

***Mathematics, Music, Art, Architecture,  
Education, Culture***

**Bridges 2020 Poetry Anthology**

**Celebrating 10 years of poetry readings at Bridges!**

**Helsinki and Espoo,  
Linz, Stockholm, Waterloo, Jyväskylä, Baltimore, Seoul,  
Enschede, Towson, Coimbra**



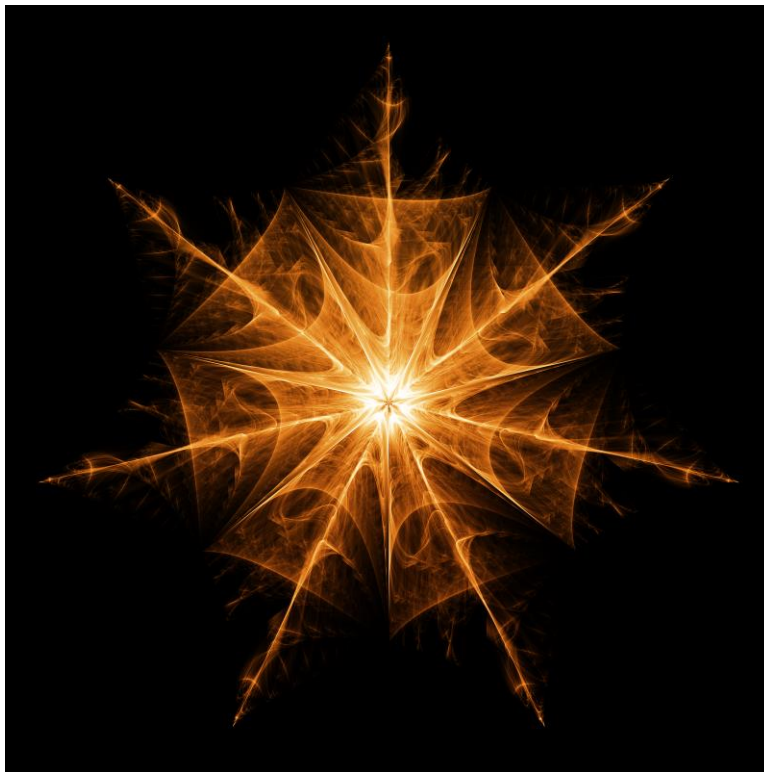
**2011 – 2020**



# Bridges 2020 Poetry Anthology

**Celebrating 10 years of poetry readings at Bridges!**

**Helsinki and Espoo, Linz, Stockholm, Waterloo, Jyväskylä, Baltimore,  
Seoul, Enschede, Towson, Coimbra**



**A collection of poems with strong links to mathematics  
by the poets featured at Bridges 2011 – 2020 poetry readings**

**Sarah Glaz, Editor**



**Tessellations Publishing  
Phoenix, Arizona**

Editor: Sarah Glaz  
Department of Mathematics  
The University of Connecticut  
Storrs, Connecticut 06269  
Sarah.Glaz@uconn.edu

Bridges 2020 Poetry Anthology (<http://www.bridgesmathart.org>). All rights reserved. General permission is granted to the public for non-commercial reproduction, in limited quantities, of individual poems and art work, provided authorization is obtained from individual authors, artists, or translators and a complete reference is given for the source. All work within is used by permission of individual publishers, authors, artists, or translators. All copyrights and responsibilities for individual work in the Bridges 2020 Poetry Anthology remains under the control of the original authors, artists, or translators.

ISBN: 978-1-938664-34-2

Published by Tessellations Publishing, Phoenix, Arizona, USA  
© 2020 Tessellations

Printed in the United States of America

Cover Design: Kerry Mitchell  
Title Page Image: "Shield 1" by Kerry Mitchell ([www.kerrymitchellart.com](http://www.kerrymitchellart.com))

## Preface

Due to the COVID-19 pandemic the Bridges organization was not able to hold the Bridges Conference planned for Aalto University in August 2020. The mathematical poetry reading that was scheduled to be held on Sunday, August 2 became virtual. Selected videos of poets reading their work are linked from the Bridges 2020 Mathematical Poetry site:

[https://www2.math.uconn.edu/~glaz/Mathematical\\_Poetry\\_at\\_Bridges/Bridges\\_2020/The-program-and-the-poets-2020.html](https://www2.math.uconn.edu/~glaz/Mathematical_Poetry_at_Bridges/Bridges_2020/The-program-and-the-poets-2020.html)

We hope that you enjoy the virtual reading as much as you would if we were all there in person.

The present poetry anthology was completed before the outbreak of the pandemic. The introduction to this volume, which we decided to leave unchanged, reflects the joy we all had in getting together at the annual Bridges conferences every year — a joy we wish to remember, and one we hope will return at future Bridges conferences.

Stay well! Stay positive! Let the poems in this volume light up your life!



# Bridges 2020 Poetry Anthology

Sarah Glaz, Editor

## Contents

<i>Introduction</i>	ix
<b>Poems</b>	
<b>by Bridges Aalto Featured Poets</b>	
<b>Tatiana Bonch-Osmolovskaya</b>	
On the Unchangeability of the Paths of the Planets	3
The Girl from Arcadia	5
<b>Robin Chapman</b>	
Mary Laycock	7
The Route to Chaos	8
with <i>Routes to Chaos</i> by <b>Julien Clinton Sprott</b>	
Nonlinear Functions	9
with <i>Dynamical Systems</i> by <b>Julien Clinton Sprott</b>	
Distance, Rate, Time	10
<b>Marian Christie</b>	
Lightcone	11
Autumn Sunrise	12
Earth Geometry	13
Degrees of Freedom	14
<b>Carol Dorf</b>	
I Forgot the Turnkey to the Void	15
Afterwards, the House	16
Winter	16
Ask for a universe and what do you get?	17
The Geometry of Distraction	18
<b>Susan Gerofsky</b>	
Legato Gelato	19
No Man My Time	21
Wings Over Dry Land	21
<i>from</i> Kepler: A “Renaissance Folk Play” in Verse	22

<b>Sarah Glaz</b>	
Between the Lines	23
Fall	24
The Mathematician’s December	25
On the way to New Jersey in winter of 2000,	26
<b>Emily Grosholz</b>	
Stargazing	27
Measuring Andromeda	28
The Alliance	29
The Backstory of the Echinacea Project	30
<b>Gizem Karaali</b>	
hope’s misery	31
Trypanophobia	32
The Bread Crumbs of Proof	33
A Mother’s Math Is Never Done	34
<b>Lisa Lajeunesse</b>	
How Taylor Series Can Resonate on a First Date	35
Ode to Polynomials	36
Nine Is a Poem	37
Fatal Flaw	38
<b>Marco Lucchesi</b>	
Reading Hadamard	39
Spiral	40
Nascita di Venere	41
Math Again	42
<b>Alice Major</b>	
<i>from</i> The Set of All Gods	43
The God of Prime Numbers	
The God of Symmetry	
The God of Infinities	
The God of Probabilities	
Union Through Projection	44
Rectangularization of the Morbidity Curve	45
The Movers’ Dilemma	46
<b>Mike Naylor</b>	
Singularity	47
Entirely Nothing	48
<b>Eveline Pye</b>	
Dust to Dust	49
Chingola Tankhouse	50
Cladh Hallan, South Uist	51
Marriage	52



<b>Stephanie Strickland</b>	
2 Integers	53
Presto! How the Universe Is Made	54
SO it comes in the fullness of mind and it came to	55
Distaff Tech	56
<b>Ursula Whitcher</b>	
Tuesday	57
Confidence Interval	58
Difference Equations	59
K-Theory	60
<b>Poems</b>	
<b>by Past Bridges Conferences Featured Poets</b>	
<b>Mike Bartholomew-Biggs</b>	
Two poems from <i>Poems in the Case</i>	
Digital Alarm 1999	63
Before I proved the theorem ...	64
<b>Marion Deutsche Cohen</b>	
The Deterioration of the Theorem	65
Memoirs of a High-School Math-Brain	66
<b>JoAnne Growney</b>	
Love Mathematics!	67
Baker's Dozen	68
<b>Philip Holmes</b>	
A Maze of Lines	69
Bookshelves	70
<b>Lawrence Mark Lesser</b>	
DI/VISION	71
Worry Lines	72
Systematic Sample from a Children's Song	72
<b>Kaz Maslanka</b>	
10,000 Dharmas Return	73
Dog Dream	74
<b>Daniel May</b>	
Glide: A Cross Country Skiing Cadae	75
An FTA Poem for the End of the Semester	76
<b>Iggy McGovern</b>	
The Mathematical Barman	77
Algebra	78

<b>Deanna Nikaido</b>	
Six Made Me Certain	79
Arcing with My Father	80
<b>Tom Petsinis</b>	
<i>from: Euler's Vision</i>	81
<b>Amy Uyematsu</b>	
Countdown	83
<i>from: Praise for the Irrational</i>	84
<b>Poems</b>	
<b>of Response and Collaboration</b>	
<b>Ekphrastic Poems</b>	
<sup>6</sup> MAZE by <b>Tatiana Bonch-Osmolovskaya</b>	87
responding to <i>CR 163</i> by <b>John Hiigli</b>	
<i>Two Bridges</i> by <b>Sarah Glaz</b>	88
responding to <i>Tray of Love</i> by <b>Reza Sarhangi</b>	
<i>The Disposition of Art</i> by <b>JoAnne Growney</b>	89
responding to <i>An Outgrabed Mome Rath</i> by <b>Allen Hirsh</b>	
<i>Labyrinth</i> by <b>Amy Uyematsu</b>	90
responding to <i>Knots?</i> by <b>Robert Bosch</b>	
<i>Even a Moon Crater Bears His Name</i> by <b>Amy Uyematsu</b>	91
responding to <i>Buzjani's Heptagon</i> by <b>Robert Fathauer and Reza Sarhangi</b>	
<b>Companion Poem</b>	
<i>The Natural Numbers, Base Ten: Finitude</i> by <b>Emily Grosholz</b>	92
with <i>Fractal Tree No. 10</i> by <b>Robert Fathauer</b>	
<b>Puzzle Poems</b>	
<i>Instructions</i> by <b>Lisa Lajeunesse</b>	93
<i>from The God of Teapots</i> by <b>Alice Major</b>	93
encoded in a Latin Square puzzle by <b>Lisa Lajeunesse</b>	
<i>Daughter</i> by <b>Daniel May</b>	94
encoded in a Latin Square puzzle by <b>Lisa Lajeunesse</b>	
<i>the poem of the night</i> by <b>Gizem Karaali</b>	94
encoded in a Latin Square puzzle by <b>Lisa Lajeunesse</b>	
<b>CentO Poems</b>	
<i>2017 Bridges Cento</i> by <b>JoAnne Growney</b>	95
with lines by the Bridges 2017 featured poets	
<i>Celebrating Dissertations</i> by <b>JoAnne Growney</b>	96
including words from the titles of <b>Sarah Glaz's</b> and <b>Gizem Karaali's</b> dissertations	
<i>About the Artists</i>	97
<i>Acknowledgments</i>	99
<i>Mathematical Poetry Collections</i>	102
<i>Bridges Poetry Links</i>	102

# 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 2020 Poetry Anthology! This year's conference marks the 10<sup>th</sup> year anniversary of poetry readings at Bridges and we celebrate this milestone with a festive reading and a special anthology.

Held at Aalto University in Helsinki and Espoo, Finland, Bridges 2020 promises to be 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 ten 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 becomes larger with every passing year. It is a pleasure to be part of the vibrant and creative community at Bridges, and to watch it grow.

The present volume is the fourth poetry anthology that has grown out of the Bridges poetry readings. 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 organize 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. In addition to many poems originally written in English from Anglophone countries around the world, Bridges poems also include poems translated into English from many other languages. 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 and universities 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, editors, and poets; primary and secondary school teachers, and more.

This volume is organized in three sections, two of which follow the format of the previous anthologies and the third, a special feature of this anniversary volume. The first section contains poems written by the poets invited to read at Bridges 2020. An unprecedented number of prominent poets

accepted my invitation to join us at this festive and celebratory reading and contribute their work to the anthology. The proximity of Norway, Scotland and England brings with it the exciting mathematical poetry of Mike Naylor, Eveline Pye, and Marian Christie. Joining them at the reading from further away, and represented on these pages, is the equally exciting work of Tatiana Bonch-Osmolovskaya (coming from Australia); Marco Lucchesi (Brazil); Susan Gerofsky, Lisa Lajeunesse, and Alice Major (Canada); and from the U.S., Robin Chapman, Carol Dorf, Emily Grosholz, Gizem Karaali, Stephanie Strickland, Ursula Whitcher and myself. Also in this section, appears the art of Julien Clinton Sprott, which accompanies Robin Chapman's poems.

The second section is devoted to work by poets who read at previous Bridges conferences but could not participate this year. They join the celebration in print: in this section of the anthology are samples of the lovely mathematical poetry of past Bridges poets: Mike Bartholomew-Biggs, Marion Deutsche Cohen, JoAnne Grownney, Philip Holmes, Larry Lesser, Kaz Maslanka, Daniel May, Iggy McGovern, Deanna Nikaido, Tom Petsinis and Amy Uyematsu.

The third section includes a selection of poems that arose out of the Bridges community. The Bridges poets inspire and support each other's craft in many direct or indirect ways, from the boost in creativity resulting from having our work appreciated by others to sharing techniques at workshops. In addition, the visual art surrounding us at every Bridges conference lends its own artistic influence on our poems. This section brings a small sample of poems of collaboration and response among Bridges poets and artists. It contains ekphrastic poetry by Tatiana Bonch-Osmolovskaya responding to art by John Hiigli; Sarah Glaz responding to art by Reza Sarhangi; JoAnne Grownney responding to art by Allen Hirsh; and Amy Uyematsu responding to art by Robert Bosch, Reza Sarhangi and Robert Fathauer; as well as a companion pair from a collaborative publication: a poem by Emily Grosholz with an art piece by Robert Fathauer. It also contains poems by Alice Major, Daniel May, and Gizem Karaali encoded in Latin Square puzzles by Lisa Lajeunesse; and Cento poems by JoAnne Grownney, weaving lines authored by the poets featured at Bridges 2017, or musical math words from dissertation titles of female mathematicians. This section is dedicated to the memory of Reza Sarhangi (1952 – 2016), founding president of the Bridges organization, whose generous spirit gathered around him a group of diverse individuals who share an interest in mathematical art and made us into the community we are today.

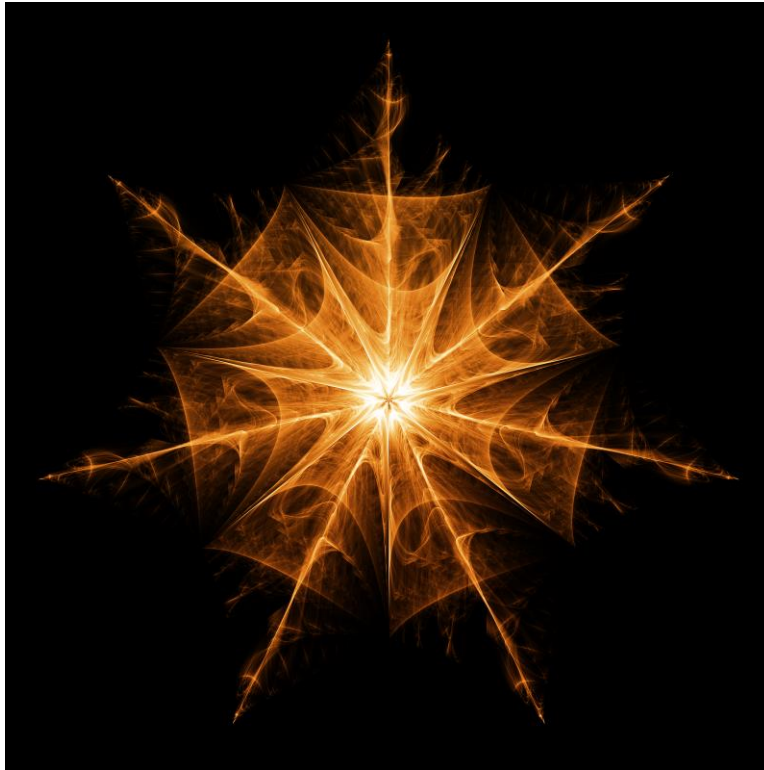
Complementing the information about the poets and the artists found on these pages, and linked from the Bridges 2020 Poetry Reading site, is a new webpage "Bridges Poets' News." It features the latest poetry-related publications, honors, and activities of the Bridges community. URLs for the sites of the Bridges poetry readings, anthologies, and poets' news appear on the last page of this volume.

I am indebted to the poets and artists whose poems and images appear here for their work. In particular, thanks to Kerry Mitchell for the celebratory image appearing on the title pages of this volume. I thank all contributors for patiently going over parts of the anthology and making good suggestions for improvements. Particular thanks for gracious help with some aspects of this anthology to Alice Major, Emily Grosholz, and JoAnne Grownney. 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 Aalto Featured Poets**



**A Mathematical Poetry Reading  
Sunday, August 2, 2020**



# 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, where she earned a Ph.D. in Russian experimental poetry. Tatiana is author of fourteen 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 Publications*, *London Grip*, *POEM*, *Rochford Street Review*, and *Journal of Humanistic Mathematics*. She is a member of the editorial committee of *Articulation* and the board of PEN Moscow, and was guest-editor of a *Symmetry* literary issue. Tatiana organized the *Mathematics and Arts* seminar, the *GolosA Festival of Combinatorial Poetry*, and the *Symmetry Festival Literary Session*.  
<http://antipodes.org.au/en.aboutTatianaBonch.html>

## On the Unchangeability of the Paths of the Planets

having performed numerous measurements  
Aristyllus and Timocharis of Alexandria  
found that some stars keep the same distance  
from each other  
as if they were pinned to specific places  
on a solid sphere rotating above us

in Leo two eastern stars and the stars of Hydra  
lie on one straight line  
in Cancer a star from the southern claw  
remains in the southern claw on a straight line with the other stars

later Hipparchus of Nicaea checked their imperfect data  
and reaffirmed their generally fair conclusions

in Virgo there are two stars between the northern leg of Virgo and  
the right leg of Boötes  
the southern star is of the same brightness with the one on the foot of Boötes  
the northern one shines weakly on the same straight line with its feet  
and between Spica and the second from the end tail star of Hydra  
there are three stars on the same silent straight line

Claudius Ptolemy gathered even more data  
his measurements confirmed  
the conclusions made by Hipparchus of Nicaea

# Tatiana Bonch-Osmolovskaya

for Pisces a star in the mouth of southern Pisces  
and a bright one on the shoulders of Horse and a bright one on his chest  
all lie on the same straight line

the fixed stars keep the same distances from one to another  
the sphere rotates in the east direction of the Zodiac  
keeping the positions of celestial objects more certain  
than an iron rail nailed to a dome

up to our time in their combinations  
there is no altering  
so if someone wishes to check these configurations again  
relating to the celestial globe  
they will find it is now approximately as before  
as measured by Hipparchus

fixed stars always keep  
their positions in relation to one another  
creating invariable figures of rotations on a solid space sphere

configurations comprehended by Ptolemy  
who confirmed the observations of Hipparchus  
who confirmed those of Aristyllus and Timocharis  
are still the same  
anyone who would like for the sake of adherence to the truth  
to perform similar measurements  
correlating the distances between stars  
will see their positions are preserved

after the stars bleach die and crumble into immaterial dust  
they will gather together again from the motherly sprinkle  
into new ones with the same brightness mass size colour as before  
a click — and all heavenly objects will stand on the same rails  
they will move by unchangeable paths established in ancient times  
in the long-gone previous era  
measured by ancient sages Aristyllus and Timocharis  
Hipparchus of Nicaea  
and the greatest of them Ptolemy  
who proved the unchangeability of the paths of the planets  
our path across the stellar globe is destined

*Note:* The poem is in response to Ptolemy's *Almagest*, Chapter 1 of Book 7.



# Tatiana Bonch-Osmolovskaya

## The Girl from Arcadia

before they moved to the celestial sphere  
events took place on the Arcadian mountain Nonacris  
one can clearly see the end of the story and possibly the beginning  
though what occurred between the boundary points is unclear

in the beginning she was a girl  
pretty for sure  
not the ideal perfection  
of the sovereigns of the land  
only they were ideal  
but close enough to attract their attention

they checked the chords of her face  
diagonals of eyebrows tangents of every thin hair  
found her approaching perfection  
as close as possible to imagine for mortals

in this case her fate was determined  
she was considered a duplicate of the female sovereign  
was taken to the temple

her wild relatives thought she would be a concubine  
the savages took it wrong  
indeed with the female sovereign the girl  
doubled arcs and circumferences  
of their exquisite bodies  
in the quadrature of the bed

she learned the goddess proportions  
the division in extreme and mean ratio  
though neither of them was mean or extreme

she was a good learner  
so she was to meet the male sovereign  
in some wild place beyond the temple, in a cave or in a forest

the girl's ideal mistress reflected on her alliance with the master  
their intersection fraught with multiplication of essences  
pushing the girl away from the harmony of perfection  
to the chaos of unrecognisable wild  
a chaotic anima — a bear!

# Tatiana Bonch-Osmolovskaya

maybe it was the sovereign who pushed her away  
maybe she couldn't stand closeness to the ideal  
but she was afraid indeed  
her lines trembled and mingled into chaos  
lost in fog and pandemonium of branches  
actually turning into a bear

this needed correction  
by sharp secant lines  
to stop the ugliness

ideal substances were called for  
dividing chaotic creation into primary elements  
the girl was destroyed

from now on neither order nor chaos  
neither girl nor bear  
nothingness on the earth  
ideal substance freed  
from bodily hassle

though it was said  
unreliably by her wild fellow tribesmen  
the sovereign of the land  
duplicated her image in a brilliant drawing  
and nailed it to the stellar dome  
to remember  
for himself and for everyone on the earth

see in the sky? Some call is Arctos  
some — Ursa Major  
in highland Arcadia some  
still call her pretty Callisto daughter of Lycaon

*Note:* The poem recounts the Greek myth about the transformation of the nymph Callisto, daughter of King Lycaon, into the constellation Ursa Major.

## 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 eleven books of poetry, including, *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), *The Only Home We Know*, and, with physicist J.C. Sprott, *Images*

*of a Complex World: The Art and Poetry of Chaos*. Her mathematical poems have appeared in the *Journal of Humanistic Mathematics*, *The Mathematical Intelligencer*, and the anthology *Strange Attractors*. <http://robinchapmanspoetryandpainting.blogspot.com/>

## Mary Laycock

*Mathematics educator, 1915-2011*

What did she do for us in three years of high school math?  
Let us confer like kids on the playground, rushing now  
to the monkey bars, suspended hand over hand  
between the number lines' equal intervals; or jumping now  
on the merry-go-round that spun its polar co-ordinates  
as we rode the sine and cosine waves of the palominos;  
or piling on the seesaw, learning the tradeoffs of placement  
and weight, the way the strictly-paired angles of plank  
widened and narrowed; or, on the track, how the lever  
of the pole vault's thrust could carry us to new heights,  
or the conversion of our distance and time to rate —  
for it was play that she brought to the room, and trust  
that we could map it onto Euclid, Fourier, and Descartes.

# Robin Chapman

## The Route to Chaos

### *Period Doubling*

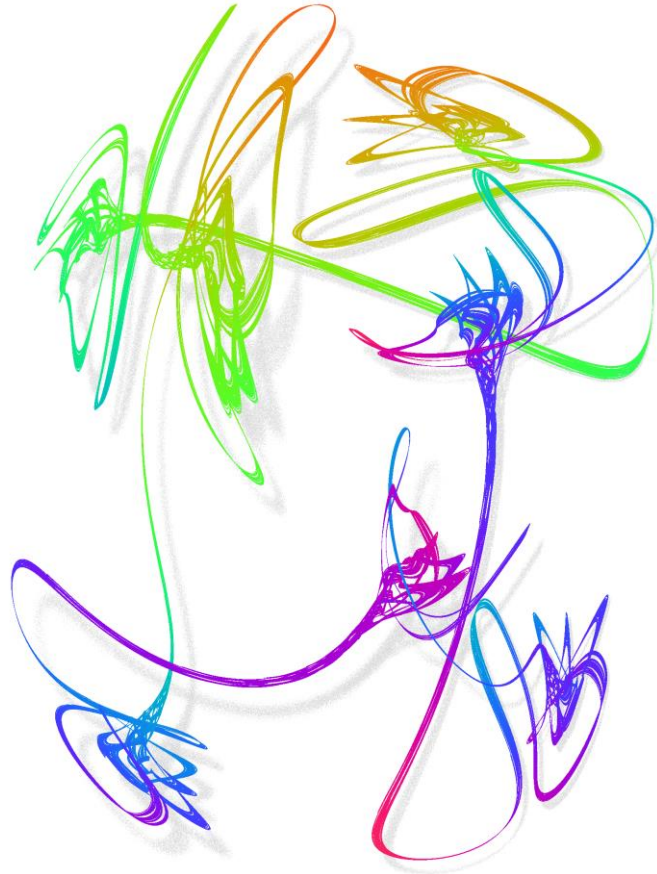
Perhaps, like my uncle,  
you have your ups and downs,  
your good days and bad,  
weeks of excitement  
and weeks of dread,  
years of enlightenment  
and years of lost sleep —  
even, like him, marry again  
every few years.

### *Blue Sky Catastrophe*

This is the day that dawns  
just like any other day,  
out to play with Honeybunch  
and her new kittens,  
run through the sprinkler  
in noon's ninety-five degrees,  
grass prickly under bare feet,  
then in for dinner to find  
your father's gone away  
and won't be back.

### *Sensitive Dependence on Initial Conditions*

You're eight, and no more  
nightly games  
of double solitaire with the dad  
who's vanished now,  
but because you can read  
and the shelves are lined  
with little red leather-bound classics  
in 6-point type, you fall instead  
into the worlds of Dickens and Poe,  
*Treasure Island* and the Brothers Grimm,  
the Swiss Family Robinson  
shipwrecked on that island  
where they all survive.



*Note:* The image "Routes to Chaos" by Julien Clinton Sprott depicts a strange attractor that arises after a sequence of period-doubling bifurcations.

# Robin Chapman

## Nonlinear Functions

*Def. 1: Not a linear function*

A nonlinear life doesn't turn out  
The way you might expect,  
More of the same each year,  
Straight line from birth to death —  
But more like David Copperfield's  
Or Horatio Alger's, the story  
Of any infant  
Where a look or word  
Made all the difference  
In who they became today.

*Def. 2: One in which  
 $f(x+y)$  does not equal  $f(x) + f(y)$*

This is easily enough understood  
By any child of divorce — Mom's house  
And Dad's house are not the same  
As the house with both Mom and Dad  
before.  
Or think of  $f$  as happiness,  
And know that what they had together  
Is not what they have now, whatever  
The plus or minus sign of once-upon-a  
time.

*Def 3: One in which  
 $f(ax)$  does not equal  $af(x)$*

This one's obvious to poets, mail carriers,  
Preschool teachers — a salary of  $a$  for each  $x$ ,  
Equal pay, is not the same as  $500a$  for the CEO  
And what's left over for the rest of us  $x$ es, even though  
The nation's average annual income would remain  
The same, and some economists would claim  
Measures of average income are perfectly adequate  
In charting progress in the economy's name.



*Note:* The image “Dynamical Systems” by Julien Clinton Sprott depicts the solution set of a nonlinear system of equations.

# Robin Chapman

## Distance, Rate, Time

Going fast  
Down the path,  
Fighting for breath,  
For footing,  
The run becomes

One long pouring  
Of legs, lungs, salt  
Into green, gravel, wind,  
Green legs, gravel lungs,  
Salt wind,

While time,  
Hawk on the updraft,  
Climbs overhead,  
Turning and turning.

# Marian Christie



Marian Christie grew up in what is now Zimbabwe. Drawn to both the arts and the sciences, she wrote poetry from an early age finding inspiration in the southern African landscape. At university she studied applied mathematics and went on to teach mathematics at schools in the Middle East and Scotland. Throughout her teaching career, she sought creative ways to stimulate students' interest and enjoyment in mathematics, particularly through cross-disciplinary projects incorporating the arts and the humanities. Now retired from teaching, she lives in

Southeast England where she has recently completed a master's degree in creative writing. In her poetry she frequently interweaves mathematical imagery with everyday experience, at times explicitly, at times more obliquely. Her work has been published in a number of journals, both online and in print. Website: <https://marianchristiepoetry.net>

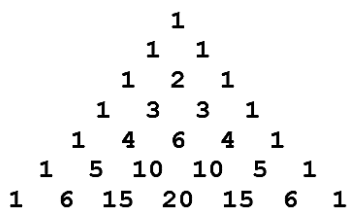
## Lightcone

A point  
    is where we are and when we are. Our past  
joins our future  
    in our present. Two cones meet,  
apex to apex;  
    beyond their bounds are stars  
we cannot see,  
    horizons we will never cross,  
time's regions  
    that are always out of reach. Our hands  
clasp, then let go.  
    What need is there to touch?

# Marian Christie

## Autumn Sunrise

*A Pascal's Triangle poem*



*Note:* Pascal's triangle is a triangular array of the binomial coefficients. The diagram to the left shows Pascal's triangle with rows 0 through 6.



# Marian Christie

## Earth Geometry

*Let us assign the cube to earth. (Plato)*

*In this Muladhara Lotus is the square region of Prthivi. (Purnananda)*

Solid stacking.  
Four triangles  
per plane; six planes.  
Cube. Immobile.

Beautiful as  
lightning, a square  
surrounded by  
eight shining spears.

Shifting plates on  
a spinning sphere;  
magnetized, with  
a molten core.

My mother, toes  
dew-sensuous,  
at dawn among  
her fuchsias.

# Marian Christie

## Degrees of Freedom

Time as reassurance —  
the familiar moon,  
waxing crescent; a child  
in the playground, alone  
with her thoughts, on a swing  
suspended from a cross-  
bar; a pendulum's slow  
pulse. One degree of freedom.

But couple a second pendulum  
to the moving bob  
of the first and  
our careful system starts to  
misbehave disjointed  
as a Charlie Chaplin dance  
hesitates an unexpected  
swivel  
and how we skip rise  
fall  
depends on the smallest  
impetus —  
an email sent in anger a phone call not made a train missed a word left out just one more pint a  
bounding deer a moment of unprotected love too  
busy  
to see the doctor  
and we tumble  
flailing  
in a  
ravine  
while  
on  
a  
swing  
suspended  
from  
the  
moon a child whirls through  
unresisting space.

# 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. For many years, she taught high school mathematics, and has led poetry workshops as a California-Poet-in-the-Schools, at Berkeley City College, and other art venues. She brought her loves together by introducing poetry into the mathematics classroom and by teaching poetry writing to mathematics teachers. Carol has two chapbooks available, *Some Years Ask* (Moria Press) and *Theory Headed Dragon* (Finishing Line Press). Her poetry appears in *Great Weather For Media*, *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/>

## I Forgot the Turnkey to the Void

*for Eileen Tabios*

I forgot the word "permutation"  
and the way it leads to  
an endless dinner party

You said speed measures  
how fast something is travelling  
I asked, "Where are you going?"

You never did drive like a person  
who understands momentum.

A party consists of at least two.  
Who's the guest? Who's the host?

# Carol Dorf

## Afterwards, the House

There                    where  
we greeted            those people  
so many ghosts      come and go

## Winter

You  
imagine happiness  
in solitary structure

Close  
the windows  
observe feeding birds

*Note: Hay(na)ku is a poetry form that can be either syllabic or based on the number of words in a line — in a 1,2,3 or 3,2,1 pattern. The Hay(na)ku form was invented by Eileen Tabios, based on Filipino forms.*

# Carol Dorf

## Ask for a universe and what do you get?

*A Golden Shovel for Beatrice Tinsley*

For a while scientists' proposed loopholes  
crossing the universe, wormholes a technique in  
which to traverse distance to other worlds, this

unpleasant constraint which most reasoning  
holds us to a single solar system or may  
be, just perhaps a transit could exist

to get us to Proxima Centauri but  
travelling 4.25 light years is a big if —  
human tolerance of forces matter — so

most likely our AI will proceed us and they  
will send back slow data just to say *We are  
fine and happy in the primordial*

*reaches of space making the invisible  
visible while we observe expansion — or*  
it is possible we will forget them perhaps

because the heat becomes unbearable or maybe just  
because too close to light we lose night's black.

*Note:* Beatrice Tinsley (1941 – 1981) was an astronomer who made fundamental contributions to our understanding of the evolution of galaxies. *A Golden Shovel* is a poetry form used for writing homage poems. The last words of each line in a Golden Shovel poem are, in order, words from a line or lines from the work of the person in whose honor the poem was written. This form was invented by Terrance Hayes, and was originally used in a tribute to Gwendolyn Brooks.

# Carol Dorf

## The Geometry of Distraction

You may attend a party where strange costumes prevail  
It will take you many hours to devise a way to fit in  
Words will be cinders in the fire: hope, light, water  
You will read smoke and interpret it for your children

It will take you many hours to fit in  
To the geometry of distracted attention  
You will read smoke and interpret it for children  
Who have been chasing each other for hours

The geometry of distracted attention  
You realize this illness is a communal affliction  
Events have been chasing each other for days  
You decide there is no point in organizing them

You realize this restlessness is a communal affliction  
Pouring tea is an unlikely cure but that's what you've got  
You decide there is a point in organizing them  
Night outside. Inside the air is full of smoke

Pouring tea is an unlikely cure but that's what you've got  
You attend a party where strange customs prevail  
Night outside — Inside the air is full of smoke  
You will read it and interpret it for your children

# Susan Gerofsky



Susan Gerofsky, Mathematics Education professor at the University of British Columbia, Canada, brings experience from many fields to mathematics education. Her research is in embodied, multisensory, multimodal mathematics education through the arts, including poetry, dance and movement, film, theatre, gesture and voice. She also works in garden-based environmental education, language and genres of mathematics education, and media theory. She holds degrees in languages and linguistics and mathematics education, and worked for years in film production, adult education, and as a high school teacher. Dr. Gerofsky has studied and taught in England, Brazil, Italy, Germany and Cuba. She speaks several languages, is an active musician, and a published poet and playwright.

She contributed to the award-winning book, *Poetic Inquiry: Enchantment of Place* (Vernon Press, 2017) and has a verse play published in *The Mathematical Intelligencer*.

<https://link.springer.com/article/10.1007/s00283-018-9818-2#citeas>

## Legato Gelato

Adepts pasted sateen  
The palest pastel petals —  
To please those senators asleep to treason

They tended dented sacred cedars  
Dropping a peremptory crusty curtsy  
Sirens applied rinses  
Ochres thicken  
Bruise earth's rubies  
Silver livers sliver  
She poises her burden  
Serves and severs verses,  
As the lifter of fares

The signer may resign  
If we reared a dearer reader  
To browse bowers shaded

"Drink up the latest lattes  
And let Andrew wander,"

to podiums of the senate,  
stapled plates to pleats  
whose elapsed duties suited them too well

that scared cadres had chopped with chesty scythe  
to entrap a curt parent  
to resins  
kitchen chores  
and buries busier hearts  
the risen siren  
of burned posies  
stayed steady  
fears and filters safer trifles.

and the singer reign  
and reread their latent talent  
with bowser's drowsy dreams.

and a macho mocha  
warned the warden;

## Susan Gerofsky

Padres rasped and parsed prayers  
Gobbling sauces for good causes,  
Slump lumps of plums,  
Burning tapers at the dregs of the repast  
To a lewder welder, and a stray artsy satyr,

What care we if the acuter curate flogs golf  
Those are ogres who censor crones  
The clergy enrolls loners  
A priest places the ripest tripes  
Their denial nailed Daniel  
Those saints whose hoarse cry  
In their craven cavern  
Who enters, the nester  
The chaser who would search arches  
Their mimosa Maoism  
Strew straw on warts  
Their manse means our names

Desire resides in eiders,  
Deist diets stanch edits to tides  
Re-echo and cohere  
Sonic icons to scold cold's clods  
And miles of slime,  
We remain marine airmen,  
The penal plane where angels glean angles  
Is a saner snare for he who nears  
They saw ladies' ideals of shoe and hose  
The shale hales, leash heals,

spread drapes, and spared no splendor  
blows upon basting bowls  
sipped rustic citrus  
as a barbed dabber prates on taming mating  
licking the tray of grease, agrees.

and the parson wears aprons?  
ergo, their censers give no salves to slaves  
curses cures with a cruse of *vin Sucre*  
in the easier aeries, attracting a stripe of sprite  
alined to organ's groans.  
stains satins ashore  
drawn by the allure of laurel;  
quick to resent tenses times?  
repels lepers, erase saree  
that scares a simple caress.  
and nurse the secret runes —  
will mingle mares' manes with amens.

greet egrets with sharp harps  
sited on beaches where a snatch of chants  
to the horses on lonely shores  
scions of coins  
sour limes to bring a smile.  
allied with he who utters truest  
in alpen Nepal  
and earns peace's escape;  
as they sailed seaward  
legato gelato, amen.

*Note:* This poem is an *Anglo Saxon alliterative anagrammatic poem* — a poem in blank verse, possessing a caesura near the middle of each line, using devices such as alliteration and kenning, and containing one or more anagrams (words constructed from other words through a permutation of letters) in each line.



# Susan Gerofsky

## No Man My Time

My time belongs to no man  
 Bee longs my thyme man to know  
 Belongs man my time to know  
 Man belongs to know my time  
 Man to know belongs my time  
 To no man my time belongs  
 To know my time man belongs  
 My time to know belongs, man.  
 My time belongs to know man.

## Desert Poem

Wings over dry land  
 Over wings, land dry  
 Over land, wings dry  
 Land over dry wings  
 Land dry over wings  
 Dry land wings over  
 Dry wings land over  
 Wings dry over land —  
 Wings over dry land.

Desert Poem:			
Wings	over	dry	land
Over	wings,	land	dry
Over	land,	wings	dry
Land	over	dry	wings
Land	dry	over	wings
Dry	land	wings	over
Dry	wings	land	over
Wings	dry	over	land
(Wings	over	dry	land.)

*Note:* The two poems above are based on a combinatorial pattern from bell-ringing: the Plain Hunt (in this case, the Plain Hunt on Four, or PH4). An example appears in the diagram to the left: Here PH4 takes a string of four words: wings, over, dry, land, (in bell-ringing, four distinct bells) and swaps them pairwise (first the two outer pairs, then the one inner pair, recursively) to create eight permutations of the  $4!=24$  possible permutations before returning to the initial string. More information about the combinatorics can be found in *Experiencing Group Structure: Observing, Creating and Performing the Plain Hunt on 4 via Music, Poetry, Visual and Culinary Arts*, Susan Gerofsky, Eva Knoll, Tara Taylor and Avalon Campbell-Cousins, Proceedings of Bridges 2018, pp. 659–666.

# Susan Gerofsky

## *from: Kepler: A “Renaissance Folk Play” in Verse*

On an old nag to Regensburg he came  
A fever burning in his eyes, whose flame  
Increasing ever more, sent him to bed  
Where, mute, he'd point his hand, now at his head,  
Now at the sky above him, as to say  
His mind would grasp the heavens, far away  
And quench his fever with the rising sun —  
And maybe he thought of all the work he'd done —  
His Three Laws, and his New Astronomy,  
Ground-breaking work in crystallography  
And optics: works on lenses and refraction  
Camera obscura, telescopic action,  
His championing of haughty Galilei,  
His new star (“Kepler’s Nova” to this day),  
His work on barrels’ volumes, and solution  
To volumes of complex solids of revolution,  
His work on polyhedra, and the key  
To math of variable quantity  
In quasi-integration, which could serve  
To sum the areas beneath a curve.

Through optics, he gave to geometry  
The principle of continuity  
And postulated a point at infinity  
(The basis of projective geometry).  
For stellar calculations, he made clear  
The basis of logarithms of Napier  
And, armed with his new log tables and theory,  
Avoided the toil of calculations dreary.  
He helped to invent machines for calculation  
And started work on differentiation.  
But most, his work on orbits’ physical cause  
Made way for gravitation and Newton’s Laws.

So Kepler, far from friends in a strange town,  
Wearied by illness, laid his body down  
And gave up the ghost. We hope he’s reached the stars.  
His grave was long ago destroyed by wars  
Though we still have his epitaph, this treasure:  
“I measured once the skies, now shadows measure;  
Sky-bound the mind; earth-bound the body rests” —  
Peace to you now, Johannes, in your quest.

*Note:* This poem consists of the concluding verses of the final act of the play, based on the life and times of Kepler, *Kepler: A “Renaissance Folk Play” in Verse*, *The Mathematical Intelligencer* 41, pp 57-66, 2019.

# Sarah Glaz



Sarah Glaz's first poetry collection, *Ode to Numbers* (Antrim House, 2017) was a finalist for both Next Generation Indie Book Awards and Book Excellence Awards. Sarah is Emeritus Professor of Mathematics at the University of Connecticut specializing in the mathematical area of Commutative Ring Theory. 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* (CRC Press, 2008), 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>

## Between the Lines

*Look at the unknown!*

What is the ratio of free time  
to the homology left behind?

At the origin lies a circle  
in its fullness of youth.  
Now only an arc.

Is it worth the effort  
of excavating the little that remained?

*Have you taken into account  
all essential notions involved in the problem?*

*Note:* The lines in italics are from "How to Solve It" by George Pólya (Princeton University Press, 1945)

# Sarah Glaz

## Fall

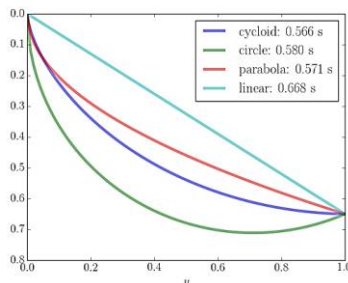
There is always too much  
or too little.

Too much — like floods after torrential rains,  
too little — one dewdrop after a long drought.

But actually today is an exception.

The leaves  
turn golden in the sun  
and the tall tree in our yard,  
whose presence is a menace  
when the winds blow strong,  
watches them fall  
so gently on the lawn  
along the curve  
of least resistance,  
the *brachistochrone* —  
arriving fastest at the grave.

Perhaps my fears  
have voiced their worst  
and now can join  
the moldy vegetation papering the grass  
with brilliant colors  
and whispering:  
*It's only Fall.*



*Note:* The *brachistochrone* (Greek for “shortest time”) is the curve along which a ball will roll from a point A to a point B, which lies below A (but not directly under it), in the shortest time. This curve, an upside-down cycloid, was discovered in 1697 by Johann Bernoulli.

# Sarah Glaz

## The Mathematician's December

I wake to a bare branch  
poking the window pane with a fierce  
  sound.

Logic of air, reason of nothing,  
decibels off logarithmic scales,  
                    the vast December sky lying flat on the ground heavy with snow.

Snow in the air,  
snow on the ground,  
                    whiteness invades every room.

Deceptively airy and light,  
such mixture of primary colors  
                    repels all the warmth.

My heart is filled with anxiety,  
stomach clenched tight as a muscle,  
                    car on slippery road.

Already five inches on the ground and falling.  
This morning the weather turned its head  
                    like Janus, its wild face showing.

I bundle up,  
blow on my fingers,  
                    open my mouth and taste a snow flower.

Sculpted mid-flight by mathematics and chance,  
snow flowers melt  
                    on the tip of my tongue.

Come in for hot chocolate and warm croissant!  
Come in from the cold, glasses steaming,  
                    blind as a bat!

# Sarah Glaz

## On the way to New Jersey in winter of 2000,

I

look

out of

the window

of the slow moving

train to catch the unexpected.

At six a.m., the sun is a young child rising out

of bed with an uncertain smile — awake but still dreaming. Birds perched on surfaces of

water build mirror cities. Between city and city — an expanse of white sand. The sand looks cool and light. Cylindrical containers of

Wyatt Oil Company play hide and seek, in pink. And although I can model the air pollution they emit using a Gaussian Plume equation, I can compute the extent of ground water contamination that may

result from a small breach at a circular tank's base over a given amount of time, and I can estimate the risk to human health, in hypothetical (but likely to occur) emergencies employing a HAZMAT modeling package — I find them beautiful beyond belief. All bathed in morning light, scrubbed pink and clean, powdered, disrobed and Rubenesque.

Behind the farthest one hides a tall crane, its long neck and gangling limbs crisscrossed with black steel patterns like lacy lingerie. On the horizon, against a backdrop of urban sky, shadowy boxes of skyscrapers, and close-by a field of wheat or barley nodding fat whiskered heads heavy with sleep and nourishment. I am preparing my ten o'clock lecture on Coherent Rings. I cast down my eyes to the yellow pad in my lap — moment of inattention taken as offense. The train lets out a shriek, a trumpet screech, a toot, an electronic overture to a triumphal march.

*Note:* The syllable count of the poem's one-line stanzas follows the Fibonacci sequence from 1 to the 12<sup>th</sup> Fibonacci number, 144.

# Emily Grosholz



Emily Grosholz is Edwin Erle Sparks Professor of Philosophy, African American Studies and English at the Pennsylvania State University. She grew up outside Philadelphia, and went to the University of Chicago and then to Yale University. She has worked and lived abroad in England, France, Germany, Greece and Italy, and traveled in Scandinavia, Russia, Japan, Spain and Portugal, Israel, Costa Rica and Argentina. She has written eight books of poetry, including *The Stars of Earth: New and Selected Poems* ( Word Galaxy Press, 2017); collaborated on three volumes of poetry translations; and has written or edited eleven philosophical books, including *Starry Reckoning: Reference and Analysis in Mathematics and Cosmology* (Springer, 2016), which won the 2017 Fernando Gil International Prize for Philosophy of Science, and *Great Circles: The Transits of Mathematics and Poetry* (Springer, 2018).

<http://www.emilygrosholz.com/index.html>

## Stargazing

There is the moon, so chaste and cold,  
Waning from full, but beautiful, with runes  
And ruins on its face, with seas and clouds.

And there is Mars, as dark as blood.  
There's the Wain, an asterismic cart  
Bearing its harvest stars across the heart

Of space, and there's the diamond bolt,  
Polaris, constant, motionless, despite  
The provocation of the reeling stars.

# Emily Grosholz

## Measuring Andromeda

When Vera Rubin wrote her Master's Thesis  
In nineteen-fifty-one, she sent her findings  
To the American Astronomical Society,  
And met with little interest or support.

A decade later, she and her graduate students  
Studied the velocities of stars  
Across the outskirts of Andromeda:  
The edges of the galaxy did not  
Move slower, but surprisingly moved just  
As quickly as the inner regions, so  
The stellar curve is flat, does not decrease  
As is expected for Keplerian orbits!

In nineteen-eighty, she reported data  
For twenty-one new galaxies: the smallest,  
Low luminosity, displayed the same  
Lack of Keplerian velocity decrease  
As did the great high-luminosity spirals.

The conclusion is inescapable, she wrote:  
Non-luminous matter must exist beyond  
The optical galaxy. We are compelled  
To posit the existence of dark matter,  
Dark halos with an order of magnitude  
More massive than the visible galaxy.  
Matter we can't see, a new enigma:  
Mathematics leads beyond the realm of sense.

*Note:* Vera Rubin (1928 – 2016) was an American astronomer who carried out pioneering work on galaxy rotation rates.



# Emily Grosholz

## The Alliance

Andrew Wiles' now celebrated proof  
Of what we call Fermat's Last Theorem (was it  
Really his last?) relies on verifying  
The Taniyama-Shimura conjecture, born  
In Japan during the nineteen-fifties: it claims  
That every rational elliptic curve  
Is correlated with a modular form. Frey  
In nineteen-eighty-five made the remarkable,  
Prescient observation that this conjecture,  
If it were true, implies the famous Theorem.  
Wiles proved its truth in one hundred and eight pages  
Using techniques developed earlier, some  
By Wiles himself, and some by Serre and Ribet.

Wiles' fascination with Fermat's Last Theorem  
Began when he was ten years old, and then  
Culminated the morning of September  
Nineteenth, nineteen-ninety-four, after two  
Unsuccessful tries, when he finally put  
The last piece of the puzzle in its place:  
He saw that he could use Iwasawa theory  
To fix that part of the proof where earlier  
The Kolyvagin-Franch approach had failed.

Cavillès would have said, it is a rupture  
And a continuation, innovation  
And yet strict reasoning: how could it be both?  
It is the magical bright dialectic  
Of good mathematics, since inventing new  
Methods or kinds of correlations, even  
Extending older methods in novel ways  
Builds a fine link between necessity  
And the surprising unforeseeable.

Fermat could not have proved his own conjecture,  
Yet it inspired the growth of number theory:  
Alliance between necessity and chance,  
Between creation and the cliffs of number  
That climb up one by one and fly away.

# Emily Grosholz

## The Backstory of the Echinacea Project

We needed a model organism first  
To focus our close study of the prairie  
That lies fragmented now and needs restoring  
Around the Mississippi's watershed,  
Along the traces of glacial moraine  
Left ten thousand years ago as lakes  
(Ten thousand lakes!) and evanescent ridges  
That glow and disappear as we drive west:  
St. Paul, St. Cloud, and Alexandria,  
Though not as far as Fargo: all our fields,  
Our prairie remnants, lie within the state.

A model organism? Not a tree.  
A common plant, perennial, and easy  
To recognize as individuals; bright  
Flowers might be nice. The purple coneflower  
Comes right to mind and shoots up on the prairie  
As well as pastures, roadsides, and degraded  
Prairie that we hope to un-degrade.

We got full funding first from NSF  
Who looked on us as filling gaps in knowledge:  
Pure theory. But then Minnesota noted  
The practical usefulness of our research  
And helped us pay a variety of students  
(High school students, undergrads and postdocs)  
To help with field work, and allowed some access  
To state-held land as well as extra funding.  
And so too did the Nature Conservancy  
Who lets us use some of the land they manage!

So now we prosper in between the strict  
Arguments that mine our data's meaning  
And clarify its import, and the stories  
We learned while pulling weeds out on the prairie  
Counting magenta flowers and then their seeds,  
Admiring that bright chlorophyllic green,  
The blue of lakes reflected from the sky.

We tell our stories to the Legislature:  
Prairies have a history, like nature,  
Starred with surprising plot-twists, and by hope  
That we can save their fierce diversity  
(Micro and macro) that served people well  
Across ten thousand years, and set a limit  
On our new habits that reduce the plains  
To fields of soy and corn, all from the same  
Poor genome that reduces all the colors  
To inessential red and dollar-green.

Combine the wisdom of the Pleistocene  
With what we learned in the great Neolithic,  
Tending our fields with help from arithmetic  
Calculation and geometry,  
The wonderful Pythagorean Theorem,  
And making up our unforgotten epics  
While hoping for an overview of sky.

# Gizem Karaali



Gizem Karaali is a 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 both *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 NextT 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/>

## hope's misery

see

no

blue jays,

hear no sound,

quiet screams, gaping mouth,

frozen dreams of a ravished mind,

deep within you will find hope's cold axe, eyes shut, hands bound

*Note:* This is a Fibonacci poem — the syllable count of the poem's lines follows the Fibonacci sequence: 1, 1, 2, 3, 5, 8,13

# Gizem Karaali

## Trypanophobia

skinny, shiny they extend;  
look clean and dainty,  
but won't bend.

Into my flesh they will spill  
the flood, flaming hot:  
instant kill.

Invaded and infested,  
borders overrun,  
contested.

With tongue fat, mouth numb,  
I succumb.

*Note:* This is a *Prime 53* poem written following the syllabic and rhyme pattern: 7-5-3 (ABA), 7-5-3 (CDC), 7-5-3 (EFE), 5-3 (GG).

# Gizem Karaali

## The Bread Crumbs of Proof

Lost on the page  
She finds herself  
Pleading again.  
Please. Please.  
Please!

Surely she knows  
The gods won't answer  
The path won't clear  
Without her putting in  
A whole lot more.

The proof won't come  
Till she lays it down  
One crumb at a time,  
One by one,  
Not all in a line.

But in the end  
There will be a path  
From the beginning to the end  
Though she cannot pretend  
To know how it works.

Though she cannot pretend  
To know how it works  
She'll put glorious flowers  
On the unadorned altars  
Of the gods she knows are watching

And she'll be dropping  
And collecting crumbs  
Day and night  
So she may find  
Her way home

So she may call it a proof.

# Gizem Karaali

## A Mother's Math Is Never Done

Beyond dark clouds is the blue sky.  
The day will come to do your math,  
Once you put away the clutter.  
Someday again you know you'll fly.  
Now's not the journey's end, just a detour on the path.  
Only today, hold your breath, for you are a mother.

Today you are the mother.  
Today she reaches for the sky.  
Today your job's to clear her path,  
Today your job's not at all math.  
Today it's not you who will fly,  
So you hold her hand, and stand still amidst the clutter.

You still stand amidst the clutter:  
Is this what it means to mother?  
Where have your wings gone now? Did you really ever fly?  
You cannot hear the wind, or even see the blue sky.  
Today is not a day for math.  
Today math is not your path.

So you want math to be her path.  
You seek patterns in her clutter.  
You know one day she'll just say "Math!"  
She's the daughter of her mother.  
Looking up to the deep night sky,  
She too is dreaming surely of learning how to fly.

She's dreaming of learning to fly,  
Of taking off, charting her path,  
Cutting through a summer eve's sky,  
Numbers left behind, a clutter.  
Who'll clean it up but the mother?  
And who, you ask, will do the math?

Then "I", you say, "will do the math!"  
"Isn't it time for me to fly?"  
Quick, do shake up your wings, mother!  
Math's ready to become your path.  
Leave aside the toys, the clutter.  
It's time again to touch the sky!

So once again math is your path.  
Now you can fly together, leave behind the clutter,  
And reach up to the sky, a daughter and her mother.

# Lisa Lajeunesse



Lisa Lajeunesse is a professor of Mathematics at Capilano University in North Vancouver. As an undergraduate, she studied mathematics and music. Before embarking on graduate studies in mathematics, she worked for ten years with Telesat Canada on the launch and control of Canada's domestic communication satellites. At Capilano University, she has developed and taught courses on the connections between mathematics and the arts to reach out to non-science students, and to express her lifelong passion for creative writing, music and other art forms. During a sabbatical in 2016/2017 she wrote a textbook for these courses, which prompted her to attend Bridges for the first time. Since then, she has adapted popular logic puzzles to encode poetry so that the solving of each puzzle unlocks a poem. A sample of Lisa's poetry may be found at:

<https://lisalajeunessepoetry.wordpress.com/>

## How Taylor Series Can Resonate on a First Date

*for Margaret*

Taylor polynomials were no surprise  
but I marvel how a curve fragment  
the width of an atom  
or a sliver of that  
just enough to measure change  
and the change of change  
and the change of change of change

...

...

can have so much to say about what happens far, far away  
holding faithful, like Blake's grain of sand  
the secrets of its stretch to infinity

Just so  
the moment  
when you looked into my eyes  
and asked  
me some little inconsequential thing  
and I felt the force of you

then I knew  
how my future would unfold

# Lisa Lajeunesse

## Ode to Polynomials

*for Sarah*

Terms

arrayed for battle  
their powers displayed  
on banners  
carried by the worthiest knights

Lines are drawn by sign  
(though shadowy odd powers  
plot to switch sides at zero)

Coefficients,  
puffed up with magnitude,  
swagger forward  
the greatest presumes dominion over all  
as though a handkerchief bestowed  
by a fine lady  
can win the day

The fight is stacked  
for these are ancient adversaries  
still  
a delicate balance of coefficients  
and the curve rises and falls  
as each prevails in turn  
before the anointed  
seizes control

at fourteen  
with graph paper in hand  
like an ant crawling over the surface of calculation  
while a higher self, watched in wonder  
awaiting the next value to turn the tide  
trusting the real numbers  
that sinuous song  
to dance the curve through its changes



# Lisa Lajeunesse

## Nine Is a Poem

One. Mother of numbers. Simple. A beginning.

Two. Complete and whole unto herself. Pristine.  
The call of a loon on a still lake at dawn.

Three. A pleaser. Knows everyone.  
Reaches out to two, but is rebuffed.  
She flits away to find another.

Four. Elegant and a bit grand. If she were music, she would be a minuet.  
Sometimes consorts with two.

Five. Comfortable in her skin, she has two's capacity for introspection, plus three's sociability. She is admitted to the most exclusive of clubs. Five is a very old number and golden. Sometimes, she bursts into soliloquy.

Six. Experienced, level-headed, industrious. She manages everyone's expectations. No number is indifferent to six, for she is a perfect number.

Seven. Inevitably prime. The first mathematician thought up seven, halted in surprise and said "hmm, I suppose there will be more." Many people favour seven; they don't need a reason.

Eight. A perfect cube. Like a prophet, she stretches into and out of new dimensions. She is a palatial estate. The rich and influential, crowd around eight. Deals are sealed in her halls of power.

Nine is the rich story that is never told. Those who worship nine speak to one another in hushed intimate voices. Only the initiated know all the reasons to love nine. She is square; she is bracing; she is complex; she is simple.

Nine is a poem.

# Lisa Lajeunesse

## Fatal Flaw

bruised rare greenhouse flower  
expires —death not waste  
fuels humanity at midnight hour  
evolution’s effect, fragrant earth

fragrant rare hour expires  
waste fuels greenhouse effect  
humanity not evolution’s flower  
bruised earth —death at midnight

1D bruised	3C humanity	4A fragrant	2B waste
3B fuels	1A rare	2C not	4D earth
4C evolution’s	2D —death	1B greenhouse	3A hour
2A expires	4B effect,	3D at midnight	1C flower

*Note:* The poem *Fatal Flaw* can be read from the Graeco-Latin Square beneath it as follows: 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. This completes the first stanza of the poem. For the second stanza, read the words paired with A from top to bottom to form the first line, then read the words paired with B from top to bottom to form the second line, etc. For more information on the poetry form based on Graeco-Latin Squares see: *Graeco-Latin Square Poems*, by Lisa Lajeunesse, Proceedings of Bridges 2019, pp 35–42.

# Marco Lucchesi



Marco Lucchesi, Professor 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 the former editor-in-chief of the ABL journal, *Revista Brasileira*, and the National Library of Brazil poetry magazine, *Poesia Sempre*. His publications include over twenty-five award winning books and numerous works of translation, among others *Novos Poemas Reunidos* [New Collected Poems], *Hinos Matemáticos*

[Mathematical Hymns], 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 Jabuti Prize, the Romanian Latin Prize, the Ministry of Italian Culture Prize, and Alceu Amoroso Lima — a lifetime achievement award in poetry. [https://pt.wikipedia.org/wiki/Marco\\_Lucchesi](https://pt.wikipedia.org/wiki/Marco_Lucchesi)

## Reading Hadamard

Prime numbers are lost {venerable numbers}

when in a forest in the dead of night

under Orpheus's scintillating lyre

they set out to dance, braver and disperse

The imagination

{cloud forest thought}

is the crystalline shortcut of mathematics

*Translated from the Portuguese by Renato Rezende*

*Note: On reading Jacques Hadamard's *The Psychology of Invention in the Mathematical Field* (Dover Publications, 1945), about the role of the imagination in mathematics.*

# Marco Lucchesi

## Spiral

Nightfall      Aurora

Sils Maria

A fast bird

rises up      into the blue



and casts      a light

which fades away

from afar

blue so densely blue

*Translated from the Portuguese by Renato Rezende*

*Note: The Archimedean Spiral in polar coordinates is given by the equation  $R = a\theta$ ; Sils Maria — the location of Nietzsche's summer residence in Switzerland — is an allusion to Nietzsche's idea of eternal return.*

# Marco Lucchesi

## Nascita di Venere

Thy nakedness in rays of piercing light

in dreams decomposed

numbers figures

On the humid apple of thine eye

oh, Αφrodite

I lay my ardour

Body without veil

froth

amazement negation

*Translated from the Portuguese by Renato Rezende*

*Note:* The incomparable beauty of the painting, *Nascita di Venere (The Birth of Venus)* by Sandro Botticelli, in the Galleria degli Uffizi, and the Fibonacci sequence 1, 1, 2, 3, 5, 8, 13, 21, 34....

# Marco Lucchesi

## Math Again

*for Ana Paula Kobe*

No dreams, cloudy and smooth is the sky. Open  
to see the stars beyond the milky way. Idea-  
number. And number-idea. The tenth Hilbert  
problem and the tortoise: rising from the depth.  
Some strange vorticity and solitude. You are  
unique, my beloved. Try Bach's Cantata 147.

\*

Her voice across my pillow. Holding hands into  
the night. You can dream a blue deep well.  
Number six and twenty eight are floating in the  
air. Do not forget our lives. And our flesh and  
heart and bone and soul.

\*

We were both easy prey. In your lost orchard, a  
smell and sign of love. A page of Gödel and  
another of Plato. We must be unfinished, like  
sunshine in the mirror. Your undeniable face.  
Who is supposed to shine during the winter? Take  
my transfinite dream.

\*

Prime numbers: a splash on a wound, a piece of  
the moon. Follow me to the edge of the abyss.  
Without fear, perhaps love. You are a little  
breathless. Empty and forgotten. Behind you an  
ominous horizon. Not sure about the past. No  
certainty. Furstenberg or Novalis. Kiss my lips  
and go forward.

# 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 an honorary doctorate from the University of Alberta and 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. More at: <https://www.alicemajor.com>

## *from* **The Set of All Gods**

### **The God of Prime Numbers**

— trinity, quintic, indivisible seven —  
visits her creation  
often in its early moments

then draws away for ever-lengthening periods

oh, how long must we inhabit  
a dreary world of common factors  
'til her return?

### **The God of Symmetry**

says *fiat lux*

not with a mighty groan of light  
but in a whisper  
that blows the smallest crease  
          cramp crimp  
into perfect equipoise

allows himself to break,  
          a fissure king

### **The God of Infinities**

is wizened, smaller than the space  
between "one-over-n"  
and one gets tinier and tinier  
world without end  
and then

### **The God of Probabilities**

drags up mountains  
of improbability  
with sharp crags  
and granite sides

thereby creating the likely valleys  
where we can cluster comorbid

below the peaks where only she  
may abide

# Alice Major

## Union Through Projection

To change — that was the dream. To touch  
with stone or elixir. Lead burgeoning into gold.  
Souls growing upward.

A home-made kite, cobbled from lumber and string,  
plated with newspaper. How could so clumsy a thing  
ever reach skyward?

But the red king carries it to the cliff-edge park  
and the white queen in her high heels, laughing,  
gallops forward.

The children, puzzled but happy as puppies,  
caper on the chubby legs that soon will lengthen  
to carry them forward.

And for an amazing moment, the kite lifts  
its crazy face into the wind  
tugging skyward.

The children touch the kitchen twine, taut,  
and feel they hold the sky's own tail,  
its yearning upward.

*We have to reach the stars*, he always told them,  
dreaming the human race perfectible  
and racing outward.

The kite collapses in a nose dive to the grass,  
endeavour crumpled. They yelp and laugh and will try again  
to raise it upward.

A line of projection that carries points and angles  
to another plane, the touching geometry  
that bears us onward.



# Alice Major

## Rectangularization of the Morbidity Curve

The demographer's desired geometry:  
a hale old age and then a rapid fall —  
a sudden tumble down a slope of scree  
to that inevitable, oblong box.

And we agree.  
"Oh, that's the way I want to go."  
The unexpected failure of an artery  
from which we never waken. We dread

the lingering morbidities ahead,  
slow occlusions of cognition, bodies  
angled into immobility, diapered,  
and life a sad, sagged line, tethered

to an all-too-distant other end.  
But then I think of you. You said it too:  
"Just put me on an ice floe, send  
me off. I won't want to live."

And yet you did. At no point on that curve  
of long diminishment  
were you prepared to leave,  
to face the cliff. You wanted life until its end.

Then I think of curves — the gull's wing drawn  
from lifting shoulder to the tapered tip  
trailing its final feather into air. A line  
lovelier, perhaps, than that sharp edge

of rock plunging to ocean. How to end  
this? There will be the narrow plot,  
the dug rectangle. Until then  
there will be seagulls wheeling over headland.

# Alice Major

## The Movers' Dilemma

There is a puzzle. It includes  
words like *Pythagoras*, *hypotenuse*.

There is a hallway, papered in pale ferns.  
It comes to a right angle, a hard turn.

Back there, an apartment's open door reveals  
birdsong through windows, elegant pastels.

Ahead, around the corner, wait the sliding arms  
of a metal elevator. Silent. The shaft stands

ready to descend to depths below,  
territory that our hearts dread to know.

At the hall's sharp angle, sticks  
a forced hypotenuse, a sofa. The trick

is how to move it further. On its length  
a girl is curled, saving her fading strength.

The movers' dilemma. We cannot return  
to the bright door behind us, shedding sun.

Nor do we wish to push the bier ahead,  
around the corner, to the corridor's feared end.

And so, we wait, make tea, light candles,  
laugh together in this *pro tempore* triangle.

The calculations of Pythagoras enclose our fortune.  
If the walls were wider, or the sofa shortened,

then the corner would be turned. As it must be  
someday, through pain's implacable geometry.

The girl will shrink a little. With that space let in,  
the walls will soften like a womb, accepting.

And we must pick up grief on aching shoulders  
and move to where the other arms enfold her.

# Mike Naylor



Mike Naylor is a co-director of Matematikkølgen 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 eleven years Mike has presented artwork and poetry at the Bridges conferences. More information on Mike’s projects can be found at his website: <http://mike-naylor.com>

## Singularity

*for Gerd Åsta*

Now.  
It grows.  
Slowly at first.  
I almost don’t notice.  
A smile, an unexpected touch  
That fills me with growing wonder.  
Weightless on my way to meet you,  
Lightness I feel when you enter the room,  
A dizziness floating right to the top of my head.

You fill me with more words than I imagined possible.

And then, just like that, everything begins to collapse.  
Feelings that become so much more than words,  
Words that drop away one by one  
As we draw in, closer, closer,  
Until everything falls away.  
And it is only  
Skin and breath  
And all  
Melts.

# Mike Naylor

## Entirely Nothing

By	By	By	By	_____
keeping	keeping	keeping		_____
the	the	the	the	_____
sections	sections			_____
on	on			
each	each			
end	end	end	end	_____
intact	intact	intact		_____
all	all	all	all	_____
the				
while				
removing				
the				
center				
thirds,				
eventually				
all				
you	you	you	you	_____
will	will	will		_____
have	have	have	have	_____
is	is			
dust	dust			
that	that			
is	is	is	is	_____
really	really	really		_____
nothing	nothing	nothing	nothing	_____

Note: This poem is structured by the technique used to construct the fractal called *Cantor's Dust*.

# 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 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 is a director of the Scottish Writers' Centre. A collection of her poems about Zambia, *Smoke that Thunders*, was published by Mariscat Press in 2015. Her second collection, *STEAM*, containing poems of science, technology, engineering and mathematics, will appear with Red Squirrel in 2021.

<http://onlinelibrary.wiley.com/enhanced/doi/10.1111/j.1740-9713.2011.00510.x>

## Dust to Dust

Alone in a blackboard cube  
infinity of chalk  
no voices  
I would never make up  
a language  
never scrawl  
*I was here* on a wall

but I might draw  
prisoner's tally marks  
shaped like fingers  
discover the number 1  
a system of numeration  
in base 5 or 10  
my body as template

When they open  
my gypsum tomb  
find me laid out  
on a chalk-dust mound  
molded to my form  
what equations  
will they find?

# Eveline Pye

## Chingola Tankhouse

Have you noticed that none of your stickhands  
has any teeth? Well, I'm sure they do  
put a lot of sugar in their tea, but do you not think  
it might be something to do with the job,  
poised above tanks,  
jabbing spaces between cathodes  
while acid fumes hit them in the face?

You're not convinced. Well here it is.  
I can be very scientific when I want to be.

*The control group was matched for age, sex, tribal  
origin and grade within the company. A Mann  
Whitney U-test was carried out and the null hypothesis  
was rejected, resulting in the conclusion  
that the stickhands have significantly fewer teeth  
than the control group. Your attention is drawn  
to the Dental Surgeon's report on page 47:*

THESE MEN HAVE NO TEETH

The management has to pay compensation  
but I get big white wally smiles  
every time I set foot in the tankhouse.

# Eveline Pye

## 13 Cladh Hallan, South Uist

12=2 <sup>2</sup> ×3	Cut in pieces then cut in pieces and lost in a faraway place
11	Two skeletons fashioned from six
10=2×5	Cut in pieces and buried in a bog
9=3 <sup>2</sup>	Lost in a faraway place then cut in pieces
8=2 <sup>3</sup>	Cut in pieces then lost in a faraway place
7	The jaw doesn't fit the skull
6=2×3	Cut in pieces and lost in a faraway place
5	Buried in a bog
4=2 <sup>2</sup>	Cut in pieces then cut in pieces
3	Lost in a faraway place
2	Cut in pieces

*Note:* This poetic form was invented by Carl Andre, American minimalist sculptor and poet. *The Fundamental Theorem of Arithmetic*, also known as the *Theory of Prime Numbers*, is used to construct the poem.

More than 3,000 years ago, in Cladh Hallan, South Uist, an island off the shore of Scotland, mummies were created by placing corpses in a peat bog just long enough to be preserved. DNA analysis showed that the two mummies found there – a male and a female – were actually made from the remains of six people.

# Eveline Pye

## Marriage

*on Charles Rennie Mackintosh and Margaret Macdonald*

Charles, alone at his drawing board  
with a spring bow compass, slide rule,  
set square and spline, constructs  
a precise rendering of Glasgow Cathedral.  
He is a parabola; light enters, reflects  
back to the focus with an eccentricity of one.

Margaret sits with her sister, embroiders  
Gothic myths and Celtic images, weaves  
organic life into flowing fables, draws  
long dream women, unbelievable tresses,  
revels in the asymmetry of *pale spooks*,  
*nightmare distortion* of the human form.

They meet on the threshold between exterior  
and interior, the place where a sine wave  
intersects a straight line, a heather hill glides  
into a blue loch, in the stylistic geometry  
of a rose, bisecting curves drawn inside  
female circles viewed by a male eye.

Hill House: ladder-back chairs stained ebony;  
a sleeping princess in the drawing room;  
repetitive squares inside pink flowers;  
mother of pearl in a black writing desk.  
Hyperbolas, perfect images of synergy,  
two pairs of arms reaching out for infinity.

*Note:* Charles Rennie Mackintosh (1868 – 1928) was a Scottish architect who collaborated with his wife, artist Margaret Macdonald. Her design work became one of the defining features of the ‘Glasgow Style’ in the 1890’s. The Hill House was a joint project in which they created an exquisite interior with specially designed gesso panels, furniture and fittings.



## Stephanie Strickland



Stephanie Strickland's eleven books of poetry include *How the Universe Is Made: Poems New & Selected* (Ahsahta Press, 2019) and *Ringling the Changes* (Counterpath, 2020), a code-generated project for print based on tower-bell ringing. Her twelve collaborative works of digital literature include *Liberty Ring!*; *slippingglimpse*, which maps text to Atlantic wave patterns; the *Vniverse* app for iPad; a poem generator, *Sea and Spar Between*, accompanied by *Duels—Duets*, a poem reflecting on collaborative composition and *cut to fit the toolspun course*, a glossed code version; *House of Trust*, an homage to free public libraries; and *Hours of the Night*, an MP4 PowerPoint poem probing age and sleep. Strickland has been granted NEA, NEH, and NYFA Arts fellowships. Her digital poems have been featured at the Library of Congress and Bibliothèque Nationale de France. <http://stephaniestrackland.com>

### 2 Integers

---

( )

The Silver Power  
of Zero makes a mirror-

realm: *Are-not*.  
Domain

trails from itself the ink  
Minus, sign of Debt,

of Doubt, of Double-  
entry: books to keep

or doubled sets  
of points to win. *Zero-*

sum? Of two,  
one wins. Only one.

# Stephanie Strickland

## Presto! How the Universe Is Made

*On your Mark*, one first O/riginal Form; *Get set*, a second angular Segment; *Go* — the next step, a Rule replacing each straight side in the first by the second; if I take

a box and for each side of that box substitute a cone or peak, to make a kind of star — then do *again* what I did before: take the star-box

and where I find a straight-line replace it with a peak, to make a *starrier* star, nesting the shape even deeper in the figure, re-placing

peaks to make a Star-in-the-Box! Or, a Diamond-heart-Star at *every* level (a shape self-similar); a shape of extreme complication, in only a few — in five —

iterations, it already reads as texture and is rapidly sinking as it plummets, repeating, into bonded lock, where photons mediate, shunting between

heavy center, vibrant orbit. Or *deeper*, look. No, look, a quantum leap: the burst box — the born star — is re-emerging on the line, on the line *or/and* . . . Repeat:

# Stephanie Strickland

SO it comes in the fullness of mind and it came to  
pass to collapse the column *columns begone*  
a central sanctum cleared covered by a dome  
well first one arch two then a few intersecting  
high heavenly span if the dome were inverted  
should it become some huge dish  
what pulls it together would pull it apart  
if it could be placed in orbit it would drift apart  
a chain is used around the dome of St. Peter's in Rome

a chain is used around the dome of St. Peter's in Rome  
if it could be placed in orbit it would drift apart  
what pulls it together would pull it apart  
should it become some huge dish  
high heavenly span if the dome were inverted  
well first one arch two then a few intersecting  
a central sanctum cleared covered by a dome  
pass to collapse the column *columns begone*  
so it comes in the fullness of mind and it came to

# Stephanie Strickland

## Distaff Tech

Moonmonths synchronized with solar years,  
cycle-paths aligned, the Zodiac belt —

pebbles for patterns, for lattice-logic looms;  
our lettuce-leaf, our reef-hyperbolica, these we crochet.

The overhang, never to forget! To remember how with fire  
we lost night — we who perjured dark,

cursed the cold. Now winter's lost. (*Fire became the stake.*)  
Each day we ask: will new body-brain emerge?

But whose? How stowed? A portal mind? A gated  
world. We learn to diffract

restrictions super-imposed by the surgeons of light.  
Realities, we re-create daily,

moonshine rules. Many-fingered time has come back  
to our dock. Its twisted braid, enacting Morwen's

coded knots, stops. Awestruck before Maryam's  
incomparable openings of body —

*Maryam Mirzakhani, 1977-2017*

## Ursula Whitcher



Ursula Whitcher is an Associate Editor for *Mathematical Reviews*, a publication of the American Mathematical Society. She received her Ph.D. in pure mathematics from the University of Washington and worked as a postdoctoral fellow at Harvey Mudd College and as a mathematics professor at the University of Wisconsin – Eau Claire prior to joining *Math Reviews*. Her research sheds light on connections between algebraic geometry, number theory, and the physics of string theory. She received the Mathematical Association of America’s Merten Hasse Prize for mathematical exposition and is a regular contributor to the *AMS Feature Column*, a collection of mathematical essays for a general audience. Her poetry has appeared in a variety of venues, including the *Journal of Humanistic Mathematics*, *The Cascadia Subduction Zone*, *VoiceCatcher*, *Rosalind’s Siblings*, and *Goblin Fruit*; she has also published fiction and narrative games. <http://yarntheory.net/writing/>

### Tuesday

Sometimes it is not possible to mend  
what’s broken, either if you meant  
to prove something impossible, or else  
to save someone. Your best friend has  
not eaten for six days. Your father loses things.  
Your brother lies.  
It’s Tuesday, so the week’s no longer new, and yet  
nowhere near done.  
All you can do is move  
and keep on moving, trust  
time changes shattered things  
and lies once known are maps.

*Note:* This poem’s form is taken from the structure of the field with 7 elements: the meter, in iambs, follows the sequence 5, 4, 6, 2, 3 — the nontrivial values of powers of 5 (mod 7), which generate the group of units of the field.

# Ursula Whitcher

## Confidence Interval

Some things are about as likely  
as throwing a dart at a pie plate and hitting the uneaten slice,  
and some things are about as likely  
as *me* throwing a dart at a pie plate, and hitting the plate,  
and some things are like throwing a dart at the beach and hitting one grain of sand  
or hitting a particular grain of sand, that happens to be shaped like a clock,  
at the twelve o'clock position.

I am lying here with my hand on your breast and your hand on my hand,  
estimating whether I love you,  
and when I will know if I love you,  
which is different entirely.

You might say that knowing I love you  
given your hand on my hand on your breast  
is like throwing a dart at the ocean  
and hitting the ocean.  
But in my life I have kissed exactly two boys and five girls,  
and one of those was a dare.  
In this world there are seven billion people.  
If my soul is meant for one soul, that's like hitting grains of sand,  
or maybe pebbles.

I do not think you are my pebble.  
I dislike the way you don't talk to your mother,  
and the cups of tea you scatter around your flat,  
where your cats will taste them.  
But the likelihood I will stay here, hand in your hand,  
as this square of sunlight slides across the floor  
is the likelihood of me eating the pie  
instead of throwing darts at it, if I had pie,  
or dipping my toes in the ocean, if I had oceans,  
in other words certain, at least  
barring tsunamis.

# Ursula Whitcher

## Difference Equations

*for Sara*

There is a smallest step that you can take,  
embarking on a journey. Skips and hops  
exaggerate the lurch we always make

when setting into motion. Though you shake  
at the beginning, do not seek to stop  
before the smallest step that you can take.

Pile changes onto changes, as a rake  
collects dry leaves, or elsewhere steady drops  
from rainclouds shape a puddle. Always make

your starting into stories. No mistake  
exists except assuming you can swap  
a safe choice for the steps that you must take.

A lack of motion is a choice that slakes  
no thirst except a petty urge to shop  
for other people's faults. So, let us make

our jerky, small attempts together wake  
the power for a longer climb. The top  
of this long hill is reached by steps we take  
in union, in this work that we all make.

*Note:* This villanelle is part of a sequence of poems based on the Mathematics Subject Classification (MSC) scheme. It references MSC 39: *Difference and functional equations*.

# Ursula Whitcher

## K-Theory

*for Brian K.*

Subtraction is a formal operation.

Forty-four minus nineteen, and minus nineteen,  
and minus nineteen, leftwards off the cliff of the page —

Subtraction is a formal operation.

Sheaves grow like wheat, as bundles, sap-filled stalks.  
We reap, and we reap, and past harvest we re-reap:

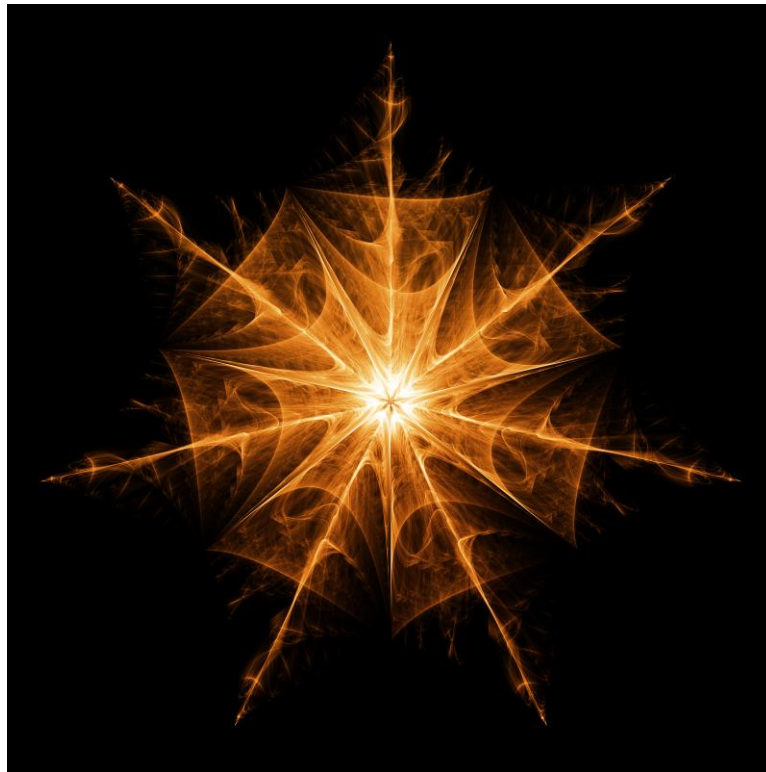
Subtraction is a formal operation.

Removing you, and then removing, and removing:  
what remains is isomorphic to a life,  
an entry in a short, exact equation.

*Note:* This poem is part of a sequence of poems based on the Mathematics Subject Classification (MSC) scheme. It references MSC 2019: *K-theory*.



**Poems by  
Past Bridges Conferences' Featured Poets**



**Mathematical Poetry Readings  
2011 — 2019**



# Mike Bartholomew-Biggs



Mike Bartholomew-Biggs is a semi-retired mathematician who is Emeritus Reader in Computational Mathematics at the University of Hertfordshire, while also serving as poetry editor of the online magazine *London Grip*. His mathematical research and consultancy specialisms are optimization and optimal control, mostly applied in the aerospace industry. His first poetry collection, *Uneasy Relations* (Hearing Eye, 2007) attempted to unite the two halves of his brain. Mike has published four poetry collections and five chapbooks of poems, the latest of which are: *Poems in the Case* (Shoestring Press, 2018) — which combines poetry with a murder mystery — and *The Man Who Wasn't Ever Here* (Wayleave Press, 2017) — which speculates about the life of his Irish grandfather. With Nancy Mattson he organizes the *Poetry in the Crypt* reading series in North London. <http://mikeb-b.blogspot.co.uk>

## Two Poems from *Poems in the Case*

*Poems in the Case*, is a poetry collection embedded in a murder mystery set in a week long writers' workshop. These poems are ascribed to Stanley Spenser, one of the workshop participants who is also a professional mathematician. The story is set in the mid 1990s when concerns about the Y2K computer bug were already being voiced and these provide a background to:

### Digital Alarm 1999

If you thought this year's end meant emergencies  
or supposed that rows of zeros were important  
then you gave too much significance to fingers.

Octal anniversaries that might have been,  
were the norm two less, have gone unmarked; two extra  
and four figure years arrived while Dr Halley  
hunted other comets in the Greenwich skies  
and hummed unpublished firework tunes by Mr Handel.

Halfway through the week, the workshop is shockingly interrupted by a couple of deaths — apparently suicides — and Stanley takes it upon himself to investigate. He is able quite quickly to deduce a logical

## Mike Bartholomew-Biggs

explanation for the tragic events; but he finds himself reluctant to go to the trouble of accumulating evidence in support of his hypothesis. He prefers to enjoy all the pleasure of believing he is right without going to the trouble of proving it. This indulgence is not one he is permitted at his place of work, where he is expected to justify all his mathematical assertions. The next poem recollects (in tranquillity) his wish to prolong that anticipatory glow of conviction which precedes the (possibly frustrating) spadework of formal validation.

### **Before I proved the theorem ...**

... I began to write the poem, letting  
key assumptions set the rhythm, trying  
rhyming schemes for unmade arguments  
and dreaming of potential sequences  
of riders and corollaries to follow.

At the night time edge of sleep, when freed  
from tyrannies of page and pen, conjectures  
nimble shaped themselves as metaphors  
whose resonance augmented reasoning  
to satisfy blurred versions of equations.

Sums recited in my head suggested  
patterns in the DNA of numbers  
to explain how primes could propagate  
themselves yet keep their pedigree intact  
among a throng of mongrel integers.

But eager as I was for QED  
I paused before I wrote down each next line  
the way seducers tiptoe to the bedroom  
via minor step-by-step transgressions,  
delightfully yet shrewdly putting off

commitment to explicit proposition —  
unambiguous adultery.  
For each advance might tread upon an error  
like a crumpled rug; and once truth stumbles  
she'll remember she must keep her self-respect.

## Marion Deutsche Cohen



Marion Deutsche Cohen's thirty-first book, *The Essence of Seventh Grade: A Sort of Autobiography*, was just released by Alien Buddha Press. Two of her other books are *Crossing the Equal Sign* (Plain View Press), about her passion for mathematics, and *Truth and Beauty* (WordTech Editions), consisting of poems about the interaction among students and teacher in the course she developed, *Mathematics in Literature*. She is also the author of two controversial memoirs about spousal chronic illness and a trilogy diary of late-pregnancy loss. Marion holds a Ph.D. in mathematics from Wesleyan University and she teaches at Drexel University in Philadelphia PA. Her first poetry collection, *The Weirdest Is the Sphere*, includes a poem dating back to age seven. Other interests are classical piano, Scrabble, thrift-shopping, four grown children, and five grandchildren, another on the way! <http://www.marioncohen.net/>

### The Deterioration of the Theorem

"Suppose  $\star$  is a binary operation on  $\mathbb{Z}^+$  which satisfies the properties of Theorem 10."

"Suppose  $m$  equals 1 and  $n - 1$  is prime."

"Suppose further that  $x \star r = i$  equals  $x \star s = j$ ."

Suppose, suppose.

Like if only, if only.

If only we had one more if, we might be able to get to the then.

Suppose, suppose.

It's the bargaining stage of grief.

At this rate we'll never reach acceptance.

# Marion Deutsche Cohen

## Memoirs of a High-School Math-Brain

"The Parabola," I announced.

"She *would* choose that one," whispered three regular teenagers in the back row.

Yes, alas, I would.

Another time I bore my T-square through a crowd.

Up and down it bobbed over the regular teenagers' heads.

"Hey, what's that?" asked a football-type boy.

I clutched my T-square and ran.

The boys didn't think of me for movies or the prom.

Many nights I dreamt that I begged them to.

I got up on stage during assembly in front of the regular teenagers  
and carried on.

Plenty of regular teenage girls got A's in math.

But they didn't prefer working on crossing polygons to going to a party.

And they didn't write little squiggly geometry and algebra shapes in history class.

And they didn't choose the parabola.

## JoAnne Growney



JoAnne Growney, Emeritus Professor of Mathematics at Bloomsburg University, Pennsylvania, now lives in Silver Spring, Maryland, where she writes poems, guides poetry workshops, blogs about math-poetry connections, and enjoys activities with grandchildren. From childhood JoAnne loved both poetry and mathematics — but mathematical studies offered needed scholarships. When again there became time for poetry, mathematics was one of her inspirations. With numerous poems in math and literary journals, JoAnne also has published several poetry collections. Hypothesizing that *everything connects*, she delights in the elegant language of both mathematics and poetry and frequently applies mathematical constraints to help shape her thoughts into poems. Her blog “Intersections — Poetry with Mathematics” offers a varied selection of poetry and commentary by poets from around the world — and a few items of her own — all found at: <https://poetrywithmathematics.blogspot.com>.

### Love Mathematics!

Love algebra! Through variable numbers  
of factored afternoons and prime evenings,  
party in and out of your circle of associates,  
identify your identity, meet your inverse.

Exceed arithmetic! Embrace calculus!  
Sway with the curve of the integral sign  
and lean forward to the tangent line. Grasp  
the first moment and center your mass.

Welcome, as the sculptors do, the Möbius band  
whose one-sidedness does not offend.  
Cherish, within reason, paradoxical points  
of view: mathematics is — by turns — constructed,

partitioned, dreamed. Love it with a love  
that does not tend to 0. Refuse to scorn  
the rationals for their repeating patterns.  
Leap from the reals to the imaginaries.

# JoAnne Growney

## A Baker's Dozen

Counting likes to start with number one.  
Another one to pair with one makes two —  
and three can be a triangle of fun.

Four enumerates my daughters and my sons.  
I have five fingers on the hand I give to you.  
Counting likes to start with number one.

With six the perfect numbers are begun.  
Seven names a rest-day, breaks the queue —  
and three can be a triangle of fun.

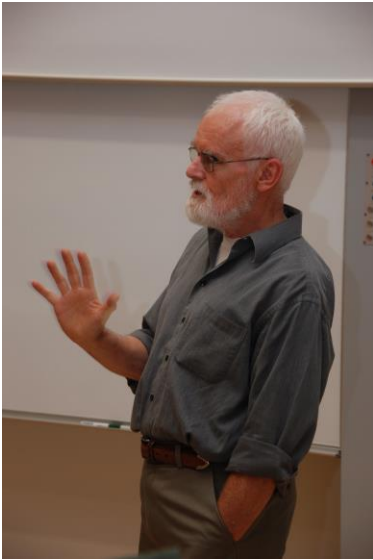
I sometimes call on eight to make a pun.  
Nine are the lives I hope will see me through.  
Counting likes to start with number one.

When ten years pass, another decade's done.  
Eleven's the hour I hope for my rescue —  
and three can be a triangle of fun.

Twelve counts a dozen — eggs or hot-dog buns.  
Thirteen offers luck that some eschew.  
Counting likes to start with number one  
and three can be a triangle of fun.



# 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 and 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. <https://mae.princeton.edu/people/faculty/holmes>

## A Maze of Lines

Windows look out onto leaves and darkness,  
suggesting loss of memory. His mind  
returns, turns over, seems to slowly mend  
while pictures rise once more to mark those  
places he has visited. Meanwhile, night  
expands, lines hesitate and stray beyond  
each path already taken to an end.  
Then words desert him, waiting for the light.

Yet through the days to follow light is sparse  
and grass grows pale where sodden leaves lie spread.  
Above these grounds thin clouds mark out a space,  
but on no path is there some guiding thread  
to follow in the maze. A world falls silent.  
Will he find a way, and time in which to write?

# Philip Holmes

## Bookshelves

Whispers of half-remembered phrases, words  
from uncounted books I shall not read again  
rise now, then fall; like bursts of summer rain  
they seem too difficult to grasp. Towards  
day's end I try to let them go. But words return,  
begin to take up space in this small room,  
to sense the moods of things and settle down.  
They conjure up so much that once was learned.

Pages lie before the window in the dusk;  
there is a kind of darkness that I feel,  
exploring notebooks scattered on the desk,  
and wondering, shall I be allowed to see  
a future present in these final lines.  
Where is the path to follow at this time?

## Lawrence Mark Lesser



Lawrence (Larry) Lesser, a Distinguished Teaching Professor at The University of Texas at El Paso, enjoys integrating poetry and song with his outreach, teaching, and research. He co-organized AMS student poetry contests and mathematical poetry evenings for several Joint Mathematics Meetings, and his mathematical poems have appeared in: *The Mathematical Intelligencer*, *Journal of Humanistic Mathematics*, *Radical Statistics*, *Amstat News*, *Journal of the Association of Mexican American Educators*, *Talking Writing*, *Texas Mathematics Teacher*, *Teaching for Excellence and Equity in Mathematics*, *Bridges* anthologies, blogs, CAUSEweb.org, and an NPR radio program. This year he won the (non-student category of the) ASA Day Haiku Contest. He is also a songwriter who just released his first CD (*Sparks*) and his STEM education songs have yielded national contest awards, articles, and the current NSF grant Project SMILES. <https://larrylesser.com/poet-larry-ate/>

### DI/VISION

In a New Mexico primary school  
In view of the new bollards,  
María takes on the division problem

*To buy the \$123 medicine he needs,  
How long at his \$7-an-hour job  
Must Juan work?*

María does it  
How her Mexican abuela taught her,  
Each subtrahend kept in her head.

Not seeing  
How different layout yields the answer,  
Her teacher scolds: "Do it the *right* way!"

What dividends if we could share  
Alternative means to reach fact,  
Not alternative facts to reach mean.

# Lawrence Mark Lesser

## Worry Lines

At our next infant wellness visit,  
the pediatrician plots  
our only child's weight on  
paper ruled  
by increasing bands  
with concavity ill-suited  
for extrapolation.

Kilograms or pounds,  
it's 40<sup>th</sup> percentile, down  
from the 60<sup>th</sup> percentile.  
Having delivered well  
into "advanced maternal age," my wife  
frowns (*"we aren't feeding him enough!"*).  
I say it just fell

half a sigma and  
we're still well  
within the fat  
part of the bell curve —  
it's normal —  
this won't be one  
of our worries.

## Systematic Sample from a Children's Song

Twinkle star  
wonder are  
the high diamond sky  
little I  
you

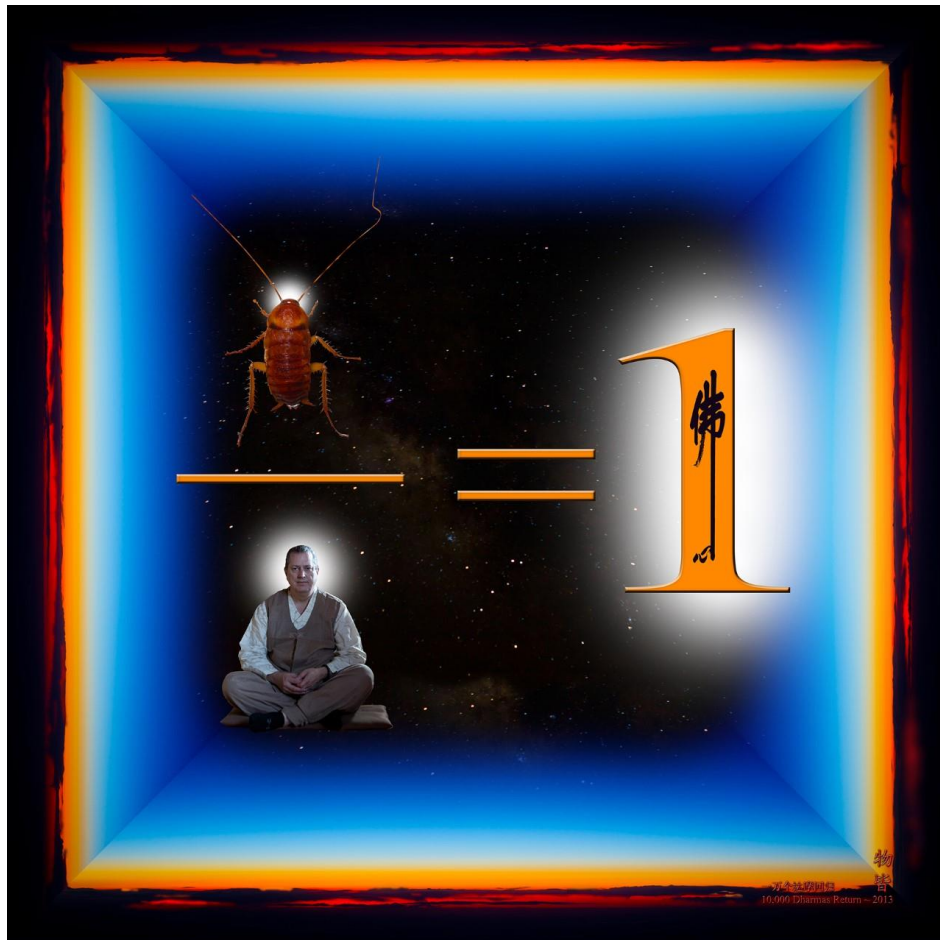
## Kaz Maslanka



Kaz Maslanka received a B.F.A. 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.

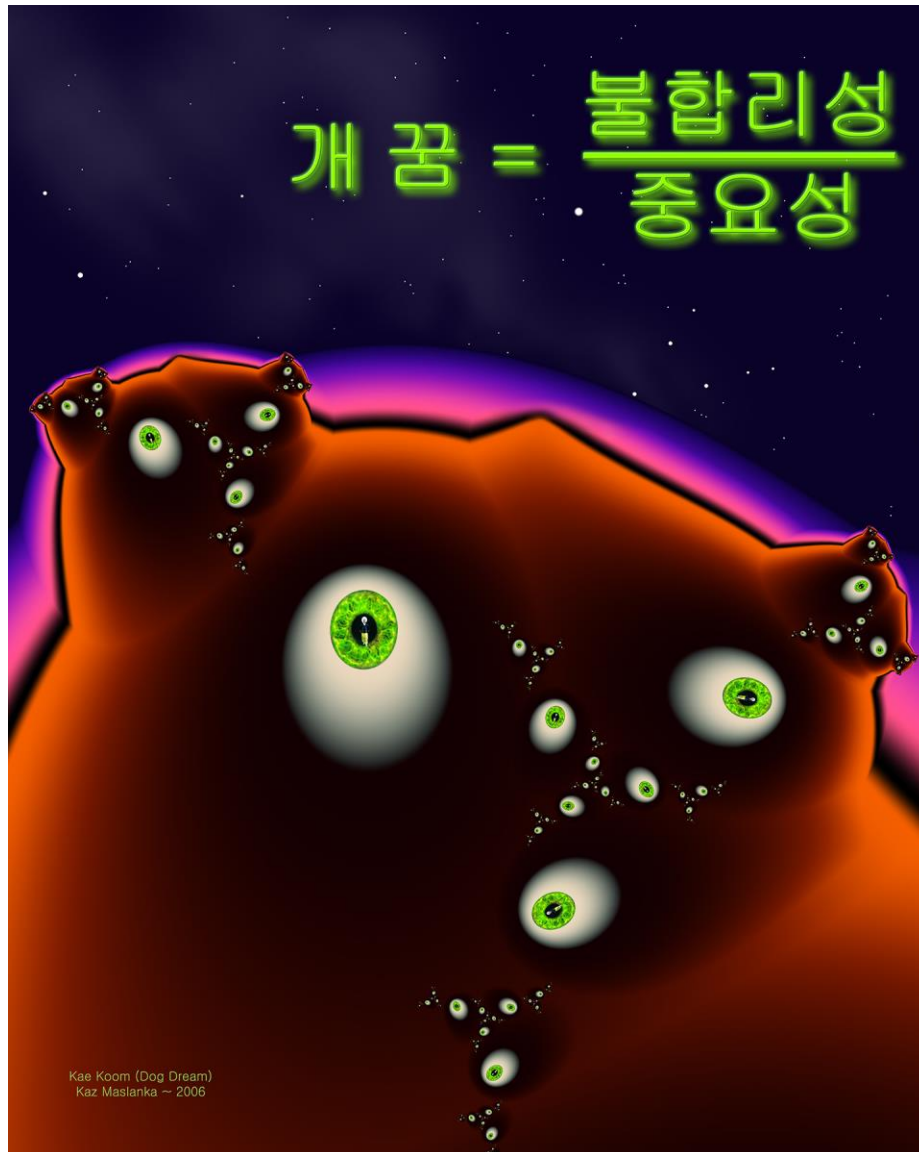
<http://mathematicalpoetry.blogspot.com/>

## 10,000 Dharmas Return



# Kaz Maslanka

## Dog Dream



*Note:* A *dog dream* is a common Korean idiom used to comfort someone who experiences a haunting dream by dismissing it as a meaningless dream. The characters on the top-right of the image form a mathematical poem in Korean, which may be read by performing the mathematical operations. Its translation into English is:

**Dog Dream = Irrationality/Importance**

# Daniel May



Daniel May is an Associate Professor of Mathematics at Black Hills State University in Spearfish, South Dakota, where he enjoys spending the majority of his time teaching all levels of undergraduate mathematics to primarily math education majors. In the tiny gaps of that teaching load, he has been exploring connections between mathematics and poetry, and very much values this community of mathematical poets who engage in similar pursuits. He also thinks about the combinatorics of card games such as *Set* and *Spot It*. Dan spent his last several summers working with Bridge to Enter Advanced Mathematics (BEAM), a mathematics enrichment program for underserved public middle school students in New York City and Los Angeles. Dan also moonlights as a musicologist, and has presented several seminar-talks on a variety of musical genres at his university. <https://talkingwriting.com/daniel-may-poem>

## Glide: A Cross Country Skiing Cadae

Left leg and  
poles,  
and right leg and

glide.

Moving to be still,  
glide until I'm snowblind to the signs  
of my  
own insufficiency.

Trees iced as bodies.

Wind humming  
high in lungs of pine,  
breath thrumming low inside of mine.  
Naked aspen casting long shadows  
from the sun's low winter glide.

*Note:* A *cadae* is a poem structured by the mathematical constant  $\pi$  in two distinct ways: it possesses five stanzas of 3, 1, 4, 1 and 5 lines (in that order), and the poem's 14 lines consist of 3, 1, 4, 1, 5, 9, 2, 6, 5, 3, 5, 8, 9, and 7 syllables (in that order). The name of the form comes from the letters' respective positions in the alphabet.

# Daniel May

## An FTA Poem for the End of the Semester

grading piles up  
deadlines fly by  
grading piles up while grading piles up  
coffee no longer helps  
grading piles up but deadlines fly by  
students have stopped coming to class  
grading piles up while deadlines fly by  
deadlines fly by while grading piles up  
grading piles up but coffee no longer helps  
this project will have to wait  
grading piles up while grading piles up but deadlines fly by  
the committee should meet one more time this semester  
grading piles up but students have stopped coming to class  
deadlines fly by but coffee no longer helps  
grading piles up while grading piles up while grading piles up  
the final exam isn't written yet  
grading piles up but deadlines fly by while grading piles up  
nineteen unread messages  
grading piles up while grading piles up but coffee no longer helps  
deadlines fly by but students have stopped coming to class  
grading piles up but the final exam isn't written yet

*Note* This poem is structured by *The Fundamental Theorem of Arithmetic (FTA)*: Each prime-numbered line consists of a unique phrase, composite-numbered lines are constructed according to the prime factorization of that line's number, where phrases corresponding to the primes in that factorization (either in the base or the exponent) appear in order, connected by single words representing multiplication and exponentiation. The title of the poem stands for line 1.



## Iggy McGovern



Iggy McGovern is Fellow Emeritus in Physics at Trinity College, Dublin. He is also a poet, blending formal structure, humor and science. Iggy has published with Dedalus Press three poetry collections: *The King of Suburbia* (2005), *Safe House* (2010) and *The Eyes of Isaac Newton* (2017), and an anthology *20/12: Twenty Irish Poets Respond to Science in Twelve Lines* (2012). *A Mystic Dream of 4* (Quaternia Press, 2013) is his verse biography of the 19<sup>th</sup> century Irish mathematician and poet, William Rowan Hamilton. Among his awards are: the Glen Dimplex New Writers Award for Poetry, the Hennessy Award for Poetry, and The Ireland Chair of Poetry Bursary. He has read his poems at international festivals in Europe, North America and Australasia. One of his recent lecture's title is: *Science and Poetry – not so different?*  
<http://iggymcgovern.com>

### The Mathematical Barman

The mathematical barman  
lives in a world of his own;  
he's calculating the average size  
of the bubbles in each pint  
or the different combinations of coins  
in the right change from a fiver  
or the time it takes a drop from the optic  
to reach the slatted floor.  
But the customers all love him,  
and not just because he never  
says: "You've had one too many"!  
He likes to put it this way:  
"There's three types of barman,  
them that can count and them that can't."

# Iggy McGovern

## Algebra

Did his 'illustrious visitant' know I  
Can trace my roots – no pun! – back to that nation?  
Al-jabr of Musa al-Khwarizmi,  
Which means, I'm told, in that tongue 'restoration'

Though some, of course, would look beyond the word  
To give the precedence to Diophantos,  
Who'd deemed the negatives to be absurd  
And on whose book did one John Chortasmenos

A thousand years hence write this tart rebuff:  
*Your soul – I paraphrase – be damned in Hell*  
*Because your theorems are just too damned tough!*  
And Fermat scribbled one last tease as well.

Let no such mockery dilute the glory  
Of his stout contributions to my story

## 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](http://www.deannanikaido.com)

### Six Made Me Certain

*"Every woman should know how to live alone... even if she doesn't like it."*  
— Maya Angelou

Two years after the divorce  
I thought I understood what she was talking about but  
Three showed me different  
Four pointed out a few more things  
Five revealed that I didn't know and  
Six made me certain that age turns mistakes  
into honest ingredients  
recipes in the blood  
truth into bone  
peace in the middle of sentences.

# Deanna Nikaido

## Arcing with My Father

*"Arcing" — a luminous bridge formed in a gap between two electrodes.*

When you motioned me to come to you —  
I thought you meant

next to,  
as close as

because all the information I'd ever had  
about the space between two objects  
was distance  
not about how to erase it.

And so the exercise is this:

The flower over there —  
is inside of me.

The maple and all of its seasons  
is inside of me.

The mountain with its heart  
split between sun and moon  
is inside of me.

And my father,  
gone a year and one season  
sitting younger in front of me  
in the white of this dream  
is challenging the physics of my resistance.

He knows I'm bad at math.  
He knows I love him.

His arm is arcing between us.  
My father is inside me.

## Tom Petsinis



Tom Petsinis was born in Macedonia, Greece, and immigrated to Australia as a child. He is a novelist, playwright, poet, and mathematics adviser at Deakin University, Melbourne. Tom has published eight books of poetry, including *Naming the Number, Four Quarters*, which won the Wesley Michel Wright Poetry Prize, and the recent *Steles* (Australian Scholarly Publishing, 2019) — 100 sonnets based on Ancient Greek funeral monuments. 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 five works of fiction include the novels *The French Mathematician*, nominated for both the New South Wales Award and South Australian Premier's Award, and *The Twelfth Dialogue*. His most recent novel featuring mathematics is *Quaternia*. Tom's work has been translated into a number of languages.  
<http://tompetsinis.com/>

### *from:* Euler's Vision

*The great Swiss mathematician Leonhard Euler (1707 – 1783) spent the last years of his life in St Petersburg, Russia. Unhindered by blindness and failing health, Euler continued his prodigious mathematical work until the very end. "Euler's Vision" is a verse-play in which the blind Euler interacts with the seven entities that comprise one of the most important formulas in mathematics, Euler's Formula,  $e^{i\pi} + 1 = 0$ . Entities  $e, i, \pi$  are female;  $1, +, =$  are male; and  $0$  is genderless.*

EULER: As students, are you expecting a lecture from me?

1: Doctor, I'm not a student, as one can see.

=: I'm not the equal of your humanity.

+: I'm not crucified to flesh by gravity.

0: I'm nothing if not an ethereal entity.

EULER: But a voice implies a mouth, tongue, breath.

$\pi$ : Unless it's not circumscribed by the head.

$i$ : Or like a vowel sighed by what's never existed.

$e$ : Or an expression of decay and death.

EULER: Here, take my hand, prove you're real.

1: I guide fingers to ten but am unable to feel.

+: I'm transparent in the midst of every deal.

=: I'm the space between rolling wheels.

0: And I, what's left when an onion's peeled.

EULER: If you're intangible, are you angels of sorts?

$\pi$ : Oh, more like Plato's ideal forms.

$e$ : Existing from when the cosmos was born.

$i$ : Indeed, Doctor, and even before.

# Tom Petsinis

EULER: Conversing with mathematical entities!

1, +, = [*in unison*]: Moving through human minds for centuries,  
We've learnt your language, habits, eccentricities.

EULER: If some religious-minded folk have claimed conversations with angels, then I suppose...

0: You'll discuss numbers with what a nobody knows.

EULER: To what do I owe your visit then?

*e, i, π* [*in unison*]: You've drawn us here, dear friend —  
The irresistible force of your intelligence.

EULER: This blindness is a blessing and a blight.

*The entities stand in a semi-circle before Euler.*

1: There's seeing without sight.

+: There's knowledge in night.

=: There's the glow of inner light.

0: Darkness has its delights.

*i*: Imagination and insights.

$\pi$ : And, if we may be so polite,

*e*: It's closer to the infinite.

EULER: Yes, what characters Homer conceived in his blindness. If only I could envision you as he saw Helen in the glow of her devastating beauty, Achilles in the blaze of his anger, Priam in his tearful surrender to fate.

1: First — concentrate.

0: Make your mind a blank slate.

+: Now start to free associate.

=: Use metaphors to equate,

$\pi$ : To circle and decimate,

*e*: To power and extrapolate,

*i*: To imagine our unreal state.

EULER: Yes, there you all stand, in the light of my imagination.

*i*: What am I under your imaginary sun.

EULER: A shadow in search of its substance.

1: And what of my appearance?

EULER: A pebble that pushes back the sea.

*e*: How do you envision me?

EULER: The form new numbers will take.

+: What do you make of my shape?

EULER: An open-armed celebrant.

0: How large is my pupil at this instant?

EULER: Enough to contain the emptiness of space.

=: Can you read the lines on my face?

EULER: And the point where your parallels meet.

$\pi$ : Am I continuous or discrete?

EULER: You're the circle and the lake.

# 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>

## Countdown

1

Is indifference  
the new math —  
passive acceptance  
to the next surging  
list of victims?

2

Exponentially —  
August 4, 2019  
216<sup>th</sup> day of this calendar year  
251 mass shootings  
1,300 killed or injured

3

A good friend told me  
she began losing hope  
when nothing changed  
after that massacre of  
first-graders at Sandy Hook

4

Gun shop just down my street  
family-owned  
next to a 7-11  
catty-corner to our local mosque  
business is good

5

Our leaders tell us to fear  
foreign terrorists —  
from what I can see  
the shooter is young,  
angry, American as hell

6

Another quick count —  
in Dayton  
9 people killed  
by 1 gunman  
in just 32 seconds

## Amy Uyematsu

*from: Praise for the Irrational*

v

Among the most famous  
in the irrational numbers' family —  
*pi*, the empress of unending  
and nonrepeating digits —  
secret to binding diameters  
to perfect circles,  
simplified for students  
as  $\pi = C / d$ .

"How beautiful," says  
a man who can recite  
over 23,000 digits of *pi* —  
recalls them by certain  
colors and forms —  
some, like 3-2-8, conjure  
a mountain of lime and blue,  
or 7-5-6, a bromeliad bloom.

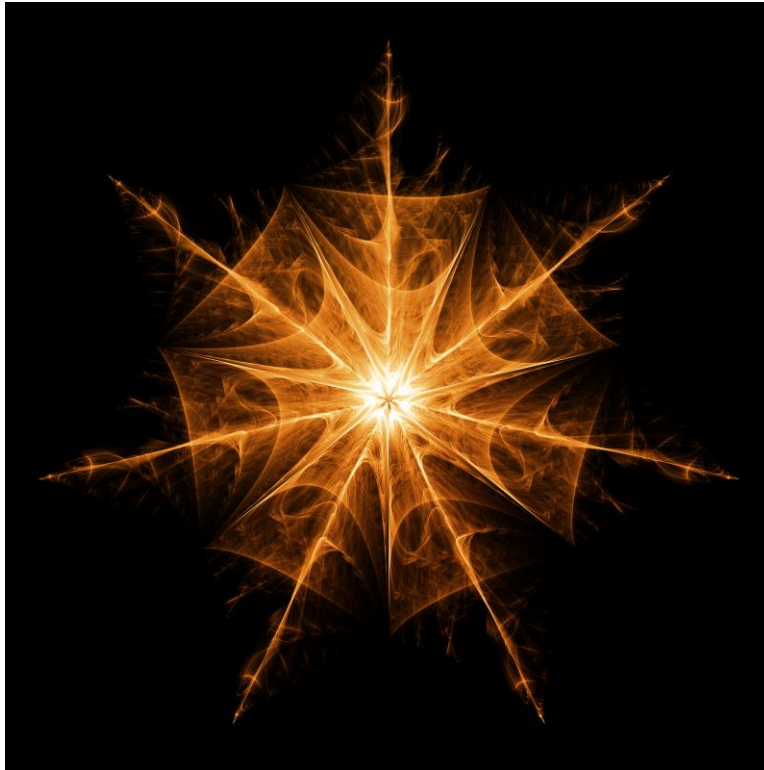
If I asked you your favorite  
earthly shape, you might say  
a round ball at the age of seven  
or that milk-scented areola  
before you could talk.  
Long ago we worshipped  
suns and moons, laid out  
stones in the shape of circles.

It was no small leap  
to invent riding on wheels,  
or capture life's crazy imbalance  
with the yin/yang symbol —  
even better the Zen circle  
embracing all and nothing  
in just one or two  
strokes of the brush.

And maybe I'm in  
on a secret I don't understand —  
no accident that since last night's yoga  
I'm now caught in the spell  
of an ancient brass gong —  
ripple after ripple, encircling  
some tiny region  
of my heart unbound.



**Poems of  
Response and Collaboration**



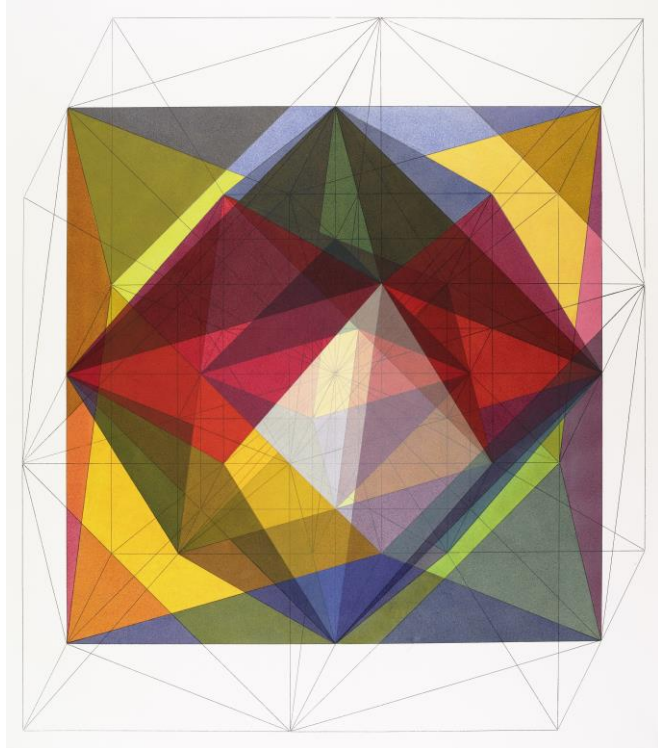
**Among Bridges Poets and Artists  
2011 — 2020**



# Ekphrastic Poems

Poem by Tatiana Bonch-Osmolovskaya responding to art by John Hiigli

CR 163: Cuboctahedron,  
Rhombic Dodecahedron,  
Octahedron II, Tetrahedron,  
Octahedron: Top View  
Tetranet Series, 2002-2005,  
by John Hiigli,  
Bridges 2010



**G<sub>M</sub>AZE**

*for John Hiigli*

E  
N  
T  
E

RAY reflects from the planes, falling into an airless corner of  
SPACE

rotates clockwise, turning the other

FACETS

are transparent, letting the ray through, holding it, then thickening inapparently at one

EDGE

becomes a prism, breaking the ray, splitting it into visible

SPECTRUM

shines like a rainbow, from violet on one side to red on the other

EDGE/S

move towards each other, reflecting, dissolving, drawing dangerously close the

FACETS

tinkle, with silvery song filling the silent

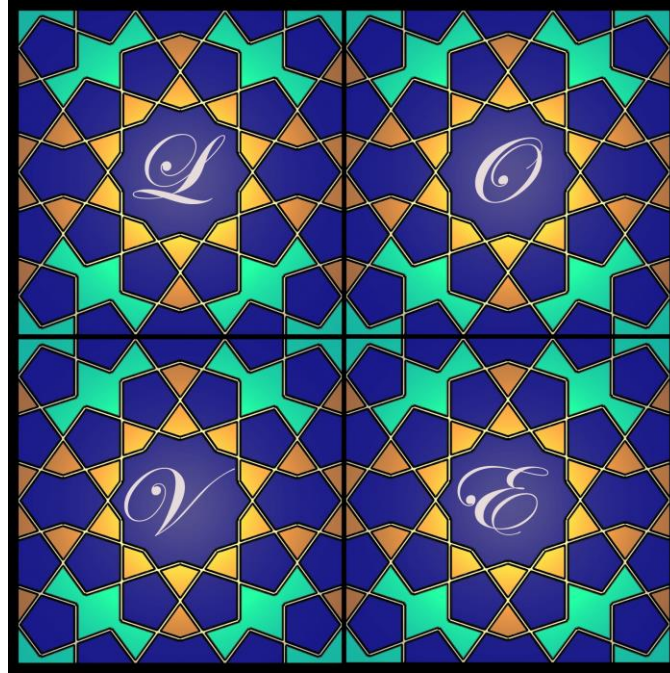
SPACE

breathes, returning to sight the hasty RAI

S  
E  
E  
Y  
O  
U  
!

# Ekphrastic Poems

Poem by Sarah Glaz responding to art by Reza Sarhangi



*Tray of Love* by Reza Sarhangi, Bridges 2016

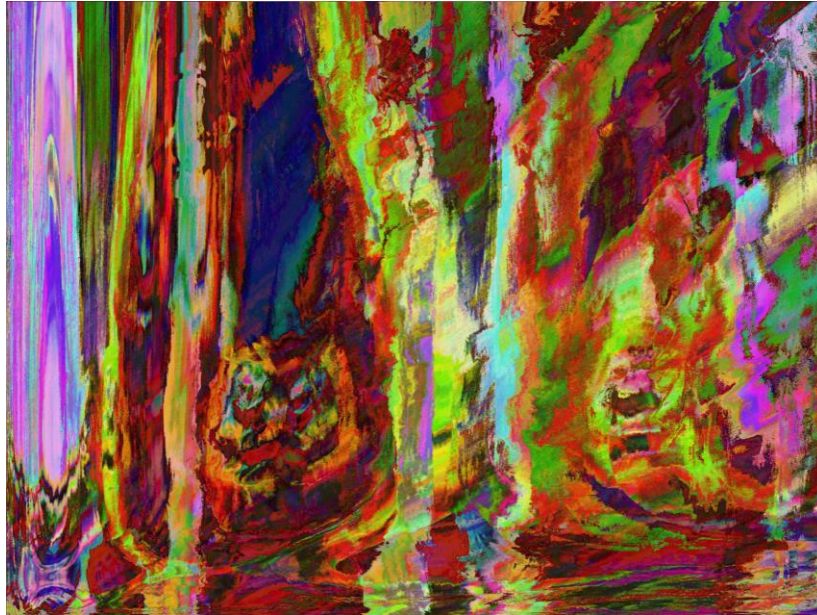
## Two Bridges

*in memory of Reza Sarhangi*

<p>That summer, at Bridges Enschede, Reza raised the glass of wine and made a toast: <i>To mathematics and art! To friendship! To all of you invited to the feast!</i></p>	<p>I was the photographer's eye, not in the picture, the best way to see his radiant smile casting a spell on everyone within its range.</p>
<p>Today, at Bridges Jyväskylä, Mehri wears a widow's black dress. In front of her, on the table, lies Reza's last offering: a tray full of love — exquisitely made.</p>	<p>As if to defy time's relentless linearity, if only for a moment, his generous spirit, which brought us together, seems to be present — inviting us to partake.</p>

# Ekphrastic Poems

Poem by JoAnne Growney responding to art by Allen Hirsh



*An Outgraped Mome Rath* by Allen Hirsh, Bridges 2015

## The Disposition of Art

— written in response to Allen Hirsh's "An Outgraped Mome Rath"

my poetry teacher said everything  
connects  
my physics teacher said nothing  
is a vacuum  
and the Queen said sometimes  
I've believed  
six impossible things  
before breakfast

the artist said if equations  
can predict the weather  
then equations  
can recycle Fritos wrappers  
into paintings

it is true that Stein said a rose  
is a rose  
but the windmill is tilting and *Jabberwocky*  
is a Looking-glass poem

*'Twas brillig* Humpty Dumpty said  
*And in the wabe* those slithy toves  
*and mome raths* outgrabe

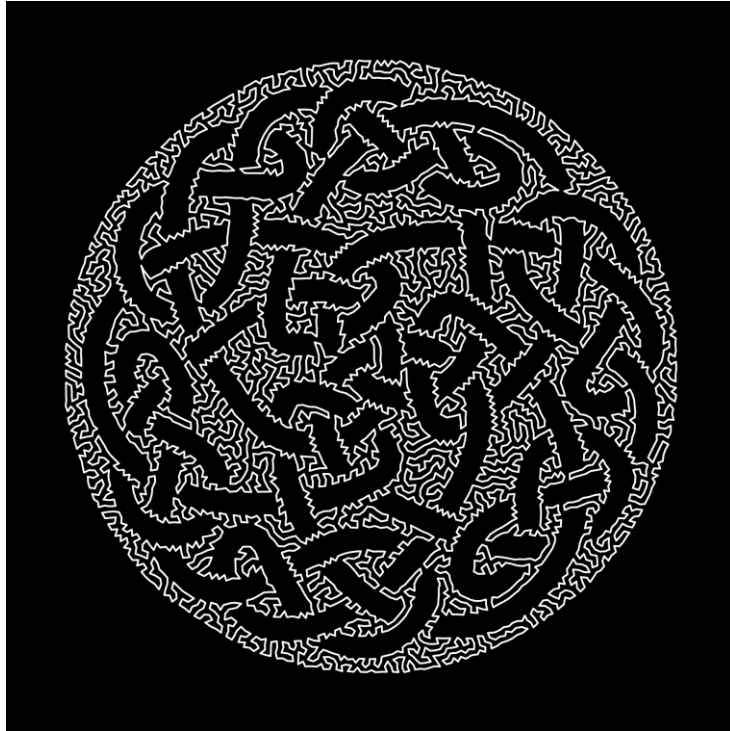
when I say *a rational number* always  
*can be expressed*  
*as a ratio of integers*  
someone always  
doesn't understand

Humpty Dumpty chooses what words will mean  
and will pay a word extra  
if it means a great deal

a picture means a thousand words  
*Humpty Dumpty, open your purse.*

# Ekphrastic Poems

Poem by Amy Uyematsu responding to art by Robert Bosch



*Knot?* By Robert Bosch, Bridges 2006

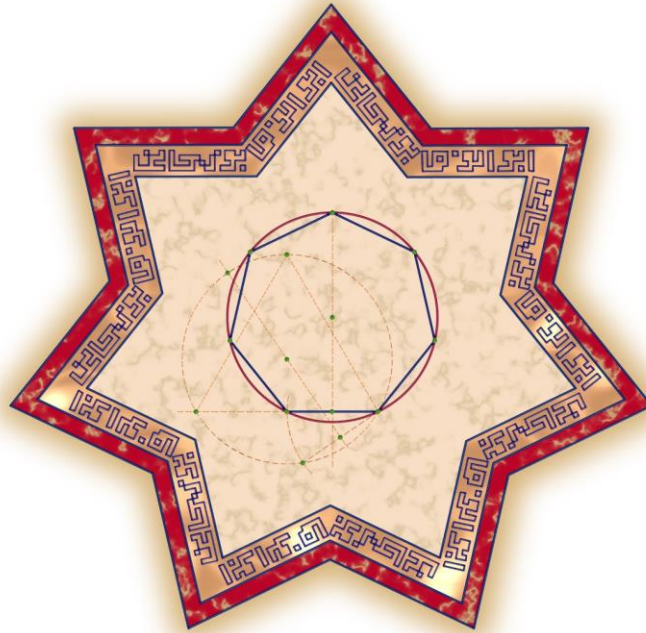
## Labyrinth

— after Robert Bosch's black-and-white "Knot?"

Have you heard the one about a traveling salesman who has to go to 5000 cities? Leave it to math whizzes to obsess about the shortest route. And guys like Bosch — a little naughty perhaps — who answers the riddle by creating an elaborate black cord shaped like a Celtic knot. But wait, is he tricking us? Now the cord pops out from a continuous white line, zigging this way and that, tiny steps of a drunken inchworm. How to move inside and out, black and white so inextricably bound? Can any of us truly navigate this tangled wonder of darkness and light.

# Ekphrastic Poems

Poem by Amy Uyematsu responding to art by Robert Fathauer & Reza Sarhangi



*Buzjani's Heptagon* by Robert Fathauer and Reza Sarhangi, Bridges 2007

## Even a Moon Crater Bears His Name

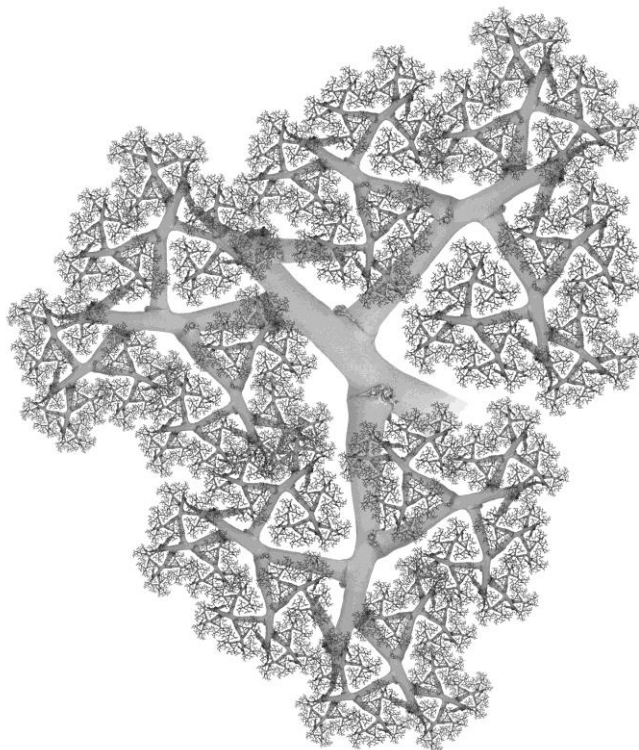
— after Reza Sarhangi and Robert Fathauer's "Buzjani's Heptagon"

No one's heard of Persian mathematician Buzjani, but we all know seven-pointed stars. Some say, symbols of perfection and love. Over a thousand years ago, he constructed a regular heptagon, seven equal sides and angles, with only a ruler and compass. Revolutionary for his time. Buzjani worked in Baghdad's House of Wisdom. We modern Westerners only see Baghdad as a blur of 9/11, Saddam, Bush, roadside bombs, Obama, oil, ISIS, war without end. No House of Wisdom in the world we've built, not one on our seven continents.

# Companion Poem

Poem by Emily Grosholz with art by Robert Fathauer

*Fractal Tree No. 10*,  
digital print,  
by Robert Fathauer,  
2010



## The Natural Numbers, Base Ten: Finitude

Awake before dawn, William and I sit drowsing,  
lapsed from a dream, luring toward consciousness,  
nursing a little, musing, counting our toes.  
There are always ten, no matter where we begin.  
Oh, look. He suddenly points at the closed door-windows  
that cast over snow, past spindly lank silhouettes  
of maple, oak, black walnut, into the dawn.

On tiptoe, weaving, he runs up close to the windows  
charmed by the panels of gold set high among mullions  
of boles, the roses fastened in tracery-branches.  
Yet how the fastening ravel: our matins are sung,  
the windows beyond the windows wither away,  
and then he returns to my arms asking his questions  
in an ancient, unknown tongue. And all of my answers,  
equally enigmatic, are kisses in shadow.

*Note:* This poem and its companion art piece are part of a larger collection of poems by Emily Grosholz paired with art by Robert Fathauer, which can be found in *Proportions of the Heart: Poems that Play with Mathematics* (Tessellations Publishing, 2014). The poem also appears in *Great Circles: The Transits of Mathematics and Poetry* by Emily Grosholz (Springer, 2018), a book about the relation between mathematics and poetry, which arose in part from the author's involvement with the Bridges community of poets, artists and scholars.



# Puzzle Poems

## Three poems encoded in Latin Square puzzles by Lisa Lajeunesse

### Instructions by Lisa Lajeunesse

Place a 1, 2 or 3  
in each cell that is free  
If there's room for one more  
then you must include 4

Read from left to right  
as you normally do  
the 1's give the first line  
next line's paired with 2

Use 5 if you have to  
and how will you know?  
So EACH number appears ONCE  
in EACH column and row

Continue this way  
Till each number's been done  
a line for each number  
we hope you have fun

When you've filled in each cell  
and the numbers are there  
you can then read the poem  
from the solved Latin Square

**Sample square gives:**  
*This is how  
the poem reads  
from the square*

3	1	2
from	is	reads
1	2	3
This	poem	square
2	3	1
the	the	how

### from *The God of Teapots* by Alice Major

		3
pours	accept	out
	2	
pour	in	what
You	it	and

*Note* The poem, *Instructions* by Lisa Lajeunesse, outlining the step-by-step procedures required to solve the puzzles and read the poems, and the two puzzle poems on the next page, are part of a larger collection of puzzle poems that were distributed as handouts at Bridges 2019, and which may be found at: [https://www.math.uconn.edu/~glaz/Mathematical\\_Poetry\\_at\\_Bridges/Bridges\\_2019/Lisa%20Lajeunesse%20puzzle-poems.html](https://www.math.uconn.edu/~glaz/Mathematical_Poetry_at_Bridges/Bridges_2019/Lisa%20Lajeunesse%20puzzle-poems.html).

*the poem of the night* by Gizem Karaali, has a hidden mathematical structure apparent when the poem is read from the solved puzzle. The first letters of all the words, ordered line by line as they appear in the finished poem create a Latin Square.

## Puzzle Poems

*Daughter* by Daniel May

2 Paints,	between	3 to	old
Boundaries	1 five	math,	learn
Professional	yet	these	sings.
3 Has	does	year	things.

*the poem of the night* by Gizem Karaali (may 2018)

	1	2		3
head	impossibly	hearing	going	i
3 gospels	glide	nearby	high	5 home
near	now	the	their	giddy
5 that	4 toward	gilded	needy	new
i	healing	5 i'm	isles	1 towers

# Cento Poems

Poem by JoAnne Growney with lines by the Bridges 2017 featured poets

## 2017 Bridges Cento

All is number,    mysterious proportions  
Like Egyptians    burying gold with the dead  
Golden Fear  
that divides and leaves    no remainder

Two loving solar numbers wind about . . . hand in hand  
That math could be starburst discovery  
one    surrounded by billions of its kind  
They are the shape and cardinal of freedom.

Maybe mathematics is your sanctuary  
Counting each and every step  
the profundity of math  
coming towards us    changing everything

*Note:* A *cento* is a literary work made from quotations from other works — most often it is a poem, assembled from lines taken from poems written by other poets. The *2017 Bridges Cento* is created from lines written by the poets who have been invited to participate in the Poetry Reading at the 2017 Bridges Math-Arts Conference in Waterloo, Ontario, Canada. Poet's names are listed in the order in which their lines appear:

Sarah Glaz, Carol Dorf, Kaz Maslanka, JoAnne Growney  
Marco Lucchesi, Robin Chapman, Alice Major, Emily Grosholz,  
Daniel May, Mike Naylor, Marion Cohen, Eveline Pye.

# Cento Poems

Poem by JoAnne Growney with words from dissertation titles

## Celebrating Dissertations

Superalgebras, Variations, Irreducibility, Ideals,  
Fundamental Properties, Hereditary Properties, Differential Properties,  
Regular Curves and Regular Points, Interpolation, Zeros,  
Random Series, Isotopy, Multicolors and Combinatorial Designs,  
Radical, Integral, Required Corners, Generalized Powers,  
Global Analysis, Mathematical Model, Group Theory,  
Existential Theory, Order, Characteristic, Algebras,  
Arithmetic, Systems, Variables, Equations, Problems.

*Note:* The cento *Celebrating Dissertations* is composed from musical mathematical words chosen from a list of dissertation titles of twentieth century female mathematicians. The cento is meant to be read ALOUD and enjoyed for the sounds. The math-women whose titles have been sampled, including Bridges poets Sarah Glaz and Gizem Karaali, are listed, in alphabetical order, below. Full dissertation titles may be found at the Mathematics Genealogy Project (<https://genealogy.math.ndsu.nodak.edu/index.php>).

Lida Barrett, Alexandra Bellow, Mary Cartwright, Fan Chung, Etta Falconer, Sarah Glaz,  
Deborah Haimo, Grace Hopper, Gizem Karaali, Patricia Kenschaft, Marie Litzinger,  
Dorothy McCoy, Florence MacWilliams, Katharine O'Brien, Vera Pless, Julia Robinson,  
Judith Roitman, Karen Uhlenbeck, Talitha Washington, Marie Wurster

## About the Artists



Robert (Bob) Bosch is Professor of Mathematics at Oberlin College and an award-winning writer and artist. He specializes in optimization, the branch of mathematics concerned with optimal performance. His sculpture *Embrace* was awarded first prize at the 2010 American Mathematical Society Mathematical Art Exhibition in San Francisco. His book “Opt Art: From Mathematical Optimization to Visual Design” was published in 2019 by Princeton University Press. <http://www.dominoartwork.com>



After beginning his working life as an experimental physicist, Robert Fathauer currently runs the small business *Tessellations*, which includes *The Dice Lab* and the publication of the Bridges organization books. His interests include recreational mathematics, designing and producing math-related products, writing books on tessellations and related topics, and creating and curating exhibitions of mathematical art. While he created two-dimensional art for many years, in recent years his artworks have mostly been abstract ceramic sculptures. <http://robertfathauer.com/>



John Arden Hiigli (1943 – 2017) was an American artist and educator. He held degrees in both art and education, and co-founded the French-American preschool *Le Jardin A L'Ouest*, on the principle that “Art is an essential component of child development, communication and education.” His art was highly influenced by his interest in geometry. In his own words, he “uses polyhedrons as a metaphor for nature and color as a mode of transcendence.” <http://johnahiigli.com/>



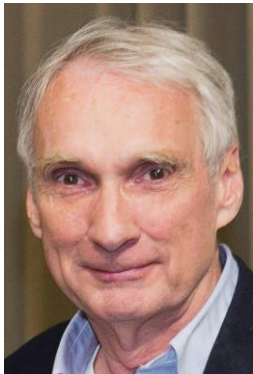
Allen Hirsh is a biophysicist and a mathematical artist. His late brother, Gene, an artist, urged him to start working on digital imaging problems, which led to his turning exclusively to scientific programming at the turn of the century. Since then, simmering in his subconscious was a scheme for a large mathematical painting engine to be used to transform photographic images. In 2012, he started creating the code, which he continues to expand. <https://www.theabstractgardener.com/>



Kerry Mitchell began his career as an aerospace engineer at NASA and then was a mathematics professor. He began working with fractals in 1985 after reading an article about the Mandelbrot Set. Once he saw how simple it was to generate the fantastic shapes, he was hooked. Since then, his works have appeared on many book covers and calendars, and have been shown in numerous gallery and museum exhibitions.  
<http://kerrymitchellart.com>



Reza Sarhangi (1952 – 2016) was a Professor of Mathematics at Towson University and a mathematical artist. Born in Iran, Reza immigrated to the US in 1986, where he completed a Ph.D. in mathematics. In 1998, Reza organized the first Bridges conference. This became an annual event, which thanks to his vision and dedication turned into the largest international conference of mathematical art in the world. His art and scholarship focused on Persian art and mathematics.  
<http://bridgesmathart.org/reza-sarhangi/>



Julien Clinton Sprott, born in Memphis, Tennessee, received his B.S. in physics from the Massachusetts Institute of Technology and his Ph.D. in physics from the University of Wisconsin. He worked at the Oak Ridge National Laboratory for several years before returning to the University of Wisconsin as faculty member in the physics department. In 2008, he became an Emeritus Professor of Physics. His research is in chaos and complex systems.  
<http://sprott.physics.wisc.edu/sprott.htm>

# Acknowledgments

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

Mike Bartholomew Biggs: “Digital Alarm 1999,” and “Before I proved a theorem...,” previously published in *Poems in the Case* (Shoestring Press, 2018), used by permission of the author.

Tatiana Bonch-Osmolovskaya: “ $G_{MAZE}$ ,” first published in *Journal of Humanistic Mathematics*, 2012, “On the Unchangeability of the Paths of the Planets,” and “The Girl from Arcadia,” used by permission of the author.

Robert Bosch: “Knot?,” image used by permission of the artist.

Robin Chapman: “Mary Laycock,” previously appeared in *Six True Things* (Tebot Bach, 2016), first published in the *Journal of Humanistic Mathematics*, used by permission of the author and Tebot Bach. “The Route to Chaos,” and “Nonlinear Functions,” previously appeared in *Images of a Complex World: The Art and Poetry of Chaos* by Robin Chapman and Julien Clinton Sprott (World Scientific Publishing, 2005); and “Distance, Rate, Time,” previously appeared in *Distance, Rate, Time* (Fireweed Press, 1989) and first published in *The Madison Review*, 1986, used by permission of the author. Sixth line of *2017 Bridges Cento*, used by permission of the author.

Marian Christie: “Lightcone,” first published in *Allegro Poetry Magazine* 19, 2018; “Autumn Sunrise,” “Earth Geometry,” and “Degrees of Freedom,” used by permission of the author.

Marion Deutsche Cohen: “The Deterioration of the Theorem” and “Memoirs of High-School Math-Brain,” previously published in *Closer to Dying* (WorldTech Editions, 2016), used by permission of the author. Eleventh line of *2017 Bridges Cento*, used by permission of the author.

Carol Dorf: “I Forgot the Turnkey to the Void,” first published in *Redheaded Stepchild*, 2019; “Afterwards, the House” and “Winter,” first published in *Hay(na)ku Anthology*, 2018; “Ask for a universe and what do you get?” first published in *Maintenant*, 2019; “The Geometry of Distraction,” used by permission of the author. Second line of *2017 Bridges Cento*, used by permission of the author.

Robert Fathauer: “Fractal Tree No. 10” image used by permission of the artist.

Robert Fathauer and Reza Sarhangi: “Buzjani’s Heptagon,” image used by permission of Robert Fathauer and Mehri Arfaei Sarhangi.

Susan Gerofsky: Excerpt from “Kepler: A Renaissance Folk Play in Verse,” first published in *The Mathematical Intelligencer*, 2019, used by permission of the author and *The Mathematical Intelligencer*. “Wings Over Dry Land,” first published by *Proceedings of Bridges 2018*; “Legato Gelato,” and “No Man My Time,” used by permission of the author.

Sarah Glaz: “On the Way to New Jersey in Winter of 2000,” previously published in *Ode to Numbers* (Antrim House, 2017); “Between the Lines,” “Fall,” and “The Mathematician’s December,” used by permission of the author. “Two Bridges,” previously published in *Journal of Mathematics and the Arts* 12, 2018, used by permission of the author and the *Journal of Mathematics and the Arts*. First line of *2017 Bridges Cento*, used by permission of the author.

Emily Grosholz: “The Natural Numbers, Base Ten: Finitude,” first published in *The Hudson Review*, previously appeared in *Proportions of the Heart: Poems that Play with Mathematics* (Tessellations publishing, 2014); “Stargazing,” first published in *PN Reviews*, 2017; “Measuring Andromeda,” “The

Alliance,” and “The Backstory of the Echinacea Project,” used by permission of the author. Eighth line of *2017 Bridges Cento*, used by permission of the author.

JoAnne Growney: “The Disposition of Art,” previously published in *Bridges 2015 Online Gallery*, “2017 Bridges Cento,” “Celebrating Dissertations,” “Love Mathematics!” and “A Baker’s Dozen,” all five poems appeared in JoAnne Growney’s blog, “Intersections — Poetry with Mathematics” (on September 21, 2015; August 4, 2017; February 15, 2019; November 5, 2013; January 17, 2013, respectively), <https://poetrywithmathematics.blogspot.com>., used by permission of the author.

John Hiigli: “CR 163: Cuboctahedron, Rhombic Dodecahedron, Octahedron II, Tetrahedron, Octahedron: Top View Tetranet Series, 2002-2005,” image used by permission of Dominique Bordereaux-Hiigli.

Allen Hirsh: “An Outgrabled Mome Rath,” image used by permission of the artist.

Philip Holmes: “Bookshelves,” a slightly different version appeared in US 1 Worksheets 65, 2020, and “A Maze of Lines,” used by permission of the author.

Gizem Karaali: “The Bread Crumbs of Proof,” first published in *The Mathematical Intelligencer*, 2019, used by permission of the author and *The Mathematical Intelligencer*. “A Mother’s Math Is Never Done,” first published in *The Sundress Blog*, 2018; “hope’s misery,” and “Trypanophobia,” used by permission of the author. “the poem of the night” encoded in a Latin-Square puzzle, used by permission of the author.

Lisa Lajeunesse: “Fatal Flaw,” first published in *Proceedings of Bridges 2019*; “How Taylor Series Can Resonate on a First Date,” “Ode to Polynomials,” and “Nine Is a Poem,” used by permission of the author. Poetry-Puzzles: “from The God of Teapots” by Alice Major, “Daughter” by Daniel May, and “the poem of the night” by Gizem Karaali, used by permission of the encoder and the authors.

Lawrence Mark Lesser: “DI/VISION,” first published in *Teaching for Excellence and Equity in Mathematics*, 2019; “Worry Lines” and “Systematic Sample from a Children’s Song,” first published in *Journal of Humanistic Mathematics*, 2020; used by permission of the author.

Marco Lucchesi: “Reading Hadamard,” “Spiral,” and “Nascita di Venere,” previously published in *Hinos Matemáticos [Mathematical Hymns]* by Marco Lucchesi (Dragão, 2015) translated by Renato Rezende; and “Math Again,” used by permission of the author. Fifth line of *2017 Bridges Cento*, used by permission of the author.

Alice Major: Excerpt from “The Set of All Gods: The God of Prime Numbers, The God of Symmetry, The God of Infinities, The God of Probabilities,” “Rectangularization of the Morbidity Curve,” and “The Movers’ Dilemma,” previously appeared in *Standard Candles* (University of Alberta Press, 2015), and “Union Through Projection,” previously appeared in *Memory’s Daughter* (University of Alberta Press, 2010), used by permission of the author. Seventh line of *2017 Bridges Cento*, used by permission of the author. Excerpt from “The God of Teapots” encoded in a Latin-Square puzzle, used by permission of the author.

Kaz Maslanka: “10,000 Dharmas Return” and “Dog Dream,” images used by permission of the author/artist. Third line of *2017 Bridges Cento*, used by permission of the author.

Daniel May: “Glide: A Cross Country Skiing Cadæ” and “An FTA Poem for the End of the Semester,” used by permission of the author. Ninth line of *2017 Bridges Cento*, used by permission of the author. “Daughter” encoded in a Latin-Square puzzle, used by permission of the author.

Iggy McGovern: “The Mathematical Barman,” previously published in *The Eyes of Isaac Newton* (Dedalus Press, 2017), and “Algebra,” previously published in *A Mystic Dream of 4* (Quaternia Press, 2013), used by permission of the author.



Kerry Mitchell: "Shield 1," image used by permission of the artist.

Mike Naylor: "Singularity" and "Entirely Nothing," used by permission of the author. Tenth line of *2017 Bridges Cento*, used by permission of the author.

Deanna Nikaido: "Six Made Me Certain" and "Arcing with My Father," used by permission of the author.

Tom Petsinis: "*from: Euler's Vision*," used by permission of the author.

Eveline Pye: "Chingola Tankhouse," previously published in *Smoke that Thunders* (Mariscat Press, 2015), and first published in *West Coast*, 1995; "Marriage," first published in the *Honest Error Anthology: Poems about Charles Rennie Mackintosh*, 2017; "Dust to Dust," and "Cladh Hallan, South Uist," used by permission of the author. Twelfth line of *2017 Bridges Cento*, used by permission of the author.

Reza Sarhangi: "Tray of Love," image used by permission of Mehri Arfaei Sarhangi.

Julien Clinton Sprott: "Routes to Chaos" and "Dynamical Systems," images used by permission of the artist.

Stephanie Strickland: "SO it comes in the fullness of mind and it came to," previously appeared in *Dragon Logic* (Ahsakta Press, 2013) and first published in *Mad Hatters' Review* 2007; "2 Integers," and "Presto! How the Universe Is Made," previously appeared in *True North* (University of Notre Dame Press, 1997); "Distaff Tech," first published in *Touch the Donkey*, 2018; used by permission of the author.

Amy Uyematsu: "Labyrinth," and "Even a Moon Crater Bears His Name," first published in *Talking Writing*, March 2016; "Countdown" and "*from: Praise for the Irrational*," used by permission of the author.

Ursula Whitcher: "Tuesday," and "Confidence Interval," first published in *Journal of Humanistic Mathematics* 2019 and 2012 (respectively), "Difference Equations," and "K-Theory," used by permission of the author.

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

*Bridges 2018 Poetry Anthology*, Sarah Glaz (editor), Tessellations Publishing, Phoenix, AZ, 2018.

*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.

## Bridges poetry links

*Mathematical Poetry at Bridges*

[https://www2.math.uconn.edu/~glaz/Mathematical\\_Poetry\\_at\\_Bridges/index.html](https://www2.math.uconn.edu/~glaz/Mathematical_Poetry_at_Bridges/index.html)

*Bridges Poets' News*

[https://www2.math.uconn.edu/~glaz/Mathematical\\_Poetry\\_at\\_Bridges/Bridges\\_Poets\\_News/Bridges-Poets-News.html](https://www2.math.uconn.edu/~glaz/Mathematical_Poetry_at_Bridges/Bridges_Poets_News/Bridges-Poets-News.html)