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## A Selection of Poems from Ode to Numbers

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# Poetry Folder



## A Selection of Poems from *Ode to Numbers*

Sarah Glaz

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My first poetry collection, *Ode to Numbers*, was published by Antrim House in September 2017 (<http://www.antrimhousebooks.com/glaz.html>). The book contains poems written over a quarter of a century and inspired by mathematics and my life as a mathematician. The poems trace the story of my life from early childhood in Europe to the forty years long research and teaching career in mathematics in the United States. The poems respond, in turn, to my students and the topics of the courses I have taught, the colleagues I have worked with and the research projects in the area of Commutative Algebra that I have been involved in, the joys of professional travel, the pleasures and the difficulties facing a woman pursuing a career in mathematics, and most of all, my life-long love of both mathematics and poetry.

*Ode to Numbers* is a poetry category finalist for both 2018 Next Generation Indie Book Awards and 2018 Book Excellence Awards.

The poems in this folder are a small selection from the second chapter of the book titled *Pythagoras Plays His Lyre*, a name derived from the poem by the same title, which appeared in 2016 in this journal.<sup>1</sup> As the title implies, the poems in this chapter of the book were inspired by mathematical results and the history of mathematics. The present selection, driven by history, time-travels from ancient Mesopotamia, where numbers and letters were invented circa 4000 B.C., to post World War II Britain, the home of the Number Theorist, G.H. Hardy. Along the way we visit the 5<sup>th</sup> century B.C. Pythagoreans in Metapontum and Euclid in 3<sup>rd</sup> century B.C. Alexandria, we meet the 17<sup>th</sup> century cofounders of Calculus, Newton and Leibniz, in London, Paris and Hanover; and during the 19<sup>th</sup> and early 20<sup>th</sup> centuries, we briefly encounter Cantor, Hilbert, Gödel, and their followers in Germany, Austria, and United States.

–SARAH GLAZ (Sarah.Glaz@uconn.edu), Connecticut, USA.

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<sup>1</sup>Glaz, S. “Pythagoras plays his lyre”, *Journal of Humanistic Mathematics*, Volume 6 Issue 1 (January 2016), page 291. Available at: <https://scholarship.claremont.edu/jhm/vol16/iss1/21>, last accessed on January 25, 2019.

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NUMBERS AND LETTERS

The symbols of Mnemosyne

don't get along.

Today I heard a quarrel between B and 2,

and even as we speak, this lazy eight  $\infty$

shamelessly stretched without a limit on a limb,

pushes numbers and letters towards the outer edge.

From a to z or 0 to  $\infty$  —

a single source does not suffice

for peaceful coexistence.

They once were born-together twins,

offspring of mother memory and father wealth,

both trained from infancy as record keepers

of the first thousand kegs of wine and beer

produced by the first thousand settlers around Ur

who, tired of forever shearing wool,

started a very lucrative and joyful business:

planting of hops, barley, and grapes,

fermenting juices,

and who, in their spare time,

sloshed and satisfied,

took to the flute and lute

and sang long hymns of thanks,

recited endless stories of nomadic pasts,

composed numerous tunes of praise:

Praised be Marduk,

Nisaba shall be praised,

revered the moon god Nana,

and powerful Inana.

And to ensure

they left tradition for the children,

in brewing, counting, and song alike,

imprinted symbols

with sharp-angled wedges

into the region's malleable clay

and baked them in hot kilns.

In the beginning, letters and numbers

looked alike, happily shared a tablet. . .

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THE FIRST NEGATIVE

*In fact, there is no real reason why negative numbers  
should be introduced at all. Nobody owned  $-2$  books.*

J.J. O'Connor & E.F. Robertson  
*An Overview of the History of Mathematics*

Down the funnel of history  
I search for you—the first man  
to cup in his hands  
minus one grain of fire:

*“Ghost of departed quantity!  
Mysterious absence!  
I am afraid  
I am cradling an illusion!”*

Yet from my vantage point  
I discern a sign  
upon the still uncharted number line  
where negatives

began to light the way  
for abstract algebra to come into existence  
several thousand years  
in the future.

---

$$\sqrt{2} = 1.41421 \dots$$

We started our voyage on the gulf of Tarentum.

The sea was choppy  
and the brothers were restless.  
At dawn, we gathered on the deck  
intent to solve the conflict like rational men.

Hippasus still refused to keep the secret.

He had discovered that  
the diagonal of a square  
is incommensurable  
with its side.

Alas! Our world had collapsed  
and so did our geometric proofs.

Too much to lose, we heaved him overboard.

---

*Historical Note:* In the 5<sup>th</sup> century B.C., the Pythagorean Hippasus of Metapontum discovered the existence of irrational numbers. Particularly, he had shown that  $\sqrt{2}$  (the length of the diagonal of a square with a unit side) is an irrational number. For his sin, legend has it, Hippasus was thrown overboard during a sea voyage. The poem plays with the imaginary possibility that his murder occurred before he breached the Pythagorean code of secrecy and made his discovery public.

The line count of the poem's stanzas follows the decimal expansion of to five decimal places.

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THE DEATH OF EUCLID

*So great was Euclid's fame that he was known to the  
Greeks as ὁ στοιχειωτής, "teacher of the Elements."*

D. E. Smith  
*History of Mathematics*

And onto the barge decked with flowers  
we lifted him    our arms dark and  
strong    his body shrunk in its  
shroud of warm roses    The Nile's  
sluggish brown flow    Myth floating  
in front of us like the cloud of God  
We lifted his eyes towards heaven  
where he saw the next generation  
inherit    and we mourned    how  
we mourned his fine-tuned mind  
his irreplaceable jewels of thought    Not  
one of us came close    in our search  
for truth    to match his erudition  
Not one of us came close    And  
the barge groaned under his almost  
weightless body    once    as if in pain  
then clutched his mutilated heart  
to its own    Crocodiles circled silently  
plucking at wilted flowers    And the  
procession started slowly    heavy  
with sighs    ghost deep    oars into  
water and heaving    mud splashing  
dipping and cutting a path    upstream  
we left on the shore    rooted    tangled  
in tears    our imaginations seeking  
relief in words of reverence

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*Historical Note:* Euclid (323 B.C.–285 B.C.) lived in Alexandria, a Greek city situated in Egypt at the mouth of the Nile, and famous for its legendary library (housing 600,000 papyrus rolls), the Museum (a center of learning rivaling Plato's Academy in Athens), and its lighthouse (an engineering marvel considered one of the Seven Wonders of the Ancient World). Euclid founded a school of mathematics at the Museum. Very little is known about his life beyond the monumental achievement of writing *The Elements*, a book that had profound impact on Western thought, and set the foundation for mathematical standards of reasoning for all time. Only the Bible has been more widely reprinted and studied.

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CALCULUS

I tell my students the story of Newton versus Leibniz,  
the war of symbols, lasting five generations,  
between The Continent and British Isles,  
involving deeply hurt sensibilities  
and grievous blows to national pride  
on such weighty issues as publication priority  
and working systems of logical notation:  
whether the derivative must be denoted by a “prime,”  
an apostrophe atop the right hand-corner of a function,  
evaluated by Newton’s fluxions method  $\Delta y/\Delta x$ ;  
or by a formal quotient of differentials  $dy/dx$ ,  
intimating future possibilities,  
terminology that guides the mind.

The genius of both men lies in grasping simplicity  
out of the swirl of ideas guarded by Chaos,  
becoming channels through which her light poured clarity  
on the relation binding slope of tangent line  
to area of planar region lying below a curve.  
The Fundamental Theorem of Calculus,  
basis of modern mathematics, claims nothing more.

While Leibniz—suave, debonair, philosopher and politician,  
published his proof to jubilant cheers of continental followers,  
the Isles seethed, unnerved.

They knew of Newton’s secret files,  
locked in deep secret drawers—  
for fear of theft and from stranger paranoid delusions,  
hiding an earlier version of the same result.

The battle escalated to public accusations,  
charges of blatant plagiarism,  
excommunication from The Royal Math. Society,  
a few blackened eyes,  
(no duels),

and raged long after both men were buried,  
splitting Isles from Continent, barring unified progress,  
till black bile drained and turbulent spirits becalmed.

*Calculus*—Latin for small stones,  
primitive means of calculation; evolving to abaci;  
later to principles of enumeration advanced by widespread use

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of the Hindu-Arabic numeral system employed to this day,  
as practiced by *algebristas*—barbers and bone setters in Medieval Spain;  
before Calculus came the  $\Sigma$  (sigma) notion—  
sums of infinite yet countable series;  
and culminating in addition of uncountable many dimensionless line segments—  
the integral  $\int$ —snake,  
first to thirst for knowledge, at any price.

That abstract concepts, applicable in the beginning  
merely to unseen, unsensed objects—orbital paths of distant stars—  
could generate intense earthly passion  
is inconceivable today,  
when Mathematics is considered a dry discipline,  
depleted of life sap, devoid of emotion,  
alive only in convoluted brain cells of weird scientific minds.

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*Historical Note:* The British mathematician and physicist Isaac Newton (1642–1727) and the German mathematician and philosopher Gottfried Leibniz (1646–1716) are considered to be the co-founders of Calculus. Their seminal achievement was the formulation and proof of The Fundamental Theorem of Calculus—a theorem that relates two disparate concepts: the concept of integration (used to calculate areas below a curve) and the concept of differentiation (employed to find formulas for tangent lines to curves). Although no one had made a successful connection between the two concepts before Newton and Leibniz, The Fundamental Theorem of Calculus has its roots in the work of numerous other mathematicians who studied each of these concepts separately for many years. In fact, the roots of this area of mathematics go back several thousand years to the invention of numerals by Hindu mathematicians.

A version of this poem was first published in *Humanistic Mathematics Network Journal*, 2002.



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WHAT CAN WE DO IF WE CRAVE CERTAINTY IN MATHEMATICS?

*Thus, to salvage traditional mathematics, Hilbert proposed a bold new program. It required first that the whole of existing mathematics should be axiomatized, and second that this axiomatic theory should then be proven consistent.*

David M. Burton  
*The History of Mathematics*

Hilbert said, “No one shall expel us from the paradise that Cantor has created.” And we believed, like Cantor himself, that God had opened the gates to the forbidden garden, had invited us to enter, meet  $\aleph$  (aleph) face to face, converse in the language of sets, admire the ascent of transfinite cardinals into an infinitude of infinities. No one can possess such knowledge and remain unscathed. We lost our footing; doubts assaulted us from the very first step, set roadblocks in our path— unanswerable questions, inexplicable paradoxes and baffling results.

Before Kurt Gödel, we could still have hoped. Attempting to resolve inconsistencies, we could have spent our lives trying to grasp the tantalizing cloud of certainty hanging above our heads— just beyond reach.

The naïveté of Frege, Russell, Hilbert, and all of us, their followers, divided into schools with bombastic titles— Axiomatic, Logistic, Formalistic— with methods and approaches, plans for the future, a list of problems to last to the end of time. Little did we know of logic’s limitations: that our system would backfire, stating its own incompleteness, in its own ink signing the QED—

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that with cymbals and umlauts  
it would prove its inability to prove  
consistency of axioms within the system.  
And what else was there but the system  
we took for granted  
as we did our ability to breathe?

After Gödel proved the Incompleteness Theorems  
a grey cloud descended upon us—  
we could touch the fog.  
Nothing was pure logic.  
Pure logic was nothing.  
We could not even count on knowing what truth  
can be proved.  
Uncertainty permeated everything.

We prayed that this was not the end of the road—  
that there was more of it to travel.

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*Historical Note:* Georg Cantor (1845–1918) is responsible for the rigorous mathematical representation of infinity and the development of set theory, the “language” that allowed mathematicians to work with the concept of infinity. Almost immediately after its discovery, a number of paradoxes were found in set theory, among them the famous Barber Paradox, posed by Bertrand Russell (1872–1970). Considerable efforts were made to fix these paradoxes, including the program proposed by the prominent German mathematician, David Hilbert (1862–1943), mentioned in the epigraph to this poem. These efforts were dealt a severe blow by the Incompleteness Theorems proved by Kurt Gödel (1906–1978). Fortunately, it was not the end of the road. Realizing the exact extent of uncertainty inherent in the mathematical system had the beneficial effect of removing vague anxieties and redirecting research focus.

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HARDY

*It is a melancholy experience for a professional mathematician  
to find himself writing about mathematics.*

G. H. Hardy  
*A Mathematician's Apology*

It used to be mathematics once  
I visited to drink a cup of peace;  
I climbed the ladder rung by rung,  
reaching the highest platform.  
It used to be mathematics once  
I went to meet.  
I left the world behind in search of peace of mind;  
I flew out of myself on a trajectory of hope.  
It used to be mathematics once,  
clear unadulterated thought,  
for which I yearned.  
Among the stars it led.  
I followed unafraid.  
No fall, no bread, no tears,  
not even cries of joy allowed—  
untouched pure beauty  
my mind alone perceived  
and brought it out  
of its invisibility into the light.  
It used to be mathematics once—  
both quest and goal—  
the only place of rest my mind had known.

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*Historical Note:* G. H. Hardy (1877—1947) was a British mathematician who made significant contributions to Number Theory. His mathematical powers declined when, at the age of 62, he suffered a heart attack. Shortly after, he wrote *A Mathematician's Apology*, a book of haunting beauty and sadness, which inspired many towards mathematics.