PATHS

here we all are

you

me

and are our paths always so smooth?
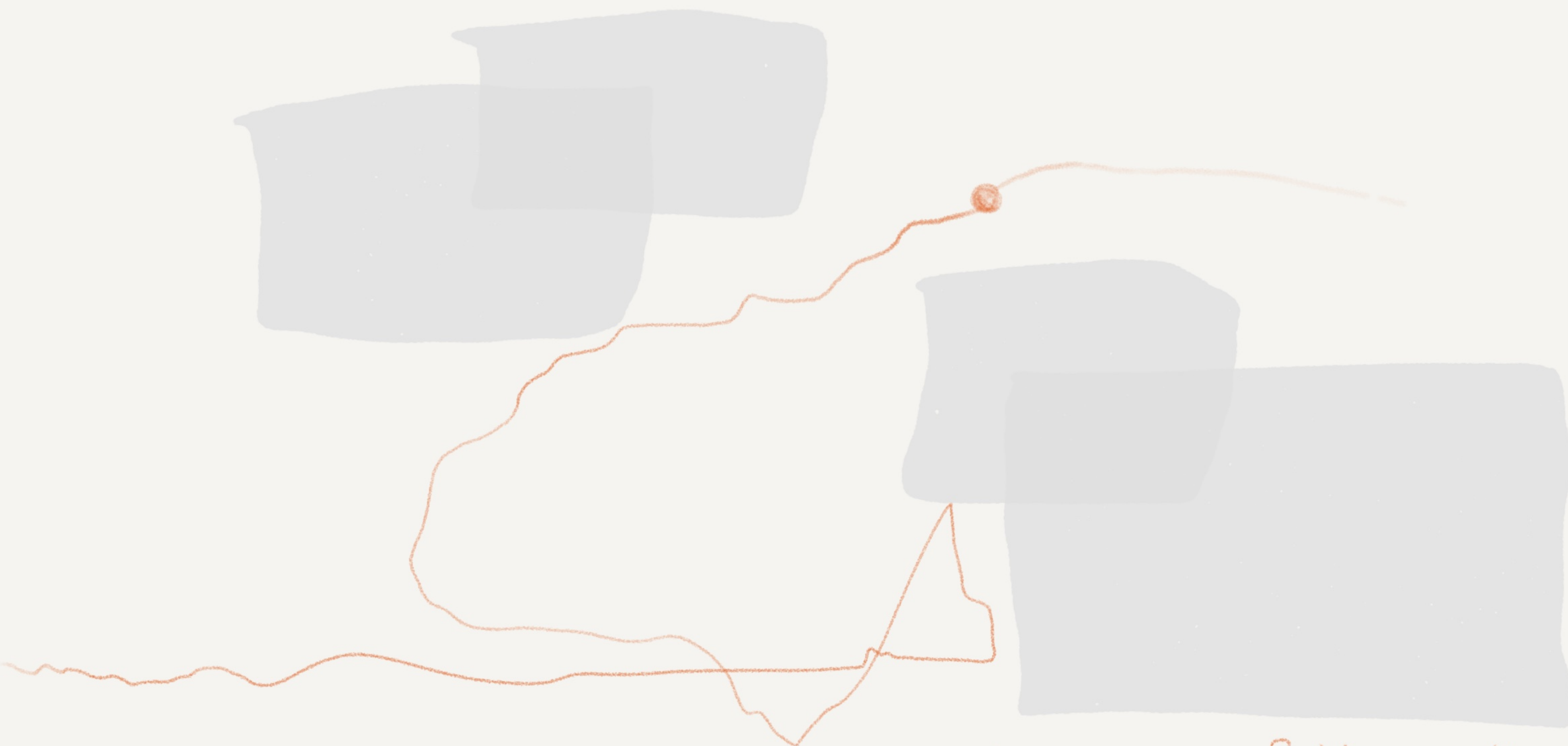
or are we sometimes less sure of the path ahead?

these are some of our stories

I remember sitting in the car,
waiting for my older brother and sister
to get out of school. My mother was
balancing her checkbook, resting it on
the steering wheel. She was
using a fountain pen with blue ink.
She showed me that once she had
lined up some numbers, there
was a consequence: it was determined
what numbers needed to come
next.

Numbers could talk to each other?
I knew I wanted to learn
their secret language!

— as told by Lillian Pierce

I grew up in Northwest England,
    and my family came from a small
       coal-mining village. This is the same part of the world
    as Nick Park, creator of Wallace and Grommit, and Chicken Run —
       growing up, I spoke with the same accent as the stars of his cartoons.

My father was an engineer,
    and his career choices were very simple —
       the coal mine or the railways —
    and he chose wisely to stay above ground.

My father and mother both left
    school at 16, and my father
encouraged me to study engineering.
    I rebelled by choosing to study
       mathematics and he was generous
    enough to indulge me. He was
       particularly fond of telling me
that at some point in my life the fun would
    need to stop and I would have
                to get a job.

    I like to think that he is
          still waiting.

— as told by Robert Calderbank

I had never dreamed about becoming a mathematician when I was little. I mean I was pretty good at math, but I had the stereotypes of mathematicians being really old men who constantly walk into trees.*

I didn't think they were very cool people.

*In primary school, I heard a story about the Chinese mathematician Jing-Run Chen, that Chen was so concentrated thinking about math problems one day and he walked into a tree.

When I entered college, I remembered the small measurement errors in labs would drive me nuts, but mathematics has a much more elegant way of dealing with those by using epsilons and deltas. I liked the feeling of preciseness and certainty in math, as I was trying to adjust to living in the US, far away from home on the other side of the earth, by myself.

I also met other young women who like math. Together, we read stories about female mathematicians. I thought I would like to become a mathematician too, because math is beautiful, these people are pretty fun, and I can be myself and don't have to walk into a tree.
— as told by ShanShan

Duke PhD 2019

Early in my math education, Algebra I probably,
I observed that integers like 4, 9, 16, ... have simple
square roots and I began to wonder about
other numbers. Pursuing this, I asked my father
what the square root of 2 was, and he replied
1.414 .

Being a skeptical sort I went and multiplied it out
(by hand, of course, in the mid-fifties a calculator
was an expensive piece of scientific equipment),

and naturally it didn't come out quite even.
I complained to him, and he told me that
the square root of 2 was an infinite,
non-repeating,
decimal fraction.

I thought he was crazy,
and I remember thinking,
"How am I going to make it in life with advice like this?"
Talk about discounting parental expertise!

The photo shows me, my two older brothers, and my father.
Of course I was much younger in the picture —
my math then was more like asking my mother,
"How much is 2+2 ? 4+4 ? 8+8 ?" until I quickly
passed beyond what she was willing to give the attention
needed to answer. (As may be seen from the photo,
at that age I was an extrovert!)
— as told by Dave Schaeffer

Duke Math Faculty
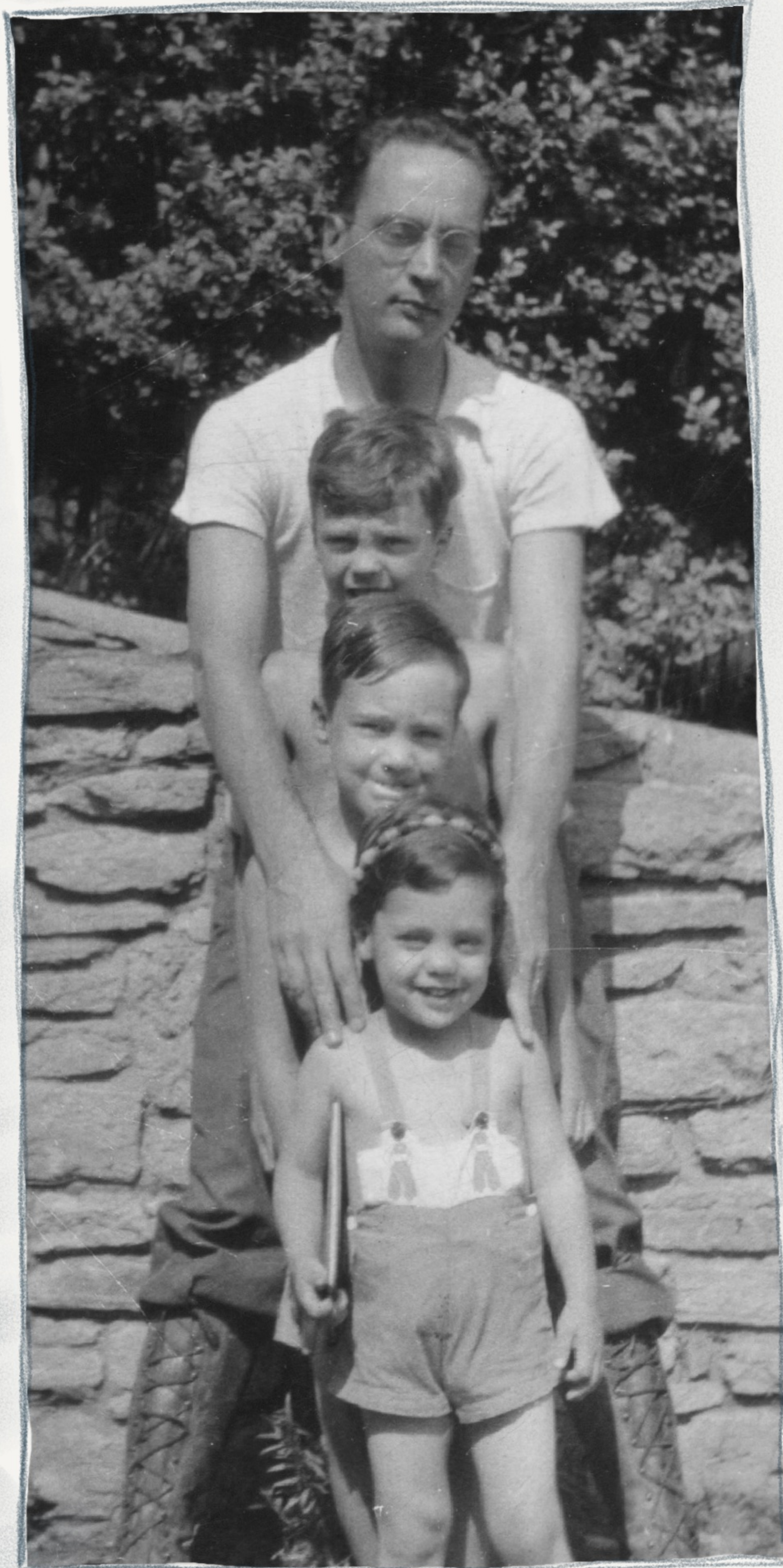
I remember getting excited about math during 4th grade,
when my teacher started giving us "Problems of the Week" on Fridays.
These felt like riddles and puzzles and not at all like "math facts,"
and I'd look forward to them all week.

I asked my mom for a picture of me from this time,
and in looking for it she found my 4th grade
"report card." I had no idea
this existed —

a letter from my teachers
with excerpts from my own
self-reflections —

and it has been amazing to read
decades later. I've been surprised
at my own self-awareness as a 9-year-old.

—as told by Shira Viel

Shira Viel (grade 4)

Teacher comments

Shira feels that " I have
gotten much better in math
and I like it. My greatest
accomplishment is probably
when I started to enjoy
math."

I did not like arithmetic as a child;
 I was mostly fascinated by all kinds of science.

   However, the summer between my 7th and 8th grades,
    I found my uncle's college algebra and calculus
   books at my grandmother's house (which was just
        through the woods from ours).

I tried to read the calculus book first, and was fascinated
  by calculus problems, such as

"find the largest cylinder that can be inscribed in a sphere,"

    and the desire to know how anyone could know
 such things motivated me to study the algebra book
  and then the calculus book.

   I remember it as a glorious time,
  when, practically every day, I learned something
new, or had a new idea. I worked all the
problems in the algebra book and then the calculus book,
  but stuck on calculus for a long time
     because I didn't know that there
 was anything after calculus.
  (Finally, in my senior year in high school,
 I met a math professor at a nearby college,
      and he set me straight.)

        — as told by Robert Bryant

My 8th grade school picture, a time when I was so alive
  with the excitement of learning calculus.
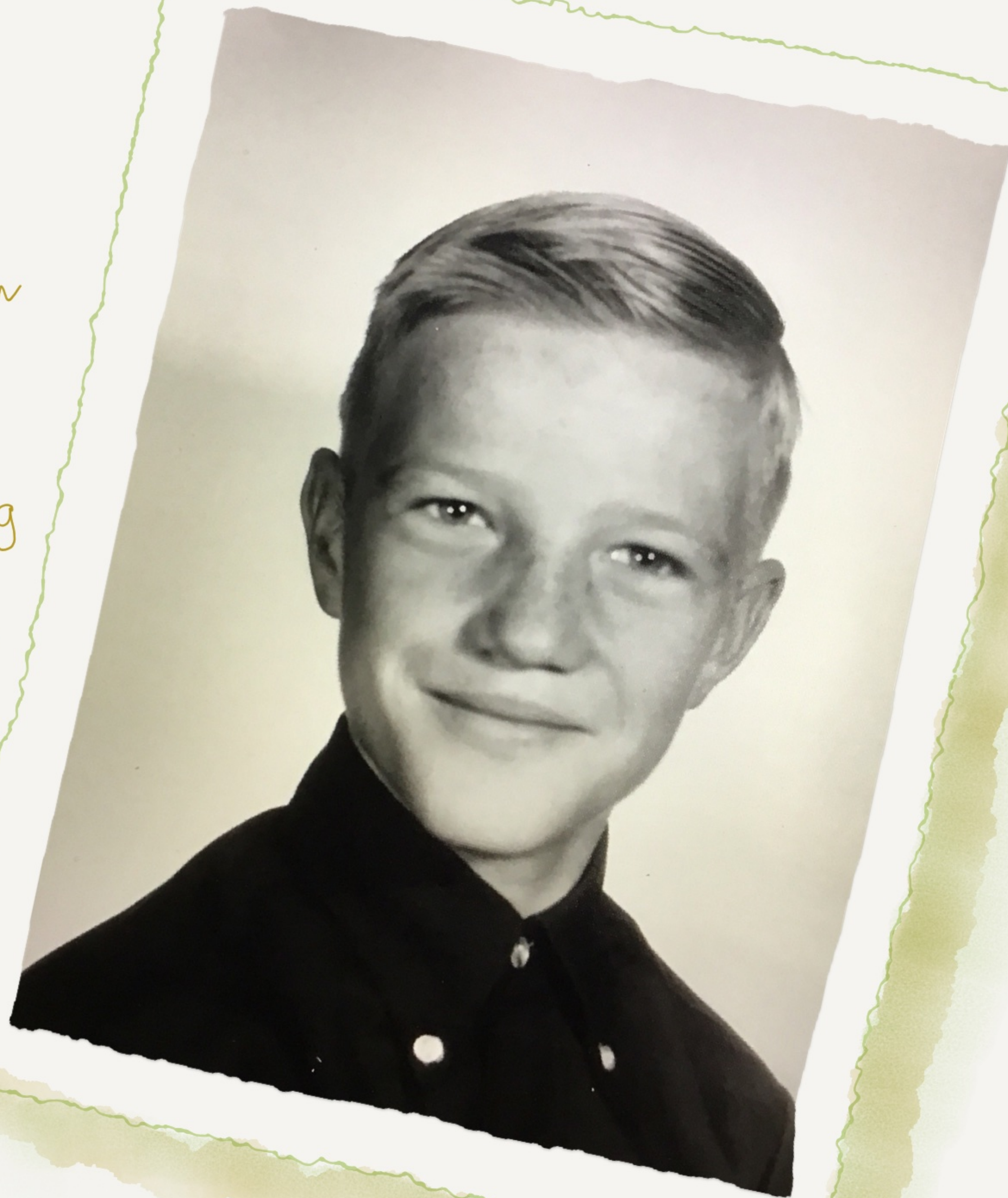
I grew up in the southeast of Romania, in a midsize town by the Danube river.

My parents were both trained as engineers, but they have found it challenging to continue their technical work during the country's long-winded transition to democracy. Their stories of growing up through some of the worst periods of communism in Romania have always kept me grounded to the privileged life I get to live.

My parents gave me math exercises to work on starting from kindergarten. I thought studying mathematics was the natural thing to do, and I loved the challenge. And there was no shortage of challenges, with plenty of math contests throughout the school years. I am most grateful for my family being so supportive of me going far away to study mathematics, despite knowing that it would mean seeing me once a year for the foreseeable future.

— as told by Veronica Ciocanel

My parents were refugees from Czechoslovakia (mother) and Germany (father) who arrived in the United States in 1938 to flee the Nazis.

In the picture, we are vacationing in Arcadia National Park in Maine; I guess I was about six years old.

When I was ten, my father gave me the four volumes of James R. Newman's "The World of Mathematics" and that started my love of mathematics.

The chapter on Buffon's needle problem fascinated me. The idea that one could use random events (whether the dropped needle intersects a crack between floorboards) to compute something fixed (in this case pi) fascinated me.

I spent a lot of time flipping needles on the floor and recording the results.

I was not a math prodigy by any means. In fact, I kind of gave it up when I was 12 to do girls and sports and didn't return to it seriously until I was an undergraduate.

— as told by Mike Reed

Duke Math Major

The first time I remember thinking about numbers in any way, I was probably in kindergarten or first grade.

My older sister is five years older than I am, and she was trying to get me to leave her alone. She said I could play with her if I counted to infinity.

I sat under the kitchen table and started counting.

I think I got to 100 before considering whether reaching infinity was possible, a rather philosophical thought for someone sitting under a table...

— as told by Rachel Helman

A LETTER

When I graduated from Warwick University, I was not at all sure what I was going to do next. I thought of teaching high school and on my visit to teacher training college the interviewer read me the recommendation letter from my Warwick student supervisor Stuart Stonehewer.

He wrote that he thought I had the talent to be a research mathematician

and that he would be disappointed if I did not give it a shot.

Without his letter, I doubt I would be here today.

Mr. Calderbank has the talent to be a research mathematician, and I will be disappointed if he does not give it a sh...

— as told by Robert Calderbank

Coming back from the farm

I would say the most difficult year for me was my last year of undergraduate school and my first year of graduate school. My older brother was the first in our extended family to graduate from college. (My uncle withdrew from college during the Vietnam War and then joined the Navy in order to avoid being drafted for the army and sent to Vietnam.) Although I loved math, I didn't really have a sense that I was good enough to be a mathematician, and I really knew nothing about graduate school. My undergraduate advisor urged me to apply, and I did, but I only applied to Harvard. (They didn't require the GRE, and I was trying to save money on the application process, as I was a work-study student at NCSU who was barely getting by financially.) Harvard turned me down, though. When I went to tell my advisor, he asked me where else I had applied and was shocked when I told him only Harvard. He asked me what I was going to do, and I said that I would probably go back to the farm. He said, "No, you aren't going to do that." He took me over to UNC and begged them to admit me, even though I hadn't applied and hadn't taken the GRE. (This was in late March.) Somehow, he convinced them to take me, which is how I started at UNC in Fall 1974.

The story didn't end there, though. I did OK my first year, not great, but, towards the end of my first year, my mother became ill and underwent an operation that, after several months, killed her. My father was with her every day of that time in the hospital and

... I was the oldest child still unmarried,
so I dropped out of graduate school a month
before the end of term and went home to manage
the farm. My mother died that summer and
my father wasn't capable of running the farm,
so I stayed home and asked the people at UNC
if I could reapply in the following year, when I
thought the situation at home would have improved.

They said yes, but, I learned later that they didn't expect to see me again.
    In the end, I did go back, but it was only after being out for nearly a year
and spending that time reading the higher math books that I was now prepared to read.
    From then on, I can't say that I ever had a really difficult time in my career.

— as told by Robert Bryant

Prove it, or else

In January of my fifth year of grad school I had a week of "extremes." At the beginning of the week my advisor told me I had proved a result sufficient for a thesis and he suggested that I start to write it up. Hurrah!

At the end of the week, as part of a job interview, I was told that the result was probably not new. Ugh! When I checked the reference I was given, I found that indeed a more general result had been obtained a few years earlier by two distinguished European mathematicians.

In desperation I asked my advisor whether, in case I was unable to complete new research by the end of the coming summer, he would accept what I had done as a weak thesis (no one doubted my work was original), but he said that was impossible.

This was in 1968, and the Vietnam war, which was raging out of control then, greatly raised the stakes for me. I had been able to obtain a student deferment from the draft for all of my time in grad school, but deferments could not be extended beyond five years.

Thus, if I was not able to graduate by August, most likely I would be drafted, suffering a dangerous, very distasteful, interruption of my studies, with who knows what prospects afterwards.

What to do?

SELECTIVE SERVICE SYSTEM
NOTICE OF CLASSIFICATION

(First name) (Middle Initial) (Last name)

Well, for about a month I was in a funk and did next to nothing. Then finally I got a grip on myself and set to work with an intensity that I had never achieved before and rarely have since. Lots of midnight oil, to put it mildly. By June I had managed to dream up and to prove a highly artificial generalization of the original result. It was an intellectual dead end, but it met the technical requirements for a thesis and put me on track to graduate in August!

My prospects were still not entirely clear. There were two months between August, when my student deferment ended, and October, when I turned 26, the magic age beyond which they didn't draft folks. But the draft board did not act during those two months, and thankfully I was able to pursue my career without that awful interlude.

Here is a hypothetical silver lining to this cloud:
If I had graduated in June, as originally planned, I would have been vulnerable to being drafted over a four-month period instead of two, and they might have nabbed me in that longer interval.

Duke Math Faculty

The photo is from an earlier, more peaceful, time in my life but already my ability to concentrate is apparent.
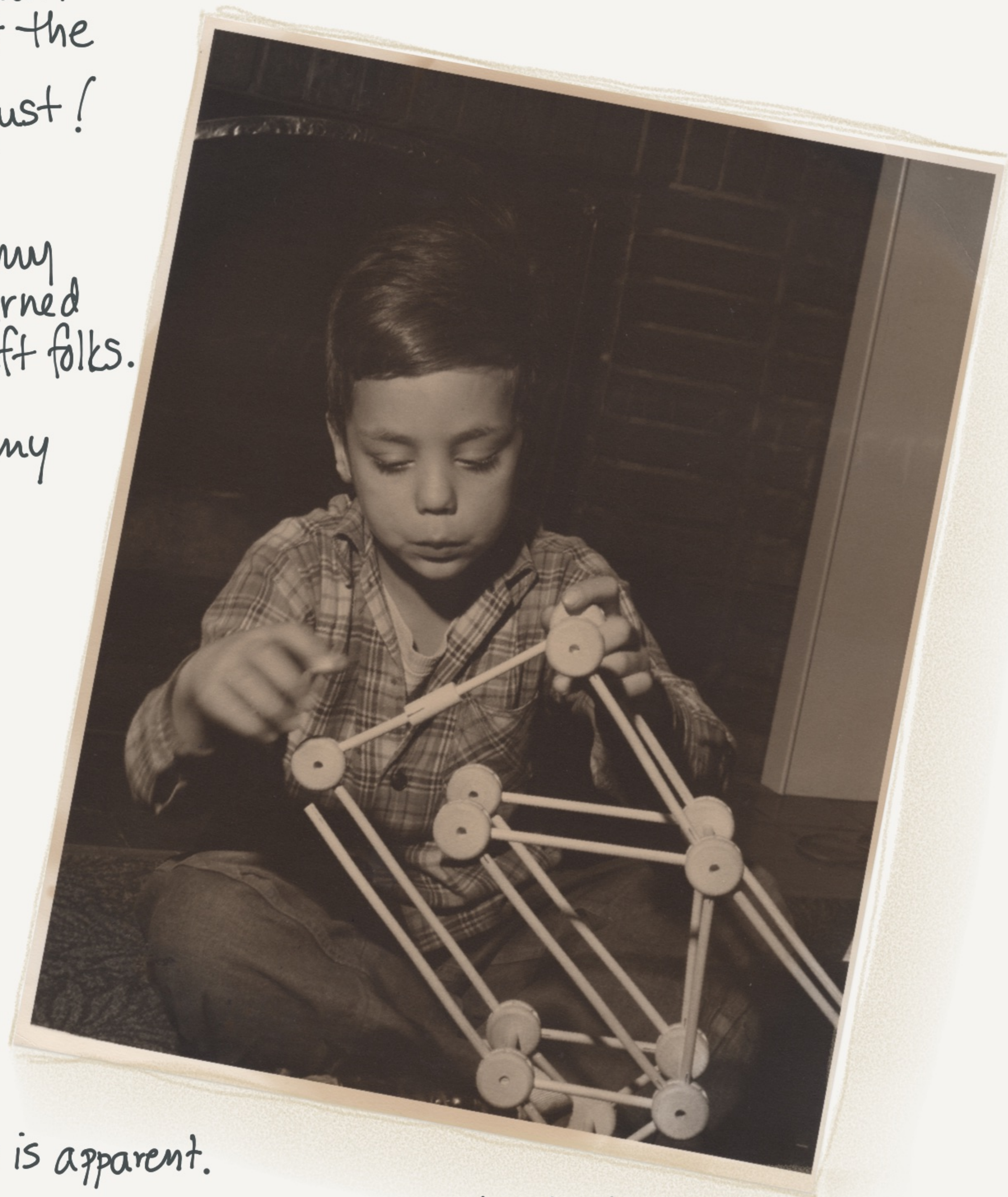
— as told by Dave Schaeffer

My path into mathematics profession was fairly straightforward. Both my parents were physicists, and I knew that I am going to do science ever since I stopped dreaming of becoming a fireman when five years old. But already when I was four, I loved playing a toy billiard, writing down and adding up very long series of numbers. My prescient grandmother has declared at that point that I am going to become a mathematician.

But this wasn't clear to me for a while. I truly fell in love with mathematics only when I was attending high school number 30 in St. Petersburg, one of the city schools with enhanced education in mathematics and physics. We were offered many fun and challenging problems, several olympiads per year, a math fighting tournament, a trip to all-country math festival — the atmosphere was irresistible to me. The central role in my conversion was played by our teacher, Alexander Karp, who is now a Professor at Columbia's Teachers College.

My life in mathematics has been a happy one, but not without ups and downs as well as temptations. Perhaps the biggest one came in 2008. One of my side interests is modeling social bubbles, including financial ones.

I had an offer from a New York hedge fund and considered testing Wall Street career in 2008-2009. It would have been an interesting year to spend in finance, but in the end I decided not to go. Instead, I got a couple decent theorems and a son out of that year.

— as told by Sasha Kiselev

Duke Math Faculty

I was raised in a family where more than half of
the members were doctors or other health professionals.
This trend grows as my cousin (the boy on the left)
has become a medical student.
Therefore, as a child, I dreamed
of becoming a doctor.

Today, I am exactly working towards becoming
a "doctor," but a mathematics Doctor of Philosophy.
The reason for the change is simple:
I am not a medical guy but a mathematical guy.

At a biology lab class, we were asked to grab fish
and do experiments on it.
I spent the whole lab trying to grab
one fish in a small fish tank but failed.
Meanwhile, I crushed almost all the math
exams in my elementary and middle school.

I also enjoyed reading fun math books as a child.
Among the topics, I liked number theory most.
I heard about the Collatz Conjecture, magic 1089,
pi to 22 decimal places (which I remember
since then), and different patterns of divisibility.

This experience influenced my taste of mathematics and is a reason for me to become a number theorist.

— as told by Chen An

Duke Math grad student

Chen is on the right

I grew up in Beijing, China where education is very structured, and we were told to perform well.

Since elementary school, I knew I always liked mathematics and was able to do well in class, but I was very hesitant in joining those "elite classes" where you spend many after school hours working on higher level math problems to compete in national mathematics tournaments to get yourself a jumpstart in academics.

But I was fortunate enough to have met Ms. Liang, who was our math teacher for 5th and 6th grades. She never pushed me to do anything I was not passionate about, but at the same time saw the potential in me.

She would encourage me to keep pursuing what I like, and never let my passion become a burden.

She made me realize that even though I am not a gold medalist, I can still become a mathematician, and give my best.

— as told by Dena Zhu Ho
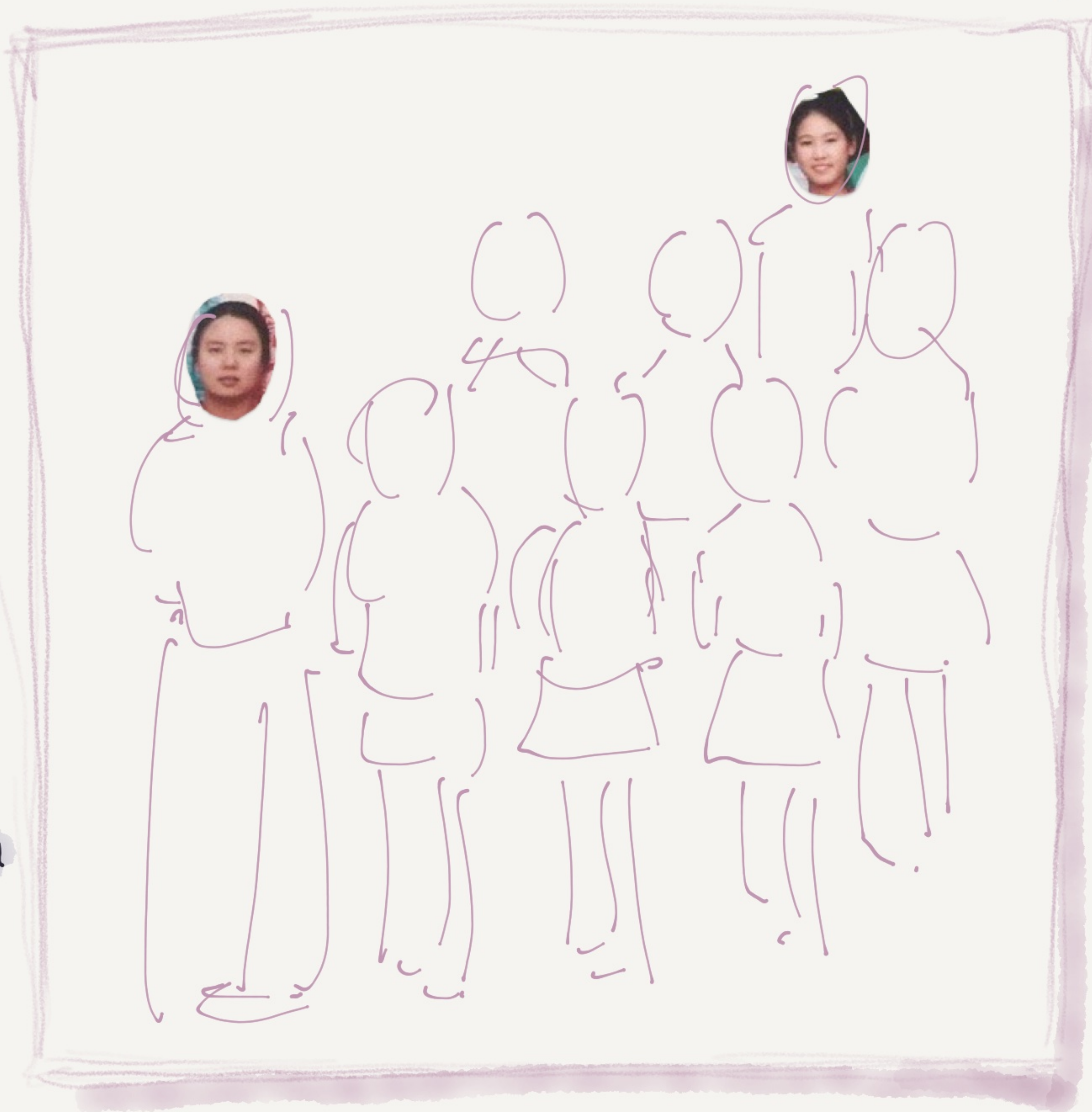
$$P: ax^3 + bx^2 + cx + d = 0$$
$$x_1 = S + T - b/3a$$
$$x_2 = -\frac{(S+T)}{2} - \ldots$$
$$x_3 = -\frac{(S+T)}{2} \ldots$$
$$\text{and } S = \sqrt[3]{R + \ldots}$$

In 11th grade, my wonderful math teacher introduced us to the history of the cubic and quartic formulas and the insolvability of the quintic, along with the colorful cast of characters who were part of that story. Our textbook had a series of exercises showing how to derive the cubic formula, and my good friend Maggie and I got together on a Saturday night to work through the proof.

To this day, the formula (with our names listed right alongside Tartaglia and Cardano) is on the frozen-in-time bulletin board in my bedroom at my parents' house.

We eventually worked out the quartic as well, which required a strip of paper about 15 feet long after plugging all the original coefficients back in. That was my first taste of math research, and there was no going back for me after that point.

— as told by Adam Levine

As a child of parents of Indian diaspora
of the 70's, I'd spend holidays with
the families of my father's friends
from graduate school, that now
lived in the US.
 We'd go to Pittsburgh,
 Cleveland,
 Baltimore,
 or Columbus
 to congregate.

I remember at these get togethers
 the other kids would be really good at math
 (at that age arithmetic)
and I sucked at it. This did not seem to bother me.

 I'd talk about the local baseball team
 and submarine style pitchers
 or how I wanted to be a garbage man
 (the trucks and sound seemed cool).
 Somehow at some point I did become "good" at math.

— as told by Sayan Mukherjee

with bunny

JOY IN MATHEMATICS

When I was at Georgia Piedmont Technical College and Georgia Perimeter College, I worked part-time as a math and science tutor as well as a nail technician.

Working at the spa financially afforded me the tuition. The job exhausted me. Meanwhile tutoring boosted by mood and energy. It was evident that I was excited to take days off from work to join math tournaments.

I enjoyed the moment I won the first place in the calculus competition at the Gainesville Mathematics Tournament.

So, I knew I would do my best in tutoring math...

At Georgia Institute of Technology, I continued to work as a private math tutor. I also became a grader and a teaching assistant for the math department. I felt excitement and joy in helping students. I discovered my passion in teaching this subject. However, I did not want to become a high school math teacher due to culture shock I experienced. Thus I took the P/1 actuarial exam to explore more options in the industry. Unfortunately, I failed to secure an internship in actuary science. I felt like it was a setback in my career, and I wondered what to do to be able to support myself after graduation...

Time was running out...

I considered going for graduate school after evaluating my strength and weakness and getting support from my parents and my girlfriend. I then sought advice from my academic mentor who guided me through the turning point decision of my career, pursuing a PhD degree in mathematics.

— as told by Thomas Huong Tran

Growing up, I was ok at math, but never particularly fond of it. However in 10th grade, I fell in love with math at Calculus Camp. At my high school, all calculus students spent four days on a retreat in the San Gabriel mountains before the AP exams. The goal was to study for the test by working on problems 10 hours a day, with short meal breaks. From the description alone, Calculus Camp did not sound like a very exciting trip.

The opportunity being a huge privilege within the Los Angeles public school system, I was pushed by my peers and teachers to go.

I reluctantly registered for the trip, and before I knew it, I found myself in the woods with people I didn't know... we immediately got to work upon arrival, and I braced myself for the days to follow. However, on the second day, something changed. It was during one of our long group study sessions. Whenever I encountered a question I didn't understand, I talked to my classmates. My classmates also asked me for help. We collaborated, and I lost track of time.

Before I knew it, the session was over. A classmate asked me when I became so knowledgeable. In that kind of environment, everything had started to flow. This was when I realized how fun it is to talk about math with others...

I loved learning how to communicate mathematics in different ways and enjoy the collective feeling of accomplishment once everyone understood a problem...

Since then my dream has been to teach mathematics.

—as told by Ruby Kim

Duke Math grad student

I recalled another throughline of my life: baking.
...to give myself some time and space
to think and work.

I've always thought it should be
"math and cookies,"
not "milk and cookies."

Here is one-year-old Shira baking,
and the cake I made to accompany my PhD defense.

— as told by Shira Viel

Duke Math Faculty

Math as parachute

In 2008 there was a financial crisis.
I was in my final year of graduate school,
and pregnant with my first child.
I was conscious that at a time of financial trauma
for so many people, I should not take it for granted
that everything might go for me how
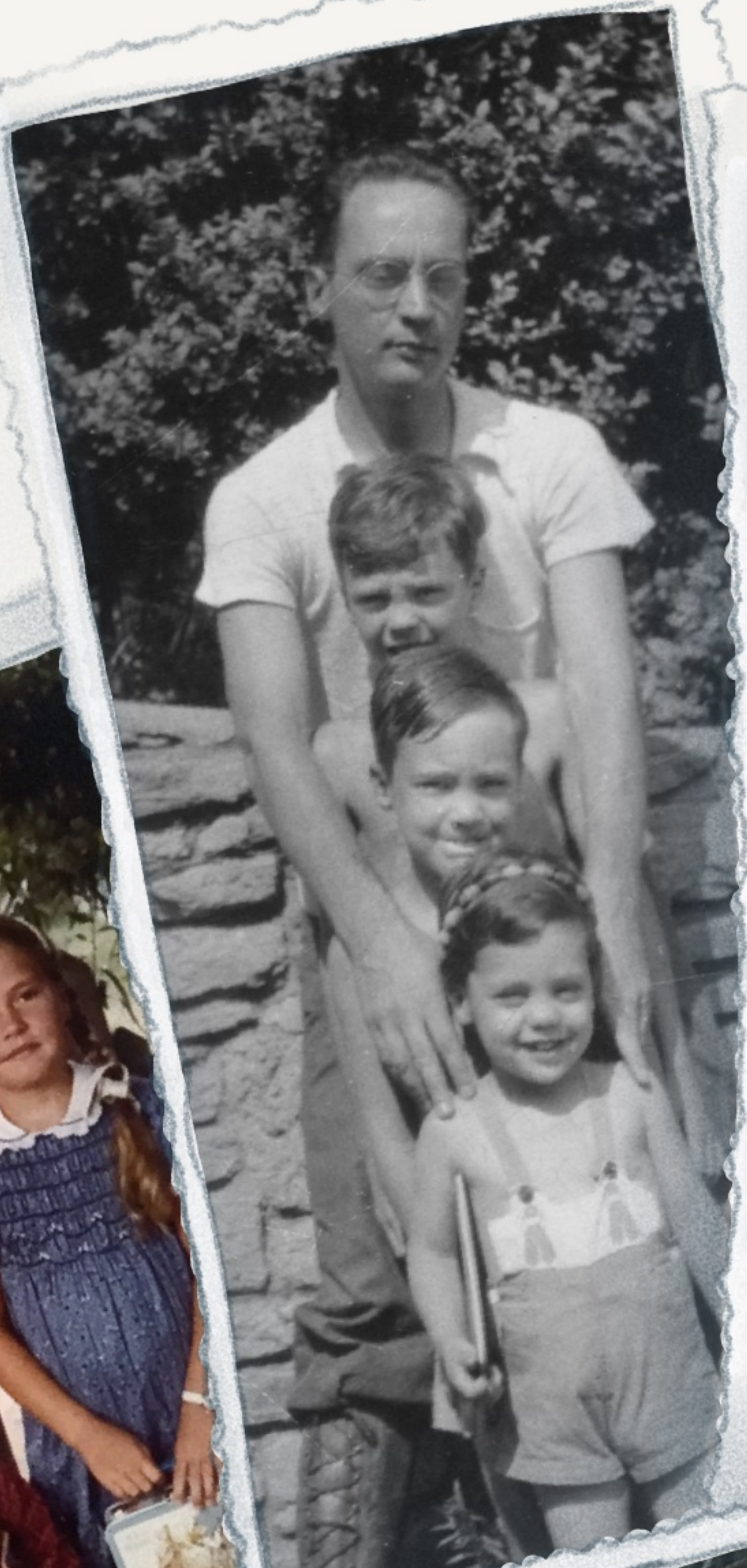I'd prefer to envision it; a postdoc, life as
an academic, etc.

But I felt very calm.
I remember thinking,
there is always going to be
some job a mathematician can
help with in some way.

I felt my education could carry me
in many directions, and bring me
to a safe landing.

— as told by Lillian Pierce

more paths will come

collected by Lillian Pierce