Making Mathematics A Habit!

Presented by:
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at the
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New Orleans, LA
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What are habits of mind?

Cuoco, Goldenberg, Mark
JOURNAL OF MATHEMATICAL BEHAVIOR 15, 375-402(1996)

- Elementary to Middle to high school
- "mental habits that allow students to develop a repertoire of general heuristics and approaches that can be applied in many different situations."
- Our Focus today: General habits of mind
  - Pattern sniffers -Inventors
  - Experimenter -Visualizers
  - Describers -Conjecturers
  - Tinkerers -Guessers

Common Core State Standards

http://www.corestandards.org/the-standards/mathematics

- Standards for Mathematical Practice
  - Make sense of problems and persevere in solving them.
  - Reason abstractly and quantitatively.
  - Construct viable arguments and critique the reasoning of others.
  - Model with mathematics.
  - Use appropriate tools strategically.
  - Attend to precision.
  - Look for and make use of structure.
  - Look for and express regularity in repeated reasoning.

Polya
(from a lecture on teaching)

"Mathematics is not a spectator sport. To understand mathematics means to be able to do mathematics. And what does it mean to be doing mathematics? In the first place, it means to be able to solve mathematical problems."

Mathematical Immersion and Emergence

- Importance of DOING mathematics
- What does it mean to be a mathematician-doing the work of a mathematician?
- Engaging both math teachers (us) & their (our) students in mathematical problem solving

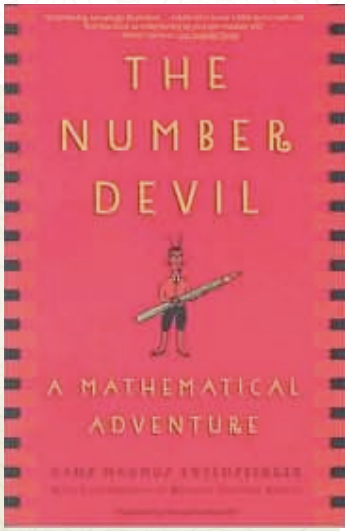
Goal

For students to engage in mathematical problem solving and problem posing immersing them in mathematics providing emergence of mathematical understandings to develop strategies that support lifelong learning of mathematics

The Number Devil: A Mathematical Adventure

by Hans Magnus Enzensberger, 1997

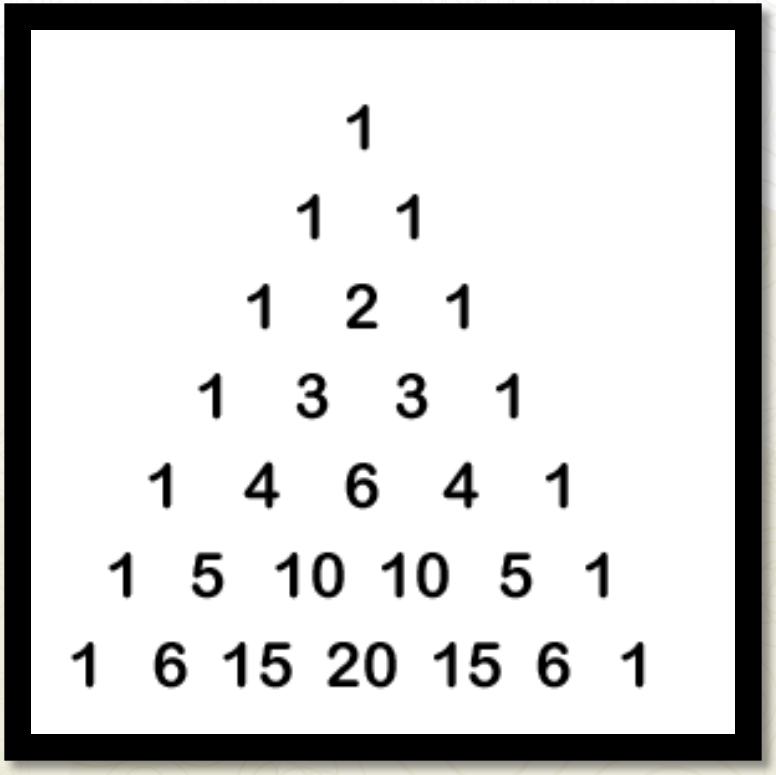
"There are times when I don't understand a thing".
Robert, P. 107



- Pascal's Triangle
- Fibonacci Sequence
- Handshake Problem
- Triangular Numbers
- Permutations & Combinations
- Continued Fractions
- Sieve of Eratosthenes
- Geometric Shapes
- Euler's Formula
- Fractals
- Imaginary Numbers
- Fractions
- Golden Mean
- Goldbach's Conjecture
- Exponents
- Irrational Numbers
- Prime Numbers
- Pythagorean Theorem
- Factorial

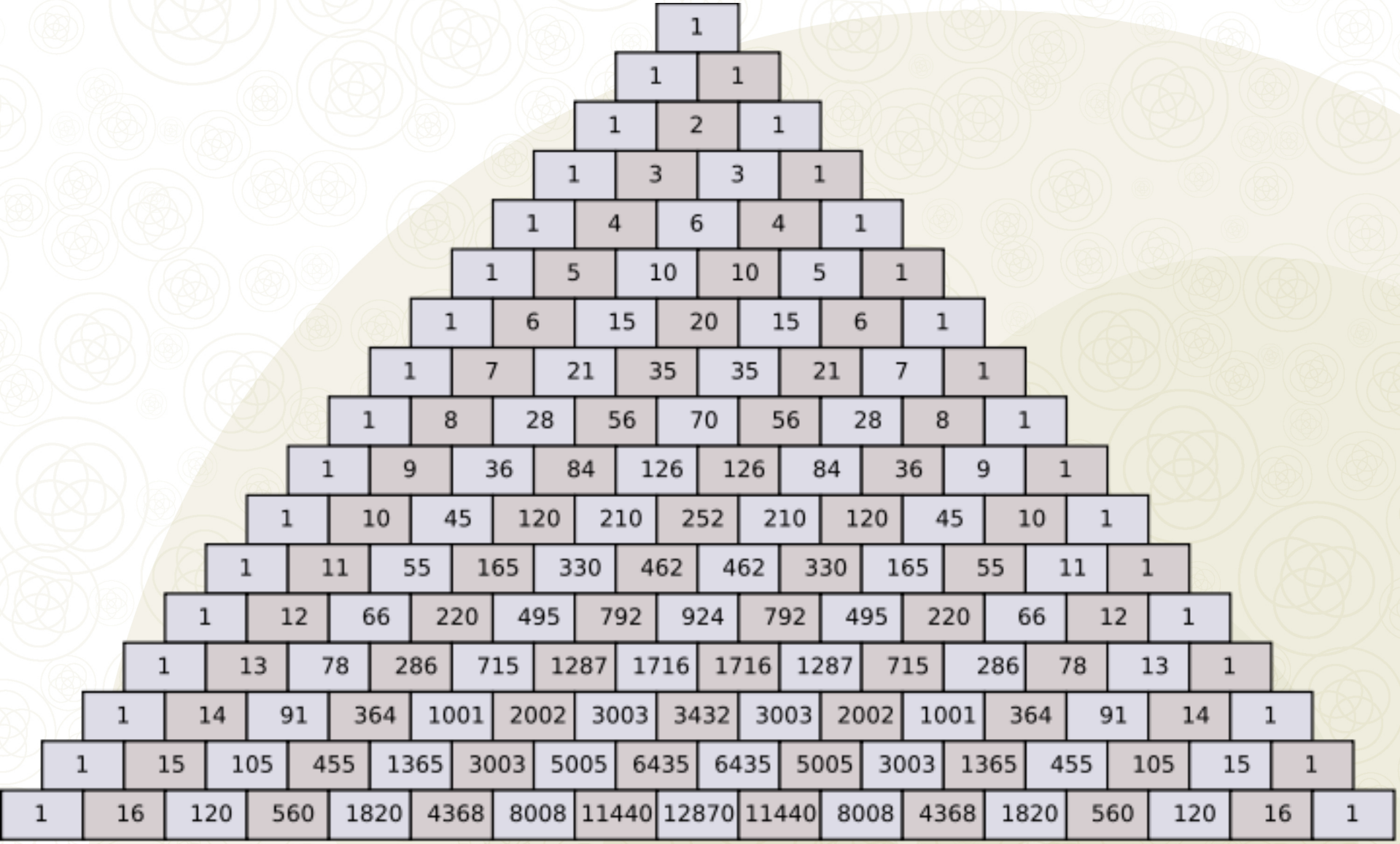
Let's explore!

- The Problems:
  - Pascal's Triangle
  - Handshake Problem



- Individually-Partner-Small Group
  - Observations
  - Conjectures
  - Strategies
  - Connections

How many different handshakes are possible in a room with 20 people?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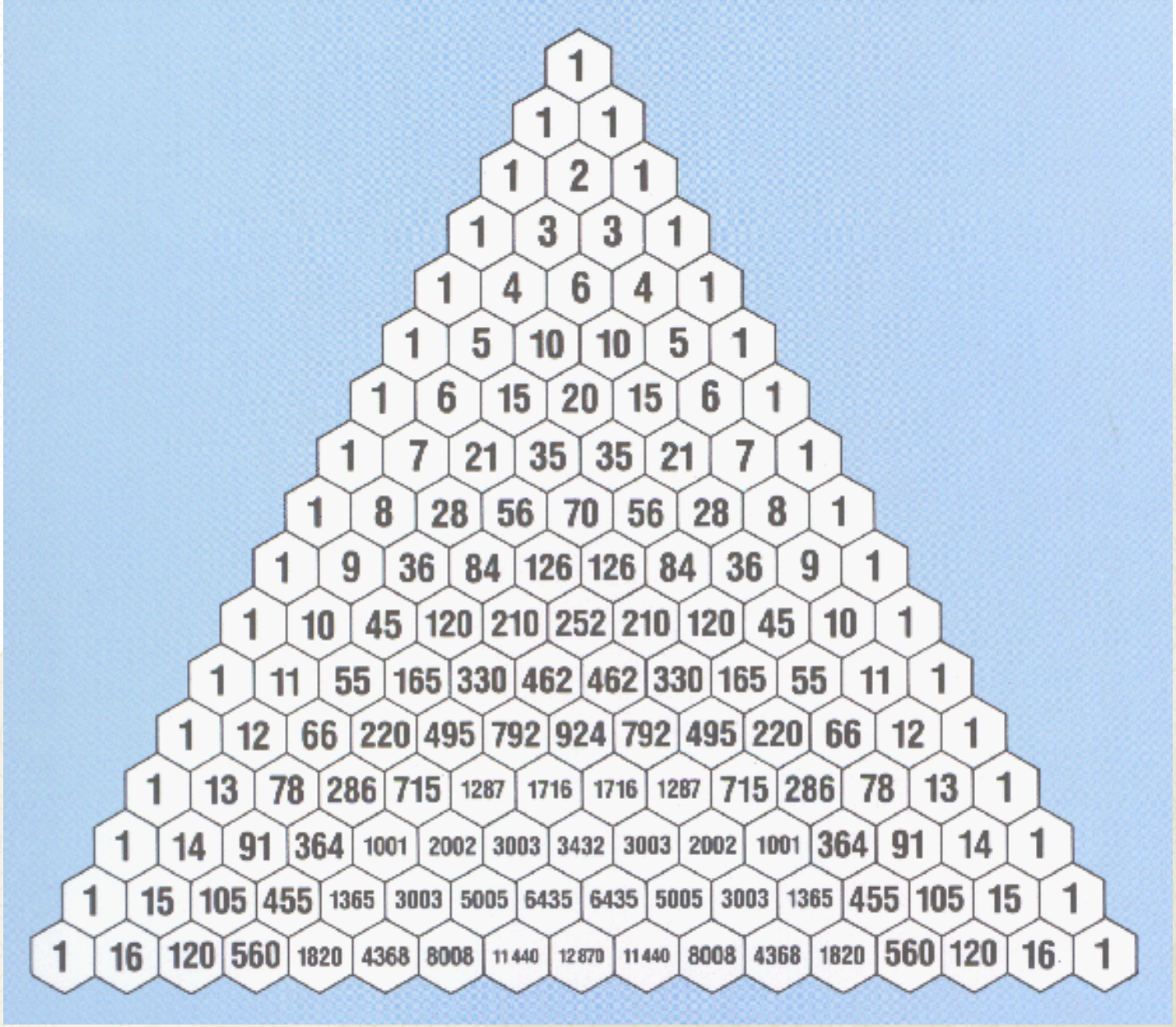
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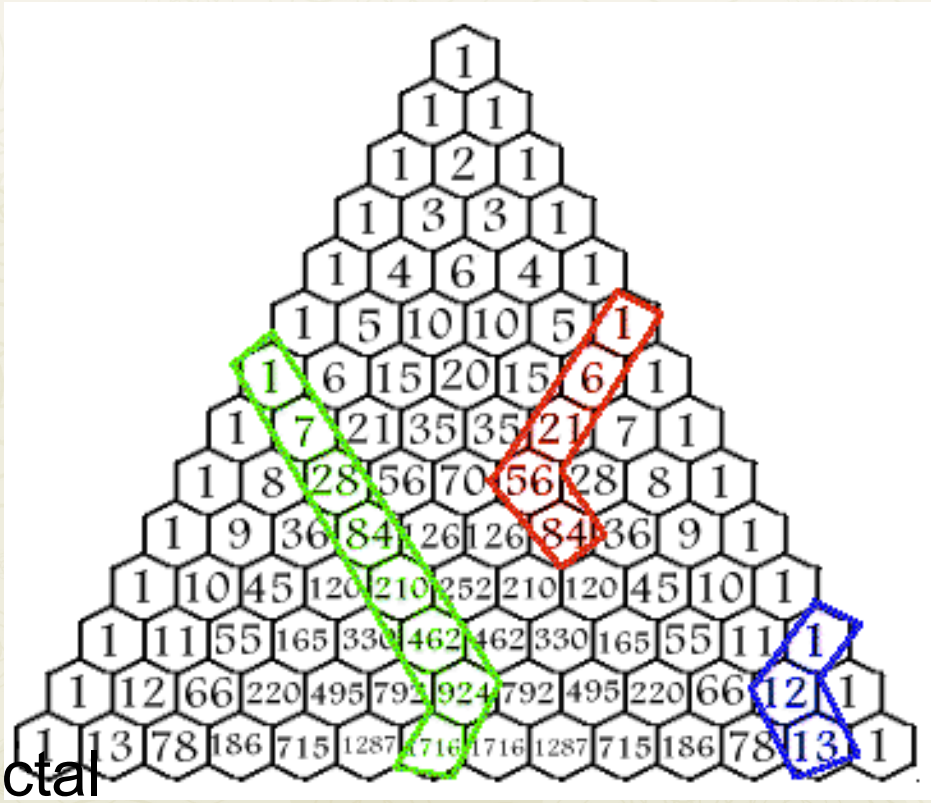
http://ptri1.tripod.com/
http://www.mathsisfun.com/pascals-triangle.html

- Diagonal of ones
- Counting Numbers
- Sums of Rows
- Prime Numbers
- Hockey Stick
- Magic 11's
- Fibonacci Sequence
- Triangular Numbers
- Square Numbers
- Points on a Circle
- Connection to Sierpinski Fractal
- Polygonal Numbers
- Tetrahedral numbers



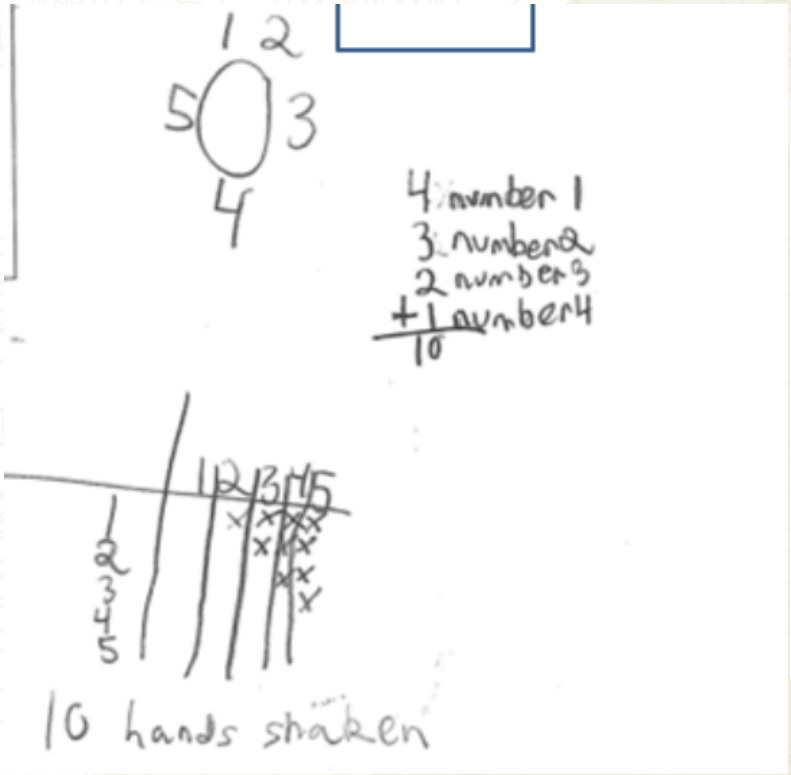
Handshake Problem

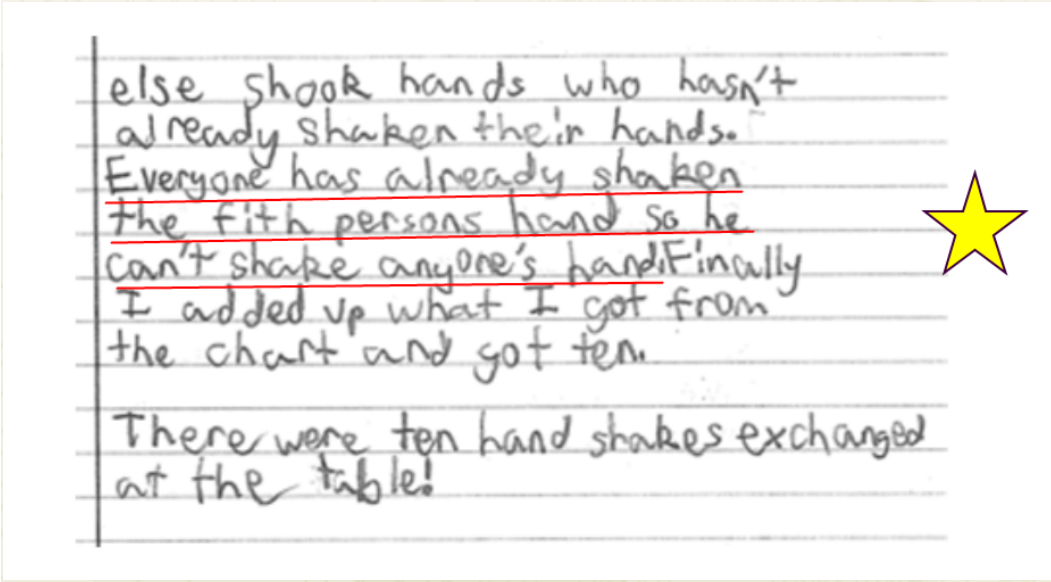
How many different handshakes are possible in a room with 20 people?

- Approaches & Strategies
- Geometric & Algebraic
- Visualize, kinesthetic
- Generalize

Student Examples

Elementary- 5 people



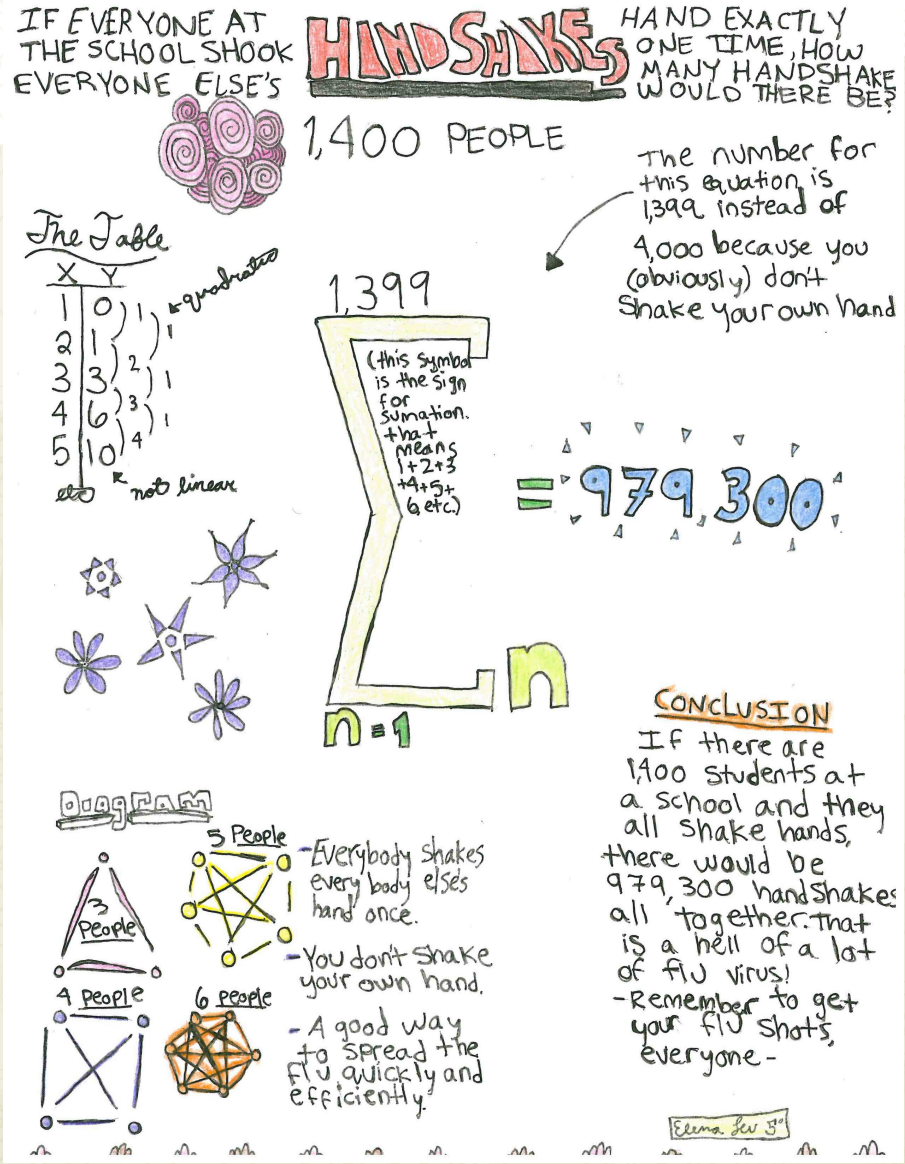


http://lluttrell.weebly.com/uploads/1/3/3/6/13362031/handshake_problem_student_work_samples_4_ac.pdf

Student Examples

Secondary-

1,400 people

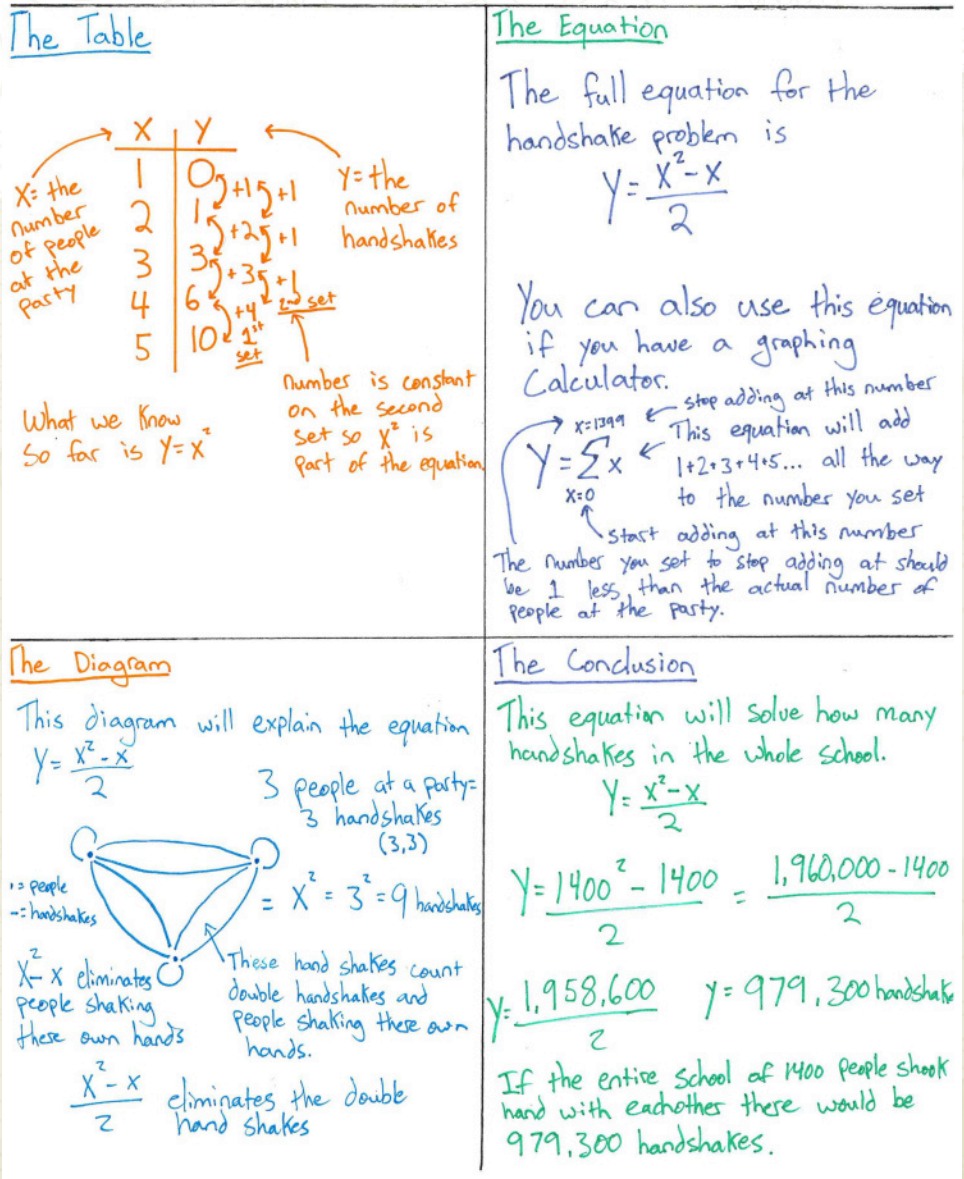


http://mrmillermath.wordpress.com/2014/02/06/the-handshake-problem/

Student Examples

Secondary- 1,400 people

http://mrmillermath.wordpress.com/2014/02/06/the-handshake-problem/



From *The Art & Craft of Problem Solving*

Paul Zietz, 1999 (p.x)

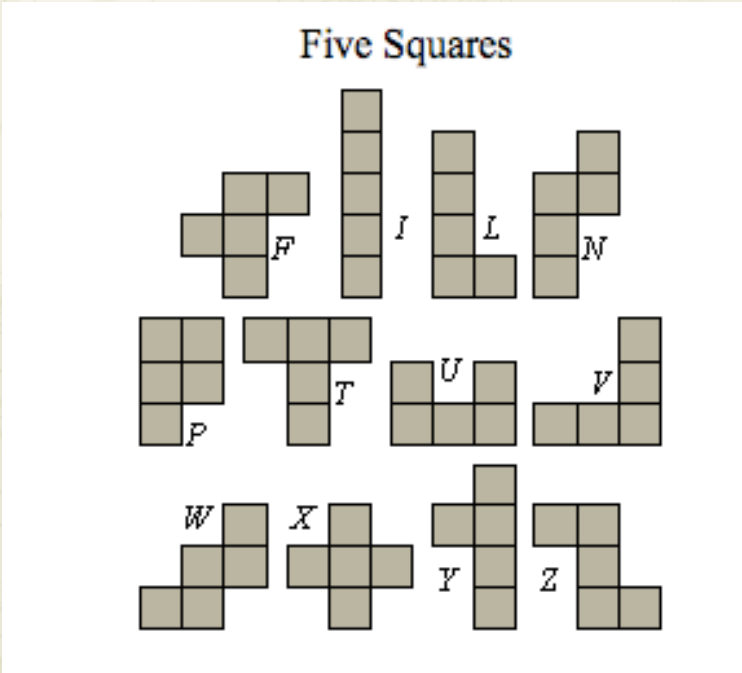
- Problem solving can be taught, and can be learned
- Psychological Factors
  - Confidence
  - Concentration
  - Courage
  - Persistence
  - Mental toughness
  - Flexibility
  - Creativity
- An intense investigation is as important as a rigorous argument
- Other aspects of p/s include strategy, focused approaches, and technical tools
- Problems are as important as mastery of technical tools

Potential Outcomes
What might happen!

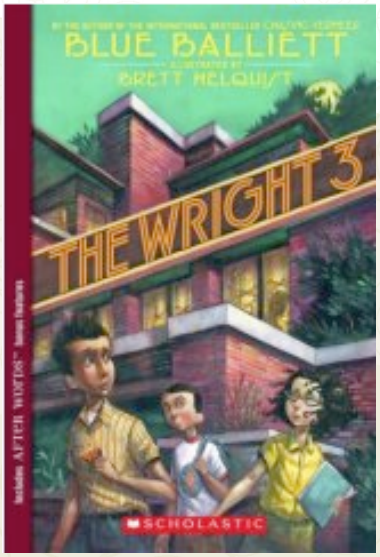
- Develop of 'habits of mind'
- Increase positive attitudes toward mathematics
- Advocate the importance of sophisticated mathematical understandings
- Provide a supportive problem-solving environment
- Increase persistence & perseverance in problem solving
- Build confidence as a mathematician
- Appreciate the beauty of mathematics
- Enjoy the math journey!

Chasing Vermeer by Blue Balliett

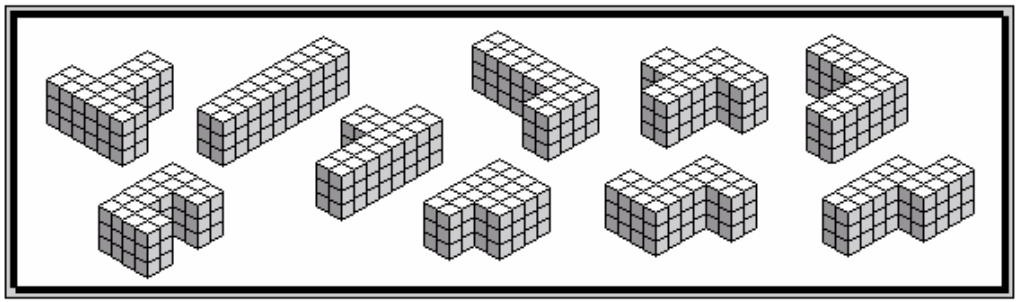
- Geometry-*Pentominoes*
  - Transformations
  - Similarity & Congruency
  - Nets
  - Tessellations
- Measurement
  - Area & Perimeter
- Algebraic Thinking
  - Patterns
    - *ominoe* Investigations
  - Graphing
- Connections, Representations, Communication, Problem Solving



The Wright 3 by Blue Balliett



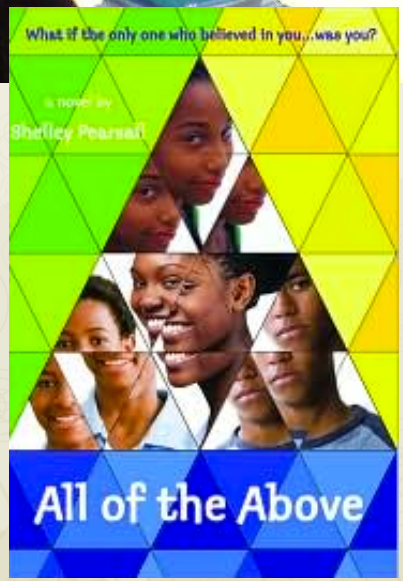
- Geometry
- 3-D *Pentominoes*
- Frank Lloyd Wright-Architecture
- Reflections
- Optical Illusions-Spatial Visualization
- Isometric Drawings



All of the Above

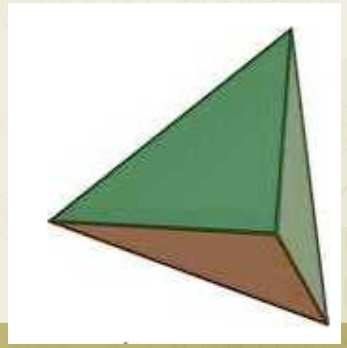
by Shelley Pearsall

- Geometry-
  - Tetrahedrons
  - Platonic Solids
- Measurement
- Functions/Algebraic thinking
  - Sierpinski's Triangle

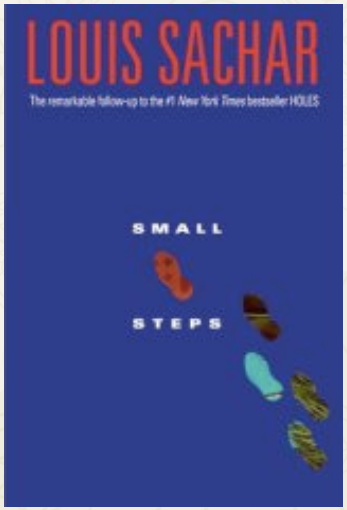


Tetrahedron

- 4 Faces
- 4 Vertices
- 6 Edges



Small Steps by Louis Sachar



- Problem-Solving
  - Business Simulation
  - Advertising/Logo Design
- Linear Functions
  - Bats, Motion Detectors (CBRs)
- Map Skills-Coordinate Graphing

We need to be seekers ourselves developing our mathematical habits of mind!

- Pattern sniffers
- Experimenter
- Describers
- Tinkerers
- Inventors
- Visualizers
- Conjecturers
- Guessers

Thank you!

Contact Information

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