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Strumming the Lute of Pythagoras

By Evelyn Lamb | May 29, 2013

When I was at the [Joint Math Meetings](#) in January, the evocative name “Lute of Pythagoras” jumped out at me in a talk by Ann Hanson of Columbia College in Chicago. Hanson teaches a course, Math in Art and Nature, that satisfies the general math requirement for Columbia College but comes with a healthy helping of creative arts as well. Students learn about geometric constructions, tessellations, and other mathematical ways of generating patterns and designs, and then they find or create artwork using those ideas. Columbia is an arts and communications college, so the course is particularly suited for the school.

The Lute of Pythagoras is just one of the geometric constructions Hanson uses in her course. Two of Hanson’s students generously shared art they created for her class using the Lute of Pythagoras.

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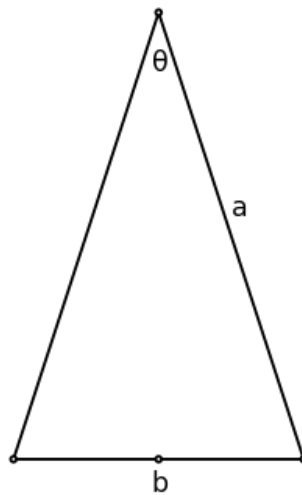
A drawing by Joseph Koch incorporates the Lute of Pythagoras into a portrait of Pythagoras himself. Image copyright Joseph Koch. Used with permission.

Both superimpose the Lute on another picture, highlighting the proportions of the underlying images.



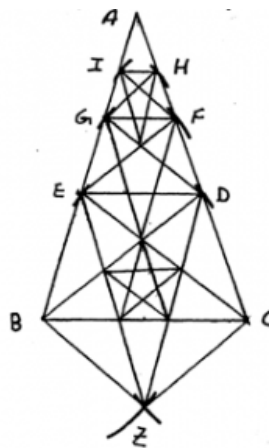
The Lute of Pythagoras superimposed on a photograph of a forest. Image copyright Tanya Nikolic. Used with permission.

The Lute of Pythagoras is based on the “golden” isosceles triangle, a triangle with two equal sides and an apex angle of 36 degrees.



A golden triangle. The ratio $a:b$ is the Golden ratio. The angle θ is 36 degrees, or $\pi/5$ radians. Image: Krishnavedala, via Wikimedia commons.

Each of the bottom angles is twice the size of the top angle, and with liberal use of sine and cosine addition [formulas](#), you can check for yourself that the ratio $a:b$ is indeed $(1+\sqrt{5})/2$, the famous [Golden ratio](#). Some compass and straightedge steps give you a cool pentagon-y, triangle-y, starry figure, the Lute of Pythagoras.



The Lute of Pythagoras, built from the

golden triangle with vertices ABC. Image:
Ann Hanson.

The ancient mathematical/musical Pythagorean cult is a bit [mysterious](#), and apparently one of those mysteries is why this construction is called a lute! I don't even know whether the figure was known to the Pythagoreans. I'd be thrilled if a math history buff educated me about the origin of the name.

In my correspondence with Hanson, I focused on the Lute of Pythagoras, but her students have also created quilts, origami, and tessellations for the class, in addition to learning to recognize mathematical inspiration when it appears in other people's artwork. "One of their assignments is to go to the Art Institute [of Chicago]," Hanson says. "They say, 'I never thought about all these painting and artwork having a relationship to mathematics.'"

Hanson, who is herself an artist as well as a math instructor, says that her math-art class is useful for students who are anxious about their math skills. "I'm not saying it's a cure-all. This is just one approach that seems to help," she says. "They come away with a different appreciation of math." If you'd like to shake out the geometry cobwebs and get creative with the Lute of Pythagoras, [full instructions for making the figure are here \(pdf, kindly provided by Ann Hanson\)](#).



About the Author: Evelyn Lamb writes about mathematics and other cool stuff. Follow on Twitter [@evelynjlamb](#).

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