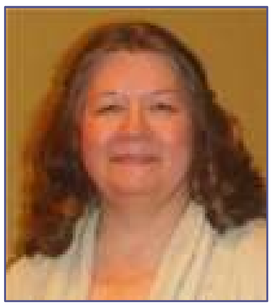
TexMATYC News

Texas Mathematical Association of Two-Year Colleges Fall 2013

President's Message

By Sharon Sledge, San Jacinto College.



Greetings!

One of the joys of teaching is the opportunity for starting fresh each semester. New students, new or refreshed curriculum, and new ideas for implementation and uses of technology. This fall 2013 semester brings those same opportunities plus more. Nine colleges are teaching the New Mathways Project courses – Frameworks and Foundations to be followed with Statistics in the spring. Students registering on the first day of classes or later take the new Texas Success Initiative Assessment. State funding for colleges is now tied to student completion and success in development mathematics as well as the first academic mathematics courses.

Does this impact you? It is time to find out. It is time to get involved. It is not OK to continue business as usual. The world outside your classroom is knocking on your door and it is time to answer. Each of the three new state initiatives will impact you somehow. Find out who, what, when, where and how. Plug into your state organization (TexMATYC), read TCCTA Blogs and TexMATYC newsletters, attend conferences, talk to your colleagues, become informed and involved. Get answers to your questions – make your voice heard.

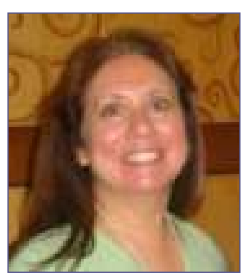
We have two major conferences right here in Texas during the spring semester. Take advantage of these outstanding professional development opportunities. TCCTA/TexMATYC will be in San Antonio on Feb. 6 – 8, 2014 and ICTCM will also be in San Antonio on March 20-23, 2014. Make plans to attend and network with colleagues, share information and experience new ideas.

Here's to a new year with new opportunities for new successes!

Sharon

From the TexMATYC VP

By Cynthia Martinez, TexMATYC Vice President



Welcome back to the 2013-2014 academic year.

Keep up with the latest in mathematics education by being a part of TexMATYC!

You have options when it comes to joining a mathematics organization to keep up with the latest changes in mathematics education. Being a

Contents:

member of TexMATYC brings attention to mathematics at our state level.

TexMATYC is a non-profit, educational association whose purpose is to:

- Encourage the development of effective mathematics programs
- Afford a state forum for the interchange of ideas
- Further develop and improve the mathematics education and mathematics related experience of students in two-year colleges
- Promote the professional welfare and development of its members
- Provide the opportunity to study and keep abreast of new trends in mathematics
- Promote professional cooperation and communication between teachers and administrators for the realization of sound educational achievements
- Promote support for and involvement in the American Mathematical Association of Two-Year Colleges

Still haven't decided if you should join? Here are the top five reasons to join TexMATYC:

1. You have access to TexMATYC newsletter three times per year, updating you on the latest issues in Texas!
2. We meet at least once per year. If you attend TCCTA in San Antonio, February 6-8, 2014, what better way to get a two-fer-one – TexMATYC sets the math agenda based on what you want to know about!
3. Affordable annual membership dues – Just $10 !!
4. Collegiality!
5. Collegiality!

So, what are you waiting for? Go to http://texmatyc.org/ and select "Become a Member!" Follow the directions on joining or renewing your membership by either paying online safely and securely with PayPal or a major credit card, or download a form to fill out and send to your campus representative or Habib Far (mail to Lone Star College – Montgomery, 3200 College Park Drive, Conroe TX 77384).

Don't forget about our annual conference that is held in conjunction with TCCTA convention. This year it will be held at the San Antonio Marriott Rivercenter February 6-8, 2014. Check out the TexMATYC website for more information. Using great ideas can create a good learning atmosphere which in turn can produce good quality students.

Hope to see you at the next TCCTA/TexMATYC convention in February 2014.

Topics Affecting Mathematics Education

By Kathryn (Kate) Kozak, AMATYC Vice President for the Southwest Region

I was hoping to write an informative article about a topic that is currently important in mathematics education, such as common core standards changes, developmental education redesign, or availability of open source books. However, I have to admit that I haven't been able to concentrate on any of these topics. Currently, I am on sabbatical and sitting at my brother and sister-in-law's farm in New South Wales, Australia, and watching the Grand Final of Australian League Football. So I am a bit distracted, and these topics are not on my mind right now. However, all of these topics and more are immensely important today.

Forty-five states have adopted the common core standards. When students who are being taught using these standards come to community colleges, there may be some changes of what community colleges need to teach. I realize that not all states in the southwest region have adopted the common core standards, but their existence affects all of us. So schools may want to start looking at the standards and see what curriculum changes could be recommended.

Developmental education redesigns are being proposed all over the country. Some of the redesigns are accelerated courses, emporium models, and student mentors. You can find out more about redesign models at an AMATYC conference, such as the Annual AMATYC meeting in Anaheim, October 31 through November 3, 2013. If you cannot attend the conference, there are webinars that AMATYC offers and also conference proceedings are posted on the amatyc.org website. Members of AMATYC receive emails with information about webinars and conferences, so become a member of AMATYC to keep informed. Information on being a member can be found at amatyc.org.

With the rising price of textbooks, many faculty are looking for better options for textbooks. Some of these faculty are writing textbooks and publishing them as open source books. There is even an open source homework system that exists. When choosing textbooks, you may consider reviewing the many open source textbooks out there. Please note, AMATYC doesn't have a position statement on open source textbooks, and my suggestion to use an open source textbook is my own opinion and not AMATYC's.

There are many other topics that are important to faculty at community colleges. Many of these have been addressed by AMATYC. Consider being a member so you can be a more active voice in mathematics education. More information can be found at amatyc.org.

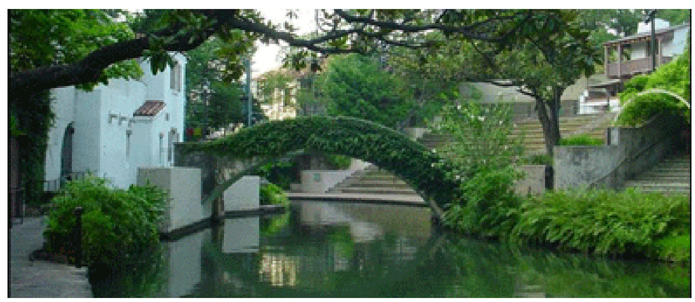
.

MATH: There's no end to the fun! AMATYC Anaheim 2013

39th Annual Conference
Anaheim Marriott
Anaheim, CA
Oct. 31 - Nov. 3, 2013

See **www.AMATYC.org** for more information.

TCCTA 2014 Convention



The 67th Annual Convention
Marriott San Antonio Rivercenter
February 6-8 2014
San Antonio, Texas

How Do We Define the Number "1"?

By Don Allen, Department of Mathematics, Texas A&M University

Preamble. In human history, the origin of the numbers came from definite practical needs. The famous statement by the German mathematician Leopold Kronecker (1823-1891), "God made the integers; all else is the work of man," has spawned a lively modern philosophical discussion, and this discussion begins by trying to get a philosophical handle on "1." This approach remains under heavy discussion, and more-or-less unresolved (Frege, 1884).

In this short note, we look more toward the historical origins of that most important, number "1." Its history is curiously interesting but its story needs to be told in multiple chapters, as "1," having at least *five* forms or types, is a little more complicated than you might think. It reveals how important "1" is, how naturally it arose, and how abstract it can become.

The story of "1." The first two are the regular types, the *ordinal* and the *cardinal*. The *ordinal*, as in first, second, third, etc probably originated first. It was likely used as the order in which certain people or things were presented, perhaps in ceremonies. It is also an aspect of social behavior in animal groups, as we see with the term "alpha" (i.e. first) male or female. In many animal groups (e.g. chimpanzees) there is a ranking of individuals for priority for feeding, grooming, and other animal activities. Most folks understand this as the "pecking order." Also, the expression, "You're number one" used "1" in the ordinal sense.

The *cardinal* use of "1" puts it as the first counting number. This is the number "1" we think of. It is the "1" we use with all the other natural numbers for arithmetic, to create the fractions, the reals, and the entire world of mathematics. It is also the "1" considered in philosophical discussions, which posits the single unit upon which all the integers are defined, usually as successors. This is the use in most mathematical foundational works. See, for example the works of Friedrich Ludwig Gottlob Frege (1848-1925).

By Bertrand Russell (1872-1970), there is another concept of "1" that might we call a *state*. Let's refer to this state as "oneness." This abstract idea or comprehension of "oneness" came long after the number one itself. Examples one stone, one rabbit, one child preceded our current idea of "one" as "oneness." That is, consider collections (sets) of all objects of which the *number state* is "oneness." Actually, Russell explains this in terms of "twoness" as a *class*, not state. (Basile, 2007) For comparison, other states are color, density, temperature, magnitude, and many more.

The idea of "1" as a *unit* is a rather important aspect of this basic number. As a unit, it forms the basis of all kinds of measurement from money to miles. The natural evolution of this idea of "1" most probably arrived only when people had a specific need to measure (as opposed to count) quantities. Naturally, the difficulties of teaching the concept of unit for purposes of teaching fractions are legend. On the utilitarian side this use yields the full idea of *scale*. For example, the ancient Egyptians, needing to resurvey lands after annual floods, used equally spaced knotted ropes to this end. The knot spacing magnitude, the unit, created the scale.

Finally, there is the *relational* use of "one" as in one-to-one. For example, the Vedda tribesmen in their idea of counting cattle and the like had no number words, but did have the concept of *one-to-one* comparing, for example, the size of their herd as equivalent to a number of sticks to which there was made a one-to-one relation.

Conclusion. Most of us use these forms transparently and interchangeably without difficulty. For the new comer to math, they are all different and all need some explanation at one time or another. Nonetheless, in all said here, there is no arithmetic, little math, and next to no philosophy. The number "1" is foundational in nearly every aspect of our lives – for five different reasons. The hope is you agree that indeed there are five forms of "1" all of which evolved naturally over a great period. The origins of numbers and counting are fascinating (Ifrah, 2000) and for a more general history of mathematics see (Allen, 2000).

Returning to the original question, "How do we define the number "1"?" we note that whenever a single term or word is used in multiple ways, it become difficult if not impossible to give a comprehensive definition of it that applies to all, and achieves a consensus.

Epilogue. What about **zero**? Again, there is much philosophical discussion, and practical definitions. Here are some of them.

- Zero is a placeholder in the expression of numbers. (True, for place-valued number notation. The ancient Egyptians worked without it, as did the ancient Romans, neither having place-value number systems. This definition has limited utility. For example, we write 1003 to mean one thousand plus three, but we might also write 1--3, where "-" is arbitrarily assigned to be the placeholder with no number meaning. The ancient Babylonians used this kind of placeholder, though later in their representation schemes for numbers.)
- Zero is the cardinality of the empty set. (The simplest definition, but possible not very useful. Another critique is that the empty set is not observable.)
- Zero is the lower limit of positive real numbers. Examples: a perfect vacuum, absolute zero temperature, zero velocity. None can be achieved, only approached. (Assumed here is a host of mathematical processes including all real numbers and limiting processes. Indeed, the limiting process normally requires the existence of the number "zero.")
- The inverse of any property of the Universe which is infinite is zero. (Could be vacuous, as we need to find a property of the Universe that is infinite.)
- As a more practical meaning, it may be that zero is merely the numerically convenient meaning given for "nothing," in the sense, "For that effort I will give you nothing." It is thereby analogously connected to the cardinal use of "1." Let's emphasize that the transition from "nothing" to an actual number "0" was a major intellectual achievement that even the greatest ancient civilizations missed altogether.

For this late arrival on the number scene, there is another story here – full books even. See, (Kaplan, 1999) and (Seife, 2000).

References

Allen, G. Donald (2000-2010) Lectures on the History of Mathematics, online at http://www.math.tamu.edu/~dallen/masters/hist_frame.htm.

Basile, P. (2007). *Consciousness, Reality and Value.* Ontos Verlag, p. 162.
Frege, G. (1884). *Die Grundlagen der Arithmetik (English: The Foundations of Arithmetic).* Polhman.
Ifrah, G. (2000). *The Universal History of Numbers: From Prehistory to the Invention of the Computer.* New York: Wiley.
Kaplan, R. (1999). *The Nothing that Is: a natural History of Zero.* Oxford University Press.
Seife, C. (2000). *Zero: The Biography of a Dangerous Idea.* Penguin.

Construction of the Regular Pentagon

By Todd Thomas, Associate Professor of Mathematics, Lone Star College-CyFair

As a mathematician and mathematics educator, I love geometry. While students often balk at the preponderance of formulas for area, volume and surface area, I love the logic involved in the many beautiful proofs of geometric theorems.

In graduate school, I was introduced to and fell in love with Geometer's Sketchpad. Affectionately known as simply Sketchpad, the program from Key Curriculum Press gives a modern digital analog to the ancient Greek straightedge and compass, creating new vistas of discovery for student and teacher alike, encouraging experimentation in geometry without the physical constraints of paper and pencil.

Those familiar with geometry may recall that of the three classical constructions that are impossible with straightedge and compass alone, one involves the construction of a regular polygon, namely that of the regular heptagon, or 7-sided polygon. While at the 22nd ICTCM Conference in Chicago, I attended a seminar by Bill Jasper of Sam Houston State University in which he presented some outstanding student results involving Sketchpad. His talk recalled to my mind a problem I had never fully worked out when working with Sketchpad, construction of the regular pentagon.

The other regular polygons are easily constructible: equilateral triangle, square and hexagon naturally occur almost without effort while working with Sketchpad. But the pentagon does not arise easily from constructing without a plan. In fact, every time I tried to construct the pentagon without a game plan, I ended up with the hexagon.

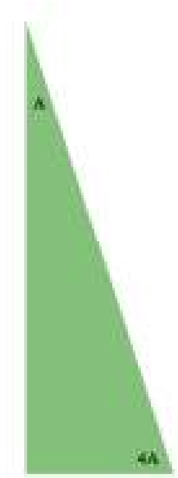
The problem is the interior angle involved. The equilateral triangle needs a 60 degree angle, the square 90 degrees, and the hexagon 120 degrees (double that of the triangle), all of which are, well, easy. But the pentagon has a 108 degree interior angle. Factoring 108 yields 2^2 x 3^3, which feels helpful, but always led me nowhere.

Mathematicians are probably thinking that I could just look this up in Euclid. Certainly this is a possibility and I have done it. But reading the proof before I solved the problem made me feel guilty. "If Euclid could figure this out, why can't I?" kept running through my head, and I would always abandon the reading before finishing.

On the plane trip home from ICTCM (International Conference on Technology in Collegiate Mathematics), inspired by Jasper's talk, I had a breakthrough. It finally occurred to me that the complement of the 108 degree angle is the 72 degree angle and 72 is a nice number! The more I thought about it, I realized that 72 is indeed nice because the right triangle with a 72 degree angle has a third angle of 18 degrees.

OH, OH, oh… (18)(4)=72. Now I knew I was onto something. I think the lady beside me on the plane worried for me as I frantically began drawing triangles and using the Pythagorean Theorem and trigonometric identities.

Because now I had a right triangle with one angle A and the other angle 4A. Oooh… Cofunction and double angle identities – good stuff!



Since our right triangle has acute angles A and 4A in it, cofunction identities give us that sin(4A) = cos A. Double angle identities give us that sin(4A) = 2sin(2A)cos(2A) = 2(2sinAcosA)(1-2sin^{2}A).

We set these two characterizations of sin(4A) equal to each other and solve for sinA.

$$\cos A = 4\sin A\cos A(1-2\sin^2 A)$$

Since we know cosA≠0, we divide both sides by cosA.

$$1 = 4\sin A(1-2\sin^2 A)$$
$$8\sin^3 A - 4\sin A + 1 = 0$$

Letting x=sinA, we solve this cubic equation by first looking for rational roots, as we teach our College Algebra students.

$$8x^3 - 4x + 1 = 0$$

Possible Rational Roots: ± 1, $\pm 1/2$, $\pm 1/4$, $\pm 1/8$

Checking these in no particular order, we find that ½ works.

1/2 |	8	0	-4	1
		4	2	-1
	8	4	-2	0

Thus we see (x-1/2)(8x^2+4x-2)=0, or (2x-1)(4x^2+2x-1)=0.

4x^2+2x-1 fails to factor, so we employ the Quadratic Formula.

If 4x^2+2x-1=0, then x=$\frac{-1\pm\sqrt{5}}{4}$.

Thus our possible solution set consists of ½, $\frac{-1+\sqrt{5}}{4}$, and $\frac{-1-\sqrt{5}}{4}$.

We can eliminate ½ since A≠30° (sin 30°=1/2).

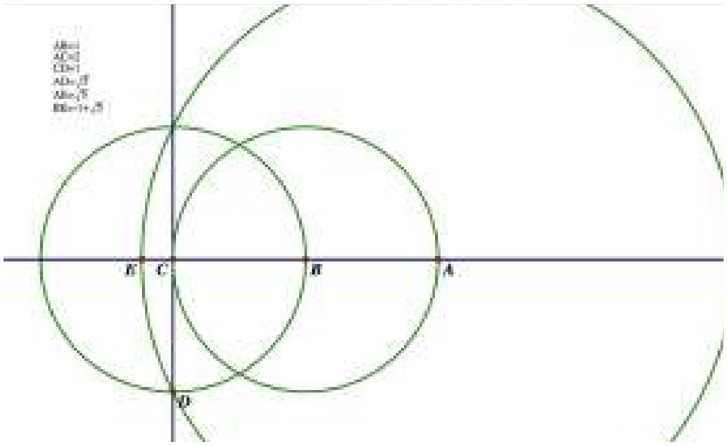
We can also eliminate $\frac{-1-\sqrt{5}}{4}$ since $\frac{-1-\sqrt{5}}{4}<0$ and sin 18°>0.

Thus sin 18° = $\frac{-1+\sqrt{5}}{4}$.

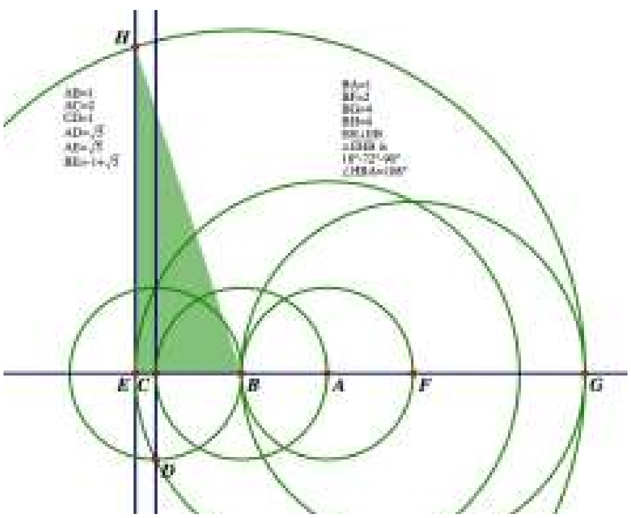
How did this help? How do we build the pentagon?

It turns out that this exact value of sin 18° is exactly what we need to build the regular pentagon. $\sqrt{5}$ is constructible because it is the hypotenuse of the right triangle with legs 1 and 2 ($1^2+2^2=5$). We build a right triangle with an angle A such that opp/hyp = $\frac{-1+\sqrt{5}}{4}$.

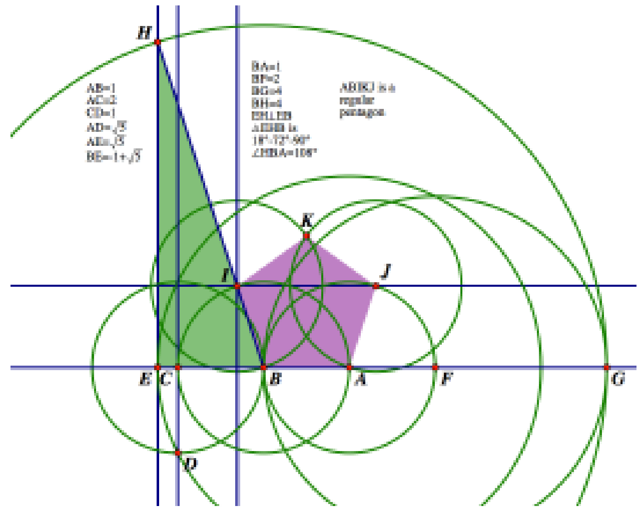
Let's do it!



Now that we have a segment, BE, whose length is -1+ $\sqrt{5}$, we need only a hypotenuse of length 4 from B. We construct the line through E perpendicular to BE and a circle centered at B of length 4 to find H, completing the 18-72-90 triangle.



The final construction:



Reflection

After completing the construction, I felt good about reading and understanding Euclid's proof. His proof was, as one might suspect, very geometric and elegant. He gives a method to construct the isosceles triangle whose third angle has half the measure of the base angles. Simple calculation shows that the third angle must measure 180/5=36 degrees. Bisecting this angle yields the 18 degree angle and the needed 18-72-90 triangle.

Joke of the Month

Q: What's a polar bear?

A: A rectangular bear after a coordinate transform

Got News?

If you know of any exciting news in mathematics, have it published in your TexMATYC newsletter. Submit articles to Heather Gamber at heather.a.gamber@lonestar.edu.

Visit us at www.texmatyc.org