

Developing Reflective & Persistent Problem Solvers

National Council of Teachers of Mathematics
Annual Conference 2018

Minette Finney

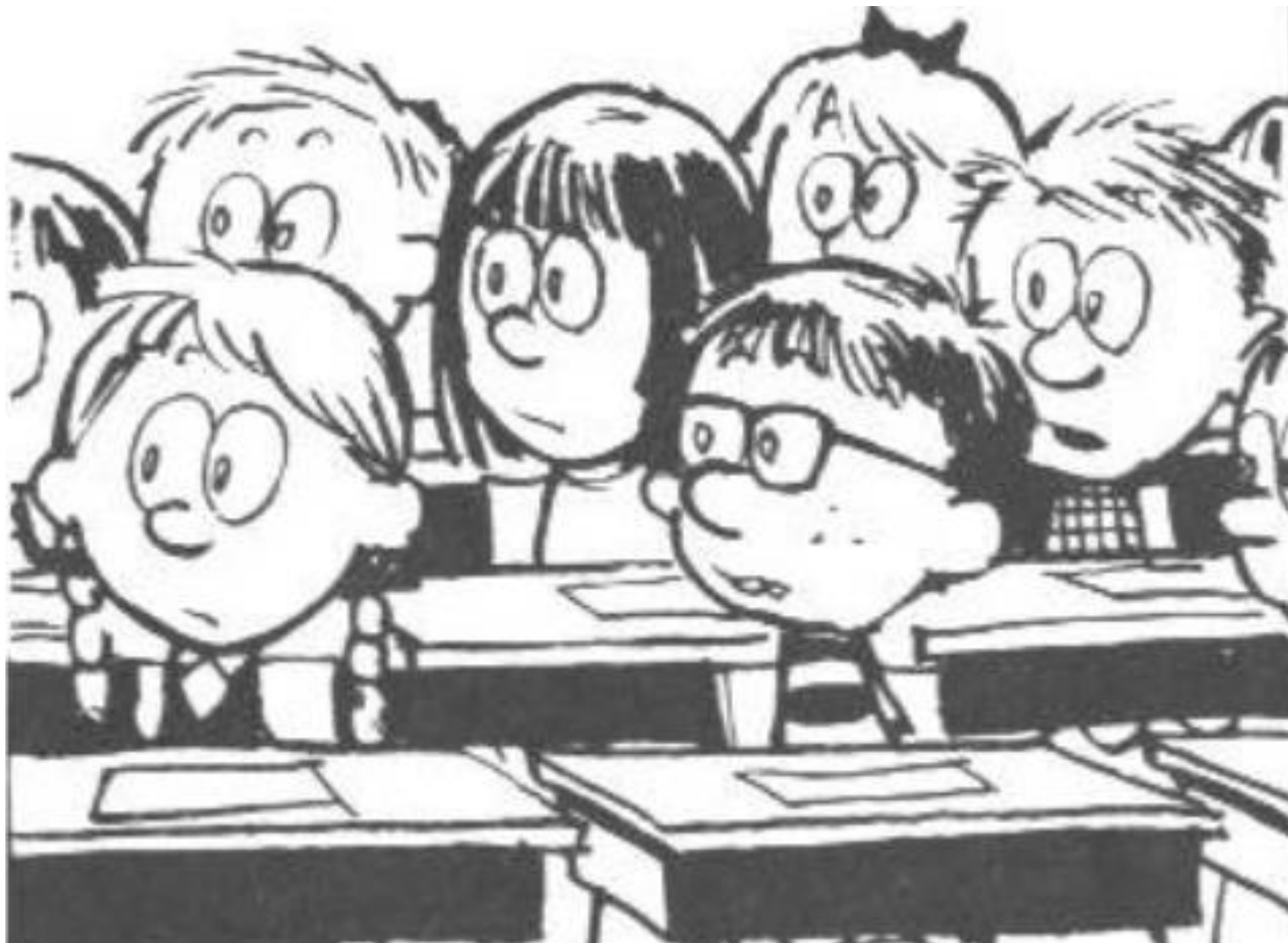
American United School of Kuwait

Kenneth Johnson

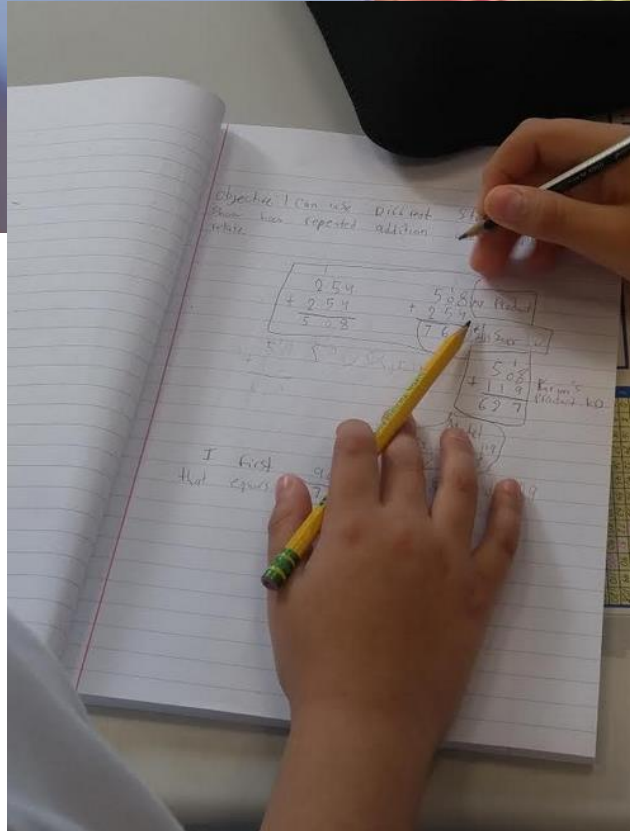
American United School of Kuwait

Cory A. Bennett

Idaho State University



Reasoning Through Problem Solving

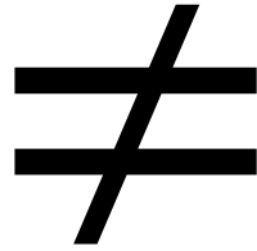


What does it mean to Do Mathematics?



Doing Mathematics

Mathematicians
often work hours,
days, or even years
on a single problem.



Students often
equate excellence in
mathematics with
speed in solving
problems.

Project Goals

1. To better understand:
 - Conceptualize
 - Classroom cultural norm
2. And to help students:
 - Productive dispositions
 - Connections to learning
3. By creating:
 - Authentic and equitable experiences
 - Accessible
 - Promote persistence



Outline of Project



Year-long Problem Solving Project Guidelines

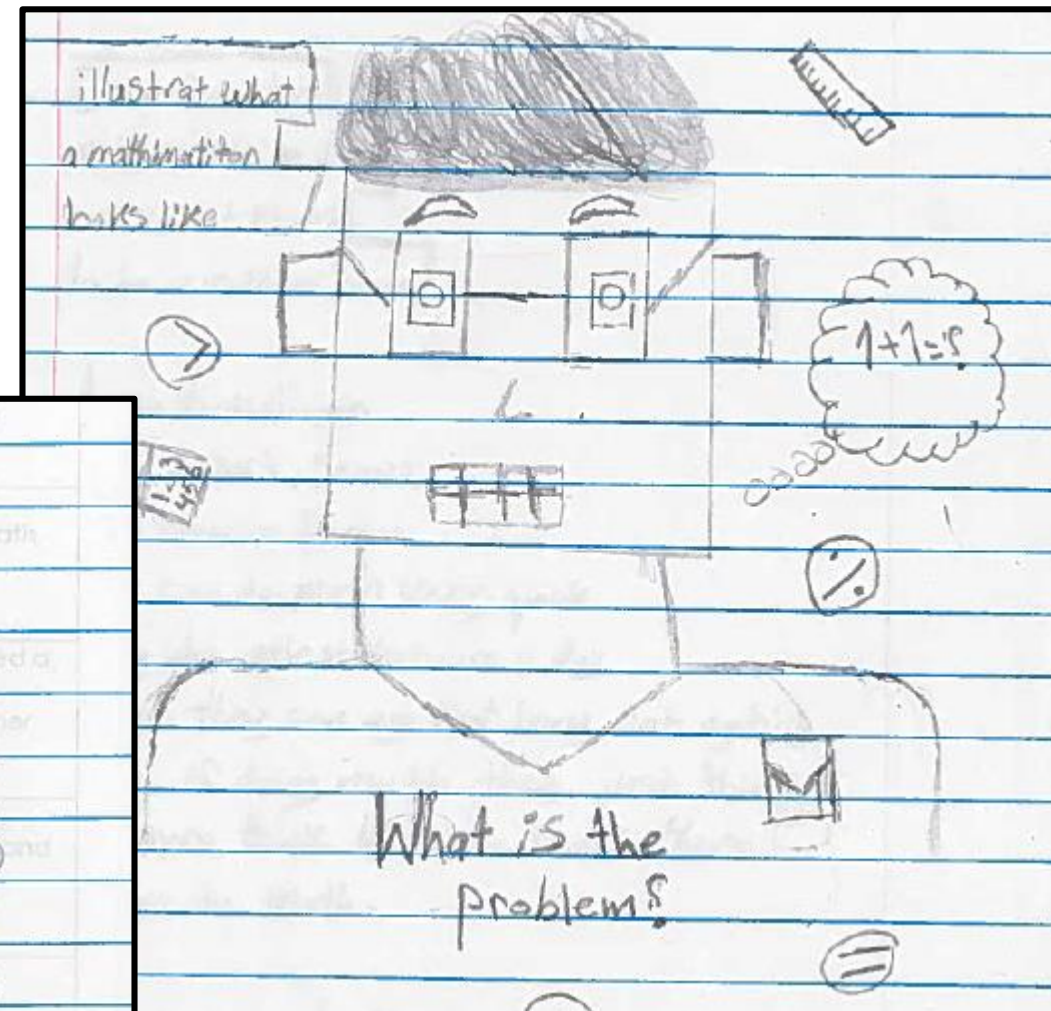
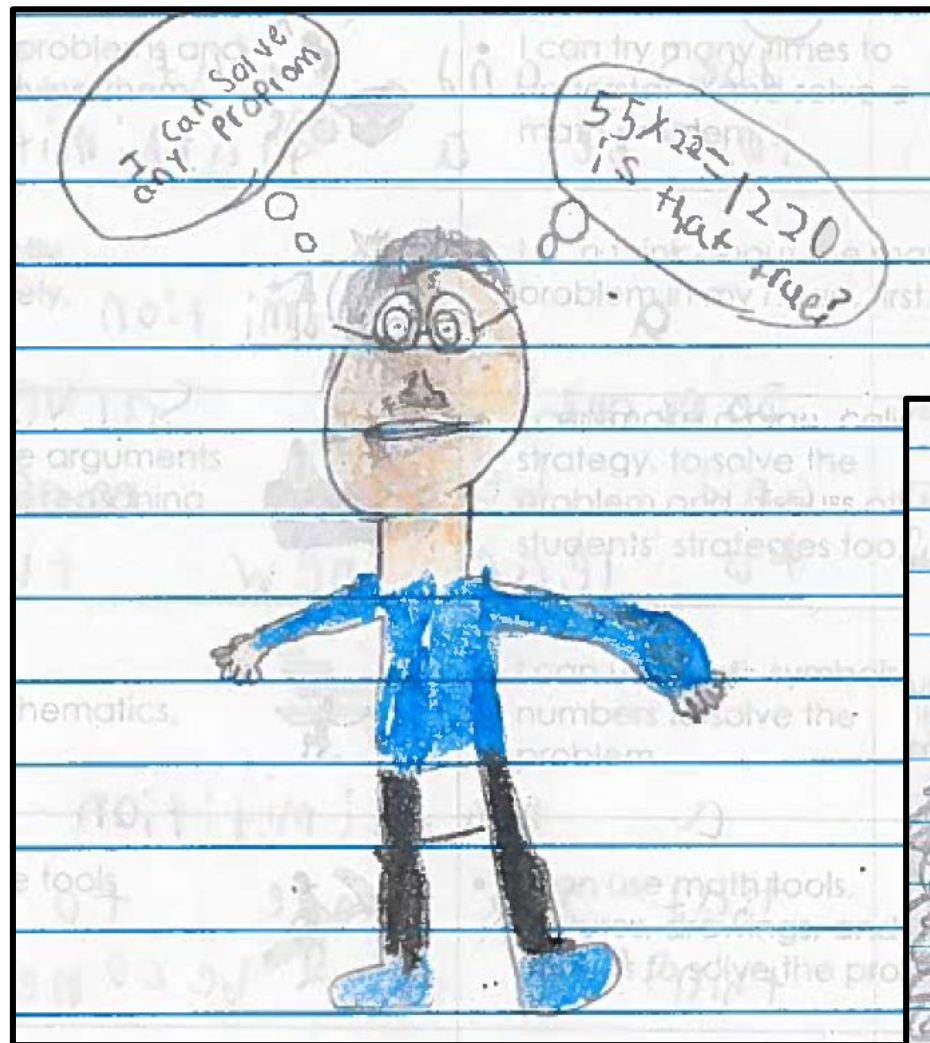
Each one will be about 10-14 days long.

Spend at least 5 days working on this problem

For at least 15 minutes for each of the days

(Truncated) Project Steps

- Teachers created project goals and a bank of problems/tasks
- Students viewed “Developing Problem Solving Strategies” videos prior to starting process
- Students filled out video reflection forms and chose their top 3 videos
- Emphasized focus/objectives to students:
- Students illustrated “what a mathematician looks like?” and explained “who is a mathematician?”
- Then problem/task was introduced and students began working on it



Teaching Problem Solving



Pólya's Problem Solving Strategies

Understand the Problem



Devise a Plan



Carry Out the Plan



Check and Extend



Developing Problem Solving Strategies



<https://www.maa.org/math-competitions/teachers/curriculum-inspirations>

Developing Problem Solving Strategies

1. Engage in successful flailing
2. Do something
3. Engage in wishful thinking
4. Draw a picture
5. Solve a smaller version of the same problem
6. Eliminate incorrect choices
7. Perseverance is key
8. Second-guess the author
9. Avoid hard work
10. Go to extremes



Developing Problem Solving Strategies

<https://www.maa.org/math-competitions/teachers/curriculum-inspirations>

Which video do you like best and why?
How would these videos help students learn to be problem solvers?



<https://www.maa.org/math-competitions/teachers/curriculum-inspirations>

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Curriculum Inspirations



Curriculum Inspirations is a multimedia experience for the middle-school and high-school communities.

Learn TEN PROBLEM-SOLVING STRATEGIES aligned with the Mathematical Practice Standards for classroom and MAA AMC success. Find practice examples galore listed by strategy and by Common Core topic. Bring excitement to mathematics learning, thinking, and doing!

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Meet James Tanton

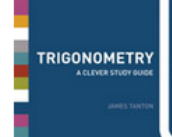


Believing that mathematics really is accessible to all, James Tanton (PhD, Mathematics, Princeton 1994) is committed to sharing the delight and the beauty of the subject.

[Read full bio](#)

[G'day Math!](#)

Featured Book



10 Strategies With Examples

- #1 Engage in Successful Flailing
- #2 Do Something
- #3 Engage in Wishful Thinking
- #4 Draw a Picture
- #5 Solve a Smaller Version of the Same Problem
- #6 Eliminate Incorrect Choices

Examples via Content Standards

- Number and Quantity
- Algebra
- Functions
- Geometry
- Statistics and Probability
- Middle School Content Standards

Developing Problem Solving Strategies

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The Nature of the Problems



The Locker Problem

There are 1000 students and 1000 lockers, numbered 1 through 1000. Suppose the first student opens each locker. Then the second student closes every second locker. The third student changes the state of every third locker (if it is open, she closes it; if it is closed, she opens it).

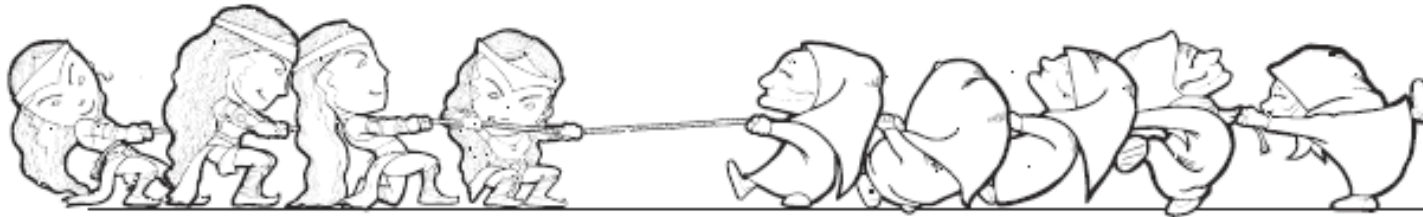


This process continues until the 1000th student changes the state of the 1000th locker. Which lockers are open after all 1000 students have passed through?

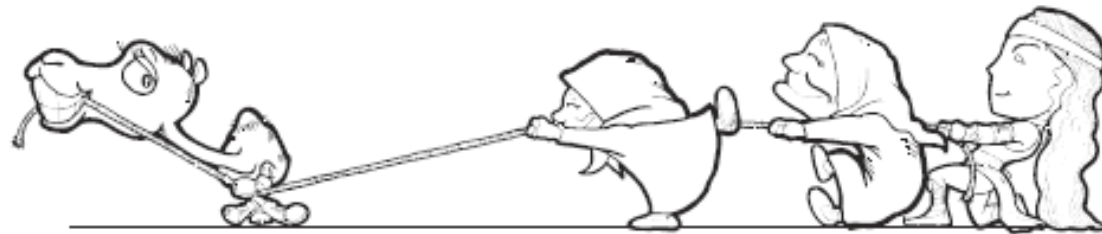
A Mathematical Tug-of-War

from Marilyn Burns

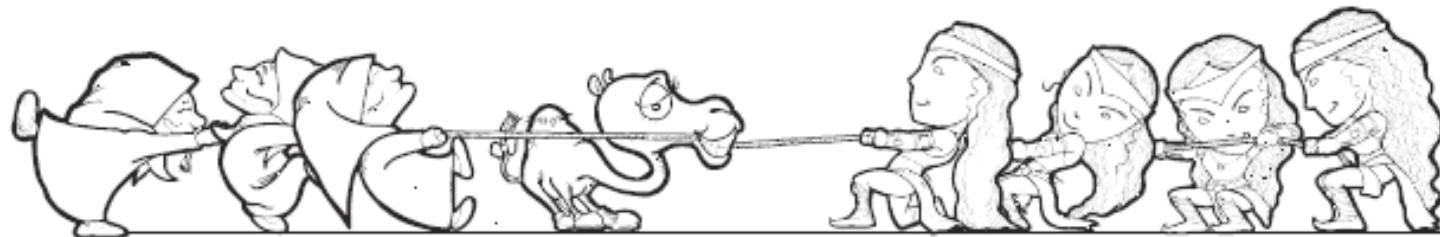
adapted by Keith Arnoff 2018



Four warrior princesses pull against five grandmas
and the result is dead even.



Omar the camel gets pitted against two grandmas
and one warrior princess. It's a tie!



Omar and three of the grandmas on one side, the four warrior princesses on the other.

WHO WILL WIN??????

AUS SWAT TEAM to the rescue!



The Water Jug Problem

You only have 2 containers, a 3 liter jug and a 5 liter jug. There is an unlimited supply of water, but no other containers. You need **precisely** 4 liters of water in 1 jug.

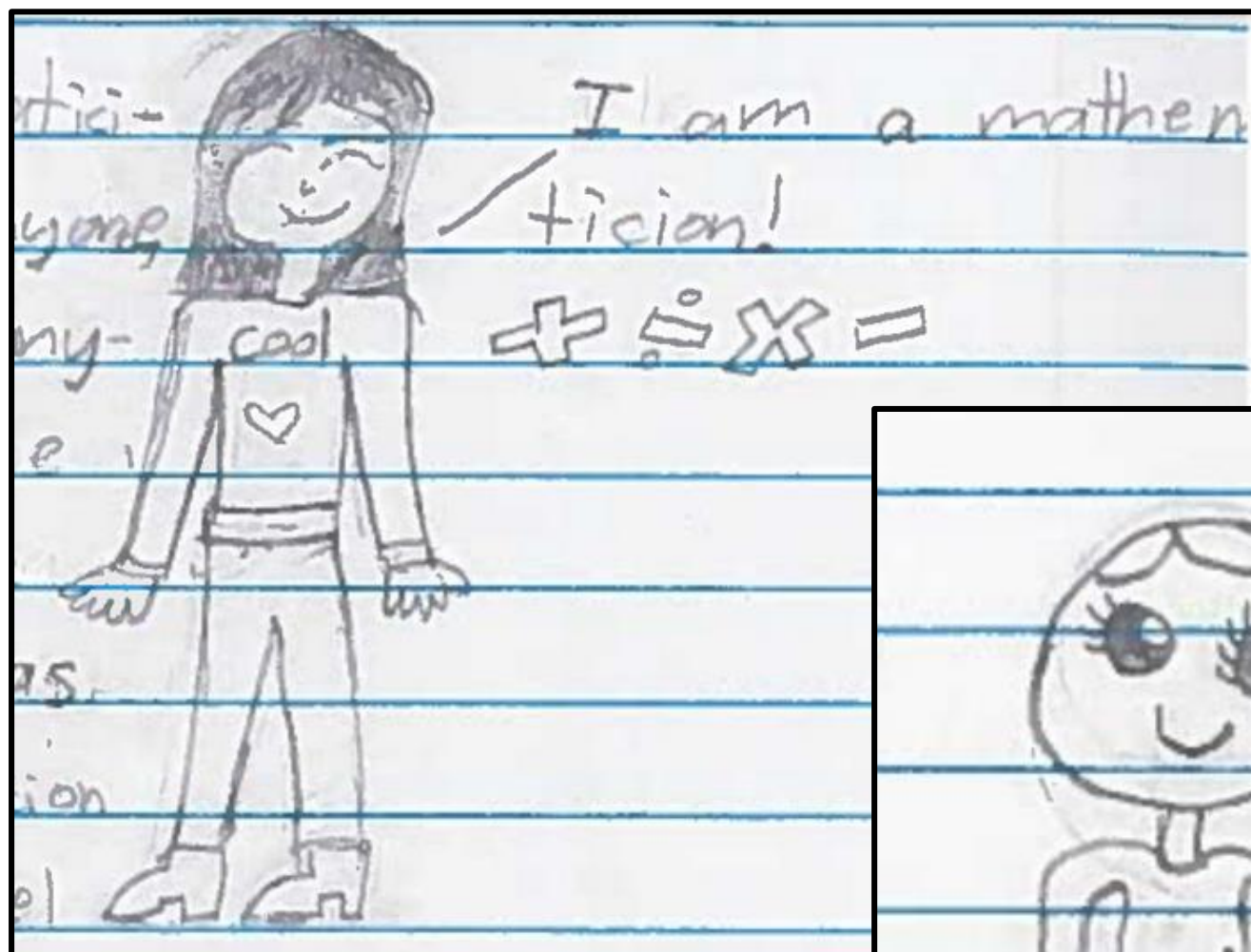
Describe a way to use these jugs to measure exactly 4 liters of water. Explain your solution and illustrate using math models and or diagrams.



A Piece of Cake

What is the greatest number of pieces you can cut a round cake into by making four straight cuts with a knife?





What We Learned



If $y = 3$, what is $6y$?

Hmmm... 63 ?



Thankyou!

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