

# Poetic Math

*Lesley Payne*

My chemistry professor friend wants to believe homeschooling is the best way to teach children, but she says she sees many of her homeschooling friends' kids getting behind, especially in math, after about fourth grade. One day as we discussed this, I pointed out that the public school students I taught last year were even farther behind in math than any homeschooled students I knew. I suggested that this is a problem for Americans in general--not just homeschoolers.



I cited a book I read in a teacher education class, *The Teaching Gap*, describing research into the

differences in how math is taught in America, Germany and Japan. This study particularly praised math education in Japan, noting that students there tend to view math as an interesting part of the natural world, with complex math problems a fun challenge. American students, on the other hand, tend to view math as a set of algorithms (step-by-step procedures) they must learn to follow to pass the class. The authors of this study acknowledged that the students in the various countries had picked up the attitudes toward math ingrained in their respective cultures. That is, most people in Japan--not just scientists and academics--view math as "cool" and are proud of their ability to master the subject. In

our culture, on the other hand, most people dislike math, and many people who should be passionate about math (scientists, teachers, etc.) view the subject as a tool they "have to" use.

As I was mulling over this conversation with my friend, I pondered the ancient Greek view of math as a philosophy. It occurred to me that the classical home education crowd would have a lot to say about how parents can instill in their children a view of math as an important, fascinating part of God's creation, worthy of their deepest contemplation. Math--not just literature--could instill in our children awe toward the beautiful, poetic aspects of creation.

Of course, I immediately called Laura Berquist, who had a great deal of advice on this subject, but no time to write an article. I also surveyed other math and/or homeschooling experts on the topic and have incorporated their comments into this article as well.

Surprisingly, the lone critic of looking for beauty in math was Dr. Jim Leek, creator of many great homeschoolers' resources, including the Latin text *Our Roman Roots* and a science supplement designed to instill in kids a love of creation, *For the Beauty of the Earth*. In an email response to my inquiry, Jim wrote:

To 'look on beauty bare' as those with the math gene may be able to do is not for many. Most use math

to gain control over some aspect of reality. It is not an accident that modern science, primarily interested in control of the real, is based in mathematics. Poetry requires standing under something—submitting to it—not controlling it. ‘Poetic math’ is therefore hateful to both poets and mathematicians—corrupting both.

Laura Berquist disagreed with this assessment. “As Catholics,” she said, “We have the right understanding of the relationship between the natural and supernatural,” and therefore we should try to form a “Catholic” vision of mathematics. Laura noted that God reveals something of himself in his ordering of creation, including relationships between numerical values, symmetry and other fundamental concepts of math. We see reflected in mathematics not only the divine attribute of truth, but also beauty. “Beauty is about order, proportion,” Laura noted.

As a graduate of Thomas Aquinas College (and wife of a TAC professor), Laura is well-versed in the mathematical philosophies of Plato, Euclid and other philosophers. She notes that she first became excited about math when she began studying Euclid’s *Elements* at the college. Although she disliked math in high school, she was excited about learning to do Euclid’s geometrical proofs. “Geometry is the place where you see the beauty of mathematics,” she says.

I next contacted Dr. Peter Redpath of Angelicum Academy, figuring that anyone promoting classical education would have great resources for passing this vision on to our children. Dr. Redpath referred me to a friend of his, farmer/physicist Arthur Larson, who wrote:

Math, as your friend Jim Leek said, is a tool. However, a simple hammer and chisel can give the world a most beautiful ‘Pieta’ and a pen or pencil, which are ‘merely tools’ to make marks, can give us Milton’s *Paradise Lost*. True poetry, iambic pentameter or any other, has mathematical relationships that our minds find pleasing. Math is definitely a tool. However, it is up to the user to determine if it is merely a tool or a means to inspiration, poetic or otherwise.

The various tones of a stringed instrument are related by definite ratios of string length, as are the tones of an organ. Each resonant or half or quarter tone is related and mathematics gives us the understanding of how that relationship is responsible for the sounds we enjoy hearing.

Remember, first came logic, then came mathematics to put the logic into organization.

If math is used to make our understanding of the galaxy better, then math becomes more than a tool. Without math, we would probably not have the telescopes we have, including the Hubble Space Telescope. Look at the NASA web site to see the beautiful photos of the various structures in the universe and the galaxies and the beautiful shots of the stars that it has provided.

No one can say that those photos are not beautiful or poetic. And we wouldn't have any of this if it were not for the tool of mathematics. Poetry in motions, the beauties of the heavens, the music of the stars – all possible because of the use of mathematics as a tool. But what a tool.

Another expert I consulted was Trevor Lipsombe, a physicist and homeschooler (see his article about Catholic mathematicians on page 10). Dr. Lipscombe noted:

Nobel Prize winner Eugene Wigner once wrote about the 'unreasonable effectiveness of mathematics' in describing the physical world in which we live. In my view, the beauty of the universe God created is most eloquently written in terms of mathematics.

Parents/teachers need to come alive in realising the power of mathematics in the world around them, to describe both the universe created by God and the man-made universe that we have used our God-given talents to create. My worry is that many parents view math as 'arithmetic' and that none of the books they use take the time to speak about God's work in the world.

For example, learning prime numbers may seem boring. But how many people know that large prime numbers provide the key to internet security?

or that a priest, Marin Mersenne, has an entire class of prime numbers named after him, one of



which is the largest prime number ever known?

Learning the formulae for the volume and surface area of a sphere might seem like rote memorization. But wait – the amount

Thou hast ordered  
all things in number,  
weight and measure.

—Wisdom 11:21

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of energy an animal can have depends roughly on its volume. The heat energy it loses depends on its surface area. Now think of an animal as a sphere of radius  $R$ . The surface area to volume ratio is  $1/R$ . So what? This predicts that small mammals (rodents) have to eat all the time – otherwise, they would lose way too much heat energy – whereas whales and elephants can go quite a while without stocking up. The prediction is confirmed by experiment.

Symmetry is the language of physics. The way oranges are stacked in a supermarket is what a physicist would call a 'face-centered cubic' pattern. Many of the chemical elements created by God are in this face-centered cubic pattern. Mathematicians believe this is the way to cram the largest number of oranges into the smallest possible volume.

Symmetry is a hallmark of God's creation.

Thomas Aquinas College alumnus Mike Augros, now teaching philosophy

at a seminary, is working on a geometry textbook for high schoolers which will incorporate Euclid (something no current textbooks do—even at the college level), in addition to the more traditional high school geometry. The introduction to his in-progress book addresses the question of why non-scientists should learn math:

What are the real reasons for studying geometry in high school, reasons why *everyone* should study geometry, and not just future engineers? Why is geometry interesting? Here are five reasons.

(1) Geometry is full of wonders, and the human mind delights in knowing wonderful things. Many geometrical truths turn out to be exactly the opposite of what you would expect. In fact, many things that at first glance seem impossible, geometry proves to be possible or even necessarily true; and conversely, many things thought to be possible are proven to be utterly impossible.

(2) Geometry is *beautiful*. There are three sources of beauty in geometry. First, there are the figures themselves: perfect things of their kind, without bump or wrinkle, such as a perfect circle, or the Five Perfect Solids. Symmetry and proportion, such universal principles of beauty in nature, architecture, music and poetry, abound in geometric diagrams.



There is also a beauty in the truths of geometry

themselves – they “make sense” when they surprise us and delight us.

Finally, the very proofs of geometry are beautiful. The best geometric proofs are adorned with a beauty all their own in virtue of their economy, precision, rigor, and clarity. Geometry, well taught, gives students a taste of intellectual beauty, thus opening to them, perhaps for the first time, the pleasures distinctive of the intellectual life.



(3) Another reason to study geometry is that it furnishes the mind with a treasure trove of fundamental examples of important universal principles. One such principle is that *sometimes we can accomplish more with less*. Often a few well chosen words make a greater impression on an audience than many words would.

Another fundamental principle used everywhere: *the difference between two things is often exactly like the difference between two other things*. It is important in all the disciplines to understand proportional likenesses between things. Arguments based on analogy are very common and very useful.

(4) Learning geometry builds confidence in one’s ability to reason and to understand. A student who learns geometry well comes away convinced that *we can really know things*. Geometry shows us how to achieve certainty about things that are

not initially obvious, things not known to everyone.

(5) Learning geometry exercises a student's imagination, memory, and reason. One geometric result is not just an isolated thing to be understood by itself, then forgotten. It must be understood, *and then used to establish later results*, which in turn are used to establish still more advanced results, and so on. Through experiencing this kind of order of dependence, a student begins to understand how sciences are structured.

For these five reasons geometry is rightly called a liberal art and is an indispensable part of the formation of any educated person.

## Ideas for Teaching Math

So, should new parents be reading Aristotle and Euclid instead of baby-care books to prepare to give their children this sacramental view of math?

That's not necessary, says Laura Berquist. "Math" with younger children should include lots of puzzles and games that encourage understanding of mathematical concepts. Parents can point out interesting mathematical relationships, in or out of the context of school work (for example, the fact that four 5's is the same amount as two 10's or examining symmetry in a toy or flower). There's definitely a place for drilling learning how to complete math problems quickly and accurately, she says, but parents can supplement with games and math-related stories (see our resource list below).



Laura encourages parents

to use Euclid's Elements in teaching geometry to their high schoolers, but she admits that this is very difficult reading, especially if the parents aren't familiar with ancient Greek logic and mathematical philosophy. She is looking forward to the publication of Mike Augros' geometry textbook.

The bottom line, says Laura, is that if the parents have the right attitude toward math themselves, they will pass this on to their children.

According to Dr. Peter Redpath, an important aspect of teaching math is teaching children about measuring.

To think of math solely as a tool is Cartesian. Descartes reduces math to logic. And logic is a tool. Math starts from a desire to know by measuring real being. To know real being is more than a useful good, more than a tool. To neglect the origin of mathematics in the senses is profoundly to misunderstand its nature. This mistake is a main reason so many contemporary students hate math. They do not start doing math by learning to love and wonder at the physical act of measuring things. Another problem with math relates to reading. Many problems with math arise from bad reading habits, not from an inability to do math. Many of the mathematicians I know tell me that most of their students cannot do math because they cannot read the directions.



Trevor Lipsomb suggests reading some math-based books:

For homeschoolers to relate math to God's creation, they need to understand the applications that mathematics has to the real world. There are a number of books along this line: Herman Weyl's *Symmetry*, Colinveaux's *Why Big Fierce Animals are Rare*, Holland's *What Are the Chances?*



These are light on math; their intention is to make the beauty and power of mathematics plain.

Everyone seems to agree that the first step in giving our children an integrated, "Catholic" view of math is that parents become aware of the beauty of math and its importance in

God's creation and try to model this attitude to their children. As with so many things, you will probably learn along with your children, as you read them math-based stories (see our resource list) and explore with them the mathematical relationships in nature, music, dance and other surprising places. Taking this vision into their adult lives, our children will have a firmer grasp of the philosophical and scientific realities of the world and they will be able to use these tools to serve God and enrich the world whatever their vocations.

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# Resources

Unless otherwise specified, obtain these books through your local library, bookstore or Amazon.com (although we have received comments from a couple readers saying that Catholics should not order from Amazon because they also sell offensive books—use your own discretion).

*Archimedes and the Door of Science* by Jeanne Bendick weaves the fascinating life of the Greek mathematician with history, philosophy and an unusually-lucid explanation of many mathematical concepts. Order from Bethlehem Books at (800) 757-6831 or on-line at [www.bethlehembooks.com](http://www.bethlehembooks.com).

*The Librarian Who Measured the Earth* by Kathryn Lasky. Similar to *Archimedes*, but dealing with the life and work of Eratosthenes. This is for younger kids than *Archimedes*.

*Sacred Geometry* by Miranda Lundy (Walker & Company). I picked up this little gem in the Discovery Store. Each page addresses a class of geometric shapes and relates the shapes' importance in math, architecture, philosophy and even religion. Basic enough for young kids and deep enough to interest adults.

*Number Stories from Long Ago* by David Eugene Smith. Reprinted by the National Council of Teachers of Mathematics. Order from NCTM at <http://poweredge.nctm.org/nctm/index.icl>.

*Mathematicians are People Too*, volumes 1 and 2 by Luetta and Wilbert Reimer.

Short biographies of mathematicians throughout history.

*Mathematical History* by Nancy Gonzalez. Fun activities, puzzles, stories and games. Order from NCTM (see above).

*Math Wizardry for Kids* by Margaret Kenda. Fun math activities for kids.

*Sir Cumference and the First Round Table* by Cindy Neuschwander.

*Famous Problems and their Mathematicians* by Art Johnson. Interesting math stories for grades 5-12.

*Grocery Cart Math*. Practice grades 3 through 5 math skills at the grocery store.

*Multiplication Tables Cloring Book* by Hilary McElderberry

*How Math Works: 100 Ways Parents and Kids Can Share the Wonders of Mathematics* by Carol Vorderman.

Anything by Theoni Pappas. Her books include *The Joy of Mathematics*, *More Joy of Mathematics*, *The Magic of Mathematics*, *Math Stuff* and *The Music of Reason*, all collections of short vignettes about the importance and beauty of math around us. Her kids books include *Math for Kids and Other People Too!*, *Mathematical Footprints: Discovering Mathematical Impressions All Around Us* and *Fractals, Googols and Other Mathematical Tales*. She also has a 2003 math calendar available.

*A Catholic Homeschool Treasury* (Ignatius) by Maureen Wittmann and Rachel Mackson has several great articles and resource lists on math.