

What I Learned at AMATYC

Robert Pruvencok

Selected Presentations at Which I Learned Some Interesting Things

- **Mathematics, Science and Reality**
Gary Rockswold, Minnesota State University
- **GeoGebra: A Tool to Connect S, T, and E with M**
Chris Heeren, American River College
- **Z(app) the Tedium with Apps and Applications in a Liberal Arts Course**
Tom Pirnot, Kutztown University
- **Digging for Gold: Discovering the Golden Ratio**
John Martin, Santa Rosa Junior College

Mathematics, Science and Reality

Gary Rockswold, Minnesota State University

Special Relativity in College Algebra:

Two assumptions:

1. Speed of light = c is constant
2. All objects have speed c in 4D spacetime

Diagram using the Pythagorean Theorem!

Mathematics, Science and Reality

Gary Rockswold, Minnesota State University

String Theory in Calculus:

Discrete time and space:

Planck length $\approx 1.6 \times 10^{-35}$ meters

Planck time 1×10^{-43} seconds

Continuity is a mathematical abstraction existing outside of time and space.

Mathematics, Science and Reality

Gary Rockswold, Minnesota State University

Max Tegmark's theory (cosmologist at MIT):

Math is discovered. Physical reality exists within mathematical structures. Spacetime exists inside mathematics. Physics is an encoding of mathematical reality, so there may be no limits on what we may discover.

GeoGebra: A Tool to Connect S, T, and E with M

Christopher Heeren, American River College

- Free download!
- Has cell phone app
- Different versions for algebra and geometry

GeoGebra: A Tool to Connect S, T, and E with M

Christopher Heeren, American River College

Similar to Desmos, but possibly better suited to STEM students modeling what they will be doing in the real world:

1. Designing
2. Coding
3. Building
4. Experimenting
5. Troubleshooting

GeoGebra: A Tool to Connect S, T, and E with M

Christopher Heeren, American River College

[Pendulum Clock Project](#)

59-step design project

Z(app) the Tedium with Apps and Applications in a Liberal Arts Course

Tom Pirnot, Kutztown University

Exponential functions: [colorpicker](#) apps

Gerrymandering:

1. Washington Post article explaining by example [how it works](#)
2. North Carolina [congressional districts](#) (map) ruled [unconstitutional](#) b/c they were racially motivated
3. Measure gerrymandering with geometry (perimeter to area ratio)
4. Algorithmic [solution](#) to gerrymandering

Z(app) the Tedium with Apps and Applications in a Liberal Arts Course

Tom Pirnot, Kutztown University

Logic (truth tables):

1. Three-valued logic (true, maybe, false)
2. Five-valued logic (true, probably, maybe, maybe not, false)
3. Infinitely-many-valued logic (vocal inflections, fuzzy logic)

Digging for Gold: Discovering the Golden Ratio

John Martin, Santa Rosa Junior College

Definition:

If an interval is partitioned into two subintervals such that the ratio of the length of the longer subinterval to that of the shorter subinterval equals the ratio of the length of the whole interval to that of the longer subinterval, then that ratio is the Golden Ratio.

$$\frac{1}{x} = \frac{x}{1-x}$$

The Golden Ratio $\varphi = 1/x = (\sqrt{5} - 1)/2 \approx 1.618$ is symbolized for Phidias.

Digging for Gold: Discovering the Golden Ratio

John Martin, Santa Rosa Junior College

BEWARE: Many instances of the Golden Ratio cited in books and on the internet are **WRONG**, so do your homework.

RIGHT:

1. Great Pyramid (draw diagram)

WRONG:

1. Parthenon ($1.54 < W/H < 2.25$)
2. [UN Building](#)
3. [Nautilus shells](#) are not [golden spirals](#)

Digging for Gold: Discovering the Golden Ratio

John Martin, Santa Rosa Junior College

$$\sqrt{1 + \sqrt{1 + \sqrt{1 + \dots}}} = \varphi$$

$$1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{1 + \dots}}} = \varphi$$

$$\begin{aligned}\varphi^2 &= \varphi + 1 \\ \varphi^3 &= 2\varphi + 1 \\ \varphi^4 &= 3\varphi + 2 \\ \varphi^5 &= 5\varphi + 3 \\ \varphi^6 &= 8\varphi + 5 \\ \varphi^7 &= 13\varphi + 8 \\ &\vdots\end{aligned}$$

Zeckendorf's Theorem: $N = \sum_{i=1}^k F_{n_i}$

$$F_n = \frac{1}{\sqrt{5}} \left[\varphi^n - \left(-\frac{1}{\varphi} \right)^n \right]$$

Additional Presentations and Things Worth Mentioning

- **Teaching the Logic and Scope of Statistical Inference**
Allan Rossman and Beth Chance, California Polytechnic State University
- **Unthinkable, Mind-Blowing Projects in Statistics**
Barbara Leitherer and Rupa Mitra, Community College of Baltimore County
- **Challenging Calculus Students with True/False Questions**
Stephanie Garofalo, Perimeter College at Georgia State University
- **GraphLock** (\$5/year for students, free for instructors)
- **Be nice!** 😊