Mathematics, Music, Art, Architecture, Education, Culture

Bridges 2018 Poetry Anthology

Stockholm

Waterloo Jyväskylä

Baltimore Seoul Enschede Towson Coimbra

2011 – 2018

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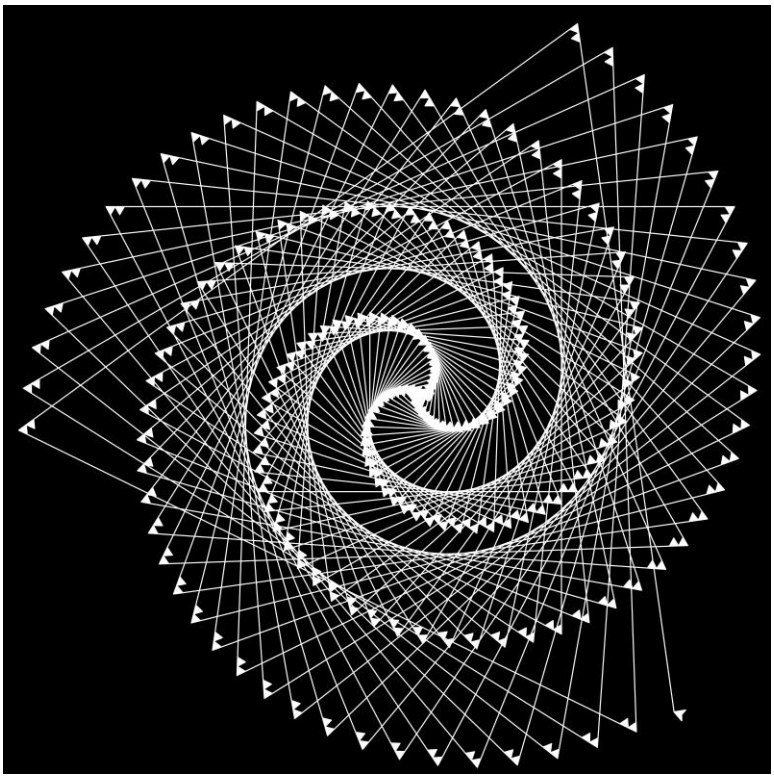

A collection of poems with strong links to mathematics
by the poets featured at Bridges 2011 – 2018 poetry readings

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Phoenix, Arizona

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ISBN: 978-1-938664-25-0

Published by Tessellations Publishing, Phoenix, Arizona, USA

Printed in the United States of America

Cover Design: Margaret Kepner
Title Page Image: “Spiraling Triangles” by Robin Belton

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Introduction

Newton's binomial is as beautiful as Venus de Milo.
What happens is that few people notice it.

—Fernando Pessoa *(as* Álvaro de Campos*)*
translated from the Portuguese by Francisco José Craveiro de Carvalho

Welcome to the Bridges 2018 Poetry Anthology, a collection of poems with strong links to mathematics written by the poets featured at the Bridges conferences from 2011 to 2018.

This year's Bridges conference, in Stockholm, Sweden, promises another exciting and inspiring installment in the annual series of math and art conferences that have been held since 1998 under the umbrella of the Bridges organization. The Bridges conferences' poetry program started in 2011, when I coordinated a mathematical poetry reading at Bridges Coimbra, Portugal. This first reading consisted of a small number of poets reading their work to a small audience. Two of us also gave presentations on poetry-related topics in the talk sessions. During the seven years that passed since then, the poetry program at Bridges has flourished and expanded. The number of poetry-related talks increased significantly, workshops on aspects of the craft became a regular feature of the conference program, and other activities—such as poetry-related discussions and theatrical performances—also made occasional appearances. The mathematical poetry readings themselves changed in response to the growing poetry community. More poets come together to read or show their work and to display or exchange their latest publications. And the audience is getting larger with every passing year. It is a pleasure to be part of the vibrant and creative poetry community at Bridges, and see it grow in front of my eyes.

The present volume is the third poetry anthology that grew out of the Bridges poetry readings. The first two volumes appeared in 2013 and 2016, respectively. This anthology's table of contents reflects the tremendous growth of the Bridges poetry community since 2011. But, although richer and more diverse than its predecessors, the current volume springs from the same source and shares many of the distinctive characteristics of the Bridges poetry readings.

From the beginning, the Bridges poetry readings have featured poems with multi-dimensional links to mathematics and a wide range of styles. The poems' connections to mathematics cover the entire gamut of what is possible. They use mathematical language as metaphor, play with geometric and symbolic imagery, treat mathematical results or history of mathematics as content for poems, allow mathematical properties to drive poetic structure, and propose mathematics itself as commentary on life, ideas, and emotions. The styles of the poems are equally diverse, ranging from traditional to multimedia and from lyrical to visual.

As a fortunate consequence of the locations and the participants at Bridges conferences, the poetry readings acquired an international flavor. Represented here are translations into English of poems from a number of languages, as well as poems originally written in English from many English-speaking countries around the globe. Finally, the exciting diversity extends to the other activities in which the poets are deeply engaged, activities that have left their mark on the poetry. The featured poets are college

professors doing research in mathematics, statistics, history, philosophy, comparative literature and education; engineers; higher-education administrators; members and officers of academies; librarians; professional artists, writers, translators, and poets; primary and secondary school teachers, and more.

This volume is organized in two sections. The first section contains poems written by the poets invited to read at Bridges Stockholm; while the second is devoted to work by poets who read at previous Bridges conferences but could not participate this year. In addition, the anthology provides biographical information about the poets, including titles of recent publications and URLs for poets' websites, where readers can find further poetic delights.

I look forward to the upcoming reading in Stockholm. The proximity to Norway, Scotland and Finland brings with it the exciting mathematical poetry of Mike Naylor and Eveline Pye, and the fine translations of Osmo Pekonen. Joining them at the reading from further away, and represented on these pages, is the equally exciting work of Tatiana Bonch-Osmolovskaya, Carol Dorf, Emily Grosholz, Lisa Lajeunesse, Marco Lucchesi, Alice Major and Tom Petsinis. Completing the volume are samples of the lovely mathematical poetry of past Bridges poets: Robin Chapman, Marion Deutsche Cohen, Francisco José Craveiro de Carvalho, JoAnne Growney, Philip Holmes, Gizem Karaali, Larry Lesser, Kaz Maslanka, Dan May, Deanna Nikaido, Stephanie Strickland and Amy Uyematsu.

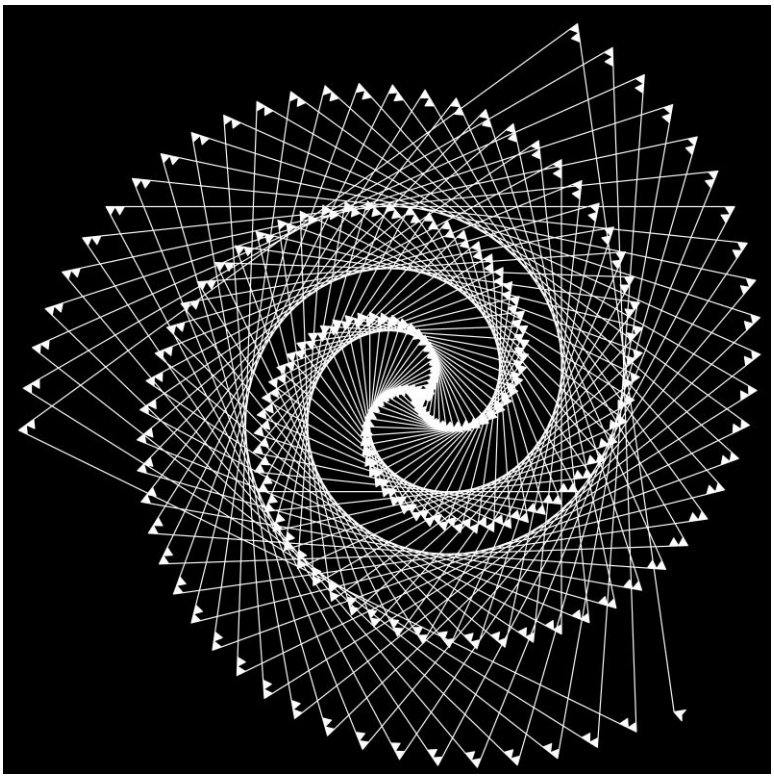
This is the first Bridges poetry anthology that is being assembled, and will appear, after the death of Reza Sarhangi, founding president of the Bridges organization. Reza was an extraordinary person, a visionary whose generous spirit gathered around him a group of diverse individuals who share an interest in mathematical art and made us into a community. This anthology is dedicated to his memory with gratitude for the many years in which he supported and encouraged our Bridges poetry activities.

I am indebted to all the poets and translators whose poems appear here for their work, and to Rodrigo de Almeida Siqueira and Robin Belton for the beautiful images. Robin's image appears on the title pages of this volume. I thank all the poets for patiently going over parts of the anthology and making good suggestions for improvements. Particular thanks for gracious help with various aspects of this anthology to Alice Major, Emily Grosholz and Claudine Burns Smith. Many thanks to Robert Fathauer, at Tessellations Publishing, for the work and care he put into producing this book. Last, but not least, I thank my husband, Joe Glaz, for sharing the experience of all the Bridges conferences with me.

Like me, many of the poets came to their first Bridges conference and were captivated: now they come every year. It happens to the best of us! I invite you to the next Bridges poetry reading to see for yourself.

Sarah Glaz
Storrs, Connecticut

Poems by
Bridges Stockholm Featured Poets



A Mathematical Poetry Reading
Saturday, July 28, 2018

Tatiana Bonch-Osmolovskaya

Tatiana Bonch-Osmolovskaya was born in former Soviet Union and studied physics at Moscow Institute of Physics and Technology and philology at Moscow State Humanitarian University. Her Ph.D. is on Russian experimental poetry. Tatiana is author of twelve books in Russian, including *Introduction to the Literature of Formal Restrictions* and *Labyrinths of Combinatorial Literature*, and co-editor of the anthology, *Freedom of Restriction*. Her poetry in English appeared in: *Can I tell you a secret?, Across the Russian Wor(l)d, Bridges, London Grip, POEM, Rochford Street Review,* and *Journal of Humanistic Mathematics.* She is a member of the Executive Board of the International Symmetry Association, editorial committee of *Another Hemisphere Journal* and a guest-editor of *Symmetry* literary sessions. She organized the *Mathematics and Arts* seminar, *GolosA (Voices) Festival of Combinatorial Poetry*, and *Festival Symmetry Literary Session*. http://antipodes.org.au/en.aboutTatianaBonch.html

Geometry of a Desert

***
at first glance
the Australian desert looks flat
plain planes of redness
red purple ginger grey foxy
rufous orange burgundy and black
sand of the desert
bottom of a prehistorical sea
covering bones of ancient marsupial mammals
minerals oil coal and opals
the most dangerous spiders and snakes
cries of eagles rocketing to the sky
secrets of a disappeared aboriginal civilization
endless contiguity
to the eternal geometry

Tatiana Bonch-Osmolovskaya

Poisonous Octagon

I recently solved a koan
harder than angle trisection
and the quadrature of a circle
more important than these tedious riddles
as your life in a desert
depends on it:
place a dot in the centre
circle it with an octagon of legs
and chelicerae with fangs
that inject venom
sufficient to murder a bull

what would be the radius of a cobweb
you get yourself into early in the morning?
almost impossible to see from the outside
the answer like in every koan when solved is obvious
there is no radius:
the web is an endless spiral
it is everywhere around you

Tatiana Bonch-Osmolovskaya

Arrow

from an empty nest
on a fork of dried branches
of an ash blackened tree
an arrow up to the sky

probably a desert eagle
they nest on tree tops
what other bird would build a nest in full view
of snakes, droughts, thunderstorms?

nest on a thin-leaved acacia
grown on sand and burned stones
visible from the top of the hill
from the slope
from other tall trees
who hatched here?
where did it come from?

a fearsome bird with feathered white legs
and a wide tail
here it grew up and breathed
when the branches squeaked green
here it grew feathers
but first fluff
a wisp of white fluff on a tangle
of branches and leaves
covered with dust
here the wind brought petals of harebells
and steppe peas

far away in the darkness
a cold song of wild dogs
in the skies drunk with cold
dogs sang at the golden egg
above its nest
here it got used to heights

when the river dried up it took off
lonely it was not afraid
large birds do not cry
when grass burns and sand melts
before dawn

the dead river bed was covered with frost
a lonely sandy smoke crawled
from one dune to another
on the horizon, fire rumbled
at sunset crickets crunched ceaselessly
grass rustled
even dried grass
the grass was rustling again

a long-tailed eagle
already knew the distances and could see
the type of prey with its telescopic eye
amongst thousands of sandy hills
rabbits kangaroo large lizards
dingo feral cats other birds
in excess

having changed plumage, it learned to soar
on ascending warm currents
to cut the clouds with a sharp scream
to stitch them with ascending turns
far away from the nest huge wings open
feathers darken
circle by circle if one looks
against the golden egg
barely distinguishable are white legs
claws and white beak

it rises
it rises higher
over a weightless valley
over blossoming lilacs
and the blue glow of the sky dome
over triumphant greenery
over dense turquoise
over the darkness
over fogged diamond crumbs
silently it rises
until it disappears from sight
like its brothers the steppe eagles
disappeared between the shiny shells
of their new home

Tatiana Bonch-Osmolovskaya

Arc

night cries with splinters of feathers
of a celestial diamond emu
extending on high legs to the top of the sky
lengths from horizon to zenith to horizon
widths to embrace them all
until the dawn comes

Carol Dorf

Carol Dorf is fascinated with the boundaries between disciplines, particularly mathematics and poetry. She is poetry editor of *Talking Writing* where she writes about issues in contemporary poetry, and has edited two issues on mathematical poetry, as well as issues on science poetry and technology poetry. Carol teaches high school mathematics and has led poetry reading and writing workshops as a California-Poet-in-the-Schools, at Berkeley City College, and other art venues. Recently she tried to bring her loves together by introducing poetry into the mathematics classroom and by teaching poetry writing to mathematics teachers. She has two chapbooks available, *Some Years Ask* (Moria Press) and *Theory Headed Dragon* (Finishing Line Press). Her poetry appears in *The Mom Egg, Sin Fronteras, E-ratio, About Place, Glint, Slipstream, The Journal of Humanistic Mathematics, Scientific American*, and *Maintenant*. http://talkingwriting.com/why-poets-sometimes-think-in-numbers/

Gravity

Lends gravitas, however temporary
because if we were all in freefall, think
how childlike that would be;
careening into each other like new walkers,
holding onto the walls to avoid tottering,
drinking juice from boxes with straws;
but that is the least of it; sans gravity
we would lose the sanity of knowing
our bottoms from our tops; and we would reverse
other polarities, like true and false,
or in and out, until outboxes and inboxes
began to run together; time would lose
meaning, and the old and the young
would have a more equal relationship
to space. Eventually we would careen
out into the universe; small groups like seeds.

Carol Dorf

In the Domain

Fanatic is the word of the day.
The domain of the function is the set of inputs.
How did the programmer know in advance?
The range is the set of outputs.

The domain of the function is the set of inputs.
Where are you going little one?
The range is the set of outputs.
Some outcomes all too predictable.

Where are you going little one?
Always be prepared: keys, flashlight, acceptable ID.
Some outcomes all too predictable.
Who isn't afraid of leaving on a jet plane?

Always be prepared: keys, flashlight, acceptable ID.
You thought you had calculated direction of change.
Who isn't afraid of leaving on a jet plane?
It used to be a simple line, a predictable curve.

You thought you had calculated the direction of change.
How did the programmer know in advance?
It used to be a simple line, a predictable curve.
Fanatic is the word of the day.

Carol Dorf

The Persistence of Objects

Dying stars throw out diamond dust,
mark a trail of what once was;
the way we leave behind houses full
of objects that must be hauled off
to imagined reuse at Goodwill, bags
of papers and reusable containers
for the dump and permanence
sealed beneath the earth.

And then you turn on the computer
see image after image of what someone else
has left behind: grandfather clocks
and mantle clocks paired with candlesticks,
clocks with keys, clocks with pendulums
all to count the analog world.
How did my grandparent's clock
with flipping numbers arrive
in this category: Clocks, antique?

Our quantum brains process
fragments we see between blinks
as continuous. Even touch susceptible
to neuron fatigue, flickering electrical
impulses. Why are you sitting in the dark?
Like Alice when you pick up a book,
it says "Read Me," promises changes,
conversation between the queen
and a suited mole, while in a quite unlikely
physics, your clothes still fit.

You accept suspension of disbelief
until argument disperses the axioms
that had been so comforting along
with the disintegrating blanket,
and girlhood's little diary
hidden beneath the mattress.

Carol Dorf

Announce the Hour You Have Clocks For

Time progresses through the bells
announcing each moment of occupation:
toilet, wash, dress, eat, work a, break, work b . . .
eat, undress, wash, toilet.

Schematic, yes. Our clocks' precision
increases until the second,
the thousandth's of a second
separates competitors for the title,
"Fastest Woman in the World,"
"Fastest Man."

Could Mussolini have made these trains
run on fractional time? For a space-
ship it matters, a millisecond off
and three years later Mars will be far
from its predicted location.

Yet who doesn't long for the time
of a mother soothing a fretful child to sleep.
"It's the middle of the night, hush, rest."

Sarah Glaz

Sarah Glaz's first poetry collection, *Ode to Numbers,* appeared with Antrim House in 2017. Sarah is a Professor of Mathematics at the University of Connecticut. As a mathematician, she has published books and articles in the area of Commutative Ring Theory. She also has a lifelong interest in poetry. Her poetry, poetry translations, and articles on the connections between mathematics and poetry appeared in a variety of literary and mathematical journals, edited volumes, and anthologies. She coedited the poetry anthology, *Strange Attractors: Poems of Love and Mathematics*, and was guest-editor of the *Journal of Mathematics and the Arts, Special Issue: Poetry and Mathematics.* Sarah serves as Associate Editor for the *Journal of Mathematics and the Arts,* and as coordinator of the poetry readings at the annual Bridges conferences and editor of the *Bridges Poetry Anthologies*. http://www.math.uconn.edu/~glaz

Like a Mathematical Proof

A poem courses through me
like a mathematical proof,
arriving whole from nowhere,
from a distant galaxy of thought.
It pours on paper
impatiently
faster than my hand
can write,
stretches wings,
flaps,
twists and turns,
strikes sparks as it forms.
It is a creature
of indescribable
mystery
like a mathematical proof—
its passage
fills me
with
inner peace.

Sarah Glaz

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.

Sarah Glaz

Luminy Light

I choose a place
  according to the quality
                of light
despite the old ghosts
standing on the path
blocking the way.

Winding up the hill
  and on the hilltop
                sky
as large as a boat's sail
seen from underneath
in the clear light
            of Provence.

Water wavelets,

            sparkles,

            slivers of mirror,

and the place I choose
bathed in light
          and dappled
                with sunshine
weaves the golden
                ratio
in its angular
proportions.

The shy girl I used to be
  saw
        this light
  long ago
under another sky.

It appears unexpectedly
          from time to time.

But not much.

Author's Note: The golden ratio, $\phi = 1.6180339\ldots$, is considered (somewhat controversially) to be an ancient aesthetic principle whose appearance in a visual object renders the object most pleasing to the viewer.

Sarah Glaz

What's in a Name

"I am in France heading from Poitiers to Paris."

Emily Grosholz, *e-mail communication*

The names conjure a train smoothly gliding
on tracks traversing winter fields.
On arrival,
garlands of light adorn the trees,
church bells clang and call
in crisp morning air,
car horns blare along cobblestone streets.
A taxicab pulls to the curb
in front of a hotel
and the stairway twists upward
to a minuscule room
with frilly white curtains lacing
the window pane.
My younger self pores over a page of equations,
a whiff of wine and brie from last night's meal,
a taste of the past.

Names bring the mind where the heart unravels
its own skein of logic.
It does not need more than that.
In this city Leibniz discovered the symbols
which guide mathematicians
towards new theorems:
Lead with the heart, they seem to say,
first intuition and only later rigor.
For a long time, I searched for proofs.

Now I am a bridge,
a citizen of neither here nor there,
nowhere and everywhere
across the gap.
Through me, far-apart worlds connect.

Emily Grosholz

Emily Grosholz is Edwin Erle Sparks Professor at Pennsylvania State University, and has been an advisory editor for the Hudson Review for over thirty years. *The Stars of Earth: New and Selected Poems* was published in 2017 by Word Galaxy / Able Muse Press, with drawings by Farhad Ostovani. Her chapbook, *Childhood*, (Accents Publishing, 2014) with drawings by Lucy Vines Bonnefoy, has raised over $3500 in the past three years for UNICEF. *Childhood* had been translated into Japanese, Italian and French. A German translation by Ulrike Blatter is underway. Her philosophy book *Starry Reckoning: Reference and Analysis in Mathematics and Cosmology* (Springer, 2016) won the 2017 Fernando Gil International Prize in Philosophy of Science, and her book on poetry and mathematics, *Great Circles: The Transits of Mathematics and Poetry*, is due from Springer in 2018.
http://www.emilygrosholz.com/index.html

Astronomy

Gunnison Valley Observatory, Colorado

The empty page reproaches me
Like the blue sky devoid of clouds,
The sun's diffuse, refracted light
Hiding ten thousand visible stars
And, further off, a hundred billion
Galaxies our eyes will never see,
Red-shifting as they leave us, waving goodbye.

Goodbye, goodbye. I can't recall
Their names sometimes; sometimes their names
Come back to me: Vega, Aldebaran.
Sometimes a lucky telescope extends
Up from a cleft observatory dome
Perched on the high plains, ringed about
By berms and mountains: then the stars appear.

Look! There are the rings of Saturn,
Horns, and there are craters on the moon,
And seas that are not seas, and there,
O look! a double star that peers
Like fox eyes from the den of space.
And there's a spiral galaxy, all arms.
And here's the poem, burning on the page.

Emily Grosholz

The Dissolution of the Rainbow

"By an extraordinary combination of circumstances, the theory of colors has been drawn into the province and before the tribunal of the mathematician, a tribunal to which it cannot be said to be amendable."

Goethe*, The Theory of Colors*

A cut-glass chandelier dangled above
The desk where Newton read and wrote:
All morning spectral dragons fought,
Mocked him and made love
Across the white wall opposite,
Flashed their blue and sea-green scales, the fur
Of tiny fires, a glittering red eyelight.
Then one day they suddenly
Fled, and no longer were.

Rising in impatience, strangely lit
By reason, the philosopher undid
Prism by prism the trembling chandelier
To run her now constrained and broken
Offspring through a maze of barriers.
The light went through its paces
But the dragons disappeared.
What remained Sir Isaac quantified,
Teaching Nature not to sing
Her sweeter variations, but in one
Low tone, geometry, to answer him.

Although white light is manifold,
A mixture, so he found, of different rays,
Each ray could be identified
In essence with its angle of refraction:
This was the only origin of colors,
Color then reduced to numbering.
The dragons lapsed to silence, mortified,
Curled up and dry as worms a child
Might question in the fire
Of curiosity and leave behind.

When Newton set his prism work aside,
He wiped his hands, and wrote on creamy paper
Long and elegant formulae,
A shadow of the sensuous retained
In his illuminating study,
Even that much immaterial.
Yet he sometimes noticed, later on,
How his sines and cosines lay
Across the paper like dark skeletons
Of dragon, couchant, rampant as the full
Proud curve of the integral.

Emily Grosholz

The Ratio of Green

"Among the colors, green, which consists in the most moderate action (which, by analogy, one can speak of as a ratio of 1 to 2), is like the octave among musical consonances or like bread among the food that one eats."

Descartes, *Treatise on Man*

Among the colors, green, we are the sudden
Unexpected but undeniable
Razzle of new grass on the fairways, hidden
By a bristling copse of southern pine and maple
Behind our rented house. We lie protected
By so many velvet links from the emptying artery
Of dark red highway, bloodied with sheer speed.

Our green is sudden but slow, the unlikely
But inevitable offspring of long sleep, revival,
And then blind inches by inches spiraling
Through earth's brown leafy curls until the octave
Rings openly in air, so its vibration
Moves outward as impalpable spheres, as heavens
Raised above the players' lowered ken.

Still half-asleep they linger, listening,
As if they merely respected the ninety-degree rule
But, slipped from the embrace of that expanding
Music now translated higher, feel
Their loss as satisfaction with the green
Burgeoning underfoot, and walk away still
Slightly dizzy, ears ringing, looking down.

Then we get up together, conjuring loaves
Of bread for our breakfast table in plain air.
Analogy makes us the ratio of one
To two: two by virtue of separate stations,
One by virtue of music, a common color
Woven like memory through our conversation.
The clear relation of one to two is love.

Emily Grosholz

from: Poems Overheard at a Conference on Relativity Theory

"All mimsy were the Borogroves
And the mome raths outgrabe."

Lewis Carroll, *Jabberwocky*

I.
It may be possible to quantize
gravity in the harmonic gauge
with ghost fields.

Einstein's equations do not hold,
and thus the theory differs
from that in the temporal gauge.

But if the quantum states
are chosen carefully, then we may find
scattering amplitudes

equal to the others corresponding
in the temporal gauge.
Not everybody sees

the quantum theory of gravity
with ghosts differs in content
from that in the temporal gauge.

The problem is, equations
involving infinity
must turn out meaningless,

so quantum states may not
be normalizable. We cannot form
inner products with such states.

But if we adiabatically
switch off the interaction,
the functional integrations

over *g* sub 0 sub mu,
as well as all the ghost fields,
yield unity. And hence,

the scattering amplitudes
must in the end be equal to the others
corresponding in the temporal gauge.

III.
How does light know how
to take the shortest path?
Why are straight lines also
the shortest lines?
Why is there any geometry
at all?

VII.
The labor of being at the source,
or rather, of being the source of time
that comes towards us in the shape
of world from the to-come,
endlessly repeating itself
without resembling itself:
this is the great Act.

The Person at the source of the arrival
of such persistent mystery must abscond,
or otherwise be merely
a being among beings in the world.
Hence that Person, source of ways and places,
doesn't abscond in place, that mere
fiction of the human mind.

It must abscond in time,
or better, behind time, that is, behind
the to-come, and the world is as *parousia*,
always renewed by temporal surprises.
Thus we assume that even Miracle
remains a possibility, and bide.

Lisa Lajeunesse

Lisa Lajeunesse is a Professor of Mathematics at Capilano University in North Vancouver. She studied mathematics and music for her bachelor degree and her graduate research area was Model Theory, a branch of Mathematical Logic. Between her undergraduate degree and graduate studies, she worked for ten years with Telesat Canada, launching and controlling Canada's domestic communication satellites. She also taught piano and voice privately and wrote poetry. Over the last five years she has taught a course that she designed on the connections between mathematics and the arts, reflecting her lifelong passion for creative writing, music and the other arts. During a sabbatical in 2016/2017 she wrote a textbook for the course which prompted her to attend Bridges for the first time. A sample of Lisa's poetry may be found at: https://lisalajeunessepoetry.wordpress.com/

Poetry Puzzle: *The Guarded Heart*

In the square at right, each word is paired with a number (some of which are missing). Unscramble the poem entitled *The Guarded Heart* by filling in the missing numbers (1 – 4) to create a Latin Square (each number must appear once in each column and in each row).

Once you've solved the puzzle, read the words paired with 1 from left to right to form the first line, then read the words paired with 2 from left to right to form the second line etc.

4 Life's	Shackled	Fixed	**2** Stone
Eyes	Chambers	**1** by	Alone
Heart	Cup	of	Inwards
2 Cold	Ever	Drunk	Fear

Lisa Lajeunesse

Wanted

Someone
to ponder imponderables and express the inexpressible

The ideal candidate has experience
working with precision and abstraction in equal measure
and is a minimalist
who delights in purging excess verbiage and unnecessary hypotheses

You are willing to work long hours
pursuing the perfect word or proof technique
motivated to string together
a word or two for anyone who'll listen, or theorems
that only a handful of people care about

You should have Arrogance to Seek Truth
tempered by humility to recognize
that all truths are relative and contingent on adopted axioms
and socio-economic background, gender, ethnicity
and other determinants of world-view

Employees are perpetually on call
and may be required to interrupt dreams at 3 am
to pin down elusive metaphors that will not settle
or test a vague idea
against an esoteric wall that needs scaling

This work exacts a priestly service
candidates are warned, advancement is not guaranteed
many do well in youth then wait long years for inspiration

Insurance against languishing in obscurity
trying to prove undecidable conjectures
or writing overly sentimental verse
is not provided

Benefits include
glimpses of rare and exquisite beauty

Lisa Lajeunesse

An Equation for Love

They've found an equation for love

It goes something like this
love equals attraction times compatibility to the power of opportunity
there's more of course and there's been much fiddling
with coefficients and lesser terms
involving age, pheromones and duration of eye contact

A team of chemists has conducted lab experiments
to quantify the coefficient of attraction
an important factor in love's expression

Someone suggests love should be divided by annoyance
but the mathematicians voice concern about division by zero
and propose division by annoyance plus one

Annoyance is never zero the physicists exclaim gleefully
except perhaps in the beginning
the married physicists laugh longest

The scientists peer down love's curve
examining its trajectory through time
a software engineer and statistician are seconded to run simulations

There are no surprises
regression shows the coefficient of attraction dwindles with time
discontinuities and zeros are found
at points of betrayal

Meanwhile, the biologists stand babbling
long sequences of *A's, C's, T's* and *G*'s
in an attempt to explain love's prime directive

The poets watch in deep mistrust
they continue to craft phrases like
Your soaring moon caresses my soul

A bewildered youth
in search of answers
holds his rent heart in cupped hands
intoning words like
haunt
plea
void

Lisa Lajeunesse

In 1926, three men spent a winter in an uninhabited region of the Canadian north. The expedition was led by John Hornby, a charismatic and extraordinary adventurer and explorer known for taking unnecessary risks. Accompanying him was his cousin's seventeen-year-old son Edgar Christian, and Harold Adlard, a young man whom they met in Edmonton. The men's survival hinged on the arrival of the caribou the following spring, a gamble that did not pay and the three men died of starvation.

The poem below is from a collection called *The Barrens*, inspired by the diary of Edgar Christian, the last to die. Christian's diary provides a plain but painful log describing the expedition, including the days leading to their deaths.

Autopsy of John "Jack" Hornby

He was caught exploring
a plane of possible futures,
a handsome and singular mark,
his bravado irresistible.

With a penchant for close scrapes,
he was ecstatic in the collapse of dimensions
recoiling only as his futures
converged beneath Death's finger.

Marco Lucchesi

Marco Lucchesi, **P**rofessor of Comparative Literature at the Federal University of Rio de Janeiro, is a Brazilian poet, novelist, essayist and translator. Marco was elected to the Brazilian Academy of Letters (ABL) in 2011 and became its president in 2018. He is a regular contributor to the newspaper, *O Globo,* and is the former editor-in-chief of the ABL journal, *Revista Brasileira,* and the National Library of Brazil poetry magazine, *Poesia Sempre.* His publications include twelve award winning books and numerous works of translation, among others *Poemas Reunidos* [*Collected Poems*], *Hinos Matemáticos* [*Mathematical Hymns*], *Irminsul* [his collected Italian poems], and translations of Rumi, Khlebnikov, Rilke, Pasternak and Vico. His work has been widely anthologized and translated into more than ten languages. His literary honors include the Prize Alceu Amoroso Lima, a lifetime achievement award in poetry. https://pt.wikipedia.org/wiki/Marco_Lucchesi

First Test

Resplendent
orchids
in the backyard
The fiery
geometry
of their petals
and the shape
of the silence
which supports them

I bring
a lost heart
and eyes terse
from the brief epiphany

Every flower
buds
at the heart of silence
and to the heart
of silence
it rushes and dissolves

Marco Lucchesi

I remember
Hardy
going into
the deep
silence
of the Greeks
Theorems
as fresh
and significant
as when they were discovered

Two thousand years
have not written
a wrinkle
on their pure countenance
(Euclid
and the infinity
of prime numbers
Pythagoras
and the irrational
square root of two)

The mathematician's
patterns,
like the poet's must
be beautiful
Flowers
theorems
faint
in sudden
gardens
under fleeting
twilights
Beauty is the first test
of mathematics

Translated from the Portuguese by Renato Rezende

Author's Note: Published, untitled, in the book *Meridiano Celeste & Bestiário*, in dialogue with the book of G. Hardy, *A Mathematician's Apology,* from which the quotes in italics were taken.

Marco Lucchesi

Garden Beds

A matchstick momentarily unties
the threads of a starless night

In the blue sky of Samos
they fly, odd.
And the even ones float
in the waters of the Ilisos

The garden
the set of garden beds
And the dark unlimited forest

How to tame the cunning of infinity?

Translated from the Portuguese by Renato Rezende

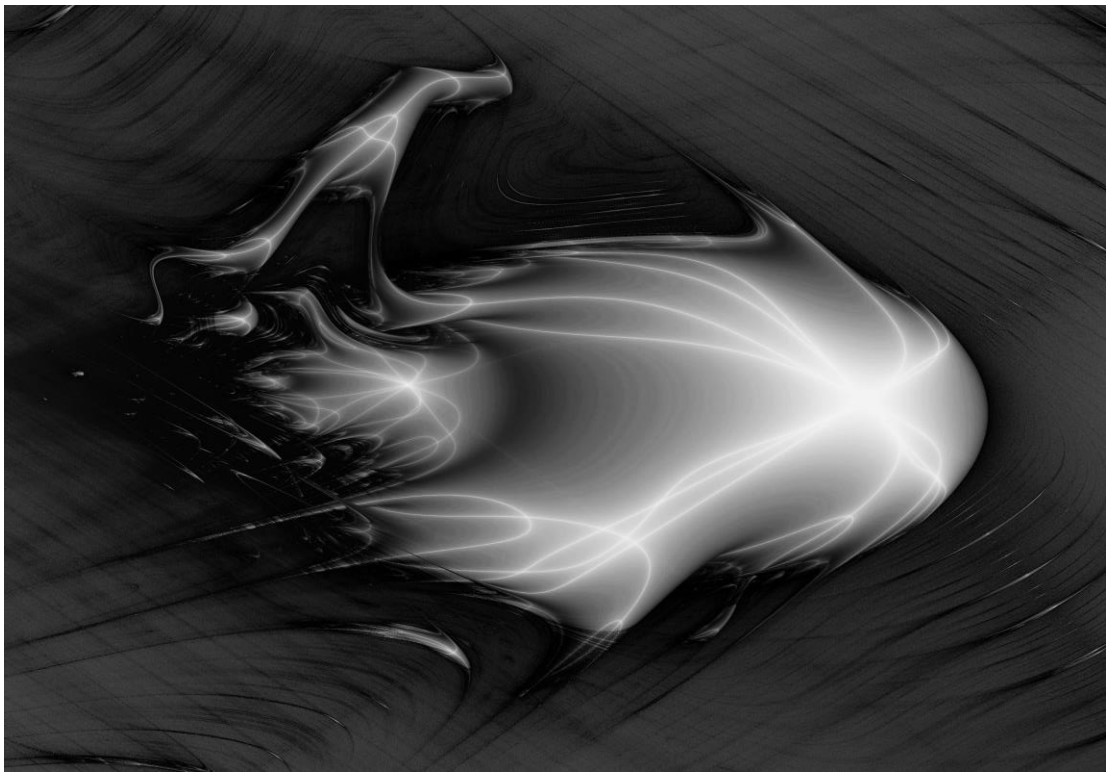
Eros

Two loving solar numbers
wind about through diffuse sortilege
hand in hand: 220
and 284
They only had to meet and recite
the verses that defined them at once:
I die in myself to be born in you

Translated from the Portuguese by Renato Rezende

Author's Notes: *Garden Beds* is a reading of Pythagorean dualism, in the interpretation of Aristotle, *Eth. Nic.* B 5, 1106 b 29. *Eros:* Amicable numbers. Specular numbers. The sum of the proper divisors of each is equal to the other.

Marco Lucchesi



Lyapunov Exponent by Rodrigo de Almeida Siqueira

Fractal Soliloquy

Pollen Lake Nebula

An oscillating flame
of burning accuracy

Lilies Lips PleniλunIum

And the shapes that never cease
to grow

Ephemeral delusions
Liquid glimmers

Translated from the Portuguese by Renato Rezende

Author's Note: On the complex plane of iterative, self-similar functions, the known formula: $z_{n+1}^2 = z_n^2 + c$.

Alice Major

Alice Major published her eleventh poetry collection *Welcome to the Anthropocene,* in 2018 with the University of Alberta Press. Her book of essays, *Intersecting Sets: A Poet Looks at Science,* has been awarded the Wilfrid Eggleston Award for non-fiction. Among her writing awards are the 2017 Lieutenant-Governor of Alberta Distinguished Artist Award. Her interest in mathematics began at the age of twelve, when she was introduced to non-Euclidean geometry in one of Martin Gardner's books. Ever since, like Percy Bysshe Shelley, she turns to math and science "to replenish my store of metaphor." She has been president of the League of Canadian Poets, first poet laureate for her home city of Edmonton (Canada), and is the founder of the Edmonton Poetry Festival. In 2012 Alice was inducted to Edmonton's Arts and Culture Hall of Fame. http://www.alicemajor.com/

Hundreds-and-Thousands

Fifty, sixty, seventy —
such small numbers really.
Children learn to count them easily,
way-stations spaced
on the climb to a hundred,
then all its escalations—thousands,
millions—and on to fanciful infinities.
Zillions, gazillions.

Sixty springs, sixty summer solstices —
so paltry a sum among
earth's billion turnings. What's old
to us is just
a few grains of coloured sugar
sprinkled on a cupcake,
a hop through squares chalked
on pavement, a child's voice rhyming
three, four, shut the door.

Author's Note: In Britain, sugar sprinkles for cake decorating are known as "hundreds-and-thousands."

Alice Major

Algorithmic Compressibility

Any string of symbols that can be given an abbreviated representation is called "algorithmically compressed."

John Barrow, *New Theories of Everything*

Algorithm: that simple sum
thing under pressure, waiting
to fizz up.

Saturday luxuriance. The lazy algebra of blankets,
brackets curled around digits, in addition to
the blank non-light of morning in December.

"Take zero, add two; take
the sum, add two." That simple
string of symbols, and you create
all the even integers – half
the numbers of the universe.

Burrowing nose in blankets, I arrive at the scent
of making love. The compression chamber lid pops off.
I want the rhythms of your body, the summing over two.

"Algorithm," from the Arabic
Al-Kwarisme. Symbols written
in sensual, satin-quilted strokes.
Thousand and one nights.

But you are already subtract, gone off about your
morning calculations. Your side is cool
negative space. And I meant to get up early, clean
the house. (It's clearly time to change
the sheets.) I close my eyes, press both duty
and desire beneath my pillow, compact words.

Alice Major

Zero Divided by Zero

There is no right answer.
The trains of logic crash, annihilate
certainty. Zero is just as good an answer
as one. Nothingness or loneliness.
There is no right answer.

The woman, Godelieve,
books an appointment to annihilate
herself. An Antwerp euthanasia clinic.
A life too long, a brain too hurt.
Nothing is her answer.

The pastor sets himself on fire
in a Texas parking lot, annihilated
by grief for a world that cannot learn
kindness. He's tried everything else,
finds no other answer.

"Mental illness" – that's one label
for the call to self-annihilation.
But is martyrdom, immolation,
never the sanest path, the kindest thing?
There is no right answer.

Zero divided by zero.
The past's black hole annihilated,
divided by the null of future.
Suicide's paradox: relief unfelt
by those who choose its answer.

Black holes are where
God divides by zero. Annihilated
light. All our singular arrangements
of matter reduced to one
undefinable answer.

My sister holds a vial
of danger, matter that could annihilate
her, but – divided into increments –
may let her sleep, let her breathe.
But there is no answer
for the anguish that strangles her,
for the losses that seem to annihilate
her past, divide her from a future
worth living. The vial's round mouth
seems an answer.

Saint Godelieve, "*God's Love,"* annihilated
by a cruel husband. Now God seems void
divided by a vacuum. Sometimes a thought
flares – *Would it be easier to let her go?*
Then the answer

No! My sister, oh my sister,
you terrify me. If you annihilate
this pain, then you divide us utterly.
You cannot be both zero and one.
There is no right answer.

Alice Major

Double Helix

Your photograph arrives from overseas. I realize
how the years insinuate themselves between us—
a series of Fibonacci numbers
        that codifies a widening
spiral, a seashell lined with opalescent memory.

You and I, born from the same small chamber,
surrounded by the same womb's water sounds.
        Photos show us
children, side by side beside a river. Swans behind us
        curve their proud interrogation.

                Photographs arrive
from overseas. You are speaking and your hands
make patterns in the empty air
        as though you are twisting
concepts into cord or donning surgeon's gloves.
In snapshots of myself, the gestures are the same.

So are the lines beside my mouth
        curved more deeply
with every numbered, nautilus-chambered year.
We are more alike than in those early photographs,
        though parted by the widening water

while we step slowly down the spiral staircase of our genes
        around our common core.

Mike Naylor

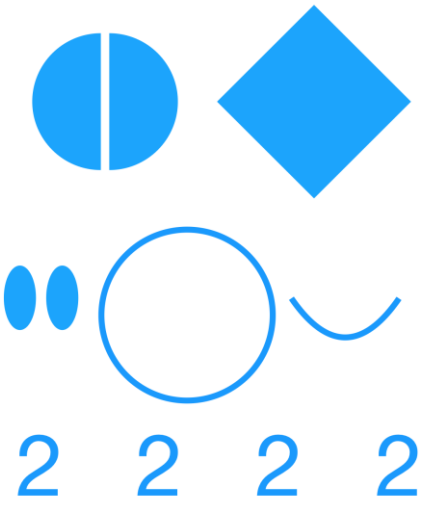
Mike Naylor is a co-director of Matematikkbølgen and of the Math Creativity and Competency Center in Norway. He gives courses for teachers, students and the public, designs math rooms for schools and develops mathematical games and learning products. Mike presents mathematical ideas in creative ways, including poetry, literature, art, music, video, software, drama, and other performances, and is author of over 100 publications spanning a range of mathematical genres. Mike is known for his *Naked Geometry* art series and book, and his quarterly column on Mathematics and Creativity in *Tangenten* magazine. In 2015 he was named a "Math and Science Hero" by the minister of education in Norway. For the past eight years Mike presented artwork and poetry at the Bridges conferences. More information on Mike's projects can be found at his website. http://mike-naylor.com

Craft Project

Split a circle up and down and hinge it at the top
Gently open at the bottom a quarter-turn and stop
Set a square upon its corner slide it in-between
Now you have a sign that shows exactly what I mean

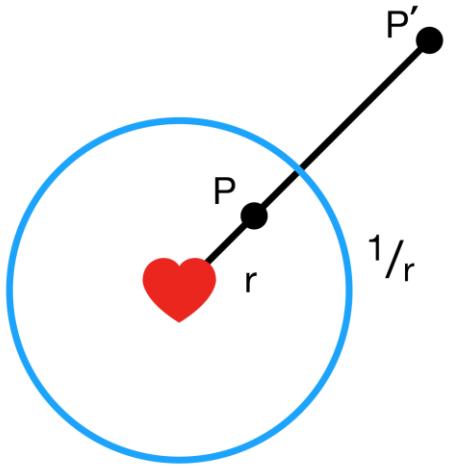
Take two vertical ellipses stand them side-by-side
Place the two inside a circle adequately wide
Sketch a concave up parabola beneath the two
Then you'll see the way I feel whenever I'm with you

And now there's one last puzzle that I give to you my friend
Let me and you take two and two and two and two again
Find the sum and write the answer sideways and you'll see
A different symbol that will say how long you'll be with me



Mike Naylor

Inversive Geometry – A Love Poem



There's so much that's outside myself I cannot know it all
If only I could have some way to reach beyond this wall
And everything within myself's so hard for you to see
If only I could have some way to bring you into me

But then I took a lesson from a most unlikely source
A secret kind of magic from a mathematics course
And with this magic power I knew I could be set free
I had finally found the answer in inversive geometry

I drew a circle round myself with all of me within
And measured all my feelings from the center of my being
And measured all the distances to every point of you
I inverted all the distances within without and through

The farther out it is the nearer that it draws to me
All that I hold tightly flies to you where it is free
And it no longer matters if I feel you are so far
All it takes to take you in, is just one over r

Osmo Pekonen

Osmo Pekonen, Ph.D., D.Soc.Sci., is a Finnish mathematician and writer based at the University of Jyväskylä. As a mathematician, he has published on differential geometry, Teichmüller theory, K-theory and string theory, as well as on topics from the history of mathematics. He serves as the Book Reviews editor of *The Mathematical Intelligencer.* As a writer, he is best known for his essays, biographies and poetry translations. In particular, jointly with the Old English scholar Phil. D. Clive Tolley, Osmo translated into Finnish, the epic poem *Beowulf* (Helsinki: WSOY, 1999). He is a member of The Finnish Literature Society, the Finnish Association of Authors, and a corresponding member of four literary academies in France. The Institut de France awarded him the Chaix d'Est Ange prize of 2012. https://fr.wikipedia.org/wiki/Osmo_Pekonen

Johan Carl-Erik Stén, who co-translated with Osmo Pekonen, the poem "The Bridges of Königsberg," is a Finnish mathematician and historian of mathematics based at the University of Helsinki. He translated Leonhard Euler's *Lettres à une princesse d'Allemagne* into Finnish, and authored the monograph *A Comet of the Enlightenment: Anders Johan Lexell's Life and Discoveries* (Birkhäuser, 2014).

Influential Finnish poet and dramatist, Eeva-Liisa Manner (1921–1995), made a breakthrough in 1956 with the publication of her poetry collection *Tämä matka* [*This journey*], which includes the poem "Descartes". Deeply critical of the intellectual climate of her times, Manner looked to the primitive innocence of ancient cultures as a source of renewal.

Lars Gustafsson (1936–2016) was a prominent Swedish poet, philosopher, and writer. In his poetry, he sometimes combined logical reasoning with philosophical and existential questions. "The Bridges of Königsberg," appeared in his 1982 poetry collection *Världens tystnad förre Bach* [*Stillness of the World before Bach*].

The City of Königsberg, 1554 (Historic Cities Research Project)

Osmo Pekonen

Descartes

Ajattelin, mutta en ollut olemassa.
Sanoin että eläimet ovat koneita.
Olin menettänyt kaiken muun paitsi järjen.

Sanokaa terveisiä heille kaikille
joiden tieto on salaista,
kuten Paracelsus, Swedenborg ja Elberfeldin laskutaitoiset hevoset,
jotka ottavat juuria ja korottavat potenssiin,
laskevat virtaavia lukuja viisailla kavioillaan, ei päällään,
sillä ruumis tietää kaiken, mutta oppineessa päässä on naula.
Sanokaa että filosofia on yksinäisyyttä ja kuollut ruumis,
joka pariutuu järjen kanssa, ja lapsi
on metodin esitys ja kuviteltu suure.

Tänään
juoksevat nopeat hevoset yli kuolevan Ranskan
ja rummuttavat kavioillaan salatun tiedon
Cartesiuksen ohimoluuhun.
Tänään olen yhtä heidän kanssaan.

Eeva-Liisa Manner

Descartes

I thought, but I wasn't.
I said animals were machines.
I had lost everything but my reason.

Give my greetings to all those
whose knowledge is secret,
Paracelsus, Swedenborg, and Elberfeld's numerate horses,
who extract a root and raise to a power,
calculate streaming numbers with their clever hooves, not their heads –
for the body knows everything, but a learned head has a nail in it.
Say philosophy is loneliness and a dead body
copulating with reason and the baby is
a discourse on method and an imaginary quantity.

Today
fast horses race over a dying France
and their hooves drum a hidden knowledge
on the Cartesian temple-bone.
Today I'm one with them.

Translated from the Finnish by Osmo Pekonen

Osmo Pekonen

Broarna i Königsberg

I staden Königsberg i Preussen
finns en ö med namnet Kneiphoff,
omsluten av två armar av floden Pregel.
Sju broar leder över de två armarna.

Sju broar. Och aldrig mer än en gång.
Vattnet hörs nu nästan överallt.
Det är blint vatten, svart vatten,
nattligt vatten. Tre slags vatten.

Kyrkor och torn och sneda gröna tak.
Här är en trappa. Här är ett hus.
Här är hunden som skäller på gården.
Den är svart, alldeles svart. Den skäller.

År. År och dagar. Så lika varandra som ...
Hör ni mig? Jag är innestängd.
Och man hör det inte. Som Magdeburgska halvklot.
Så olika varandra som: Äpplen.

Från någon frisk oktober; hundskall,
röster, och bara en bro i taget,
aldrig två gånger över samma bro.
Vissa barn går alltid på var tredje sten,

och bara var tredje. Stupet som drar.
Den tredje dörren som alltid gnisslar.
År. År och dagar. Hör ni mig? Oktober,
och ännu ingen frost i luften.

För att gå över sju broar i rad,
och över var och en bara en gång,
behövs det, säger matematikern Euler,
i själva verket en åttonde bro. Den finns inte.
Fördömda is, som inte vill frysa!

Lars Gustafsson

Osmo Pekonen

The Bridges of Königsberg

In the city of Königsberg in Prussia
there's an island by the name of Kneiphoff,
surrounded by two arms of the river Pregel.
Seven bridges lead over the two arms.

Seven bridges. And never more than once.
The water now can be heard almost everywhere.
It's blind water, black water,
nocturnal water. Three kinds of water.

Churches and towers and slanted green roofs.
Here's a stairway. Here's a house.
Here's the dog barking in the yard.
It's black, completely black. It's barking.

Years. Years and days. Resembling each other as ...
Can you hear me? I'm confined.
And you don’t hear it. Like the Magdeburg hemispheres.
As different from each other as: Apples.

From some fresh October; a dog barking,
voices, and only one bridge at a time,
never twice over the same bridge.
Some children always walk on every third stone,

and only every third. The cliff that pulls.
The third door that always squeaks.
Years. Years and days. Can you hear me? October,
and still not frost in the air.

To cross seven bridges in a row,
and every bridge only once,
you need, says Euler the mathematician,
in fact, an eighth bridge. But it's not there.
Damned ice that won't freeze!

Translated from the Swedish by Osmo Pekonen and Johan Carl-Erik Stén

Tom Petsinis

Tom Petsinis was born in Macedonia, Greece, and immigrated to Australia as a child. He is a novelist, playwright, poet, mathematician and Honorary Fellow at Victoria University, Melbourne. Tom has published seven collections of poetry, including *Naming the Number*, *Breadth for a Dying Word, My Father's Tools* and *Four Quarters,* which won the Wesley Michel Wright Poetry Prize. Of his five plays *The Drought* won the Wal Cherry Playscript of the Year Award and was short-listed for the Victorian Premier's Award. His four works of fiction include the novels *The Twelfth Dialogue* and *The French Mathematician*, nominated for both the New South Wales Award and South Australian Premier's Award. His work has been translated into a number of languages. *Quaternia*, Tom's most recent novel featuring mathematics, was published by Arcadia in 2015. http://tompetsinis.com/

Proof by Contradiction

Theorem: A poem always finds a form,
A voice, an audience of more than one.
Proof: Let's assume the contrary is true.
I have no patience for pentameters,
While the sonnet struggles and strains
To contain blank verse discursiveness;
There's no time for slick internal rhyme
And assonance that massages the ear;
As for symbols, images, metaphors
Howling drives them from a silent page;
A mix of mathematics and mother-tongue,
And too strange for critic and translator,
My work is always yet-to-be-written
And read by no-one but me. Q.E.D.

Tom Petsinis

Binary

Must've been the spring of sixty-nine
(The revolution had loosened my hair) –
One and Zero met in Johnny's pool-room
With plans to subvert the old order
For a world based freely on binomial love.

One: We'll overcome the ten-fold fist
Before it decimates our half of the universe.
Zero: We'll go back to basics first:
Yes, no; light, dark; to be or not to be.

Their whispers laced with fragrant smoke,
And punctuated by the kiss of billiard balls,
Nobody, not even the marker and I,
Heard them say they'd infiltrate the future
To digitise the unsuspecting word.

Tom Petsinis

The Ruler

Imprinted with obsolete divisions
(Twelfths and sixteenths were seldom used)
It has outlived the logarithm book
And survived an imperial fall
As a straightedge for my waywardness.

Autumn light thinning on my hands
It takes me back more than thirty years
To a boy fascinated by his teacher's eyes,
The silver pin in her tartan skirt -
Until this edge struck his knuckles white.

At recess, having suddenly outgrown
The kiss of marbles in the gritty yard,
He nursed the line with his breath,
Learnt by heart the first axiom of love.

Tom Petsinis

Circling the Square

For ages, ruled by geometry,
They played their Platonic roles
To please humanity,
Until the circle declared:
You're the meaning of my soul –
Let's consummate our affair.

Circumspect, the square sighed:
We'll never embrace -
Our forms, separated by π,
Differ as the owl from the cat.
Admire my face –
Please, don't look beyond that.

The circle wasn't deterred:
Have faith in the infinite –
Your lines and my curve
Will meet like a singer and song.
Love knows no limit
And proves geometry wrong.

Eveline Pye

Eveline Pye worked as an Operational Research Analyst for Nchanga Consolidated Copper Mines, in Zambia, for almost ten years, and was a Statistics Lecturer at Glasgow Caledonian University, in Scotland, for over twenty years. Her mathematical and statistical poetry has been published in a wide range of literary magazines, newspapers and anthologies. In September 2011, *Significance Magazine*, the joint publication of the Royal Statistical Society and the American Statistical Association featured her work in education and published a selection of her poems as part of their *Life in Statistics* series. She was poetry editor for New Voices Press and worked for the Federation of Writers (Scotland). A collection of her poems about Zambia, *Smoke that Thunders*, was published by Mariscat Press in 2015. Examples of Eveline's mathematical poems may be found online at: http://onlinelibrary.wiley.com/enhanced/doi/10.1111/j.1740-9713.2011.00510.x

Imaginary Numbers

A real life ends, but is imagined
by those left behind. An imagined
death becomes reality, eventually.

The square root of minus one
can't exist since a squared number
can't be negative

but imaginary numbers yield
real answers in the real world.
The difference between reality

and imagination: a false oasis
that blurs, shimmers
and melts before my eyes.

Eveline Pye

Black Swan

Somewhere close, nuclear warheads trundle down a potholed road and I am concerned that,
though they say the risk is low, no one says what *low* means and though there may be
a number trapped on a hard disc, no one knows if it's even halfway near to being right.

Then there's the internal report for the shiplift at Faslane, for when it cradles
Trident submarines, I worry they had to black out their own best guess so we don't know the chance
of a platform collapse, or plane crash, fire, explosion, or even being peppered with plutonium.

It's as though the MoD believe disasters won't happen to them or us, as if they believe
all swans are white, because every swan they ever saw was white, as if they think
they understand the fickle migration of birds while beyond their ken, a butterfly flaps

its chaotic wings, the wind changes direction and somewhere far away a black swan
takes to the air, lifts its heavy body upwards, defies gravity and soars above us.
Invisible in the night sky except for its blood red beak –

a
dark arrow
coming towards us
changing everything.

Author's Note: Black Swan Events in Statistics refer to high-impact, hard-to-predict, rare events beyond the realm of normal expectations.

Eveline Pye

The Law of Statistics

for Sally Clarke 1964 – 2007

You, Sally Clark, solicitor,
discover your son, Christopher
dead in his Moses basket. Harry, born
a year later, dies in his bouncy chair.

Paediatrician for the crown,
Sir Roy Meadow, tells the jury
two cot deaths in the same family
would occur only once in a century.

Odds are one in seventy-three million,
lower than the lottery, beyond all
reasonable doubt. An easy decision:
You must be guilty.

At Styal Prison, the horde screams,
Here's the nonce! Die woman, die!
They bang on the door, clamber up,
gawp as you cringe in a holding cell.

At the second appeal, your body
is free but your mind has crumpled.
You drink until you die,
your third son, left without a mother.

I tell this story to my medical students,
show death by natural causes
was more likely than murder.
Silence.

Eveline Pye

Scaffolding

after Lev Vygotsky

They need to trust you
describe their reasoning
in detail. Each premise
must be laid bare.

“Why did you do that?

Where did *that* number
come from?”

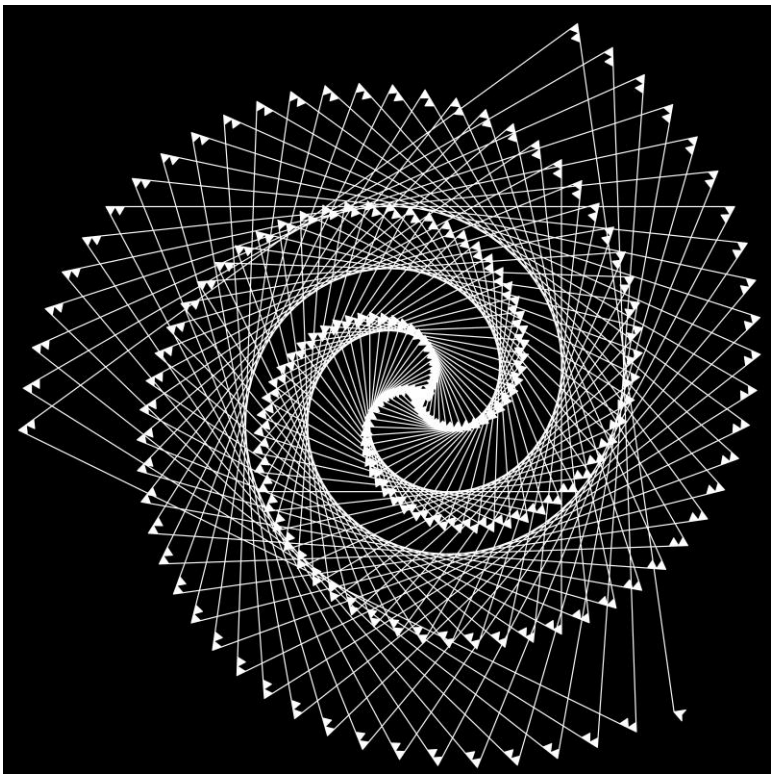
I follow each step
searching for the wrong idea,
the mistaken concept.

Sometimes, all I gift
is one new thought like….
“Dividing *can* make
a number bigger”,
and it’s as if I see
their minds inflate.

It’s like blowing air
into someone else’s lungs.
You have to stop
as soon as you can.

You need them
to breathe again
– all on their own.

Poems by
Past Bridges Conferences' Featured Poets



Mathematical Poetry Readings
2011 — 2017

Robin Chapman

Robin Chapman is a poet, painter and developmental psycholinguist. She is Professor Emerita of Communication Sciences and Disorders at the University of Wisconsin–Madison and emerita Principal Investigator at the Waisman Center, where she studied language development in children with Down syndrome. A fellow of the Wisconsin Academy of Sciences, Arts and Letters and co-organizer of the UW Chaos and Complex Systems Seminar, she is author of ten books of poetry, including, *the eelgrass meadow, One Hundred White Pelicans* (poems of science and climate change), *Six True Things* (poems of childhood in the Manhattan Project town of Oak Ridge, TN) and, with physicist J.C. Sprott, *Images of a Complex World: The Art and Poetry of Chaos* (World Scientific, 2005). Her mathematical poems have appeared in the *Journal of Humanistic Mathematics*, *The Mathematical Intelligencer*, and the anthology *Strange Attractors*. http://robinchapmanspoetryandpainting.blogspot.com/

High School

What sticks in the mind
is the black slinky in physics,
the twang of its wave
traveling the hall – still,
who could believe
water didn't travel,
watching the waves reach shore?

Or the formula for angular momentum,
forgotten, like the words
to the 45s we collected,
but its sense connected;

Or Mrs. McGhee in American history,
sitting on the table
chronicling the Civil War,
swinging her divorced legs
and letting us in on history's secret --
It's all in the pocketbook,
and now we believe her,

Though back then, spinning
slower and slower
to "Stardust Melody,"
feeling the wave's motion
traveling the body's wires,
we might have given her
an argument.

Robin Chapman

The Traveling Salesman Problem is NP-Difficult

NP-difficult: nondeterministic polynomial problem whose difficulty increases faster than its size. The salesman's problem is to schedule his visits to cities minimizing the distance traveled.

We were all for optimization of student opportunities
for taking courses and minimization of teaching time
and thought it would be simple enough for the volunteer
engineer grads to write a program for extra credit
to solve our annual scheduling problems
matching up 30 staff and 90 students and 200 clients
if only the faculty stopped being pig-headed
about their favorite teaching times and allowed the process
to begin with what each student wanted to take and when
each client wanted to come and from that determine when
each class could meet so that no student had a conflict
with class or client, so who knew it was a problem NP-difficult,
as hard to schedule as the Traveling Salesman or a herd
of cats? The program was still running long after classes
began, the schedule made up on the usual grid by the department's
graduate secretary, and when the computer finally coughed up
the recommendation that my Com Dis seminar in language
disorders meet at 11 p.m. Saturday night and the class in voice
at 6 a.m. Sunday, we put an end to optimal algorithms
and let the students and clients like it or lump it.

Marion Deutsche Cohen

Marion Deutsche Cohen holds a Ph.D. in mathematics from Wesleyan University and teaches at Arcadia University. Her more recent poetry collections are *Truth and Beauty* (WordTech Editions, 2017) and *New Heights in Non-Structure* (Dancing Girl Press, 2017). *Truth and Beauty* is about the interaction among students and teacher in her course, *Mathematics in Literature.* Author of twenty-seven books of poetry and prose, Marion published in her first volume of poetry, *The Weirdest Is the Sphere*, a mathematical poem dating back to age seven. Her later mathematical poems were collected in her volume, *Crossing the Equal Sign*. Her oeuvre includes two controversial memoirs about spousal chronic illness. Marion lives with her husband in Philadelphia, where in addition to poetry and mathematics, she enjoys food, thrift shop expeditions, and visits from her grown-up children and grandchildren. http://www.marioncohen.net/

Cats Watching Us Work

Mirage knows which points and lines I should draw
and he knows which ones I should not draw.
He sees emerging from my pen a neatly dotted line that seems to me auxiliary
but about which he's thinking "No! No! That one won't help. That one will hinder."
He could gently nudge my hand
or nip, ever so minutely.
But he prefers to keep mum.
Does he know I'll learn from my mistake?
Or does he simply *like* my mistake?
Is he thinking, it won't help but it's pretty?

Marion Deutsche Cohen

The Mathematician's Child

Devin at 5 acquires letters the way I acquired numbers
and functions
and distributions
and differential forms.
Namely, each has to be played with awhile.
A has to be A-man, with a triangle face and no arms.
H has to be a chair, the front view of one of those big ones.
And E is a mother, with three nipples, three parts of me.
He writes a textbook about each one, the way I did about
each theorem, adorning it with examples and
drawings.
A's have to stand atop other A's, or swing upside-down
from O's.
The two tippy-tops of one M have to become the tippy-
bottoms of another M.
It has to grow and grow until it becomes a hive.
And now he wants super-E's, E's with four horizontal lines
and super-B's, with six semi-circles strung on that pole.
We get into it together, he claims, I re-claim, it gets more
and more important.
We make a super-alphabet, each letter becomes an equi-
valence class, the way each number is an equivalence
class.
Letters can be super-shapes. Letters can be math.
Letters can be learned but not forgotten.

Francisco José Craveiro de Carvalho

Francisco José Craveiro de Carvalho graduated from Coimbra University, Portugal. He later wrote a Ph.D. thesis in Geometry, under the supervision of Stewart Alexander Robertson, at Southampton University, U.K. His mathematical publications include joint work with his former supervisor. While on sabbatical at Leeds University, Francisco came across the poem "Einstein" by Katharine O'Brien. This event sparked his interest in the connection between mathematics and poetry and led to his publication, *ainsÓniadefibOnacci*, an anthology of O'Brien's poems translated into Portuguese. He has also translated into Portuguese poems by Neil Curry, Arvind Krishna Mehrotra, Aram Saroyan, George Swede, David Lehman, Charles Simic and others. English translations of his own poems appeared in a number of publications including *Topological Commentary: Springer-Verlag Poster* (Volume 10, 2005), and both *Bridges Poetry Anthologies* (2013 and 2016).
http://novaserie.revista.triplov.com/numero_21/francisco_craveiro/index.html

Dialogue with Elon Lages Lima

May 7, 2017

He would have liked to be a writer.
For this reason
he began with a comment

on Stevens's Jar in Tennessee.
Of that January afternoon
recorder and recording are both lost.

Not lost are the gift of time
he granted me
and the written lines of his life.

Noble serenity
and the ear
of an unassuming apprentice.

Translated from the Portuguese by Paulo Henriques Britto

Author's Note: Elon Lages Lima (1929 – 2017) was a Brazilian mathematician whose research concerned differential topology, algebraic topology, and differential geometry.

Francisco José Craveiro de Carvalho

Gödel Number

Though
with a more relaxed definition
of *X number,*
my *Gödel number*
is an impressive 3.

From Brno, via Shanghai,
landing in Princeton,
reaching me through a one-sentence
poem

that makes no mention of Adele,
talking and talking away
but failing to talk the professor
out of wearing his overcoat
on such a hot day.

Translated from the Portuguese by Paulo Henriques Britto

Author's Note: A variation of the *Erdős number*, the *X number,* describes the "friendship distance" between a person and *X*. Thus, the *X number* is 1 if one is a friend of *X*, 2 if one is a friend of a friend of *X,* and so on. The one-sentence poem referred to in the second stanza is by Steve Klepetar.

JoAnne Growney

JoAnne Growney has retired from teaching mathematics at Bloomsburg University, PA and now lives in Silver Spring, MD where she writes poems, guides poetry workshops, blogs about math-poetry connections, and enjoys activities with grandchildren. During childhood on a Pennsylvania farm JoAnne began to love poetry, but it was a mathematics scholarship that financed her education. While a math professor, she began to write poems, eventually achieving the collection *Red Has No Reason* (Plain View Press, 2010). She delights in the elegant language of both mathy and poetic domains and hopes to use words effectively – for valuable insights and to promote vital causes, including recognition for women and protection of our environment. Growney offers a varied selection of mathy poems from poets around the world in her blog, "Intersections: Poetry with Mathematics" at https://poetrywithmathematics.blogspot.com

Cento

Thinking in its higher forms is … poetry,
Hold infinity in the palm of your hand,
When I use a word … it means what I choose it to mean,
Poetry is a sort of inspired mathematics.

The grand thing is to be able to reason backwards,
The mathematician tries to get the heavens into *their* head,
There is always a third point between any two,
Mathematics is the music of reason.

Author's Note: The authors of these lines are, in the order presented, Havelock Ellis, William Blake, Lewis Carroll, Ezra Pound, Sir Arthur Conan Doyle, G. K. Chesterton, Michael Rosen, James Joseph Sylvester. In line 6, I have corrected the original pronoun to a gender-neutral form. The lines of this cento have been selected from a file of about 300 statements linked to mathematics and poetry that I have gathered and made available at: http://joannegrowney.com/CENTO-Names-Quotes-Table.pdf. Readers are invited and encouraged to create their own Cento poems.

JoAnne Growney

Good Fortune

is good numbers –
the length of a furrow,
the count of years,
the depth of a broken heart,
the cost of camouflage,
the volume of tears.

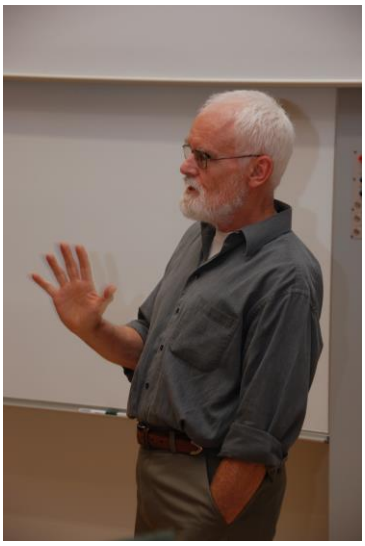
Counting on a December Morning

one chickadee, one squirrel
my own two feet left-right left-right on the soft track
around the soccer field three blocks from my home
sparkling bright against grey sky five crows alight
in the lacy spread of fractal branches of eight bare locust trees

when I am early morning's first human to arrive at Shepherd Park
when I am first and the wind is gentle and the temperature
is not bitter cold
dozens of robins hop and flutter near me
as I plod some thirteen laps

smiling, maybe losing count
and loving my Fibonacci world

Philip Holmes



Philip Holmes is Emeritus Professor of applied and computational mathematics and mechanical and aerospace engineering and member of the Neuroscience Institute at Princeton University. He studied engineering at Oxford and Southampton Universities, U.K., and taught at Cornell University from 1977-1994. He works on nonlinear dynamical systems and collaborates with biomechanicians and neuroscientists. Philip has published four poetry collections, including *The Green Road* (1986) and *Lighting the Steps* (2002), all with Anvil Press, and, with Florin Diacu, *Celestial Encounters* (Princeton University Press, 1999) — an historical account of the origins of chaos theory. He is a member of the American Academy of Arts and Sciences, an Honorary member of the Hungarian Academy of Sciences, and a Fellow of the American Mathematical Society, the American Physical Society and the Society for Industrial and Applied Mathematics.
http://www.princeton.edu/mae/people/faculty/holmes/

Mathematical Chemistry?

Lord Kelvin thought that knots might speak
for all the elements, each atom having
its unique fine braid: an elegant conceit;
alas, entirely wrong. We are in love
too much with theory, formulae that close
so neatly on themselves, spinning plausible
conjectures, and being most of what we know.
Meanwhile the world rolls by, unseen, inaudible.

Then serendipity drew Peter Tait
to classify, count crossings and make the strands
of an abstract discipline, perhaps a game.
And as it happens, knots *are* right, in part,
for, recognized or not, they point our minds
to the intimate coils and sums in DNA.

Philip Holmes

Who Will Ask?

"He was the solitary and lucid spectator of a multiform, instantaneous and almost intolerably precise world."

Jorge Luis Borges, *Funes the Memorious.*

A thing completely new cannot be grasped
yet it appears and hunts about our yard
inviting questions that one does not ask.

Wait! Something seems familiar in its path,
halting, ears pricked and pointed to the void;
but what's completely new will not be grasped

and we are apt to let it slide, look past
or back at a familiar task, all to avoid
questions that the days would have us ask.

Funes knew each dawn was different, masked
for us by our belief in common words.
His terms, completely new, allowed a grasp,

but who could follow them? No name or past
implies the thing is not, and we go round,
ignoring questions that we might have asked.

Yet stubbornly *it is*. It jumps and squawks,
all scales and fur and disputatious sound.
This thing, still nearly new, escapes our grasp.
Is there a question we could learn to ask?

Gizem Karaali

Gizem Karaali is Associate Professor of Mathematics at Pomona College. She earned a Ph.D. from University of California, Berkeley, in 2004. Her mathematical research lies in the areas of representation theory, super quantum groups, and algebraic combinatorics. Her scholarly interests include humanistic mathematics, quantitative literacy, and social justice implications of mathematics and mathematics education. Gizem is a founding editor of the *Journal of Humanistic Mathematics,* and is an associate editor of the *Mathematical Intelligencer* and *Numeracy*. She has organized panels, paper sessions, and poetry readings, and presented invited addresses to diverse audiences. She has a National Security Agency Young Investigator Award, is a Sepia Dot (2006 Project NExT fellow), and is serving currently as chair of SIGMAA-QL. In her spare time she likes traveling, reading and writing, and hanging out with her two children.
http://pages.pomona.edu/~gk014747/

An Invitation

Mathematical
poetry -- give it a try.
You won't be sorry.

Math in Seventeen Syllables

Numbers and letters
Sad crumpled up scraps of math---
Remains of the night

Gizem Karaali

Naïve Set Theory

A set is a Many that allows itself to be thought of as a One.

Georg Cantor

Red luscious pomegranate
One fruit---proud and round.
Cut it open you will find
Delicious dark seeds abound.

Lonely bricks lie all about
Till together they build walls.
Separate fingers of a hand
Are one fist when hatred calls.

In my bowl--mixed in with corn--
Tiny peas all from one pod.
Unity in diversity--
Or one nation under God?

How can many be a One?
How can one be a Many?
And what if gods don't and won't
Believe in Cantor's theory?

Lawrence Mark Lesser

Lawrence Mark Lesser, University of Texas at El Paso Mathematics Education Professor, enjoys integrating poetry and song with his outreach, teaching, and research. He co-organized evenings of mathematical poetry at several Joint Mathematics Meetings, and his mathematical poetry appeared in: *The Mathematical Intelligencer*, *Journal of Humanistic Mathematics*, *Radical Statistics*, *Journal of the Association of Mexican American Educators*, CAUSEweb.org, *Talking Writing*, *Texas Mathematics Teacher*, a show on an NPR station, and mathematical poetry blogs and anthologies. His poetic math songwriting has won national educational contest awards, attracted international media coverage, yielded pioneering juried papers on using songs and guitar in mathematics and statistics classes (including a paper in the 2014 poetry-focused issue of the *Journal of Mathematics and the Arts*), yielded invited presentations for national audiences, and was part of his NSF-funded Project SMILES.
http://www.math.utep.edu/Faculty/lesser/poet.html

Cantor's Ternary Palindrome

R E D I V I D E R

R E D D E R

R D D R

Forebear Square

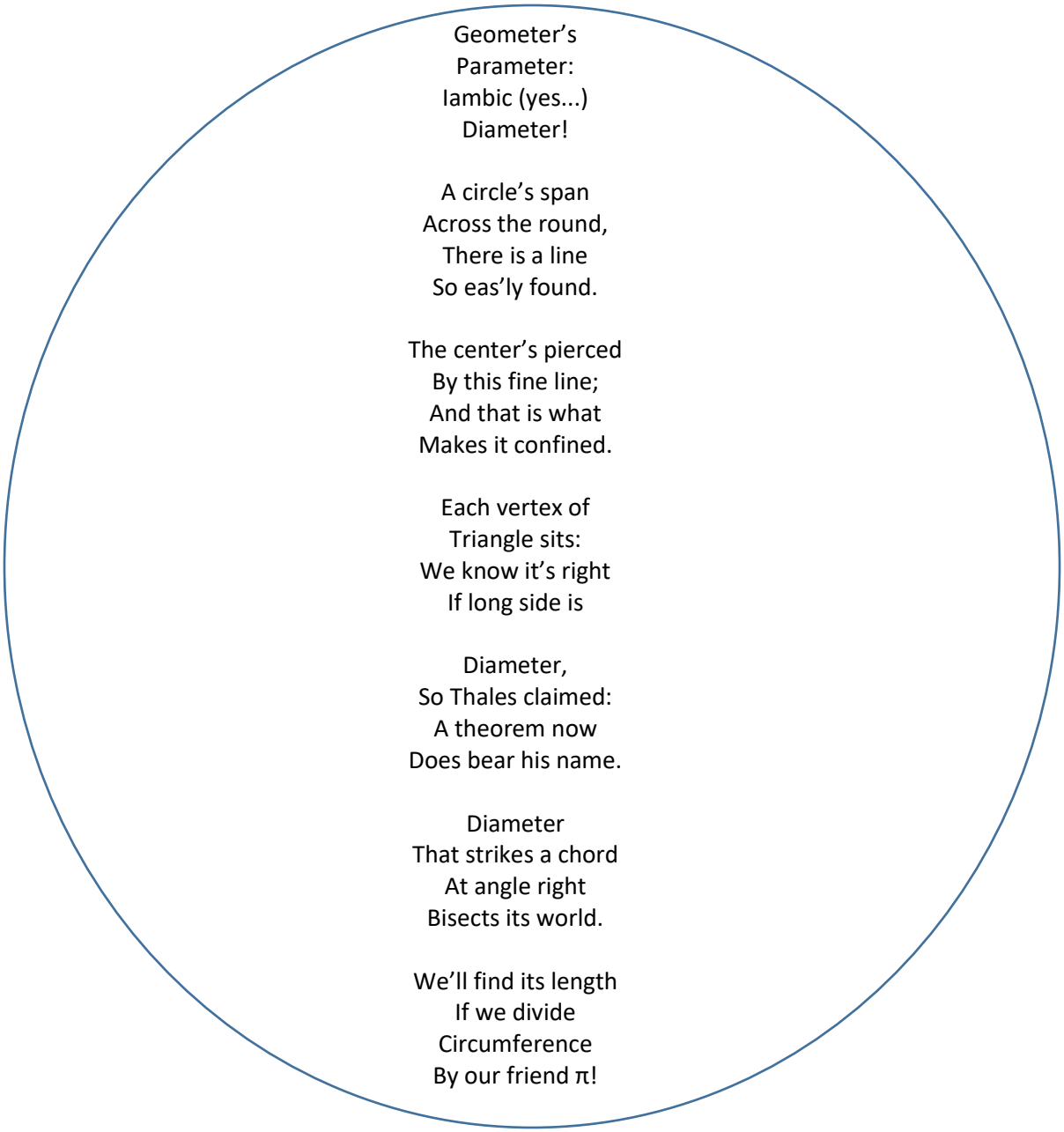
T H R

W E

O N E

Lawrence Mark Lesser

Diameter



Geometer's
Parameter:
Iambic (yes...)
Diameter!

A circle's span
Across the round,
There is a line
So eas'ly found.

The center's pierced
By this fine line;
And that is what
Makes it confined.

Each vertex of
Triangle sits:
We know it's right
If long side is

Diameter,
So Thales claimed:
A theorem now
Does bear his name.

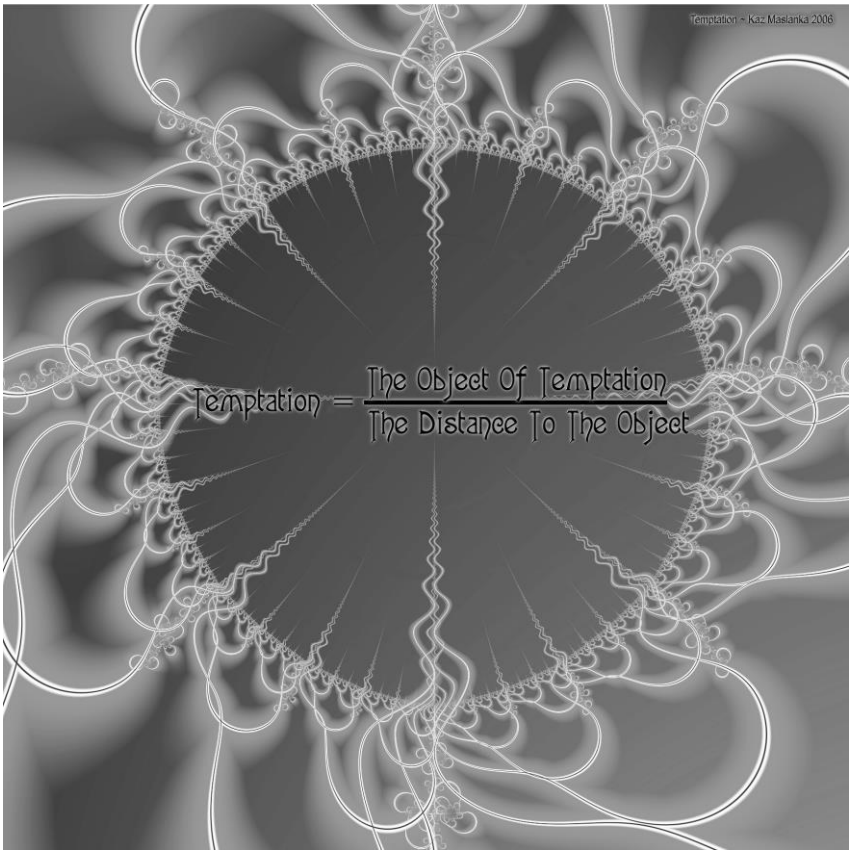
Diameter
That strikes a chord
At angle right
Bisects its world.

We'll find its length
If we divide
Circumference
By our friend π!

Kaz Maslanka

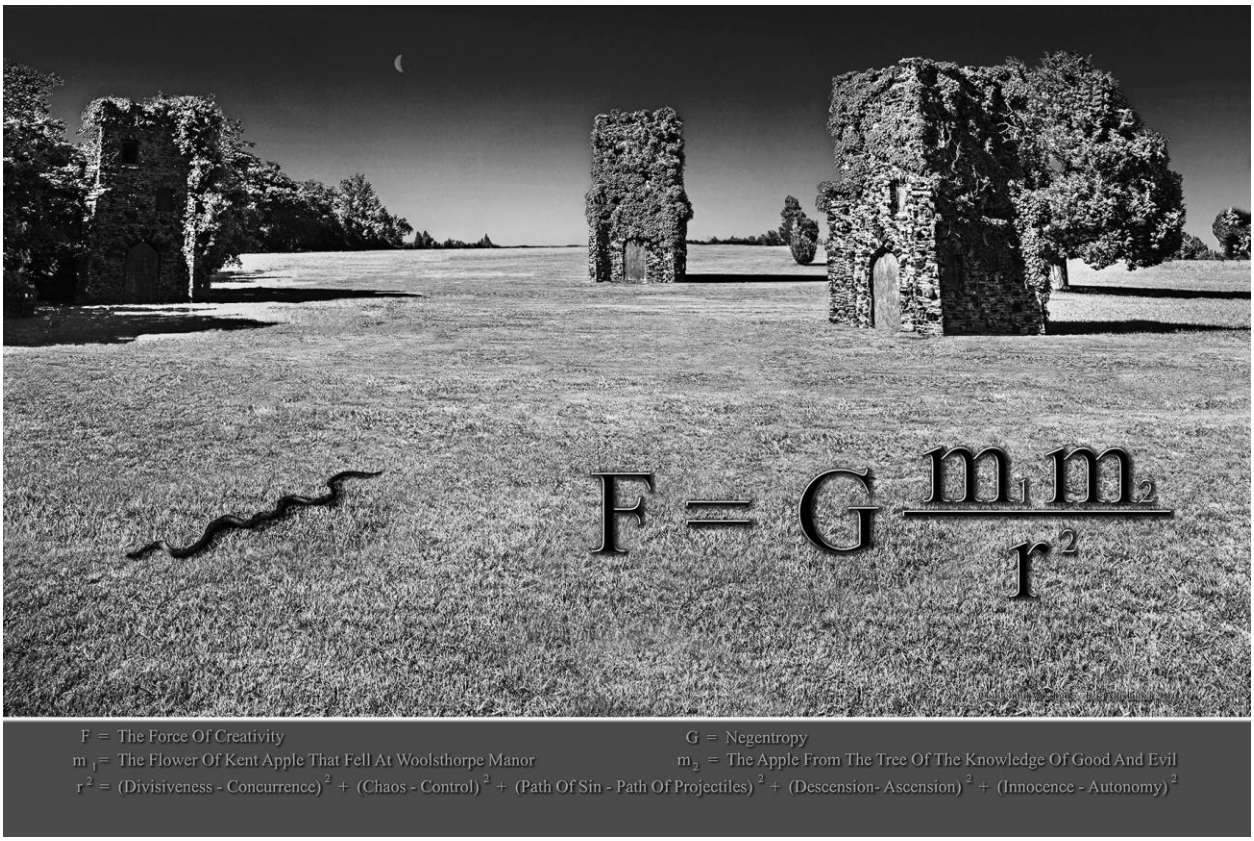
Kaz Maslanka received a BFA in sculpture from Wichita State University, where he also studied music, mathematics and physics. He has been pioneering mathematical poetry for over thirty years and was nominated for a pushcart prize in poetry. His polyasthetic work maintains an international presence through exhibitions and museum collections around the world, as well as through his award winning blog, *Mathematical Poetry.* Kaz lives in San Diego, California where he works both as an artist and as an engineering group leader designing parametric CAD models for aerospace technology. He is on the board of directors of San Diego's *Sonic Arts Studio* and serves on the advisory boards of the *Bronowski Art and Science Forum* and the project, *DNA of Creativity*, sponsored by San Diego Visual Arts Network. http://mathematicalpoetry.blogspot.com/

Temptation



Kaz Maslanka

Congenital Wisdom



Author's Note: "Congenital Wisdom" is a mathematical visual paradigm poem. The paradigm that I am using is Newtons equation for the law of gravity. In a paradigm poem concepts are mapped into the existing equation to create conceptual metaphors across the cognitive domains. The piece points to the idea that the legendary events involving two different apples were both creative events. One being Newton's apple that he saw falling out of the tree and the other being the apple from the knowledge of good and evil. In the poem, the force of creativity is acting on both apples. Note that the distance between the apples is described by mapping concepts across a five-dimensional Pythagorean Theorem.

Dan May

Dan May is an Assistant Professor of Mathematics at Black Hills State University in Spearfish, South Dakota. His Ph.D. research focused on Mutually Unbiased Bases, an area which incorporates topics from linear algebra, group theory and finite geometry. His recent research interests include the connections between poetry and discrete mathematics, and the combinatorics of card games such as *Set* and *Spot It*. Dan has been spending his last several summers working with Bridge to Enter Advanced Mathematics (BEAM), a summer residential mathematics program for underserved students from New York City public middle schools. He has also received Title II grants to create and teach in-service workshops for South Dakota middle school teachers. Dan moonlights as a musicologist, and has presented several seminar talks on a variety of musical genres at his university.
https://wordsdanwrote.wordpress.com

BEAM: A Fibonacci Poem

Now
you
are home —
Brooklyn, Queens,
the Bronx, your boroughs.
Only yesterday still at camp,
learning knots and graphs, writing proofs on infinity.
I taught you the one hundred and sixty-eight automorphisms of the Fano plane.
You wear hijabs, or Jordans, or both. Diverse faces
display the doubts of twelve-year-olds.
But each of you, when
you get it —
your face
lights
up.

Author's Note: The poem's syllable line count follows the Fibonacci sequence numbers 1, 1, 2, 3, 5, 8, 13, 21 forward and backwards.

Dan May

Ice Floe at Pactola

Brittle creaking – sound first the sign of
this ice floe's rapid creep onto the shore at Deadwood Point.
A dim sizzling music like static.

Delicate eggshell edge folds onto and falls into itself,
reticulating into diamond cracks and shards.
The center defiantly thick, hemostatic beneath a stone deluge.

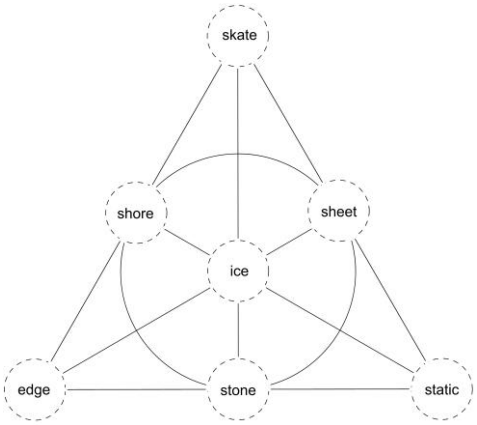
Velocity requires an origin. Edged out and
excised, from opposing manufactured shore, glacial berg
set to skates by the cold winds of early April

from October's antipode. A frigid flagstone reminder
of hiding under the sheets during autumnal anxieties, shoring against
the winter that looms somehow yet again.

Iceberg's crunchy peninsula pinball, some frozen
force of semi-fluid dynamics rakes this rink,
more broken more than melted, over jagged stones and skate bones.

Spruce shadows lengthen –
the haphazard ricochet has skated the sheet
into the arms of a narrow cove, hugging close as an overbearing
parent. Now static, dappled sunrays thaw inward.

Continentally vast from eye level, the vantage
of the slithering highway above Pactola reveals
my dwindling sheet dwarfed by edgier and unyielding
quarter-lake arctic masses of immobile ice.



Author's Note: The poem *Ice Floe at Pactola* is structured by the Fano plane, which is represented by the figure to the left. Each of the poem's seven repeated words corresponds to one of the seven points of the Fano plane. The seven stanzas correspond to the seven lines of the Fano plane: the three sides of the triangle, the three altitudes, and the inscribed circle. According to the geometry of the Fano plane, any two of the repeated words appear together in exactly one stanza, and any two stanzas share exactly one of the words between them. More information may be found in: *Galaxies Containing Infinite Worlds: Poetry from Finite Projective Planes*, by D. May & C. H. Wika, Proceedings of Bridges Baltimore, 259-266, 2015. http://archive.bridgesmathart.org/2015/bridges2015-259.html

Deanna Nikaido

Deanna Nikaido is the author of two collections of poetry, *Voice Like Water* (Word of Mouth Press, 2009) and *Vibrating With Silence* (Writer's Lair Books, 2007), and co-author with Kwame Alexander and Mary Rand Hess of the children's book *Animal Ark: Celebrating Our Wild World in Poetry and Pictures,* published by National Geographic in 2017. Her work garnered her writing fellowships in Tuscany, Italy in 2010, and Bahia, Brazil in 2012. She has served as regional coordinator in the state of Maryland for "Poetry Out Loud," a national poetry recitation contest. Deanna holds a degree in Illustration from the Art Center College of Design, Pasadena, California. Currently, she is a Jin Shin Jyutsu (a Japanese healing art) practitioner in Baltimore, MD, and is working on a children's novel-in-verse. Please visit her website for more info: www.deannanikaido.com

Flower of Life

On its own a circle is continuous.
Overlap it with others and it becomes fertile;
each center on the circumference of others
like cells beginning life.

Until I actually drew enough circles on paper
I could not see the pattern,
nor where the eye was taking me.

Some say,
if you look back far enough
you can trace it to nothing;
you can connect it to everything
like the heart whose sacred shape
turns everything it touches into love.

Deanna Nikaido

Ratio

They say there are two sides to everything.

In math a way to compare--and yet
small targets are no match
for the heavy wound of words
or loss of any kind.
Tears are incalculable.

Perhaps the invisible colon
balancing *this* living
is time itself
and our relationship to it
is based on some previous agreement
made long before the constellations aligned
whispering the equations we were meant to be.

I can't say for certain
though I've found that one
seemingly insignificant glance
or brief exchange of words
can change an entire day.
Reveal something hidden.
Tip your life.

Stephanie Strickland

Stephanie Strickland's eight volumes of poetry include *Dragon Logic* and *True North*, both of which feature mathematical poems. She has also published eleven digital poems. *Zone : Zero*, book and CD, includes the poem *slippingglimpse* which maps text to Atlantic wave patterns. In the poetry generator, *Sea and Spar Between*, Atlantic shore is left behind. The poem stanzas are mapped to the surface of a torus, and there is no way to "fall off" or "leave" this ocean. Recent digital poems include *House of Trust* with Ian Hatcher and *Hours of the Night* with M.D. Coverley. Two books are forthcoming in 2019: *Ringing the Changes,* a code-generated project for print based on the ancient art of bell-ringing, from Counterpath Press, and *How the Universe Is Made: Poems New & Selected* from Ahsahta Press. http://stephaniestrickland.com

Mathematics: Galois

Evariste Galois,
mathematical theorist, 1811-1832
S. Galois, name taken by Simone Weil,
writing in *Révolution prolétarienne*

You write of him
as exemplary and stunning,
how he oriented to a mysterious

contradiction—well, I'm tired
of contradiction, tired of riddling,
Simone. No wonder

you wanted to be free
from compulsion: your own,
almost intolerable. Still,

Galois did orient toward
the inconceivable—he, a boy
dead in a duel. And you say

until it's done, good only seems
impossible. Then, when it was,
just see what he had: a field

of roots, of prime
power and identity—in groups,
kernels of a new realm.

Stephanie Strickland

To Gödel

and to his *Abundance* Theorem

particular thanks for showing Rule-governed systems are
richer than even
can be described or defined, exhaustively at one
time, so always

nougats to be made that can't
be toothed—or dis-toothed—*within* the Rule

but that will be stickily true, nonetheless;
a caution
one would think on attempts to pre-empt
tasty discussions, especially ones—like ours—self-

enunciations; a caution against
attempts to represent *entirety*, descending from there

to q.e.d., as if
one were handling truffles
or trifles, in some counter-
game; as if corruption

and abundance itself weren't, are, *is* the same . . .

Amy Uyematsu

Amy Uyematsu, who taught high-school math for 32 years, is a sansei (third-generation Japanese American) from Los Angeles. Amy's poems consider the intersection of politics, mathematics, spirituality, and the natural world. She has published five poetry volumes: *30 Miles from J-Town* (Story Line Press, 1992), *Nights of Fire, Nights of Rain* (Story Line Press, 1998), *Stone Bow Prayer* (Copper Canyon Press, 2005), *The Yellow Door* (Red Hen Press, 2015) and *Basic Vocabulary* (Red Hen Press, 2016). Amy is the recipient of the 1992 Nicholas Roerich Poetry Prize. Her work is featured in many journals, anthologies, and blogs, including "Poetry Outloud," a national program to promote poetry in American high schools. Prior to teaching mathematics, Amy was active in Asian American Studies at UCLA, and in 1971 she coedited the anthology *Roots: An Asian American Reader.* http://www.poetryfoundation.org/bio/amy-uyematsu

It Isn't Coincidence

Am I the only one who sees the number 108
everywhere these days? At the tribal casino,
a penny slot machine with Chinese dragons
where I can bet 108 cents. Or last month's
World Series, where it took the Chicago Cubs
108 years to win again.

Like any good researcher, I've Googled
to learn it's not only auspicious, but divine,
in many religions. Buddhists and Taoists
hold malas with 108 prayer beads.
Hindus have 108 deities, even 108 energy lines
uniting to form the heart chakra.

In astronomy, the sun's diameter is
about 108 times the earth's. And in nature,
math, and art, it's used in the formula
for the golden ratio – so pleasing
whether in Da Vinci's *Mona Lisa* or
spiraling sea shells and pine cones.

My husband thinks I'm too superstitious,
but I was born on the eighteenth
(18 x 6 = 108), and my 90-year-old mother,
who's one of the luckiest women I know,
just moved into a retirement home,
her apartment unit, a perfect #108.

Amy Uyematsu

when computing the math of nothing

Nothing has its own mathematics.

Terry Wolverton

1
in 2010 I was preparing myself
breast cancer surgery

life assessment – good
ready to accept the worst

it's 7 years later
no longer so sure

2
hurricanes and earthquakes
more and more we live in this
constant state of emergency

survivors on the news
with nothing but gratitude
for still being here

3
if buddha says
nothing is permanent,

does that include
nothingness itself

and a mystery
with no end

4
at school we equate nothing
with the number 0

we learn it's impossible
to divide by 0

but nothing resides
in every single calculation

5
remember shakespeare
wrote of "a wild of nothing"

wild, so perfect
for the irrepressible now

6
take a chance
you got nothin' to lose

hold up
what's the catch

7
obliterate
as in nuclear bomb

we will *destroy* you
warns the president
of the biggest arsenal

the smaller side
says it's *inevitable*
they will strike back

what's the calculus of nothing
when the target is you
no, the target is us

annihilate
as in man's self-destruction

8
in physics
the notion
of nothing
is filled
with
limitless

energy
and motion

solar
gravitational
mechanical
sound
atomic
spiritual
consciousness

going
going
gone?

9
no such thing
as a blank canvas

or a poem that comes
from nowhere

the little I know
is merely a nudge

inside out
inside in

10
the older I get
the more

I'm attracted to
infinite possibilities

the closer I come
to my own final

breath, nothing keeps
calling me home

Acknowledgments

The editor gratefully acknowledges permissions to reprint from authors, translators, artists, publishers, universities and magazine editors, as follows:

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Robin Chapman: “High School,” first published in *Beloit Poetry Journal*, 1988, and “The Traveling Salesman Problem is NP-Difficult,” first published in *Images of a Complex World: The Art and Poetry of Chaos* by Robin Chapman and Julien Clinton Sprott (World Scientific Publishing, 2005), reprinted by permission of the author.

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Carol Dorf: “Gravity,” first published in *Beltway,* 2012*,* “The Persistence of Objects,” first published in *Sin Fronteras*, 2015, “Announce the Hour You Have Clocks For,” first published in *Maintenant*, 2013, all three poems from *Theory Headed Dragon* by Carol Dorf (Finishing Line Press, 2016), and “In the Domain,” reprinted by permission of the author.

Sarah Glaz: “Like a Mathematical Proof,” “The First Negative” and “Luminy Light,” all three poems from *Ode to Numbers* by Sarah Glaz (Antrim House, 2017), and “What’s in a Name,” reprinted by permission of the author.

Emily Grosholz: Fragment from “Poems Overheard at a Conference on Relativity Theory,” first published in the anthology, *Verse & Universe* (Milkweed Editions, 1998), reprinted by permission of the author. “Astronomy,” first published in *PN Reviews*, “The Dissolution of the Rainbow,” first published in *The Kenyon Review*, and “The Ratio of Green,” from *Shores and Headlands* by Emily Grosholz (Princeton University Press, 1988), all three poems from *The Stars of Earth, New and Selected Poems* @ by Emily Grosholz (World Galaxy Press, 2017), reprinted by permission of Able Muse Press and the author.

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Lisa Lajeunesse: “Poetry Puzzle: *The Guarded Heart*,” “Wanted,” “An Equation for Love,” and “Autopsy of John “Jack” Hornby,” first appearances in print by permission of the author.

Lawrence Mark Lesser: “Diameter,” first published in *Texas Mathematics Teacher*, Winter 2017/2018; “Cantor’s Ternary Palindrome” and “Forebear Square,” first published in Maslanka’s blog *Mathematical Poetry*, 2017; reprinted by permission of the author.

Marco Lucchesi: “First Test,” “Garden Beds,” “Eros,” and “Fractal Soliloquy,” from *Hinos Matemáticos* [*Mathematical Hymns*] by Marco Lucchesi (Dragão, 2015) translated by Renato Rezende, reprinted by permission of the author.

Alice Major: “Algorithmic Compressibility,” from *Time Travels Light* (Rowan Books, 1992), “Zero Divided by Zero,” from *Welcome to the Anthropocene* (University of Alberta Press, 2018), “Double Helix,” and “Hundreds-and-Thousands*,”* reprinted by permission of the author.

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Mike Naylor: “Craft Project” and “Inversive Geometry – A Love Poem,” reprinted by permission of the author.

Deanna Nikaido: “Flower of Life” and “Ratio,” reprinted by permission of the author.

Osmo Pekonen: “Descartes” by Eeva-Liisa Manner, Finnish original and English translation by Osmo Pekonen; and “The Bridges of Königsberg” by Lars Gustafsson, Swedish original and English translation by Osmo Pekonen and Johan Carl-Erik Stén, reprinted by permission of Osmo Pekonen.

Tom Petsinis: **“**Proof by Contradiction,”“Binary,”“The Ruler,” and “Circling the Square,” from *Naming the Number* by Tom Petsinis (Penguin Books, Melbourne, 1998), reprinted by permission of the author.

Eveline Pye: “Imaginary Numbers,” first published in *Litro*, 2014, “Black Swan” and “Scaffolding,” first published in *Significance*, 2011, and “The Law of Statistics,” first published in *Talking Writing*, 2016; reprinted by permission of the author.

Rodrigo de Almeida Siqueira: “Lyapunov Exponent,” image accompanying the poem “Fractal Soliloquy” by Marco Lucchesi, used by permission of the artist.

Stephanie Strickland: “To Gödel,” from *Zone : Zero* by Stephanie Strickland (Ahsahta Press, 2008), and “Mathematics: Galois,” from *The Red Virgin: A Poem of Simone Weil* by Stephanie Strickland (The University of Wisconsin Press, 1993), reprinted by permission of the author.

Amy Uyematsu**:** “It Isn’t Coincidence” and “when computing the math of nothing,” reprinted by permission of the author.

For interested readers, additional collections of poems with strong links to mathematics

Bridges 2016 Poetry Anthology, Sarah Glaz (editor), Tessellations Publishing, Phoenix, AZ, 2016.

Bridges 2014 Virtual Poetry Reading, Sarah Glaz (editor), Mike Naylor (host), Steve Stamps (video editor), http://bridgesmathart.org/past-conferences/bridges-2014/2014-poetry-day/, 2014.

Bridges 2013 Poetry Anthology, Sarah Glaz (editor), Tessellations Publishing, Phoenix, AZ, 2013.

Strange Attractors: Poems of Love and Mathematics, Sarah Glaz & JoAnne Growney (editors), CRC Press/ A K Peters, Wellesley, MA, 2008.

Numbers and Faces: A Collection of Poems with Mathematical Imagery, JoAnne Growney (editor), Humanistic Mathematics Network, Claremont, CA, 2001.

Verse & Universe: Poems About Science and Mathematics, Kurt Brown (editor), Milkweed Editions, Minneapolis, MN, 1998.

Songs from Unsung Worlds: Science in Poetry, Bonnie Bilyeu Gordon (editor), Birkhäuser, Boston, MA, 1985.

Against Infinity: An Anthology of Contemporary Mathematical Poetry, Ernest Robson and Jet Wimp (editors), Primary Press, Parker Ford, PA, 1979.

Imagination's Other Place: Poems of Science and Mathematics, Helen Plotz (editor), Thomas Y. Crowell, New York, NY, 1955.

Songs of Science: An Anthology, Virginia Shortridge (editor), Marshall Jones Co., Boston, MA, 1930.