Mathematics + History + Social Justice = Global Mathematics

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Presentation outline

- Why create math electives / why Global Mathematics?
- Course outline
- Course materials

Questions/mathematics throughout

Do you agree or disagree? Discuss:

“Mathematics is often thought of as a culture-free subject.”

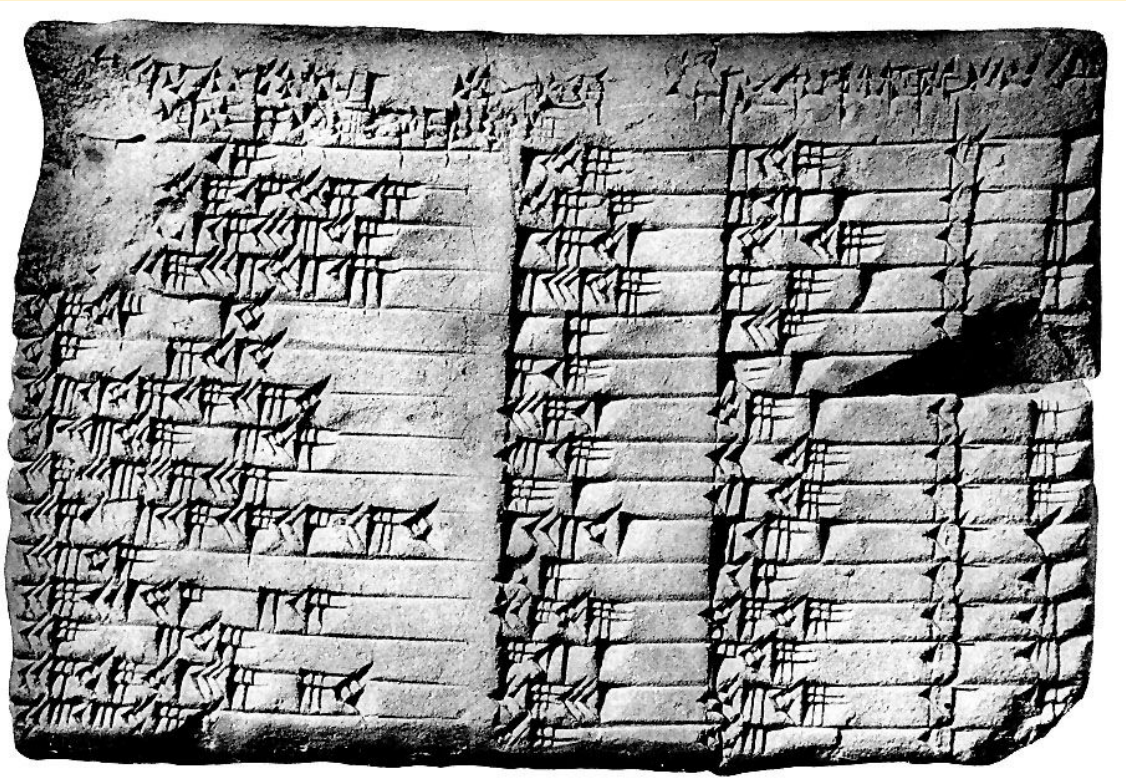
Shenaz Keshwani, Teaching Mathematics Using African Cultural Numerical History

The Pythagorean Theorem

Pythagoreans lived in southern Italy

Pythagoras 570-495 BC

Plimpton 322 southern Iraq 1800 BC



Discuss:

What is the earliest evidence of mathematical thinking?

When?

Where?

Ishango Bone - Uganda - 20,000 BC

Why Global Mathematics?

1. Equity - we teach the mathematics of Europeans

Why Global Mathematics?

2. Re-evaluate the curriculum through a social justice lens rather than a college and career lens

Why Global Mathematics?

3. Not all students need the same learning pathway to achieve the same goals.

   Plus, not all students have the same goals.

Why Global Mathematics?

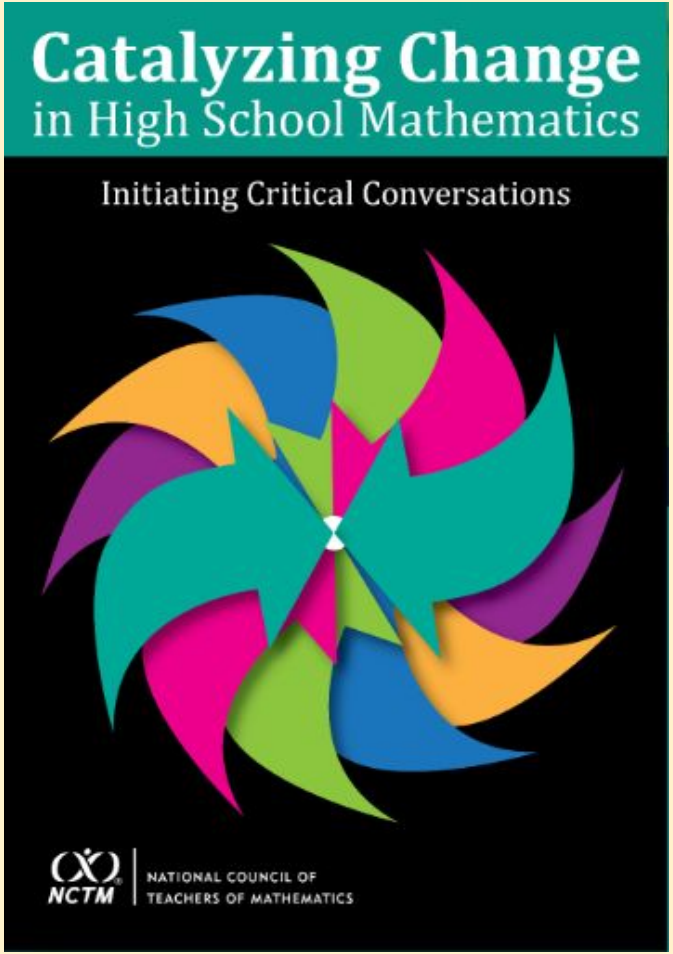
4. We need to expand our thinking of what mathematics is - NCTM Standards: problem solving, reasoning, connections, communication (1989)

Why Global Mathematics?

5. Catalyzing Change: Understand and critique the world; Experience wonder, joy, and beauty (2018)

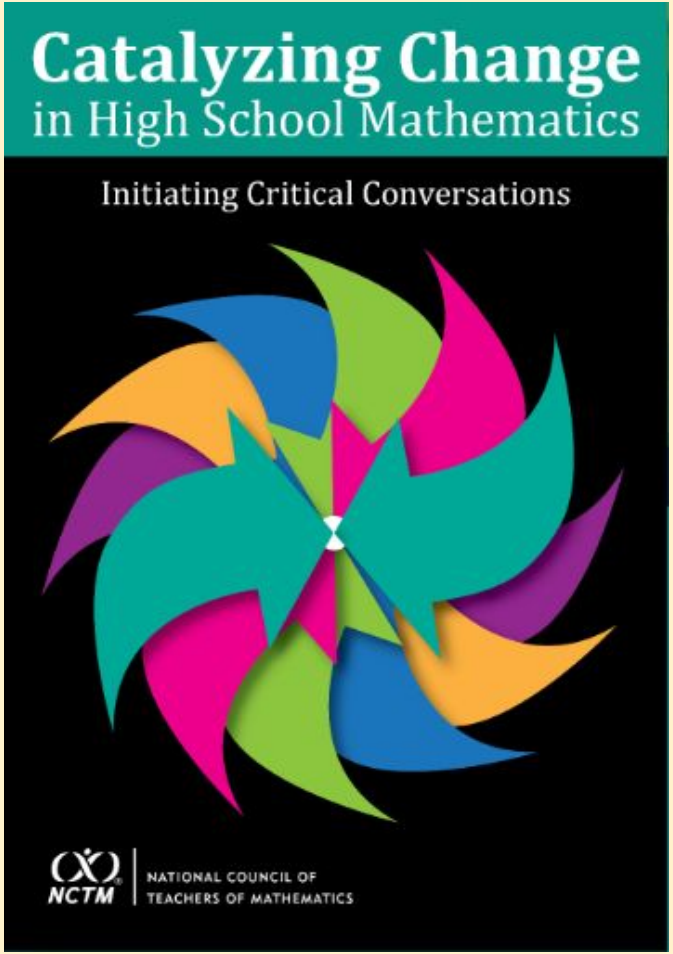
Catalyzing Change

“It is also critical that all students study other mathematics beyond these (essential) concepts. Catalyzing Change recommends four years of continuous engagement in the study of mathematics at the high school level.” p.5



Catalyzing Change

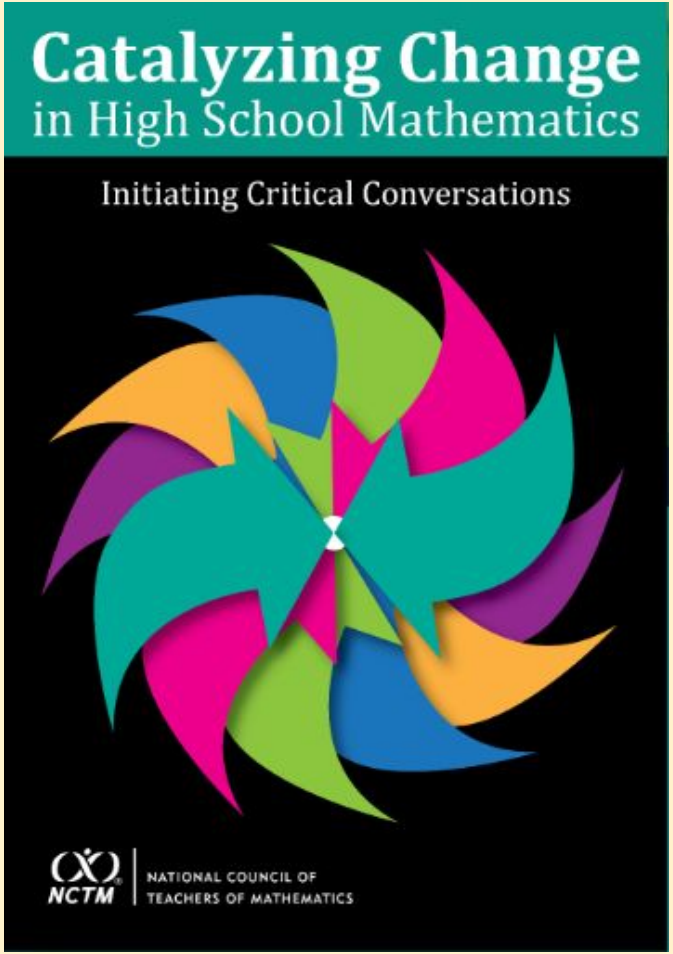
"The pathway of courses that students follow beyond the Essential Concepts will vary and should be based on students' interests and aspirations." p.5



Catalyzing Change

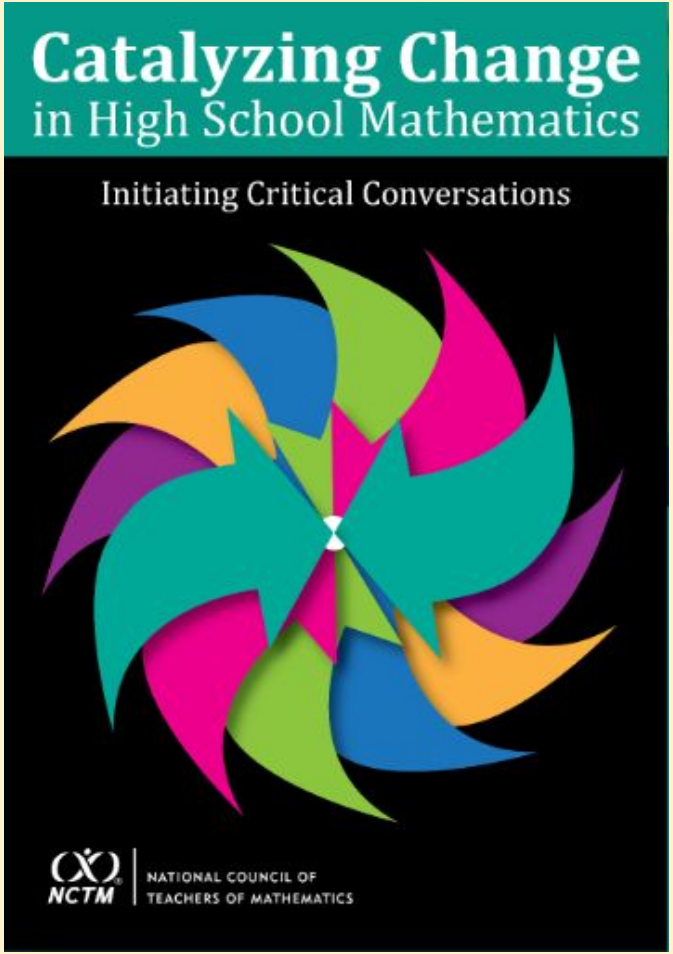
“High school mathematics empowers students to -

- Expand professional opportunity
- Understand and critique the world
- Experience wonder, joy, and beauty” p.9



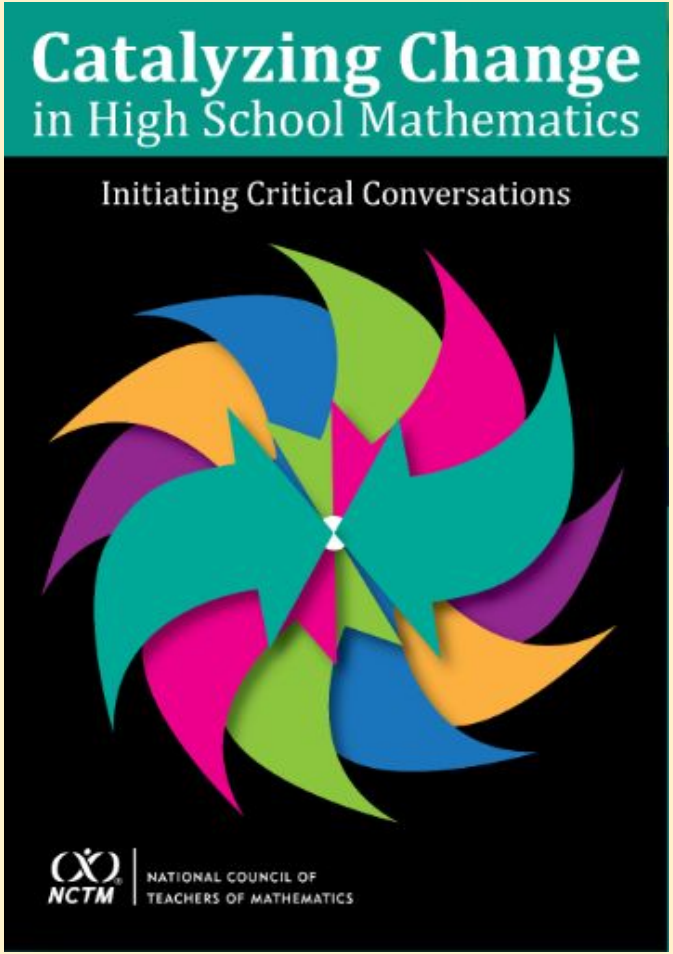
Catalyzing Change

“High school mathematics should strive to highlight the contributions of a variety of cultures to mathematics - not just western contributions.” p.12



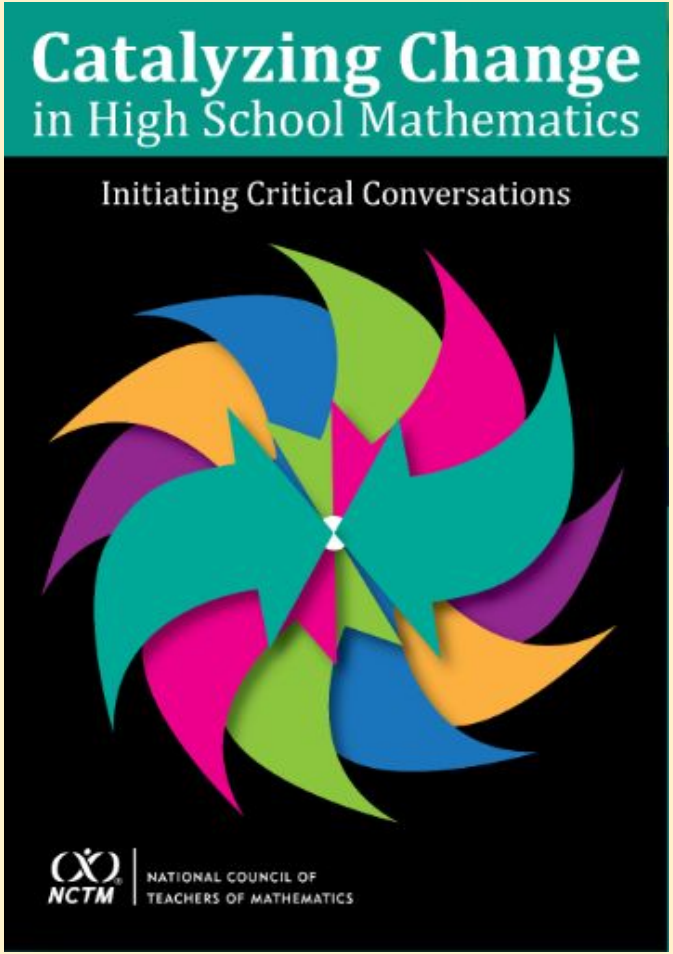
Catalyzing Change

“A high school mathematics program must be designed to give this diverse set of students a mathematics education that will not only prepare them for the next steps in the future but also give them an appreciation of what mathematics is and how it can be useful in their lives, no matter what their current post-high school plans are.” p.83



Catalyzing Change

"This final one to two years of high school mathematics could offer students a variety of possible courses, including … history of mathematics" p.88



Why Global Mathematics - my journey

Expand offerings for advanced students

Options for students in need of credits

Study mathematics because it is interesting, not to prepare for the next course

Why Global Mathematics - my journey

Global Education certification Wisconsin Department of Public Instruction

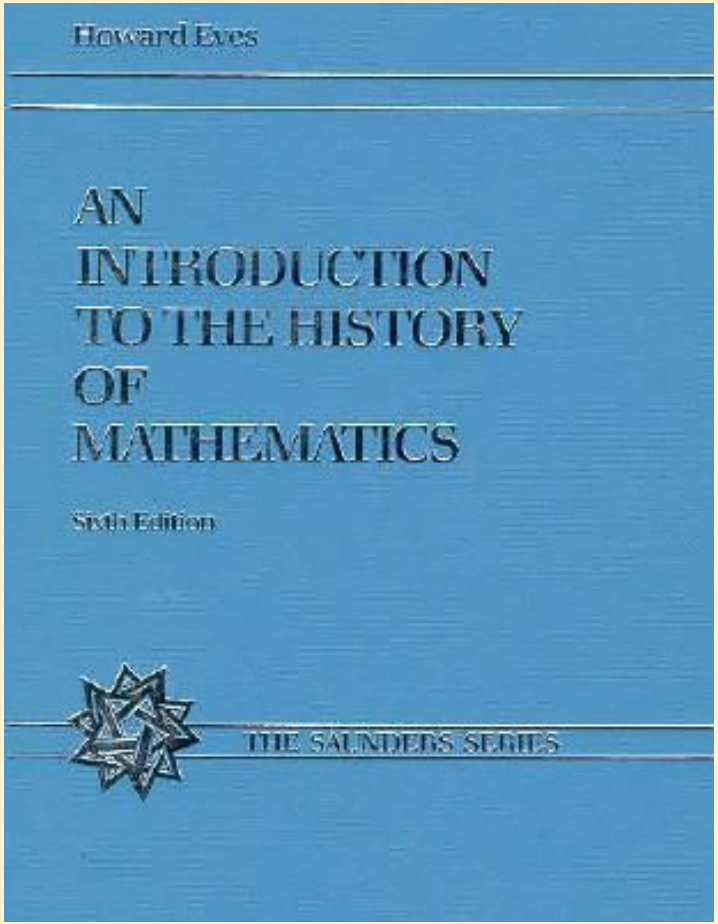
OHS Global Education Achievement Certificate - 8 credits including foreign language, World Civilizations, Go Global, International Marketing, Global Cuisines, Global Art

Resources

An Introduction to the History of Mathematics by Howard Eves

Rethinking Mathematics: Teaching Social Justice by the Numbers by Eric Gutstein and Bob Peterson

Multicultural Mathematics Materials by Marina Krause

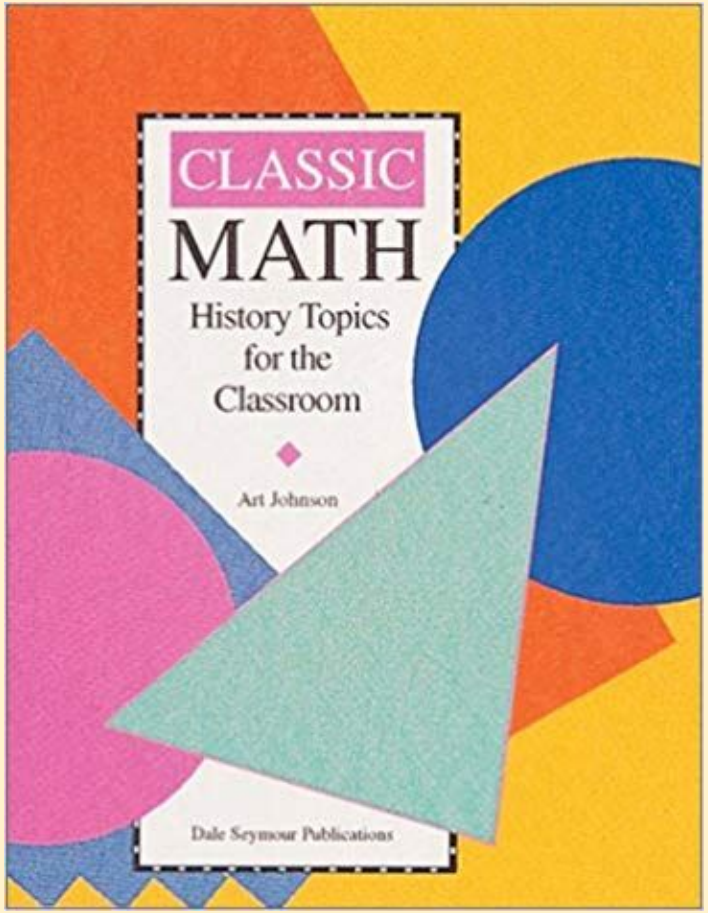


Resources

Classic Math: History Topics for the Classroom by Art Johnson

[EdSteps Global Competence Matrix]

Journey Through Genius: The Great Theorems of Mathematics by William Dunham

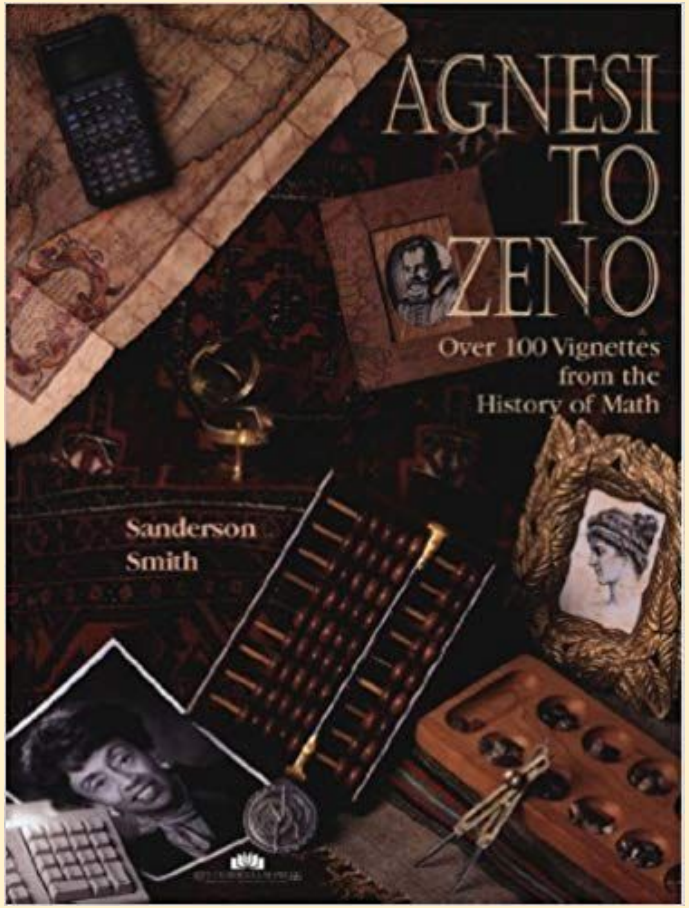


Resources

Agnesi to Zeno: Over 100 Vignettes from the History of Math by Sanderson Smith

The Story of Mathematics television series from the BBC

Can You Count in Greek: Exploring Ancient Number Systems by Judy Leimbach



Course outline

- Number Systems
- Greek Mathematics
- Eastern Mathematics
- European Mathematics
- Global Problem Solving
- Final Presentation

Number Systems

- Primitive counting
- Early number systems: Egyptian, Greek, Babylonian, Roman, Chinese/Japanese, Mayan, Hindu-Arabic, Binary
- Early operations: Egyptian, Russian, Lattice
- Presentations

Russian Peasant Multiplication

146 x 21

Russian Peasant Multiplication

146	x	21
73		42

Russian Peasant Multiplication

146	x	21
73		42
36		84

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146	x	21
73		42
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9		336
4		672

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2		1344

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Russian Peasant Multiplication

146	x	21
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Russian Peasant Multiplication

~~146~~	x	~~21~~
73		42
~~36~~		~~84~~
~~18~~		~~168~~
9		336
~~4~~		~~672~~
~~2~~		~~1344~~
1		2688

42 + 336 + 2688 =

3066

Greek Mathematics

- Algebra (Number Theory) and Geometry
- Thales, Pythagoras, Zeno, Plato, Euclid, Apollonius, Archimedes, Eratosthenes, Heron, Diophantus
- Proofs, practical applications (defense, music)
- Presentations

Heron’s Method to Approximate a Square Root

Find the square root of 10.

Heron’s Method

1. Find factors of 10.

Heron’s Method

1. Find factors of 10.
2. (2 + 5)/2 = 3.5

Heron’s Method

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2. $(2 + 5)/2 = 3.5$
3. $(3.5 + 10/3.5)/2 \approx 3.1785$

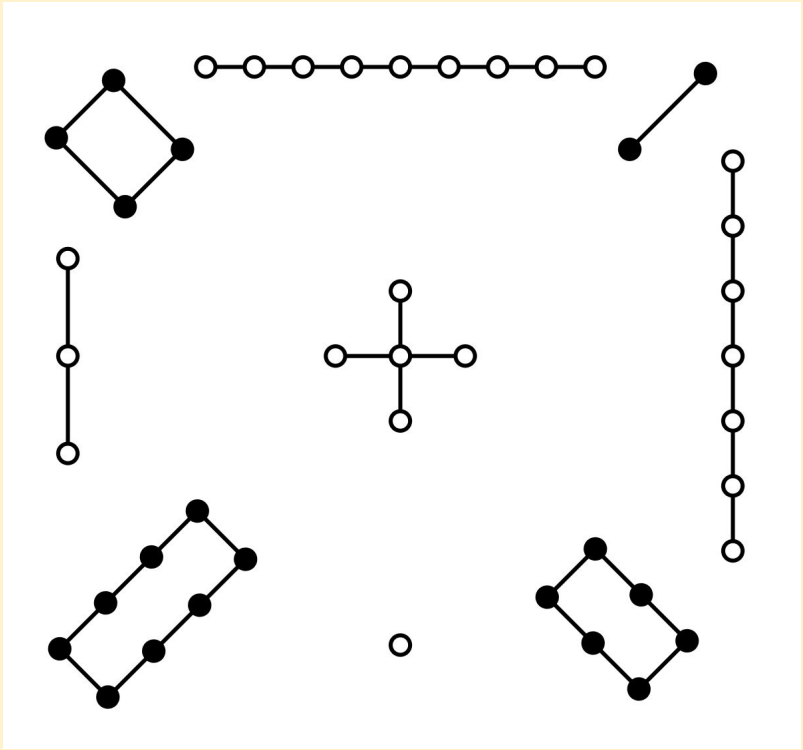
Heron’s Method

1. Find factors of 10.
2. $(2 + 5)/2 = 3.5$
3. $(3.5 + 10/3.5)/2 \approx 3.1785$
4. $(3.1785 + 10/3.1785)/2 \approx 3.1623$

Eastern Mathematics

- China, India, Persia
- Decimal system, negative numbers, “Pythagorean” Theorem, “Pascal’s” Triangle, algebra, trigonometry, zero, approximation of pi
- Recreational math - games and puzzles
- Presentations

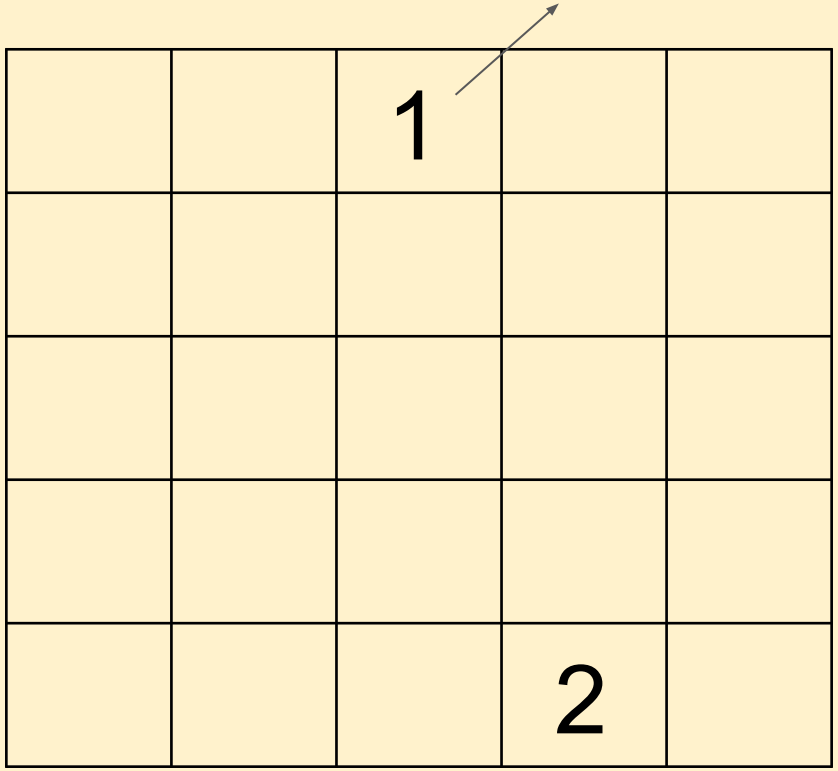
Lo-Shu Magic Square



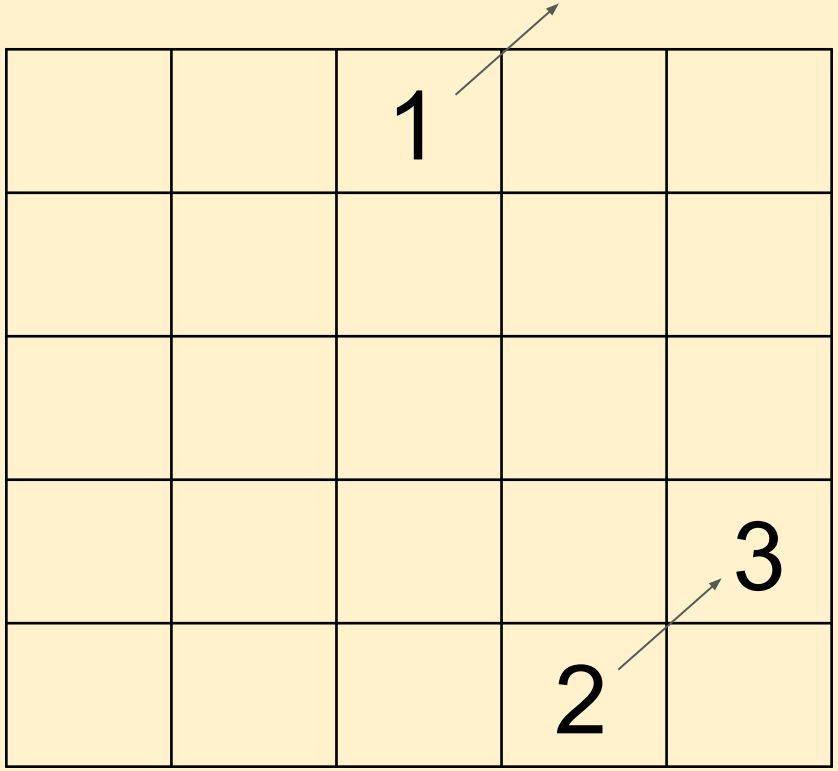
Magic Square

		1		

Magic Square



Magic Square



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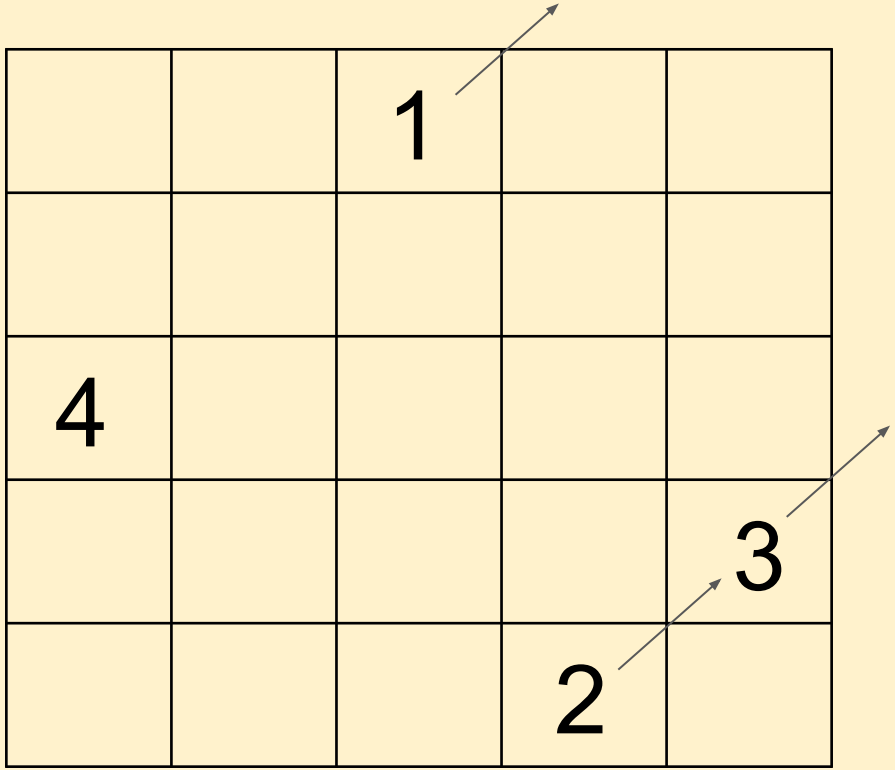

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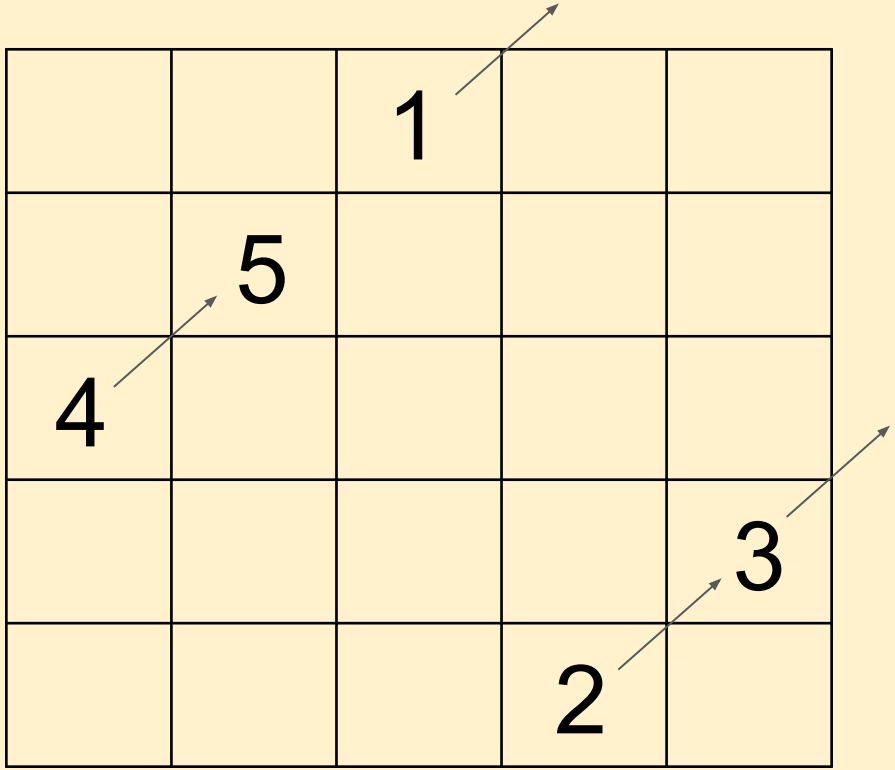

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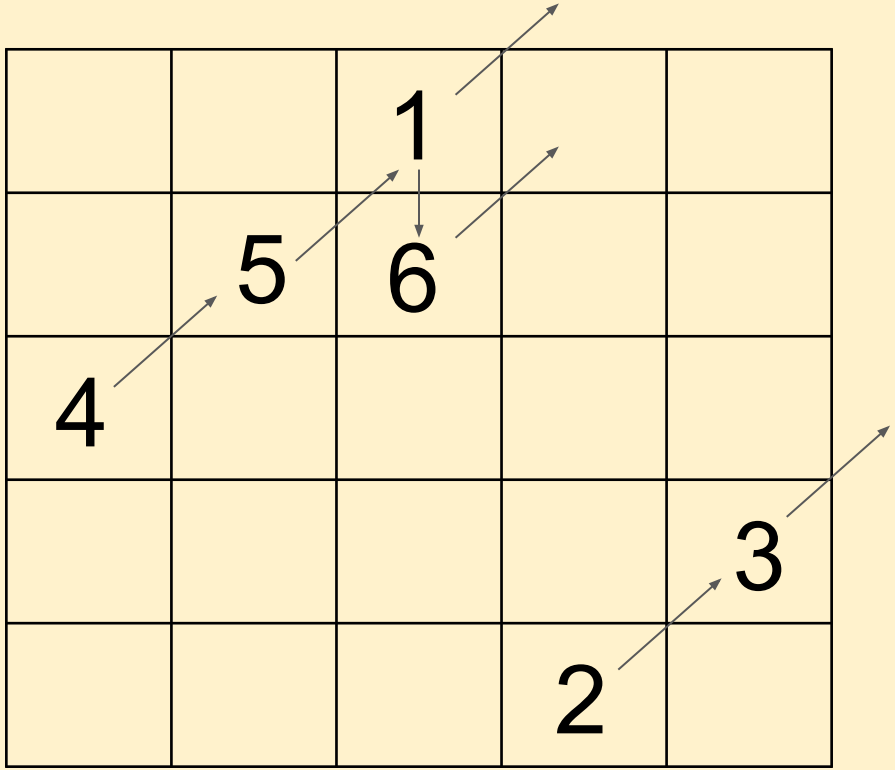
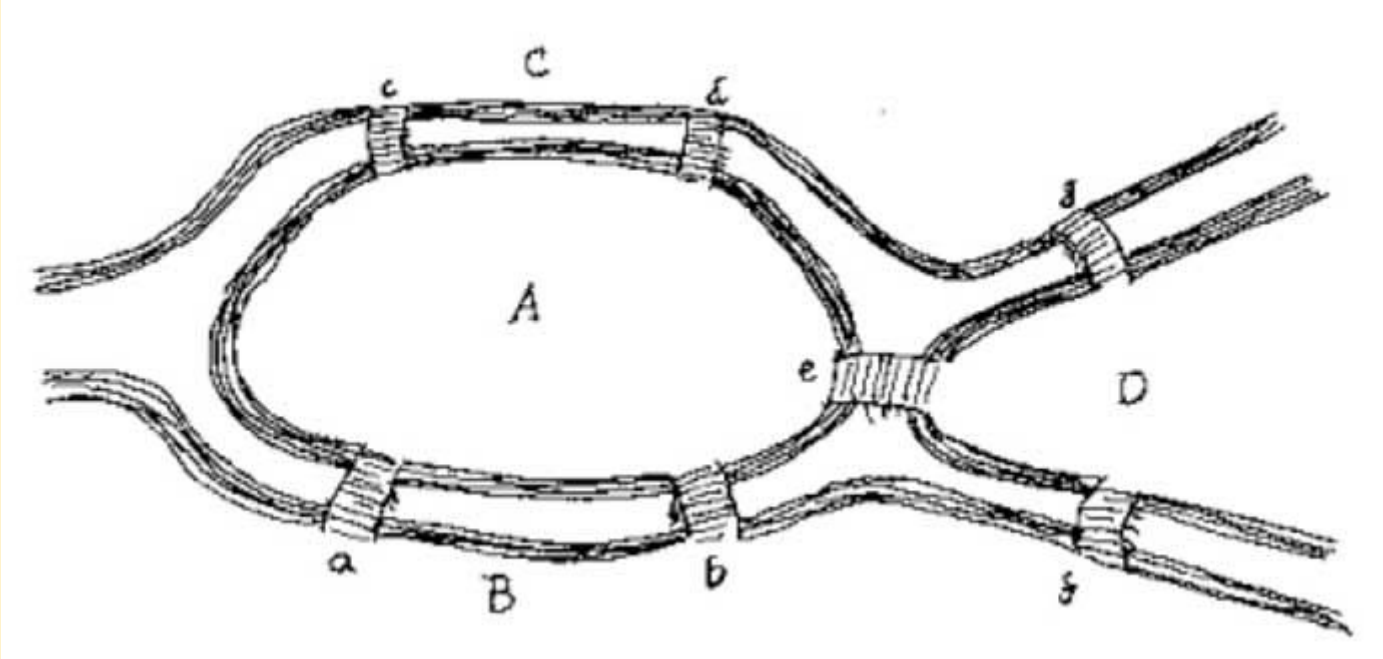


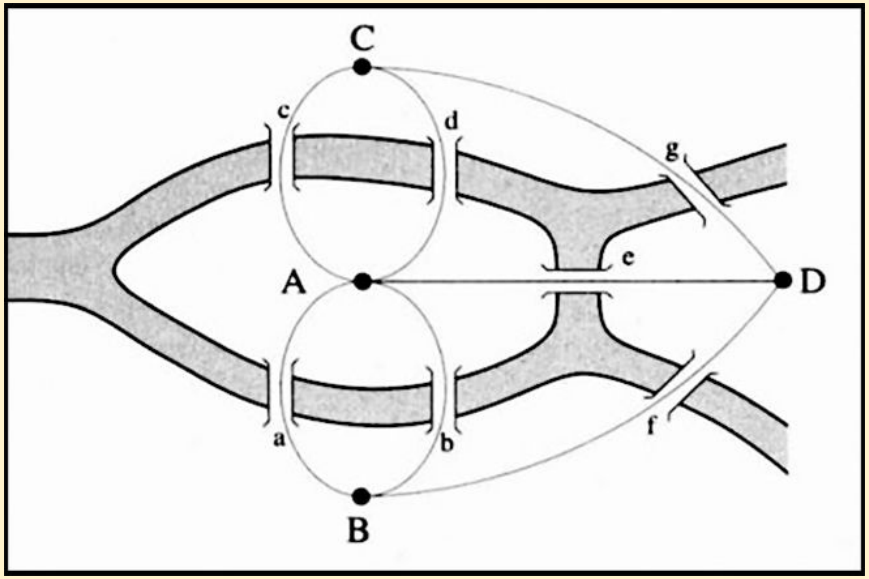
European Mathematics

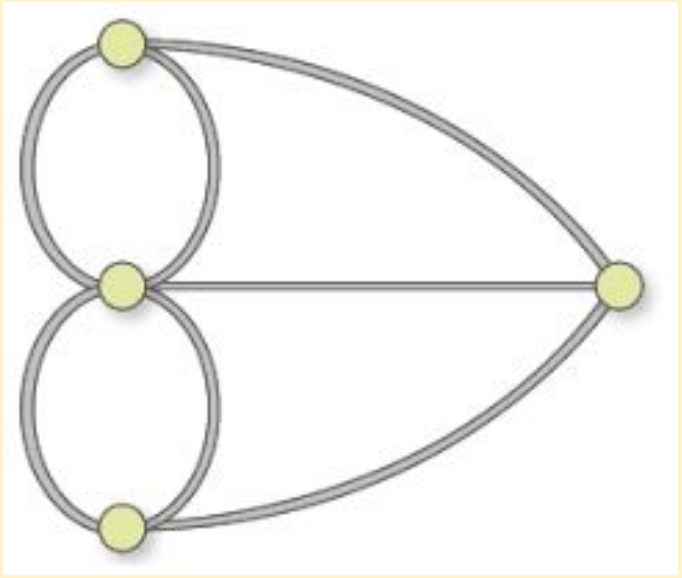
- Fibonacci, Napier, Descartes, Pascal, Fermat, Copernicus, Galileo, Kepler, Newton, Leibniz, Euler, Goldbach, Gauss, Carroll, Cantor
- Printing press, metric system, astronomy, probability
- Presentations

Bridges of Königsberg



Bridges of Königsberg





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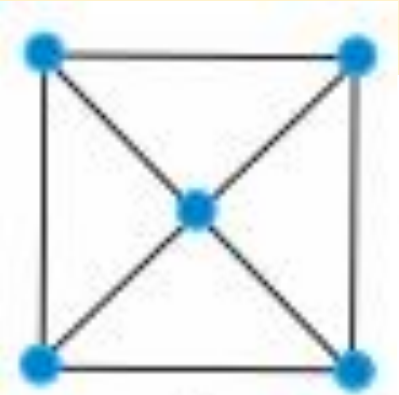

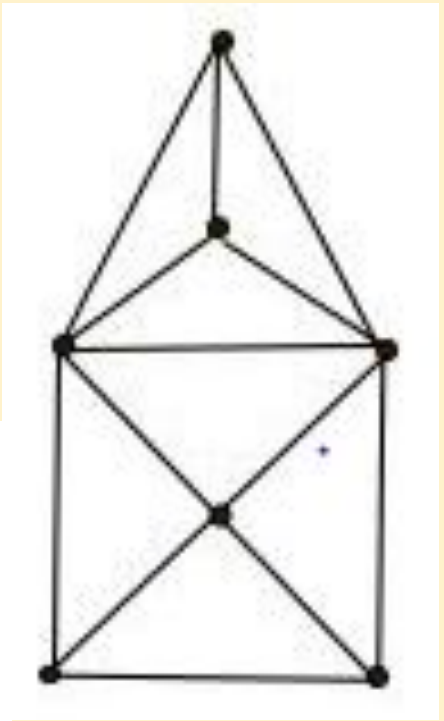

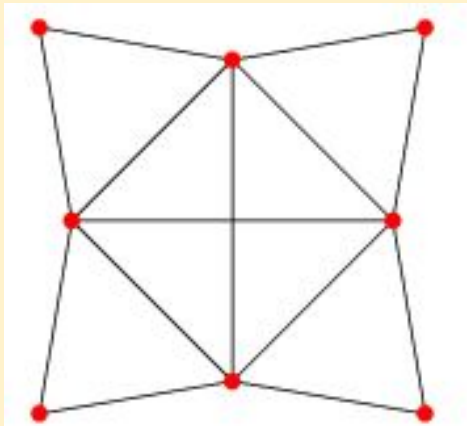

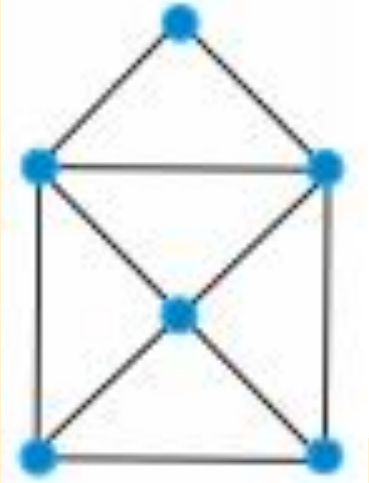

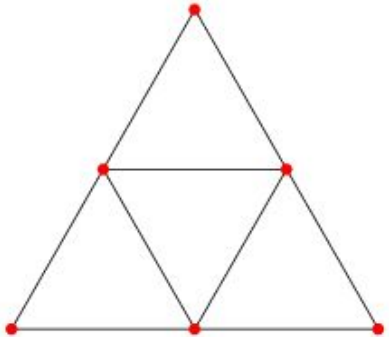

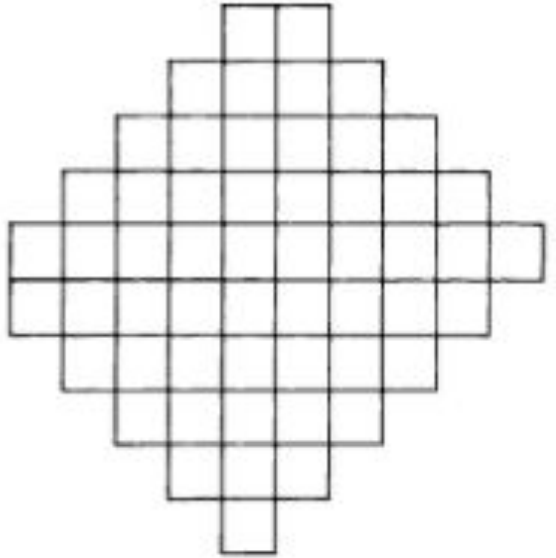

Global Projects

EdSteps Global Competence Matrix:

1. Identify an Issue
2. Weigh Relevant Evidence
3. Analyze, Integrate, and Synthesize Evidence
4. Develop an Argument

Sample Projects

Solar energy in the Congo

Ho-Chunk “18 Money”

Should I buy an electric car?

Sample Final Projects

Racial profiling

Affordable housing

Ocean polution

Flint water crisis

Gender pay gap

Nuclear waste disposal

Corporate vs. family farms

California wildfires

Universal healthcare

Prison reform

$15 minimum wage

Tropical deforestation

Not sharing diversity not only hurts our children of color, but also our students who don’t ever learn the whole picture and the true story.

Mathematics + History + Social Justice = Global Mathematics

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