

# Mathemalchemy: Student Experiences at the National Academy of Sciences



Alice Petillo Marymount University MAA Spring Sectional



# NAS Great Hall

Images that illustrate the history of science including mathematics.





# Cultural Programs of the National Academy of Sciences *Mathemalchemy*



# Mathemalchemy:

A traveling multimedia math-meets-art installation that has been Dr. Ingrid Daubechies' constant passion (some might say obsession) for the last five years. The exhibition — a 360-degree diorama of sorts, 20 feet long, 10 feet wide and nine and a half feet high — was created in collaboration with Dominique Ehrmann, a fiber sculptor from Quebec, and a team of 24 artistic mathematicians and mathematical artists. It debuted in 2022 at the National Academy of Sciences in Washington, D.C., and has made several stops since.

<https://mathemalchemy.org/>





# Sample student comments

- it was magical to me i fell in love with the statue of it, seeing some of what i saw on the website like the lighthouse, Chinese math, the turtle, etc.
- I was very interesting to see how everything in the exhibit worked together to make a larger picture of how math is in everything.
- I thought that the exhibit was really cool. I was impressed how much they were able to fit into such a small space. I think that its great that so many different people came together to create each piece. There were so many details and interesting factors to the exhibit that you could spend all the time in the world talking about the entire exhibit.



I think that having something like that where there are characters geared towards kids can encourage students to have more interest in math. It's always good to associate fun with ALL subjects, not just the tradition "fun subjects". Math gets a bad rap for being a hard or un-fun class when really it can be creative and fun and be integrated into just about everything.



# Favorite location: the Bakery

- I loved the bakery, I thought that the tessellating cookie cutters were really cool as well as a lot of the other geometry within the bakery.
- The bakery: i didn't know that math could be so artistic and beautiful
- The bakery was very interesting. The guide explained how the cookie sheets were laid out so that there was no leftover dough. And the cookies were in the shape of Pi. The bakery also had shapes lining the bakery and inside. The fact that a cat was baking was fun and interesting.
- My favorite artifact was the cat and the bakery. I noticed that the bakery was called Pi but at first I did not notice that the cat was making Pi cookies!! It was very cool to also find out that when Dr. Daubechies was creating this artifact they calculated a way to cut the cookie shapes in a way where there is the least amount of dough left.



# Relevance to being a math student

- I think the exhibit is relevant because we get to see "physically" the concepts we were talking about in class. Some mathematical concepts are vague and seeing them made me understand the concepts more.
- I really liked seeing how so many things were related to one another. If I didn't go I would not have known how closely related a lot of the topics in class we covered are.
- Gives me a better understanding of math and a new appreciation. It opened my eyes to a greater world and that math is so much more than just the classroom.



# Self-reflection on change....

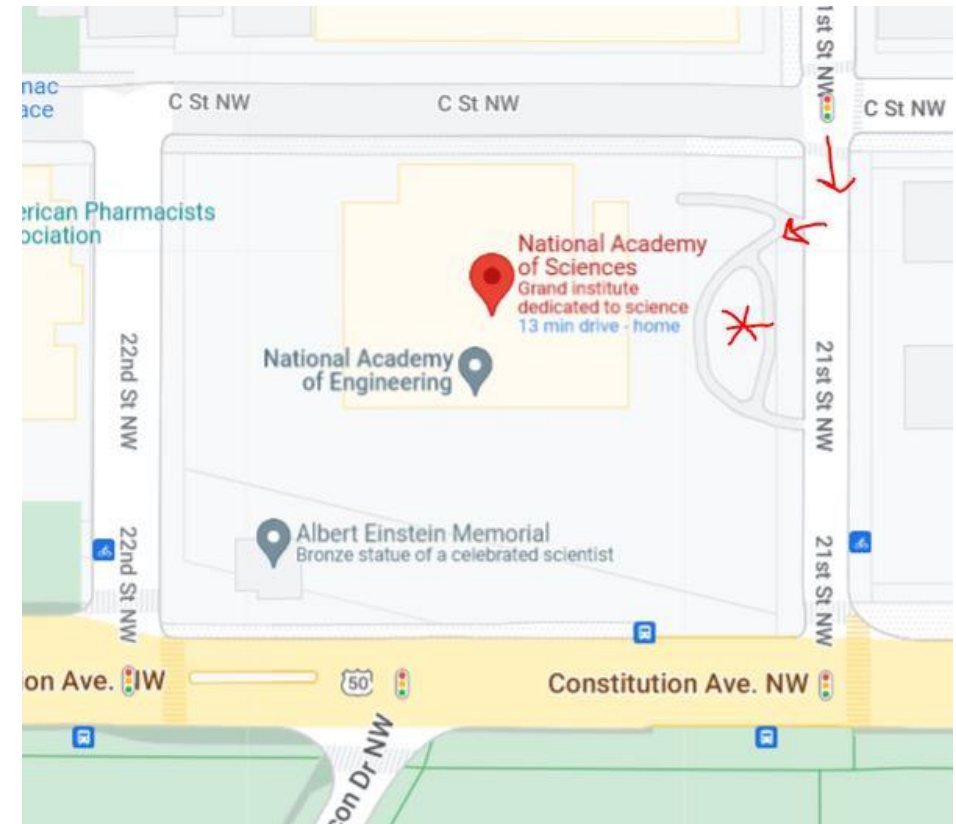
- I've always struggled with math and always related to it to the classroom, even after being told countless times that it will be used in real life situations. Once seeing and hearing the meaning behind the exhibit, I saw math in a different light and realized that there are countless people in this era that are invested in math.
- This is relevant to me as someone who wants to become a teacher because it helped me see how worldwide and applicable mathematics is to everyone's daily life.

# One way to scaffold this kind of “field trip” assignment

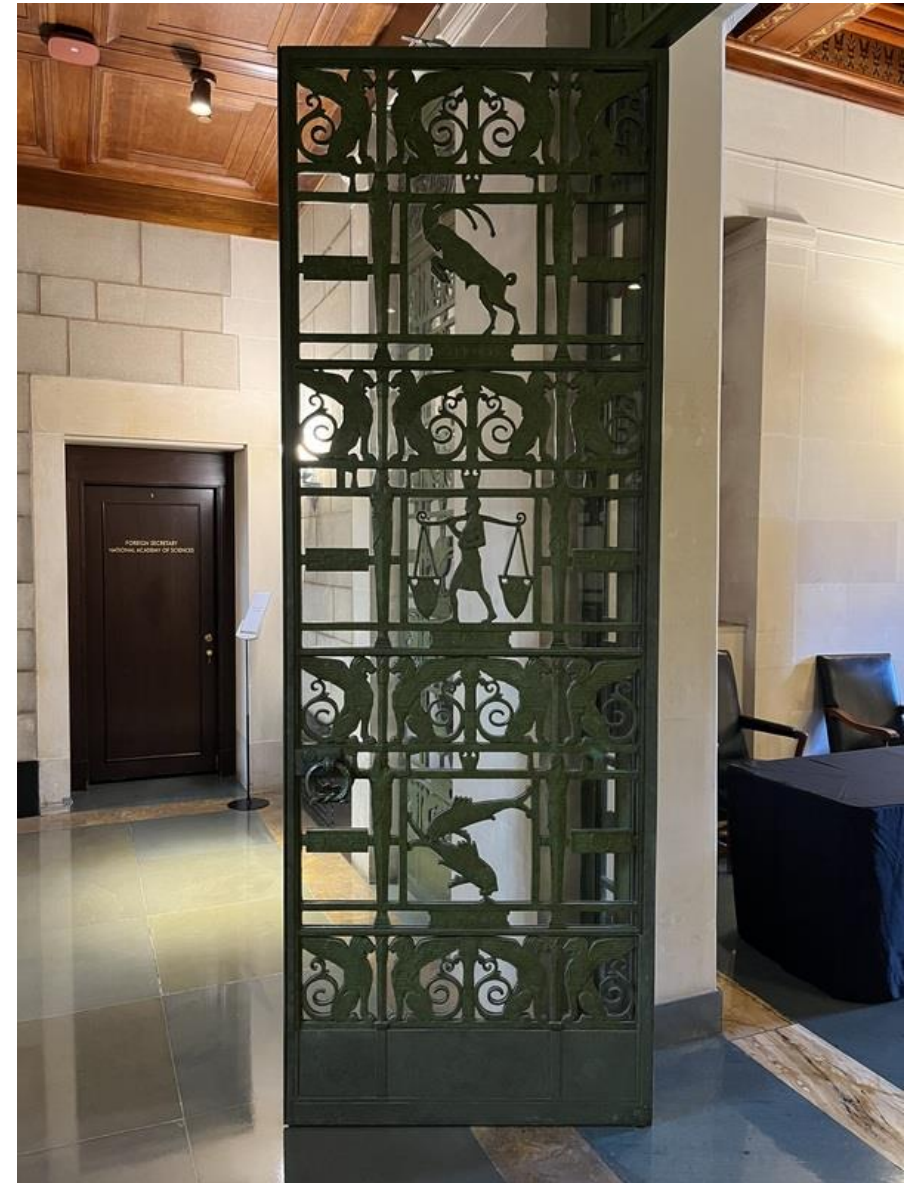
1. “Recon” visit
2. Arrange transportation
3. Pre reflection
4. Post reflection
5. Photo essay
6. Rubric



Visit the exhibit yourself.  
Familiarize yourself with  
the location,  
parking, transportation  
and ID requirements.



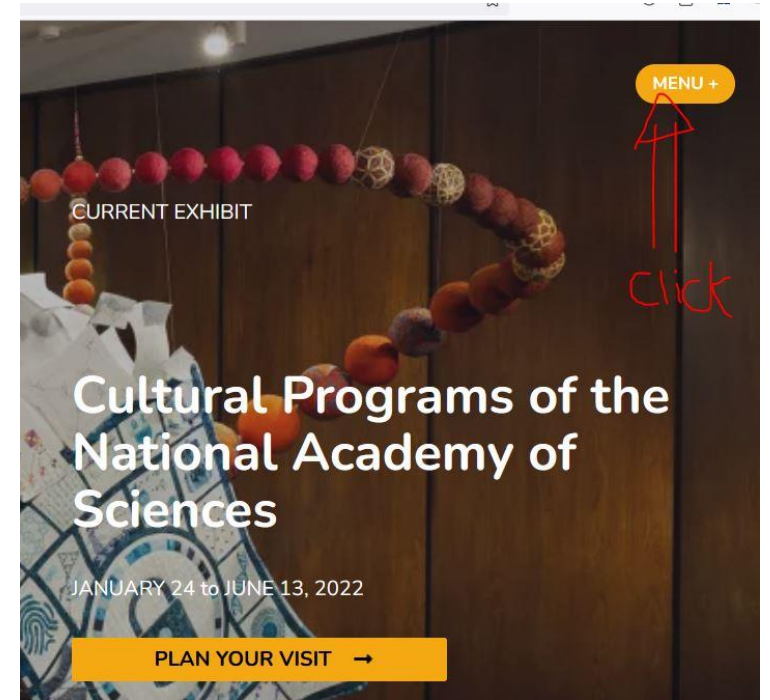
# Getting there.....





# Pre reflection-Google Form

- [Google Form link](#)  
(please make your own copy)
- Completed BEFORE the visit.



# Post reflection-Google Form

- [Google Form link](#)  
(please make your own copy)
- Completed the same day AFTER the visit.








# Photo “Story/Essay”

- Completed using student photos.
- Instructions:

Take 5-8 photos while at the event where you saw mathematics or mathematicians. Then create a narrative of a few sentences per photo to tell a photo story of your NAS experience with the Mathemalchemy and the Women in STEMM exhibit.

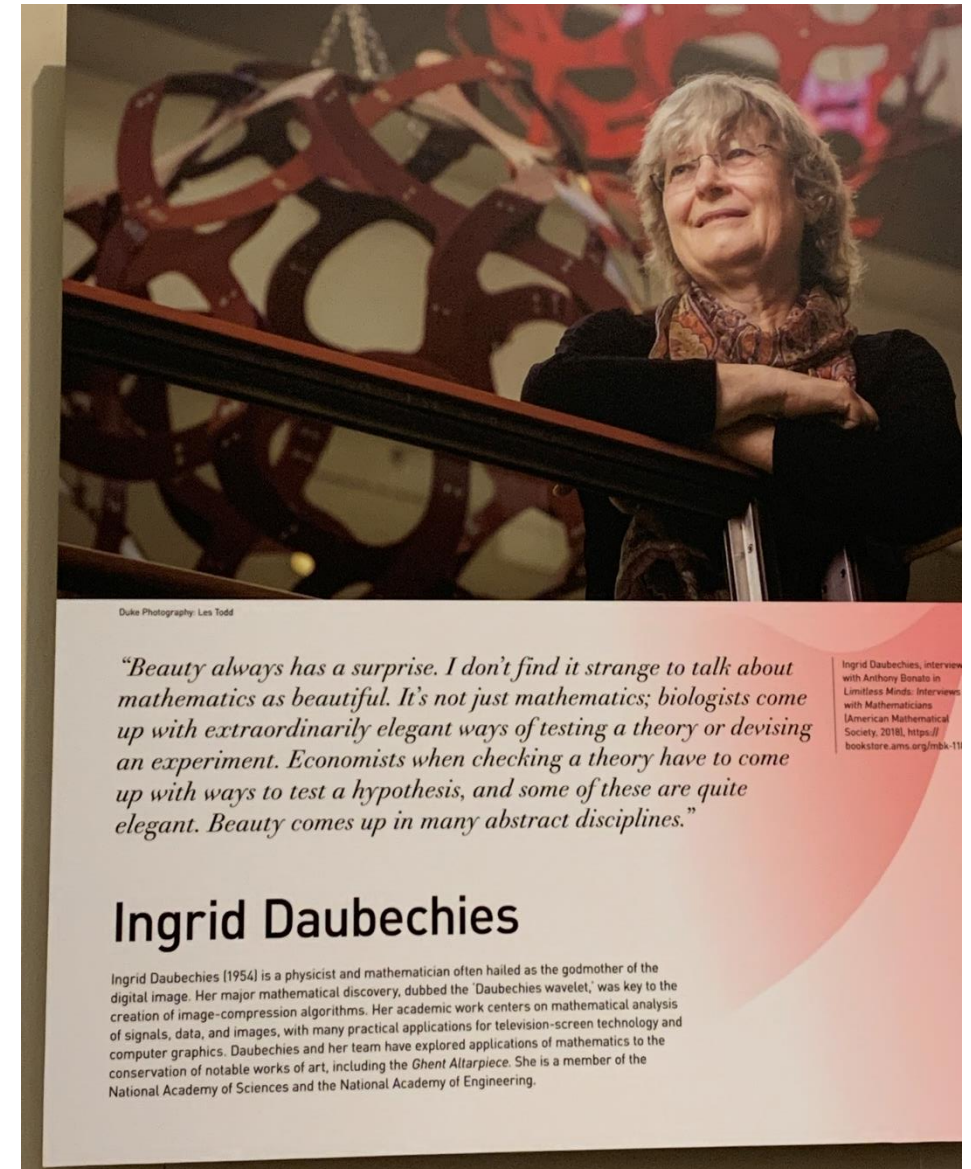
# Rubric

Mathemalchemy Exhibit									  
Criteria	Ratings							Pts	
Completed Pre Reflection google form	5 pts Full Marks				0 pts No Marks			5 pts	
Attending the Mathemalchemy Exhibit	30 pts Full Marks				0 pts No Marks			30 pts	
Seeing the women in STEMM exhibition at the NAS.	10 pts Full Marks				0 pts No Marks			10 pts	
Photo Story of field trip to NAS Take 5-8 photos while at the event of where you saw mathematics or mathematicians. Then create a narrative of a few sentences per photo to tell a photo story of your NAS experience with Mathemalchemy and the Women in STEMM exhibit.	40 pts Full Marks Exceptional work. Went above and beyond the requirements.	38 pts A 5-8 photos. Excellent well-written narrative.	36 pts A- 5-8 photos. Good descriptions and connections to post reflection.	34 pts B A good variety of photos. Met all basic requirements, Good descriptions.		30 pts C Only 3 pictures. Narrative was only brief sentences.	26 pts D Pictures were not representative of the event. The narrative was weak.	0 pts No Marks	40 pts
Post-reflection completed.	15 pts Full Marks				0 pts No Marks			15 pts	
Total Points: 100									

# Women in STEMM exhibit


*Progress was  
neither swift  
nor easy*

(quote from Marie Curie)





# Women in STEMM exhibit




*"Humans are allergic to change. They love to say, 'We've always done it this way.' I try to fight that. That's why I have a clock on my wall that runs counterclockwise."*

Grace Murray Hopper, quoted by Philip Schuler in "The Wit and Wisdom of Grace Hopper," The OCLC Newsletter, 1997, no. 167

**Grace Murray Hopper**

Grace Murray Hopper (1906–1992), a mathematician and United States Navy rear admiral, was a key figure in the development of computer technology. She contributed to the creation of the first commercial electronic computer, known as the Universal Automatic Computer, or UNIVAC 1. Hopper co-developed "compilers" that allowed humans to program computers using word-like commands instead of mathematical codes. COBOL (COmmon-Business-Oriented Language) was one such early programming language that came from her work and is still in use today.

Photo by Lynn Gilbert, 1978 (printed 2014), edge print, National Portrait Gallery, Smithsonian Institution, © 2014 Lynn Gilbert



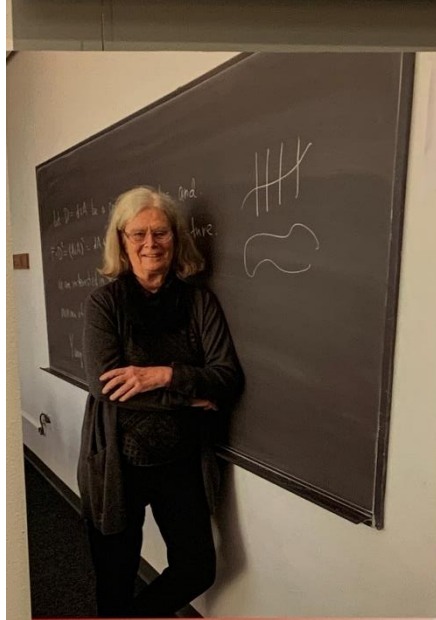
*"Girls are capable of doing everything men are capable of doing. Sometimes they have more imagination than men."*

Katherine Johnson, used by permission

**Katherine Coleman Goble Johnson**

Katherine Coleman Goble Johnson (1918–2020) was a mathematician who contributed to the success of the U.S. space program. Her calculations tracked the orbital mechanics of spaceflights carrying astronauts. Johnson not only executed complex calculations manually but also assisted NASA in its pioneering use of computers for such work. Her 35-year career with NASA and its predecessor, the National Advisory Committee for Aeronautics, was featured in the book and film *Hidden Figures*.

Photo by Bob Nye/NASA



*"I am aware of the fact that I am a role model for young women in mathematics, and that's partly what I'm here for. It's hard to be a role model, however, because what you really need to do is show students how imperfect people can be and still succeed. . . . I may be a wonderful mathematician and famous because of it, but I'm also very human."*

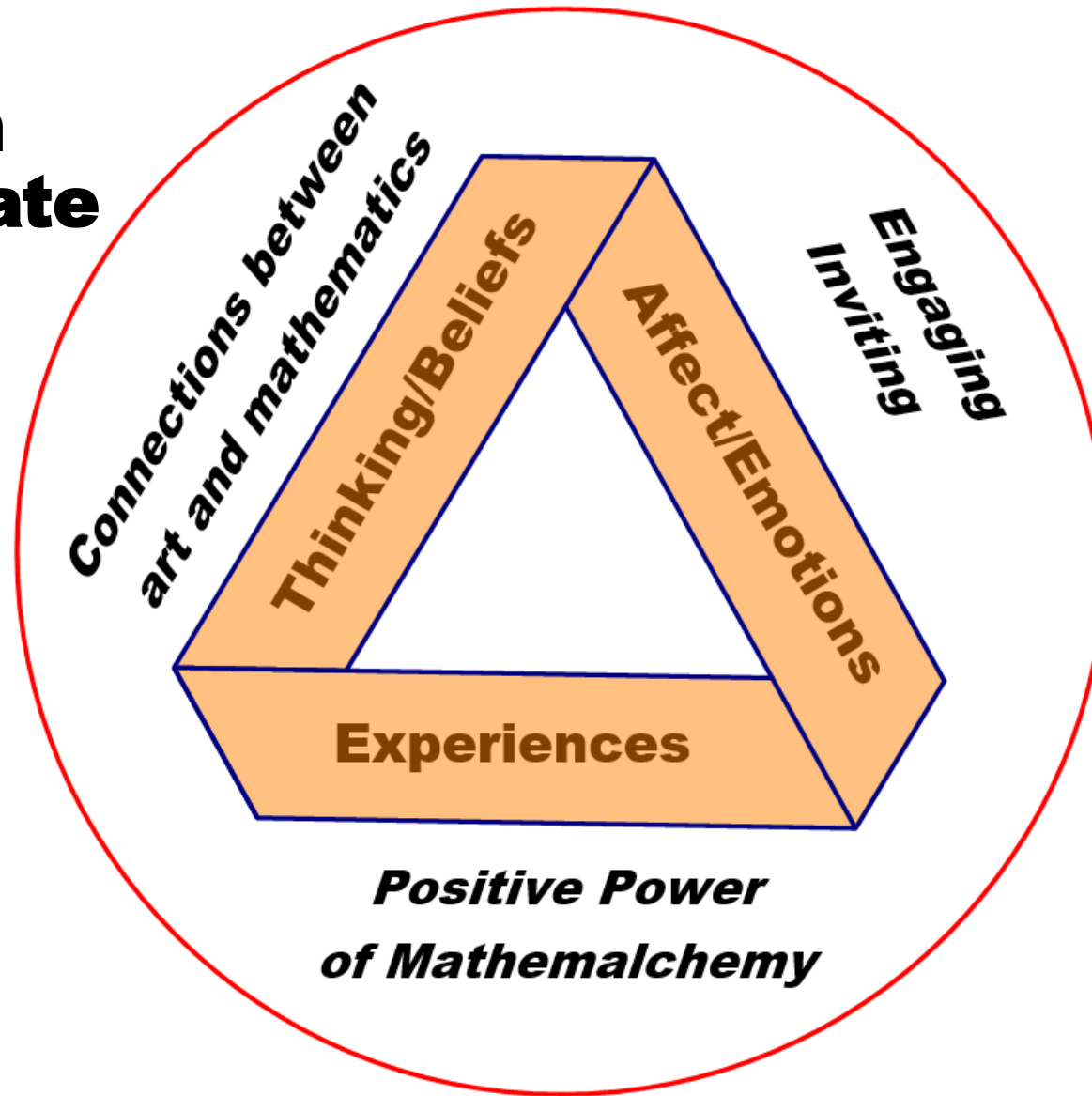
Karen K. Uhlenbeck, *Math Horizons* 3:4 (April 1994). © Mathematical Association of America, 1994. All rights reserved.

**Karen K. Uhlenbeck**

Karen K. Uhlenbeck (1942) is a mathematician who pioneered modern geometric analysis, a new field that combines techniques of analysis and differential equations to study geometrical and topological problems. She introduced a rigorous mathematical approach to areas of theoretical physics, including quantum field theory, string theory, and general relativity. Among her other research interests are the calculus of variations, integrable systems, and duality in physics. In 2019, she was the first woman awarded the Abel Prize for extraordinary contributions to mathematics. She is a member of the National Academy of Sciences.

Photo by Lee Sandberg, Institute for Advanced Study

# Impact on Undergraduate students



23 students and 4 faculty members

IRB approval for students with consent forms

# Any questions, comments, or suggestions?

Thank you very much.

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