Nothing Works!

Henri Picciotto

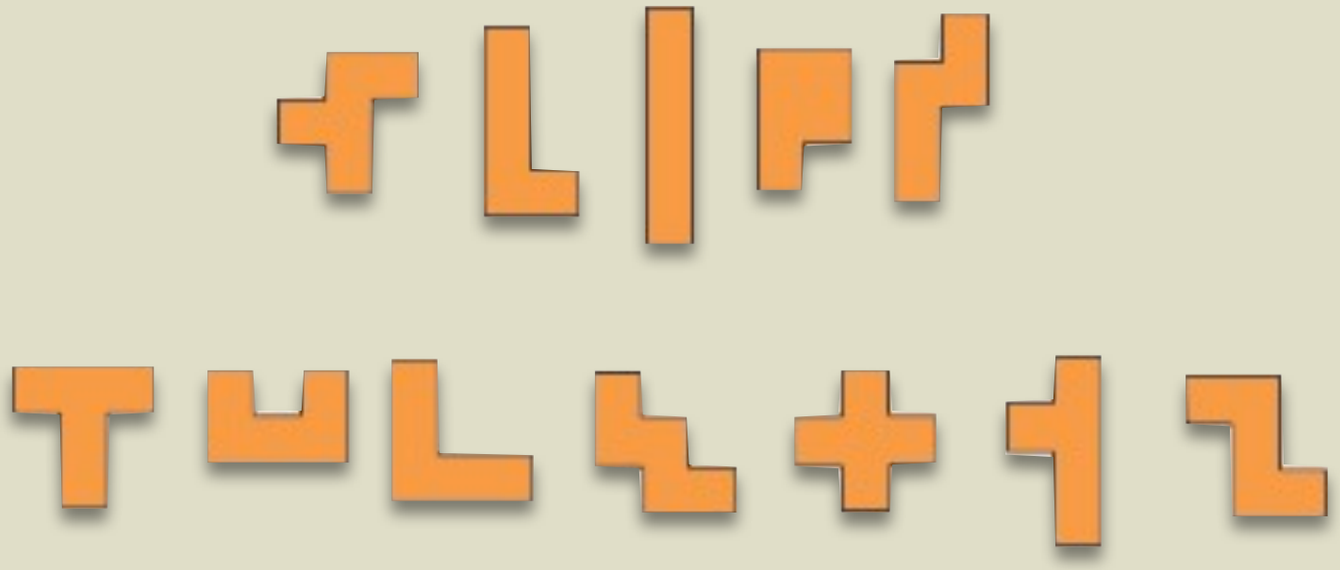
www.MathEducationPage.org

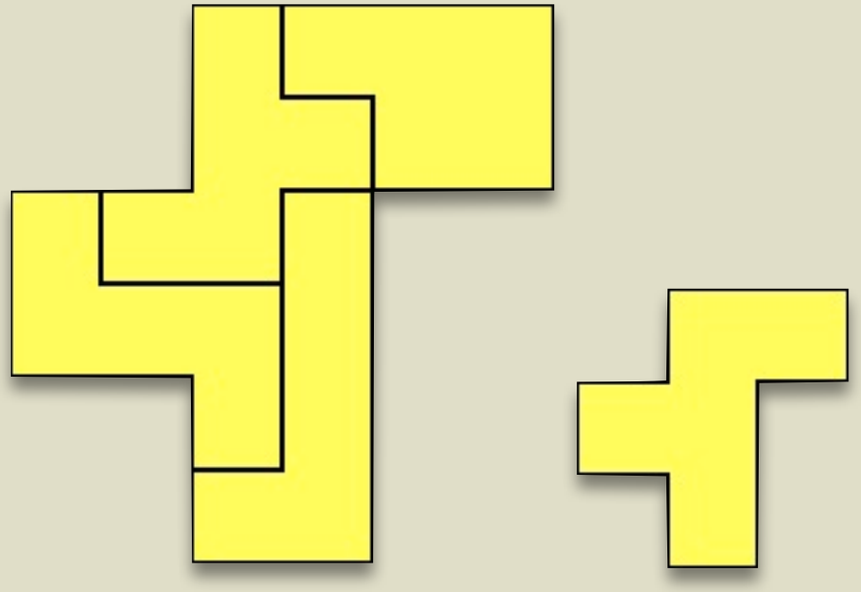
henri@MathEducationPage.org

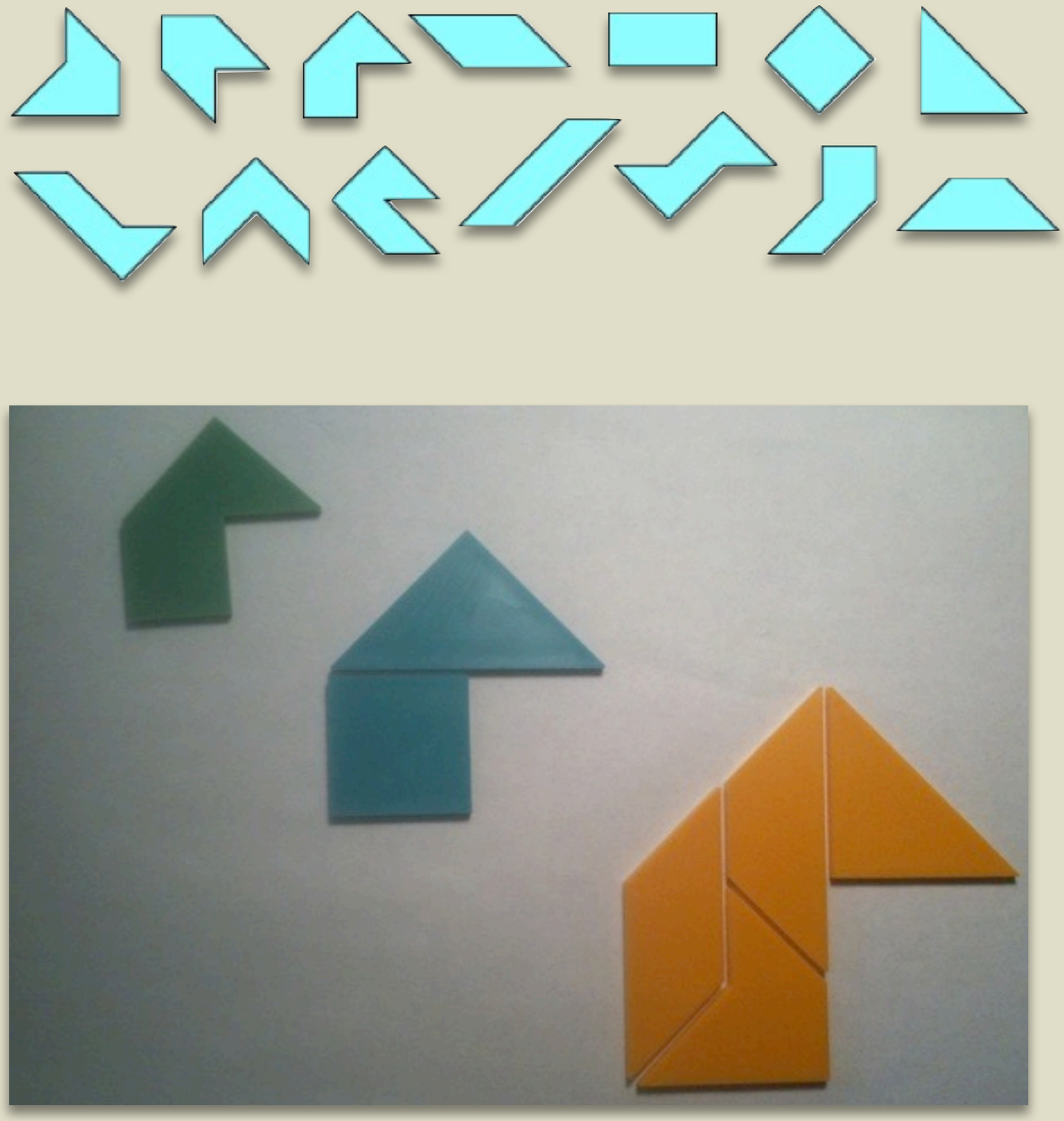
... not even the ideas

I'm about to share

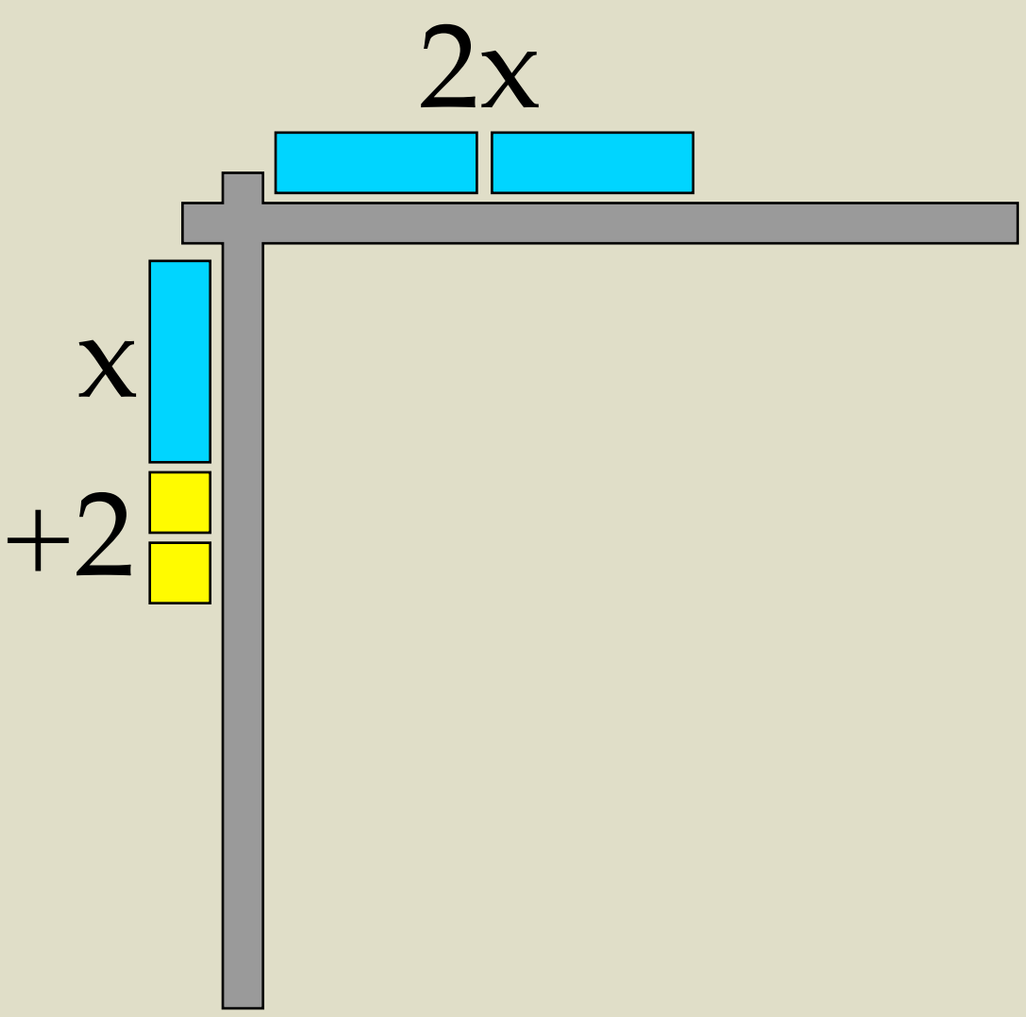
Manipulatives



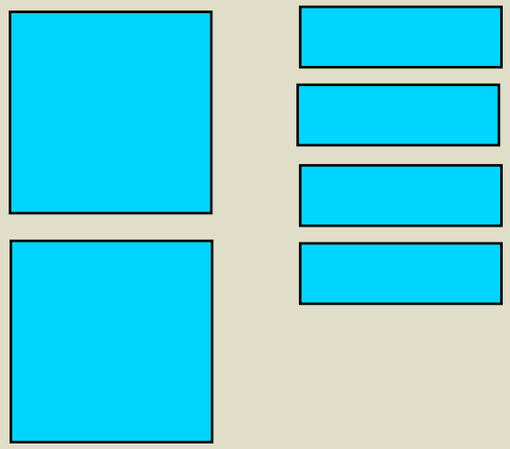




Make a Rectangle

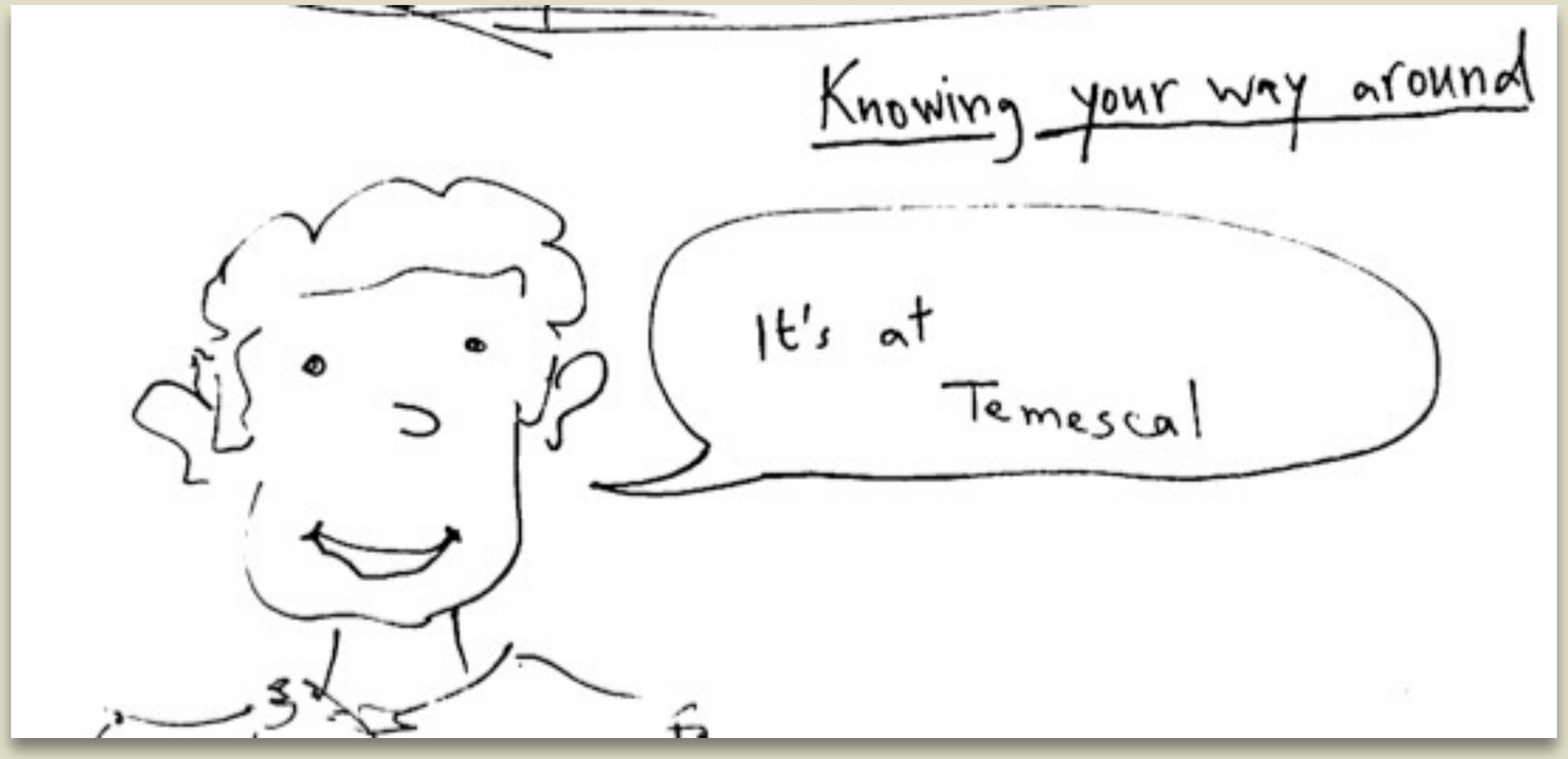


$$2x^2 + 4x = 2x \cdot (x+2)$$



He said:
"Go South on Martin Luther King Junior Way (Old Grove Street). Left on Alcatraz. Right on College. Left on Keith. You'll get to a Stop sign; then a stop light. Make a left onto Broadway, but get into the right lane. When you see the overpass"... er..."when you see the freeway... um... What did he say?

Following Directions


Knowing your way around
It's at
Temescal

Oh, here's another route...
Oakland
Reading a map

Technology

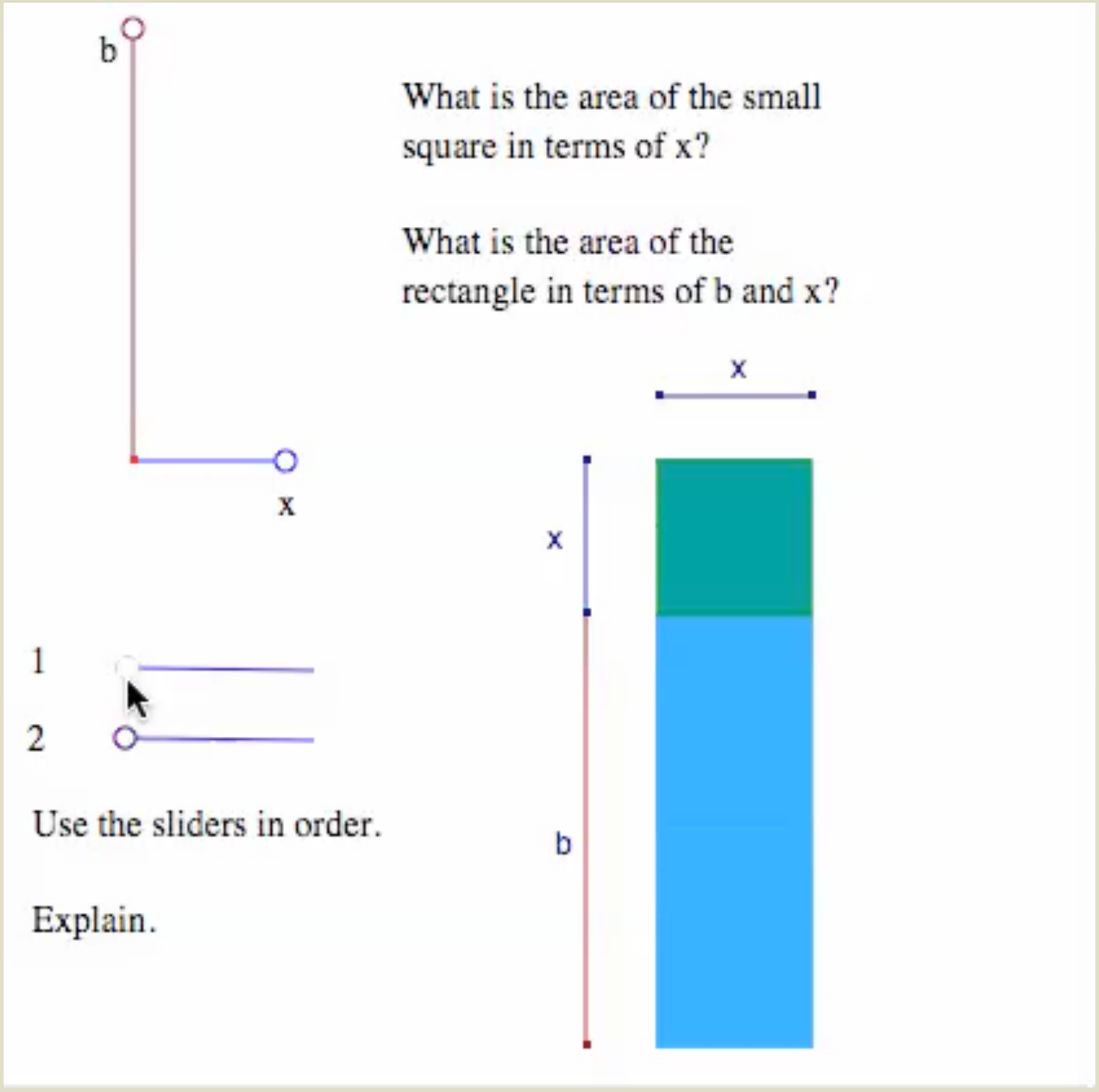
http://www.wolframalpha.com/

Speed and accuracy in computation are no longer legitimate priorities for math education.

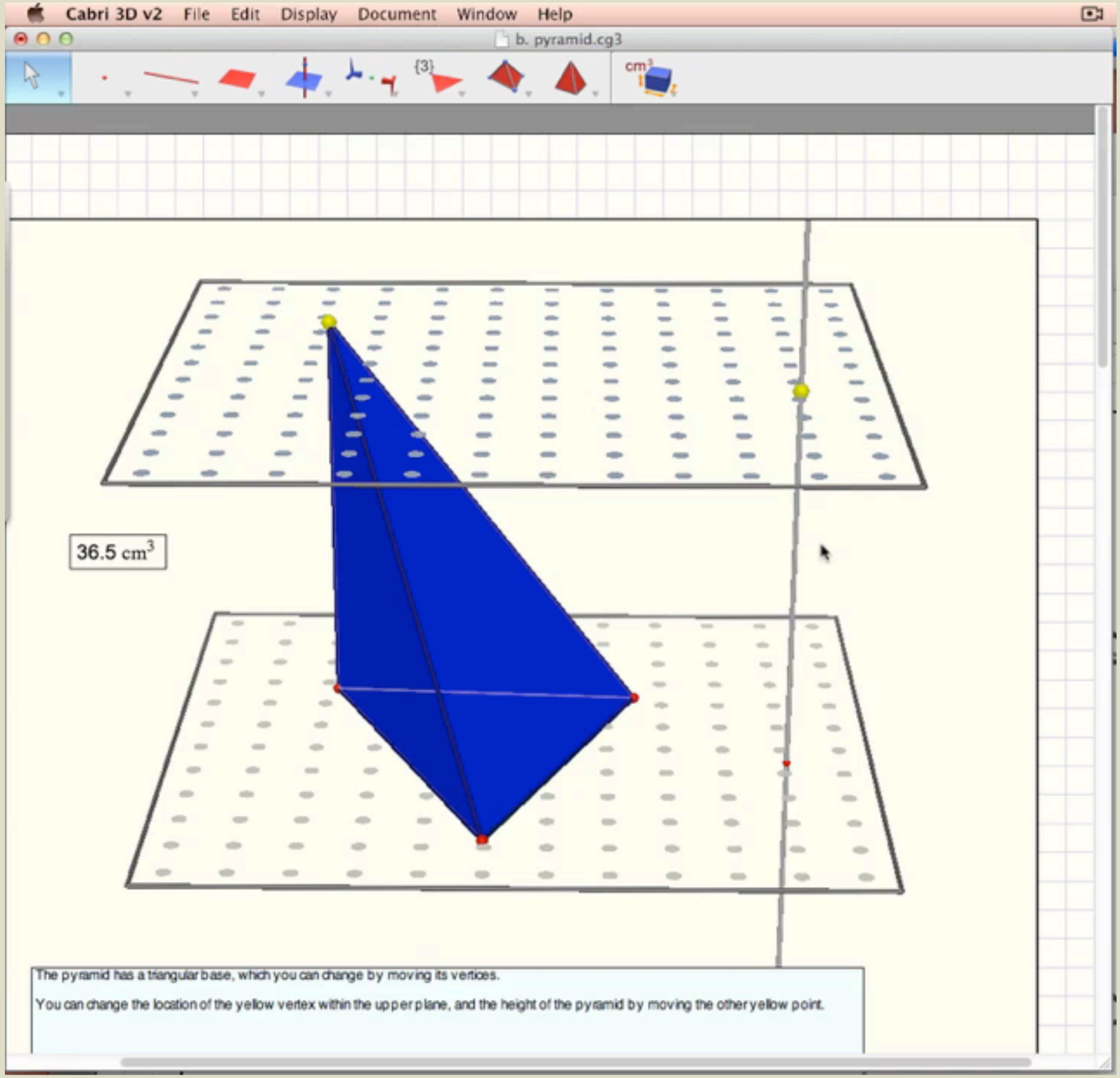
Technology can help make math

- ◊ visual
- ◊ interactive
- ◊ creative

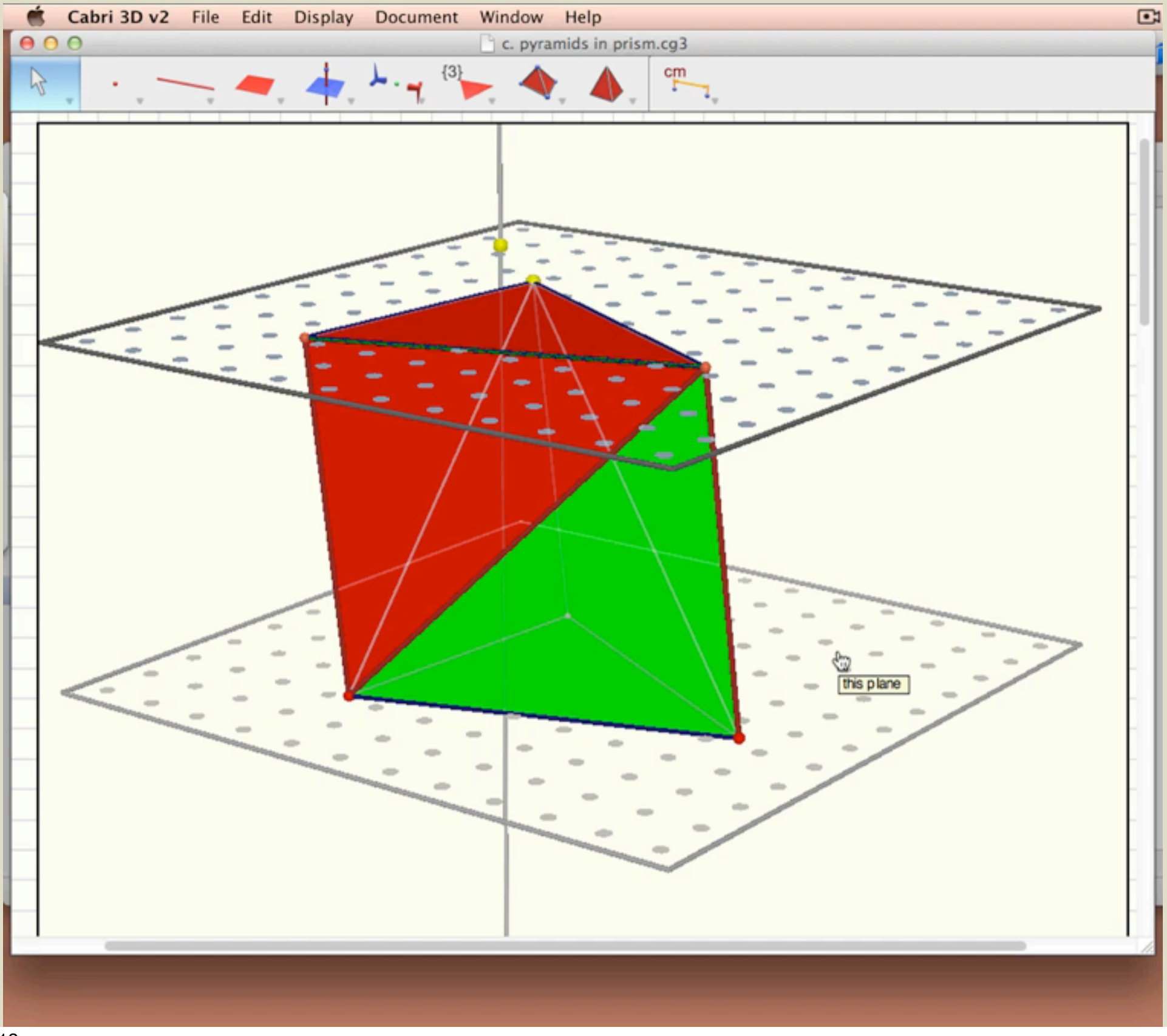
Make Math Visual



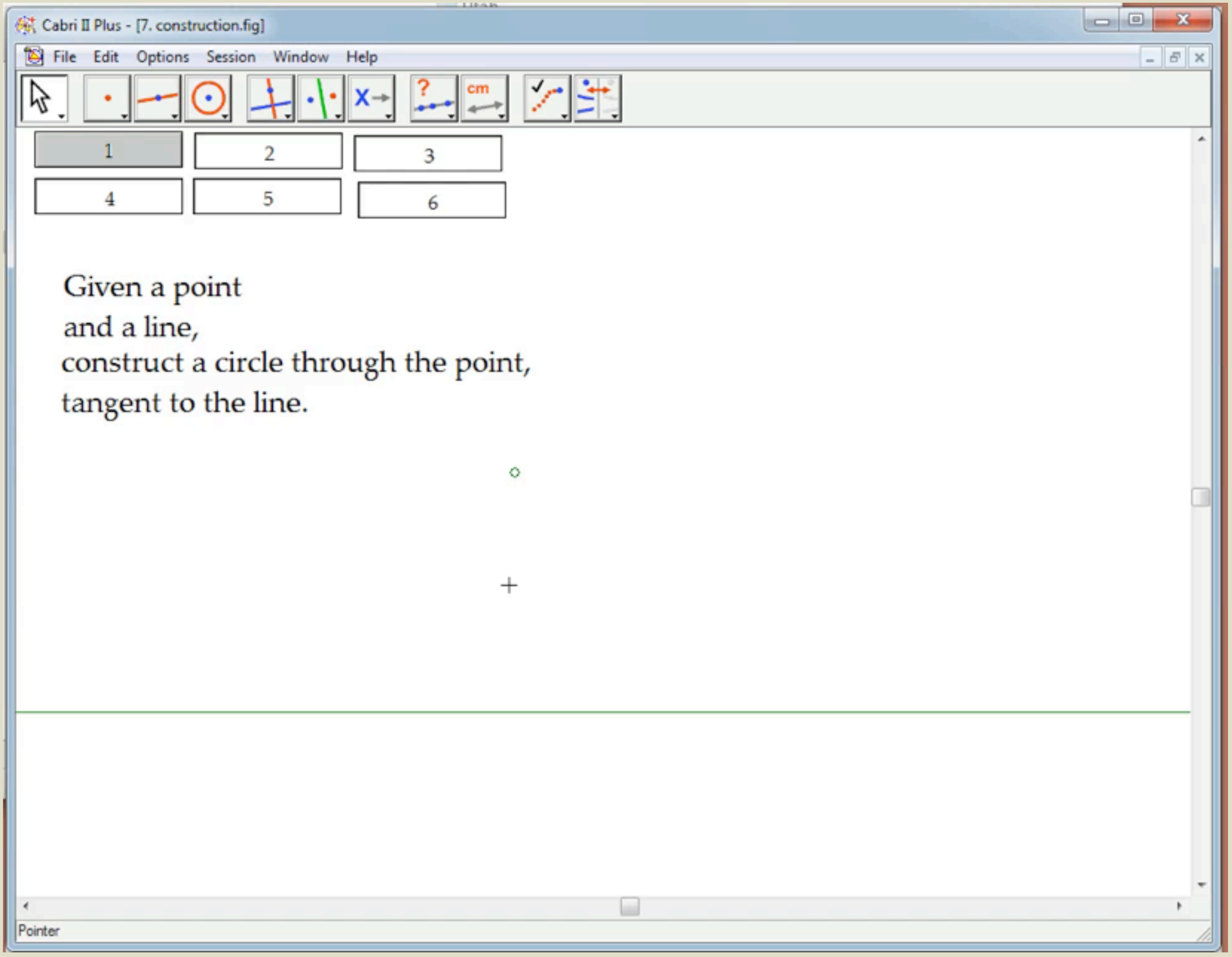
Make Math Interactive



Make Math Interactive



Make Math Creative



Tools are not magic!

A Tool-Rich Pedagogy

◊ Student-centered classroom
◊ Discussion and reflection,verbalizing
◊ Cooperative learning, group work
◊ Visual bridges to concepts
◊ Microworlds

Multiple Representations

Numeric, symbolic, graphical, geometric, applied, ...

- To provide an entry point to more students
- To preview or review concepts
- To extend exposure
- To deepen understanding
- To increase variety

Benefits

◊more motivation

◊lowers the threshold: access

◊raises the ceiling: challenge

◊deeper understanding for all

Classroom Choices

Group Work

◊ Random groups
- new groups every 2 weeks

◊ Students mostly work independently
- are expected to help each other

◊ If a group does not function well
- intervene directly to get the behaviors you want

◊ If more than one group is stuck
- stop them all for a class discussion

Verbalizing

Putting things in words is crucial to understanding

◊ Encourage talking

◊ Require writing

Don’t answer questions they don’t have

They cannot hear you!

- Seed with questions and discussion
- Then, when appropriate, lecture

Class Discussion

True discussion vs. interactive lecture

Use of open-ended questions

Creating a safe environment

◊ No putdowns

◊ Praise participation and risk-taking

- rather than correct answers

◊ "Tell your neighbor..."

◊ "Can you restate what X said?"

Handling wrong answers

◊write down many answers

◊poker face vs. telling

◊"Choose someone to help you"

◊making 'mistakes' myself

Feedback from all

◊votes

◊gestures

◊writing

Variety

- Fanfare vs. total silence
- New problems, not same as on paper
- Move around the room

Homework Choices

Homework

◊ Keep it reasonable

- most learning happens at school

◊ Keep it separate from class work

- less rushing, more cooperation

Lagging Homework

Topic 1	Week 1 class work	Week 2 homework	Week 3 quiz	Week 4 "recycle"
Topic 2	Week 2 class work	Week 3 homework	Week 4 quiz	Week 5 "recycle"

Curricular Choices

Sequencing within a course

Tackle important and/or difficult topics early

Examples from geometry:

- Inscribed angles at beginning of course
- Pythagorean theorem before congruent triangles

Sequencing within a course

Separate related topics:

◊ tangent / sine and cosine
◊ exponentials / logarithms
◊ sequences / series

Navigating a Topic

Concrete to abstract, and back

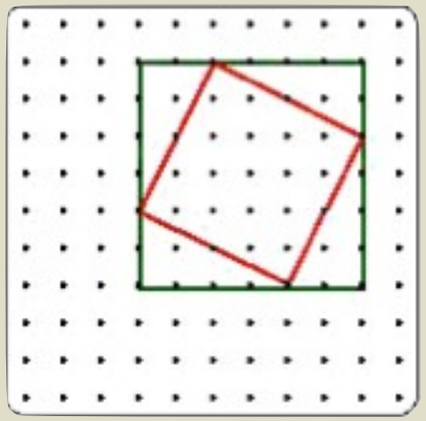
positive whole numbers to rational numbers

numbers to variables

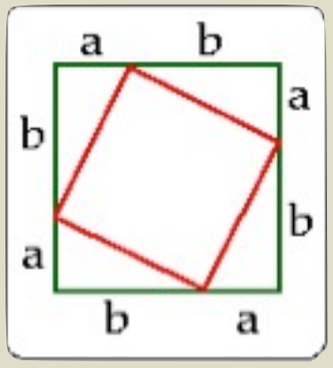
discrete to continuous

Example:
the Pythagorean theorem on the geoboard

What is the area of the red square?



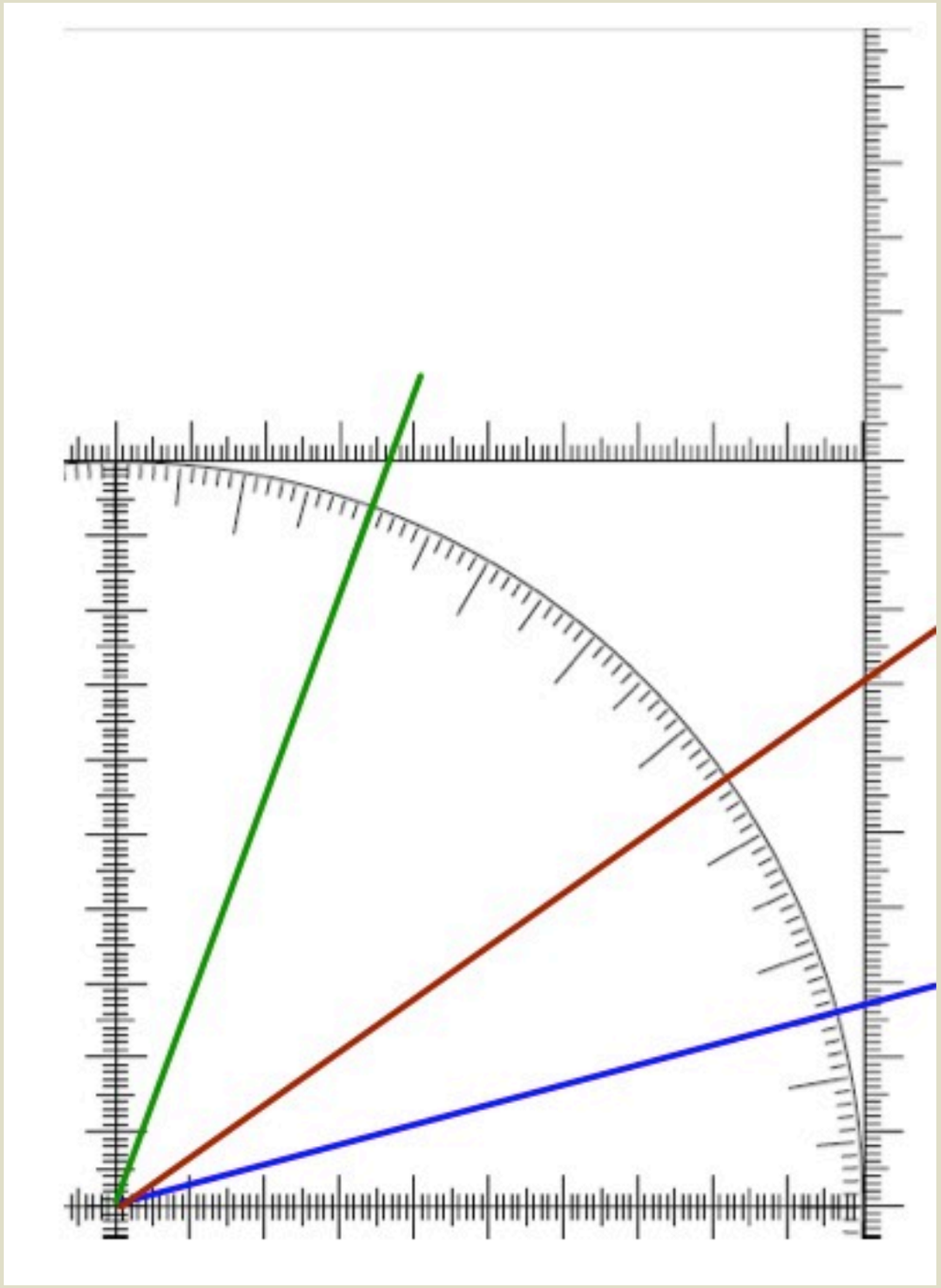
Generalize



Navigating a Topic

Concepts to vocabulary and notation, and back.

Example: trig ratios on the ten-centimeter circle ("slope angles")



Navigating a Topic

Difficult to easy, and back.

Pacing

- “Covering” vs. uncovering / discovering
- Review / View / Preview
- When to move on

constant forward motion

eternal review

Heterogeneous Classes

All classes are heterogeneous

Alliance with the strongest students

Support for the weakest

The Goldilocks Strategy

◊ Something too difficult

◊ Something too easy

◊ Something "just right"

Assessment Choices

Assessment Alternatives

◊ Participation quiz
◊ Quiz / test corrections
◊ "Recycle extra"
◊ Other take-home assignments
  - projects
  - reports
  - problem sets

Equity concerns

Keep Assessment Manageable

◊ Give homework a quick look

◊ Don't write extensive comments on tests
(do they read them? do they heed them?)

When correcting work, you're working for one student
When planning, you're working for the whole class

Love of math and learning is not triggered by assessment

Problem Solving

Discovery vs. Direct Instruction

◊ A false choice:
neither works well without the other

◊ After exploration, "institutionalization"

- Make key concepts explicit

- Clarify what is important and worth remembering and thus worth writing down

Problems

◊ Problem vs. exercise

◊ Genuine vs. guided-by-the-nose

◊ The curriculum spectrum:
Problem-based ... problem-rich ... problem-poor ... no problem!

Making Connections

◊with other representations

◊with previous knowledge

Nothing transfers

Reasoning and Sense-Making

Skills vs. concepts

Another false choice

Teach for understanding!

Understanding...

◊ is difficult to encapsulate in a checklist

◊ cannot be easily conferred by explanations

◊ is difficult to assess

◊ is not always valued by students and parents

◊ is the most important part of our job

Nothing Works

for every student

every class

every teacher

every day

Be skeptical and eclectic

Do not believe claims that some particular approach or curriculum is “the answer”.

◊ Don’t throw away or rule out any technique

◊ Constantly broaden your repertoire

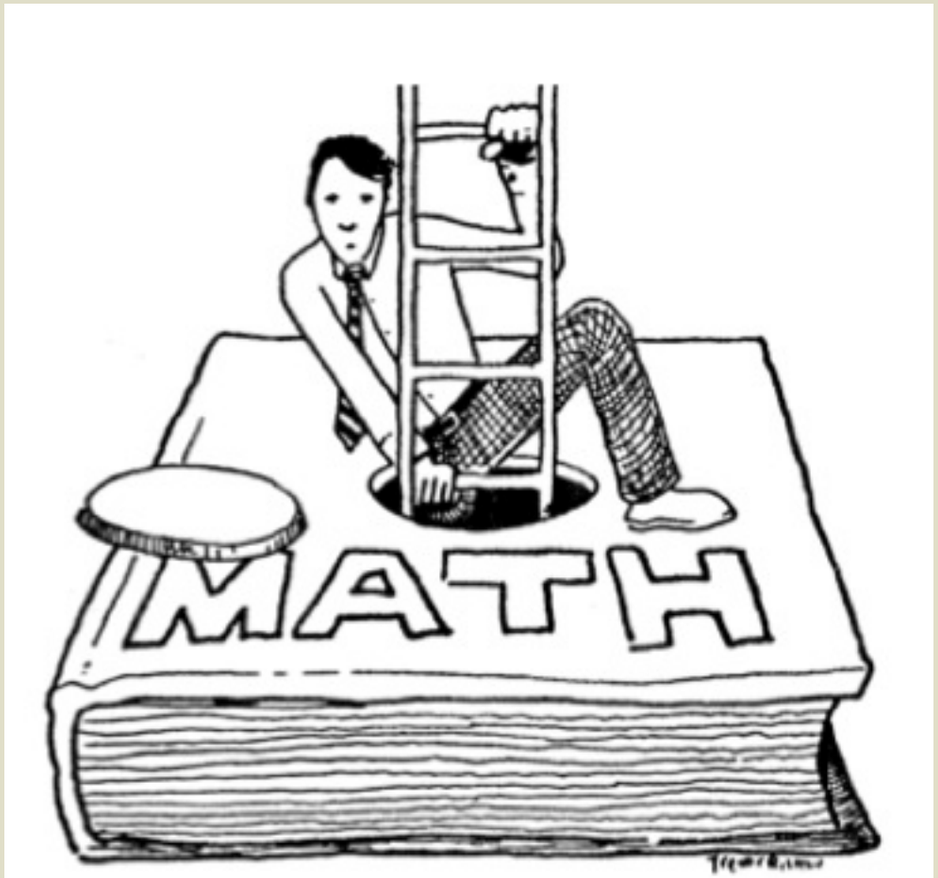
Our Own Learning

...about math,

about learning and teaching,

is what makes the job interesting in the long haul

There is no one way



Escape from the Textbook!

Online network:

www.edWeb.net/escape

Henri Picciotto

www.MathEducationPage.org

henri@MathEducationPage.org