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Saint Mary's College of California

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Does Math Help With Addition?¹

Ellen Veomett

*Department of Mathematics & Computer Science, Saint Mary's College of California,
Moraga, California, USA
erv2@stmarys-ca.edu*

Synopsis

Math always has the answer, right? In this humor-speckled piece, we probe the answer to that question in a challenging context: the mathematician as mother. Unfortunately, we'll find that skill and knowledge in mathematics does not necessarily translate to skill and knowledge in making, birthing, and raising people. But can motherhood in some way improve us as mathematicians?

My thesis advisor once told me about the most difficult combinatorics problem he ever solved. He grew up in communist Russia, and when he married, he lived in a one-room apartment with his wife and mother. "That's one room, not one bedroom," he emphasized. Once he and his wife were expecting their first son, he decided that they needed a place with at least as many rooms as people living there, which they eventually found after moving to several different countries as he advanced in his career. "That was the most difficult combinatorics problem I ever solved," he would joke.

I didn't have the same combinatorial problem to solve when my husband and I started planning our family, but I was sure the skills I honed as a mathematician would serve me well in family making, just as they had in my professional life. My mathematical training had given me skills in predictive analysis, had made me an expert in preparing for and taking difficult exams, and had honed my pattern-finding abilities. The addition of a child or two could only benefit from these skills, right?

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1. Benefitting from Probabilities

I was ecstatic upon learning that I was pregnant the first month that my husband and I tried . . . until my mother told me: “Oh Ellen, I got some interesting results back from *23andMe*. It turns out I’m a carrier for Canavan disease. I just thought you’d want to know, since Aaron has an Ashkenazi background.” Canavan is one of those genetic diseases that is more common in the Ashkenazi population, and children born with Canavan disease suffer serious neurological problems and extremely short life spans. With mom’s offhand comment, worry overtook whatever space there might have been left in my mind for joy.

But probabilities and knowledge of how genetic diseases are inherited could save me from panicking, right? I calculated my probability of being a carrier ($2/3$ if my dad was a carrier, $1/2$ if he wasn’t). I researched Aaron’s likelihood of being a carrier (about $1/40$), and I calculated the likelihood of our little embryo having Canavan if we were both carriers ($1/4$). Unfortunately these calculations only brought with them fear, which elevated when I learned that I was a carrier. Then, after two weeks of frantic calculations and recalculations, we learned that Aaron was not a carrier. We also learned that I had been focusing my mathematical energy on the wrong negative possibility; our little embryo didn’t have a heartbeat. The miscarriage was complete a few weeks later. I had no choice but to turn my attention to another data set — the chances of conceiving again.

Probabilities were still my crutch, and I leaned on them more than ever. I began by researching statistics on miscarriage. I even looked up the likelihood of having two miscarriages in a row, knowing full well as a mathematician that I should instead focus on the conditional probability of having a second miscarriage, given that I’d already had a first. I looked up the conditional probability too, of course, but naturally that number was even higher than the probability of a single miscarriage. In my desperation for reassurance, I pretended that the lower probability of two miscarriages in a row somehow applied to me. When we finally became pregnant again and made it past the miscarriage stage, my probability obsession moved to chromosomal disorders. That year my Probability and Statistics students learned a lot about how age affects the likelihood of a false positive for prenatal screening tests.

Somehow my skills in predictive analysis were not helping. Yes, calculating the probabilities of chromosomal and genetic abnormalities gave my mind something to focus on that was numerical, rather than emotional, but this knowledge didn't make my feared outcomes any less likely, nor did it calm my anxiety in any way. Nevertheless, I was convinced that this was a singular failing of mathematics in my life, and that the upcoming addition to my family could re-establish mathematics as the best way to tackle any problem.

2. A Theory Expert Takes a Practicum

I am a pure mathematician, and I like being able to prove what is true in a world untarnished with emotion or unpredictability. My mathematics is controlled, with simple, well-defined objects and models untouched by interference or unknown variables. And throughout my many years of theoretical training, I have studied for and taken innumerable many written exams. I know how to prepare for unexpected problems that I may need to solve . . . so long as the solution is a written proof. To my astonishment, my mastery of theory and of test-taking proved little help in my first parenting practicum: childbirth.

Unlike the optometry student who can examine the retina of every friend and family member she can get to sit still with their eyes open, the expecting mother must settle for holding a piece of ice in her hand and pretending that the resulting painful chill is in some way similar to labor contractions. Nevertheless, I could still study for childbirth, as I studied my mathematics. I learned everything I could about the stages of labor, ways of speeding or slowing labor, and techniques to manage labor. I was certain that my theoretical knowledge would help me to ace the final practicum.

I woke at 5:30 in the morning, nine months pregnant with my first child, with pains coming at regular ten-minute intervals. Everything was going as expected! And hey, my contractions even sped up when I took my dog on a walk, also as expected! A few hours later, I hit the 3-1-1 milestone we had learned about in class: my contractions were three minutes apart, lasting a minute or longer, for an hour. From my studies, I knew that this meant that I was in active labor, my cervix was at least 4 cm dilated, and I would be giving birth in a few short hours! Thus my surprise when I was told at the hospital that I was only 1 cm dilated and should go back home to labor some more.

Obviously I missed something in class. But no worries, I could try out all of the ways I learned to “manage” contractions. I sat on a ball. I bent over and pushed my head into my husband’s stomach. I took a shower. I sat in the bathtub refusing to get out to pee since standing increased the frequency and intensity of the contractions. (Note I didn’t say I refused to pee). Yet when we went to the hospital late that night I was told that I was only 2 cm dilated. Home we went, yet again.

I must not have been paying attention in class when they explained the 3-1-1 milestone, because I expected to have contractions that frequent only a few hours, not 34 hours. It had been a few years since I’d taken an exam; my study skills must have gotten rusty. But perhaps more likely is that childbirth defies theoretical study; it is one of those areas of my life (one of several newly acquired areas) for which I needed to gain practical skills on the fly. My theoretical knowledge could only get me so far. And yet I did, eventually, ace the practicum: I gave birth to a beautiful baby.

3. Finding the Function

In spite of my evolving skills, I still depend heavily on math. As a mathematician, I am a pattern-seeking animal. Whether I’m doing research on isoperimetric inequalities or teaching my students techniques for integration, I look for general rules that can be used in a variety of instances. Parsing through enough examples, I (and my students) find those rules, and exploit them to solve new instances of similar problems. Surely enough practice with a baby would turn me into a snooze-inducing, smile-eliciting, and tantrum-quelling master.

I can hear you snickering, but in my defense, I did learn some techniques in getting my son to sleep. After months of practice getting him to sleep innumerable times a day, I found that both holding him while breastfeeding, and bouncing him on a yoga ball lulled him into a gentle sleep. Unfortunately, I was unable to find a technique to put him down so that he would remain asleep.

A few weeks after my second child — a daughter — was born, she started randomly laughing a beautiful, chubby cheeked little baby snicker. Once she did it while I was pretending to bite her fingers, once while I was singing to her, once when I said I thought I was getting this mommy thing down.

I'm still working on the correct input for the function whose output is that gummy giggle.

And now that my son is a toddler, I'm working on the "prevent a tantrum" function as well as the "agreeing to wash hands" function and the "correct cup color" function. While trying to work out the details of these functions, I had a revelation: babies are not machines. At least, they're not like machines I'm used to using, like Fubini's Theorem, or short exact sequences. The laws and functions governing sleep, giggles, and tantrums are so complicated, and so child-dependent, I can (and will) spend a lifetime trying to "solve" them. Luckily, just as with the most complicated of mathematical questions, I've found unexpected pleasure in this impossible task. And again, just as with math, with each new insight I grow more fascinated with these awesome beings I am studying.

OK, maybe I'm finding it a little bit difficult to argue that my mathematical skills have made the addition of family members any easier. But mothering has improved me as a mathematician. Learning that cracking a couple of glow sticks and turning the lights off make for an amazing bath time has reminded me that creativity is key to finding many mathematical solutions. My toddler screaming in frustration as he tries to figure out a puzzle has helped me recognize how my students feel inside when they try to understand the epsilon-delta definition of continuity. And I've been reminded that while adding something (someone!) complicated and difficult to one's list of priorities can be challenging, it can also be thrilling, fascinating, and fun.

What This Math Mama Has Learned So Far

- Unfortunately, math doesn't always have the answer, not even when you're adding family members.
- Babies are not machines.
- Motherhood has a way of pushing you out of your comfort zone, but hopefully that can be helpful, maybe even helpful for your mathematics.