The Quest for Mathematical Truth

by Brett Edwards, Atlanta Classical Christian Academy

French mathematician Sophie Germain of the late eighteenth and early nineteenth centuries is considered one of the greatest female mathematicians of history. Germain was thirteen years old when the tumult and chaos of the French Revolution forced her to remain indoors. This confinement turned her attention to her father's library where she found a book of math history describing the apocryphal story of the death of Archimedes. It is often told that as Roman forces besieged the city of Syracuse during the Second Punic War, a Roman soldier approached Archimedes, commanding him to surrender. Archimedes was so absorbed in a mathematical diagram that he responded saying, "Don't disturb my circles." This sentiment can be understood and appreciated by math teachers around the world. Unfortunately for Archimedes and the world, the soldier decided to disturb his circles and killed the greatest mathematician of antiquity. Upon reading of Archimedes' demise, Germain was so impressed with his relentless devotion to mathematics that she committed to make it the pursuit of her own life. Her parents would often find her staying up all night working through calculations by candlelight on her slate. She would go on to become one of the pioneers of elasticity theory and for this work would win the grand prize from the Paris Academy of Sciences.

Although many human pursuits come and go, the quest for mathematical truth seems to persist throughout man's history—from Archimedes to Germain down to the present. What I find so fascinating about mathematics is its ability to so completely captivate and consume the human mind. What is so alluring about mathematics? Why were the minds of Archimedes and Germain so intent on finding truth in mathematics even to the point of death in the case of Archimedes? I would argue that one of the more engrossing characteristics of mathematics is its dual nature of being both comprehensible and incomprehensible. Man is attracted to those things that are both knowable and yet not fully comprehensible. While there is great fulfillment when a particular mathematical idea or concept is grasped, the student can return again and again to the inexhaustible field of mathematics.

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Albert Einstein remarked that "the most incomprehensible thing about the world is that it is at all comprehensible."[1] This understanding is consistent with Einstein's agnostic worldview. In a world without a creator, why should one expect the created order to be harmonious and comprehensible? Einstein's refusal to attribute the order of the world to a God of order is the dominant view of the intellectual elite in our secular culture. The unbeliever is confronted with this dilemma daily as he watches the sun rise, leaves fall, and plants grow in a predictable manner. Why does order exist in the world? The Christian sees the comprehensibility and the incomprehensibility of the created order as a reflection of God Himself.

The Christian math class ought to be a sanctuary for honest, open, and engaging discussion of both of these attributes. Our students have an innate longing for truth and should see the math class as another area to study the very nature of God. Nineteenth-century English mathematician Hilda Phoebe Hudson argued that "to all of us who hold the Christian belief that God is truth, anything that is true is a fact about God, and mathematics is a branch of theology."[2] Johannes Kepler said "the chief aim of all investigations of the external world should be to discover the rational order and harmony which has been imposed on it by God and which He revealed to us in the language of mathematics."[3] Such an understanding gives a hallowed purpose to every calculation and proof in the math class. What if the students in our classes had this view of their scientific studies? Such an understanding of mathematics would surely develop a wonder of and passion for truth in their studies.

It would be helpful to dig a

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little deeper into each of these attributes and their pervasive presence in mathematics. First, mathematics is an area in which God has provided us access to knowledge (comprehensibility). Throughout human existence we have been able to uncover mathematical truths which in turn are used for a host of creative human applications and endeavors. Our ability to find and comprehend these truths provides a great sense of achievement and fulfillment especially as the abstractions become more difficult and challenging. Consider the achievement felt by English mathematician Andrew Wiles upon successfully proving Fermat's Last Theorem in 1995.[4] A proof for this theorem had eluded the greatest minds for more than 350 years.

However, what makes mathematics particularly scintillating is that, consistent with the nature of God, there is an infinite region of mathematics incomprehensible to the human mind. Early in the twentieth century, mathematician David Hilbert and other prominent mathematicians of the time embarked on a "program" to eliminate all paradoxes and inconsistencies from the foundations of mathematics. In essence, Hilbert's pride in the intellectual potential of man propelled him to believe man could make logical sense of all complexities in the natural world. This view believed man could rise to the intellectual level of God. German mathematician and philosopher Kurt Gödel would eventually prove Hilbert's efforts to be logically impossible with his incompleteness theorems. These theorems would be another victory for the incomprehensibility of mathematics. Gödel's results shouldn't come as a surprise to the Christian but are a rather devastating blow to the progressive movement's hope and trust in the abilities of autonomous man.

Although there is an infinite supply of mathematical conundrums, two particular examples are sufficient to illustrate the incomprehensibility of mathematics. For thousands of years, man has been amazed and perplexed by the nature of prime numbers. These numbers are the basic building blocks of all natural numbers (positive whole numbers). There are an infinite amount of prime numbers and what is most fascinating is that they have no discernible pattern. Eighteenth-century Swiss mathematician Leonhard Euler concluded that "mathematicians have tried in vain to this day to discover some order in the sequence of prime numbers, and we have reason to believe that it is a mystery into which the human mind will never penetrate."[5] Twentieth-century Hungarian mathematician Paul Erdös agreed saying that "it will be another million years, at least, before we understand the primes." There are various conjectures related to prime numbers that continue to stump the brightest mathematicians in the world. Among them, Goldbach's conjecture states that "every even integer greater than 2 can be expressed as the sum of two primes."[6] Computers have found the conjecture to be true up to 4×10^{18} but no one has been able to provide a rigorous mathematical proof for this simple mathematical assertion. One can assume that prime numbers will continue to challenge human minds throughout time.

Euler's identity provides another impressive example of the incomprehensibility within the created order. The identity incorporates the five most notable constants of mathematics in a single equation stating that $e^{i\pi} + 1 = 0$. One poll conducted by a mathematical journal named Euler's identity the most beautiful theorem in mathematics.[7] Nineteenth-century American philosopher and mathematician Benjamin Peirce noted that the identity "is absolutely paradoxical; we cannot understand it, and we don't know what it means, but we have proved it, and therefore we know it must be the truth."[8] The Christian can connect such a statement to their limited understanding of the Trinity. Although we know the concept to be true, we cannot understand it.

At root, this passion for mathematical truth is an interest in God Himself. God is both comprehensible and incomprehensible. That this dual aspect is also revealed in creation through the language of mathematics should not be surprising to those of the Christian faith. The psalmist declares "the heavens declare the glory of God, and the sky above proclaims His handiwork. Day to day pours out speech, and night to night reveals knowledge" (Psalm 19:1, 2). The search for truth in mathematics has found complex and beautiful abstract models that explain the nature of the heavens, the sky, and all of creation. In describing the nature of this quest for the mathematicians of the sixteenth through eighteenth centuries, secular math historian Morris Kline says, "Indeed, the work of 16th-, 17th-, and most of 18th-century mathematicians was . . . a religious quest. The search for

The Quest . . .

mathematical laws of nature was an act of devotion which would reveal the glory and grandeur of His handiwork."[9] I believe one of the great opportunities for the Christian math teacher is to appropriately frame the work of their class in this light. They are to communicate clearly the connection between mathematics and the nature of God. When this connection has been made they can then embark on mathematical adventures revealing the intricate complexity of God's world. In finding the rational order behind God's creation, the student can truly experience and enjoy the glory and grandeur of God.

Notes:

1. Antonina Vallentin, *Einstein: A Biography*, (London: Weidenfeld & Nicolson, 1954), 24.

2. Hilda P. Hudson, "Mathematics and Eternity," *The Mathematical Gazette*, Vol. 12, No. 174 (Jan., 1925), pp. 265-270. Published online by the Mathematical Association, http://www.jstor.org/stable/3603647

3. Johannes Kepler, *Defundamentis Astrologiae Certioribus*, Thesis XX, 1601.

4. Simon Singh, *Fermat's Enigma*, (New York: Anchor Books, 1998).

5. Leonhard Euler, *Opera Omnia*, Series 1, Vol. 2, 241, edited by the Euler Commission of the Swiss Academy of Science in collaboration with numerous specialists, 1911-. Originally begun by publisher B. G. Teubner, Leipzig and Berlin. Birkhäuser, Boston and Basel, has continued publication.

6. Eric W. Weisstein, "Goldbach Conjecture," Wolfram MathWorld, http://mathworld.wolfram.com/GoldbachConjecture.html

7. Paul Nahin, *Dr. Euler's Fabulous Formula: Cures Many Mathematical Ills*, (Princeton, NJ: Princeton University Press, 2011), 2-3.

8. Edward Kasner and James Newman, *Mathematics and the Imagination*, (Mineola, NY: Dover, 2001), 103-104.

9. Morris Kline, *Mathematics: The Loss of Certainty*, (New York: Oxford University Press, 1982), 34.

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