Math in Poetry: Half of a Course

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Abstract

At Arcadia University in Glenside PA I developed and teach a course called "Truth and Beauty: Mathematics in Literature". In the course we study literature, fiction and poetry, that was inspired by or is connected to mathematics. Since I'm reading poetry at the poetry session of this conference, I thought I'd focus this paper on the "poetry half" of the course – in particular, what the students contributed, in their homework assignments, their participation in class conversations, and their own poems.

"Truth and Beauty: Mathematics in Literature" is a course I developed and teach at Arcadia University in Glenside, Pennsylvania. The course satisfies both a math and a writing requirement, and most students are not math majors. The first half of the course is spent studying fiction inspired by math along with the math that did the inspiring. Students answer both math and "non-math" homework questions about the stories, questions designed to encourage students to share their own lives and experiences (which relate to the stories) and to help them learn and appreciate math. We also have group and class discussions about these questions, and anything else that relates to the stories.

The subject of this paper is the second half of the course, which is spent doing the analogous with poetry. A poem is usually shorter than a story, but its substance is not. Thus we find ourselves talking and writing just as lengthily during the second as during the first half of the course. The text we use for poetry is Strange Attractors: Poems of Love and Mathematics, co-edited by Sarah Glaz and JoAnne Growney [1].

Poems and the Math behind Them

It is said that students are often teachers. On page 77 of this anthology [1] appears the poem, "On the Sadness", by Carl Andre. What makes it mathematical is that the poems' form is based on the idea of unique factorization in Z+. From the explanation given by the editors: "… Each of the primes between 47 and 2 [in that backwards order] corresponds to a poet-chosen sentence; for example, 2 corresponds to 'We are going to die'. To construct each composite line, its corresponding number is expressed… as a product of powers of distinct primes in increasing order. Multiplication corresponds to the conjunction 'if' and exponentiation to 'then'." As further explanation: The first line, "the door is closed" corresponds to the prime number 47. The second line, "We are going to die if the moon changes" is constructed from the prime factorization of 46 – 2 times 23. The 2 begets "we are going to die", "times" begets "if", and 23 begets the corresponding sentence, "the moon changes". Here are the first few lines of the poem:

> "The door is closed.
> We are going to die if the moon changes.
> The sky is blue then we are going to die if the grass is green.
> We are going to die then we are going to die if the sea is cold.
> The window is open.
> We are going to die if the sky is blue if men grow old…"

I don't usually relate to a math poem that is mathematical only in form. What I write and relate to best are poems *about* math. So this poem seemed silly and a bit contrived to me, and it didn't touch me in any way. Nonetheless I chose it for the course. I'm glad I did. Every year that the course has run I've acquired a better understanding of it. When I ask students what they think of it, several say what I at first felt. But more invoke the repetition of the phrase "we are going to die" – repetition because every other number is divisible by 2, the prime corresponding to that phrase. Last spring (2011) I began asking the class whether students would like to read the various poems aloud; usually at least one student volunteered and this poem was no exception. As this student read the poem I began to feel for her. It's probably not easy on the emotions to be forced to repeat the phrase "We are going to die". Yet she carried it off beautifully. There she stood, hair dyed both bleach-blonde and light pink, wearing one of those teeny-bopper dresses, intoning in her teeny-bopper voice, "We are going to die.." Sometimes, indeed, that sentence appeared consecutively. Her reading the poem aloud gave me a new appreciation of it. My point is that the classes' renderings of the poem gradually, over the years, converted me to it. It now seems brilliant and authentic, not at all silly or contrived. I also feel its impact. The students were indeed my teachers.

However, the teacher is also a teacher! There are things I understand that many students don't -- about literature, math, and life. Students often feel that literature has to be "positive" in spirit. Or they're dissatisfied if the ending of a poem or story is subtle or inconclusive. "No matter *when* a piece ends," I say, "the reader won't be satisfied, in the sense that she won't know everything". I give the example of a happy ending to some romantic comedies, where the bedroom door is slowly closed and the credits begin. "I for one want to know what happens next," I quip. "But it wouldn't have anything to do with the movie." Math is like that, too. Even a major theorem finally proven usually does not mark the end of questions. Concerning the above-mentioned poem, "On the Sadness", several students had written in their homework sentences amounting to "We know we are going to die, there's nothing we can do about it, so there's no point worrying about it." I asked the class, "Why, just because there's nothing we can do about it, does that mean we shouldn't worry about it?" There were some nods. And of course this is true of math. There's nothing we can do to change absolute truth, but it's vital that we "worry" about it.

Another poem we studied was also about dying. "Yes" by David Brooks [1, p. 10] describes how, since, as we're dying, our whole live is said to flash before our eyes, it would logically seem that this flashing would include our dying and thereby our whole life flashing before our eyes, which again would include our dying and thereby our life flashing, and so on. The poem ends,

> "… I said to myself, despite
> all the effort, all the
> pain of it,
> …again and again,
> Yes, I thought, as I was watching you
> getting ready for bed tonight,
> …Yes, I would, Yes,
> Please, Yes."

"Can you think of other examples of this kind of infinity?" was one of the homework questions. "Two mirrors facing each other" and "Alice falling through the rabbit hole" are not, as a few students thought, quite examples of "this kind of infinity", but they are examples of other kinds of infinity. And "a photo of an artist holding that photo" is an example.

Two other poems we studied are about dreams – "Floating" by JoAnne Growney [1, p. 25] and "Dialectic of the Census Takers" by Karren Alenier [1, p. 75]. One way to get students to talk about things that matter to them is to bring up the phenomenon of dreams. There were moments when students were literally jumping out of their seats, hopping-anxious to talk about their latest dreams, childhood dreams, re-

curring dreams, or the nature of their dreams. Others saved what they had to share for the written homework.

For example, the poem "Floating" begins "My best dreams are of floating…" It stresses the image of the continuum of real numbers "floating" between any two given distinct reals. In answer to the homework question, "do you have floating (or flying) dreams? Do they differ from the one(s) in this poem?", several students said that, instead of dreaming about floating or flying, they often dreamt about falling. Many viewed those dreams as "worst dreams"; the feeling was of fright. For the math part of the homework I asked the students to name an infinitude of numbers between zero and one-millionth.

The other dream-poem was "Dialectic of the Census Takers." It describes one particular dream with math in it. Here is a short excerpt from that poem:

> "Last night in the dislabor
> Of falling asleep, I dreamed
> My sheep had gone astray
> Reproducing Fibonacci sums of lambs…"

The mood and the logic of this poem seem very dreamlike. I asked, as the sole non-math homework question, "In general, merely recording a dream is not necessarily a poem. But this recording of a dream is a poem. What makes it a poem?" Students called out "rhythm" and "divided into lines and paragraphs". One student wrote, "the organization, although not too complicated, still breaks away from the 'stream of consciousness' writing style that is usually used to record dreams." A few students, though, believed that the recording of a dream *can* always be a poem if the author "declared it as such. Poetry has no rules and therefore anything can be a poem." Perhaps. After discussing this poem we studied Fibonacci numbers and related ideas, such as the golden mean and continued fractions.

There were other "dream poems" and the students had things to say about all of them. But in answer to "Have you ever had a math-dream?", all answered no… This current semester, however, I made an addendum to that question, "Have you ever had a math *nightmare?"* and that brought on more response.

One poem, not about dreams but still about something not quite real either, is "She Considers the Dimensions of Her Soul" [1, p. 114]. The author feels that her soul is shaped like a square, and not a cube as she would like. As we studied that poem, students revealed parts of themselves through mathematical imagery. "How would you describe the shape of your soul?" I asked. At first I thought students might find that corny but they didn't seem to. "…my soul is probably shaped like a star…. I think it has something to do with this feeling I have… of being poked and prodded to always strive to be the best I can, to be a 'star'. I feel these sharp points, they're hungry, and they urge me to burst forth… and see things and do things and be things. Also, I really just like the star imagery – stars are bright and shining, beacons of hope and light glimmering in the distance. They are something to reach for." Another student had other reasons for her soul being shaped like a star. "A star describes everything about myself. I am unique like a star because stars come in different shapes and sizes. The author of this poem relates to me a lot. Since her soul is in a shape of a square she has corners. My shape has corners too.. Any time there is a change in her path of life she develops a corner to her soul. So she's probably been through four impacting changes in her life…" Other souls were not star-shaped. "Because I feel that it is almost ever-present within me, I would have to say that my soul more closely resembles a liquid, filling me to the brim. But it is an opinionated liquid with attitude that does not hesitate when intruding in my life…" And "I originally wanted to say that my soul was something majestically complicated like a pentagram or a crescent moon or even some infinite fractal… But then I realized that my soul is not as jagged or piercing as any of those shapes. My soul has never injured me..."

Written Poem Critiques

Towards the end of the term I gave three assignments (in addition to studying for a math final) – critiquing a poem not already studied in the course, writing a poem, and writing an eight-page term paper on any topic relating to math and literature (including their own "math literature"). The poem they critiqued could come from either our text or another source, and the critique itself could be as long as would express what they wanted to say. They were also allowed to hate the poem. Here are a few short excerpts from their poem critiques":

(About "The Comet" by John Steven Lew, [1]. p. 103) "It has got to be boring being a comet traveling through space. Living a million years just traveling around, waiting to find your final resting place… waiting to hopefully strike a random planet just far enough away from a star where the comet's water would bring life. I chose this poem because at night when I look up into the sky I think these things all the time…"

(About Edwin Markham, "Outwitted", [1]. p. 107 -– quoted here in full because so short, and because necessary:

> "He drew a circle that shut me out
> Heretic, rebel, a thing to flout.
> But Love and I had the wit to win:
> We drew a circle that took him in!"

The student explained the poem in terms of a Venn diagram. "The narrator writes that the man actually drew a circle around himself in order to prevent her from approaching him in a romantic manner… Instead of giving up on the man she loved, the narrator proceeds to team up with Love [and]… capture her beloved in a brand new circle, one that includes part of his circle and part of her own – just enough so that they can be together in the same area!" The student drew the Venn diagram that corresponded to this. She also offers more meaning to the poem? "I do not believe that this love of the woman's was cruel or uncaring of the man's own wishes. The tone of the poem is too light-hearted for this to be the case. [It] could have been written in such a way, however, as to imply that the woman forced the man to love her. Here is my rendition of such a poem below:

> 'He drew a circle that shut me out
> Heretic, rebel, a thing to flout.
> But Love and I had the *force* to win:
> We drew a circle that *shut* him in.

The student appreciated the subtleties in the two words of the original poem, and in the exclamation point.

A third "poem critique" began: "Lyrics and poems are pretty similar, right? So I figured I could base my math poem review on a math song that I really like. The song is called 'New Math' and it's by Bo Burnham. I first heard it on Comedy Central nearly a year ago. … I've included the lyrics to his song… (but I have blacked out portions… which might be deemed too inappropriate – I almost didn't do this assignment on this song because I wasn't sure it was entirely appropriate… part of why the song is so funny is because [sic] it takes math and makes it offensive.)"

The Students' Own Poems

As for the students' own poems, many were about love (and contained, admittedly, both original and clichéd metaphors connecting it to math), many about being stymied by math, and many about life's path, one's own or in general. I was glad the poems were ungraded because I wanted to pay serious attention to them without placing judgment, and each of the poems had worthwhile aspects. Among the three classes most students had not yet written a poem. Some felt a bit apprehensive but most wound up admitting that they enjoyed the assignment. I had told them that I wasn't strict about the poem being of any particular form. I added that if they preferred, what they wrote could be "poetic prose" (not the same thing as a prose poem but close enough). And now here, without comment, are two of my favorite examples, either entire poems or excerpts:

From "Calculating":

> "Solitude is cold and calculating
> If it isn't what you asked for…
> But then one day, as I was lost in counting the empty ways
> There was you
> And I learned to count in a whole new way.
> …And there is something now I must confess…
> Love is certainly never cold
> …However, it is calculating nonetheless."

From a rather deep poem titled "Two in the Autist's Head:

> "One, two, three four – fingers tap. / *I can't help it.*
> …Four, four, four, four – fingers tap. / *I can't help it.*
> …Three hundred ninety-two steps. One hundred twelve tiles. / *Get out of my head.*
> …The sky is pretty today. / *...that. I like that. Be like that. /* ...I'll try."

For the term paper many students chose to write eight pages of their own math literature. Many wrote short stories and a few wrote collections of math poetry. (One bound her "chapbook", titling it "Algebra: When Numbers and Letters Meet".) I need to do honor to those "poem-schemata", so here are two more excerpts:

From "Synesthesia":

> 'My one is yellow
> Two is green
> Three is red
> Four is orange
> …When numbers have
> Colors it gives them personality
> Except four and seven.
> …I've tried to change it
> To consciously make
> Seven pink
> Or maroon
> But I can't.
> …we all have to settle
> For orange in the end.

From a collection of haiku by a student who was extremely excited about the prospect of writing them -- I think the idea was to write haiku about all the math she knew of:

‘Subtraction, an end:
Number leaving another
Should not be forgot.

‘To find circumference
Multiply diameter
By beautiful pi.

‘Obtuse triangles
Have one very fat angle
And two tiny ones.

‘Dreadful word problems
Just complicate and confuse.
Words are not numbers!

For the last day of the course I suggest we have a poetry reading. I know only a fraction of the students will dare to take part so I ask for a show of hands. Usually bout five hands go up, then a tentative sixth. I point out that I will be a seventh. On the appointed day last spring a student or two made the last-minute decision to read and one student got belatedly enamored and kept asking to read further poems.

Overview

During the semester several students had warned me that they didn’t much care for poetry or math. But, as the semester proceeded, they found there were exceptions on the poetry front – in particular, some of the poems written by their fellow students. And they apparently derived much from our class conversations about the poems we studied, and were very responsive in their answers to the homework questions. Liking a piece of literature and getting something worthwhile out of it seem, at least for some people, to be two different things.

What about students being converted to *math?* Possibly, if I were to ask for a show of hands, that show would be rather meager; non-majors are often not likely to consciously admit to loving math, especially in front of their peers. However, much of their writings do admit to at least partial conversion. And there were a handful who, in their term papers, wrote enthusiastically about the extent to which this course made them realize how relevant math was to their lives, both outer and inner. (See, e.g., [2])

References

[1] Glaz, Sarah and Growney, JoAnne, *Strange Attractors: Poems of Love and Mathematics*, AK Peters, 2007

[2] Cohen, Marion, *Math via Literature,* The Mathematics Teacher, to appear