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MathHappenings



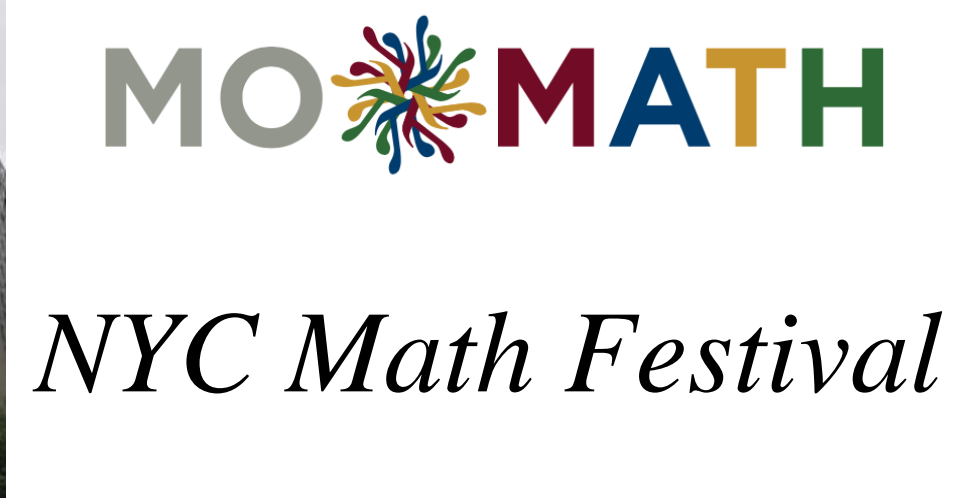
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Music and Dance



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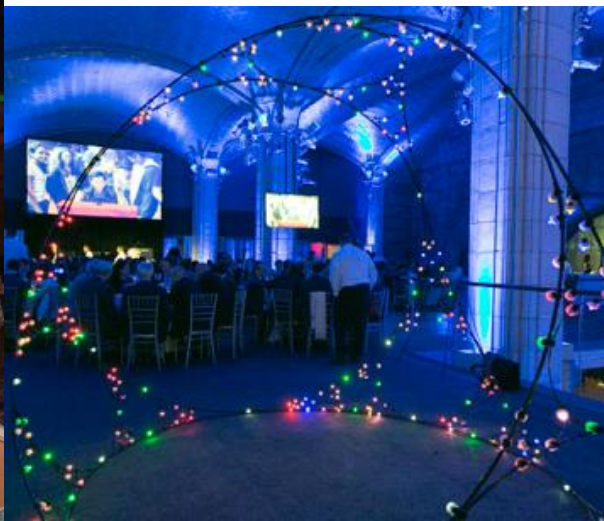
NYC Math Festival





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Annual Galas





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Thank you!



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