

LYNN EASTON

The Equation

ANNIE THROWS OPEN the front door, flies past me as I sit in the kitchen, and jumps down two steps into the family room where she heads straight for the small, beat-up wooden desk in the middle of the room.

From past experience, I am fairly sure this seven-year-old needs to pee.

"You look like you need to pee," I suggest.

"I'm okay."

"Mmmm, are you sure?"

Annie doesn't answer.

I don't bother pushing the issue even though I see the telltale bouncing from foot to foot. I have learned I have little control over when—or even whether—she goes to the bathroom. She sits, deep in concentration, at the IKEA kids' desk. The same desk where she sips invisible tea with her invisible friend Rose, an elusive fairy she likes to hang out with when they both have the time.

Rose is magic. But Annie is not interested in magic at the moment. Annie is not playing. This is science and she is working.

Her safety glasses are neon-orange swim goggles someone left at our house last summer. They are too big so she wraps the rubber strap twice around her head. Her gloves are oven mitts swiped from the kitchen. And her solar lamp is her father's gooseneck office lamp, which she's rigged up on her IKEA kids' desk without asking.

Annie is hunched over, holding a piece of tinfoil with a set of tongs we use to dish out the spaghetti. For about a month, she's been trying to make solar energy. She sits at her desk, with intense attention, as often as she can between school and what other people call regular life.

I know not to bother asking questions about this experiment, any more than I bother asking about the bathroom or Rose. I don't understand the answers anyway. And truth is, it's just more fun to watch, curious from a distance. Twenty minutes later she flies past me again in the opposite direction—toward the toilet.

"Good luck," I surmise.

She comes out wearing a different pair of pants. I don't ask.

"I'm going out to play."

"Okay."

She heads back onto the street with Jesse, her nine-year-old sister, and Andrew, her eight-year-old best friend. I wander into the family room, shut off the light still shining on the tinfoil, and lean down to touch the aluminum to see if it's warm.

Science. Magic. You never know, right?



A beat-up red pedal car that used to belong to Andrew sits in pieces on our family room floor not far from where the old IKEA desk used to be.

Andrew is now sixteen. Annie fifteen. They occasionally hang out on the street these days. Annie still needs to be reminded to head to the bathroom—just not as often.

Right now she's sprawled on her stomach as she disassembles the gear system she's been devising for the toy car her friend hasn't used in almost a decade. She wants to build a solar-car prototype for a class she's taking but she can't get it to work right.

She cries tears of frustration. I have seen them before, when she has an idea that's not coming to fruition like she wants. I have nothing to offer when they appear since I know nothing about engines and even less about the science behind solar energy.

"The gear ratio isn't big enough," she says, her hands covered in grease. A wrench in one hand, she sits on the newspaper we put down on the hardwood in an optimistic attempt to keep it clean.

I wonder if this is the time to tell her I've found a cool solar design online that some guy came up with to run a small hand drill, those pesky gears turning at the right pace, or angle... or something.

There are no marks in this class and I don't care anyway, I just want to show her there's a way out. This only makes her madder. For her, there were never any late nights working on exploding volcanoes or hunts online for blue-ribbon-winning science-fair projects. She prefers her own mistakes.

"At least you know the drill will work," I tell her as I hold her in my arms while standing in a pool of black grease which has soaked

through the newspaper onto the hardwood floor. "Or you could forget the whole thing for now. Go out into the sunshine as if you are a solar panel and recharge yourself."

Reluctantly, she settles for blue prints for the drill. Bummed she has to resort to jerry-rigging someone else's idea. Clearly less enthused than when she spent hours at her IKEA desk with her goggles and oven mitts, making magic and making science.

"Don't bother with this if it's not fun."

Annie doesn't say a word and returns to her work.

On the day she's set to give a demonstration of the solar pedal car, she gives me a preview of her sputtering success and shrugs her shoulders. Unimpressed with her progress, she tells me she knows a perfect answer is out there—somewhere. By the time we reach the school, she's recovered enough to greet her mostly male classmates who fall over themselves to help her carry the machine inside.

"See you," Annie says lightly to me through the open driver's-side window.

I let out a deep sigh and put my internal-combustion-engine-powered car into drive.



"I am going to take engineering," she announces at seventeen, a month before graduating high school.

This is not what I want to hear.

"Oh," I say. Then pause. "Are you sure?"

I don't say, "Please God, no. Not engineering."

I am nervous of engineers and not just because I don't understand what they do. I attempt to play on her independent streak and her love to work outside the box and the blueprints.

"It doesn't seem like engineers have a lot of room to explore," I venture.

I don't say, "I've been wary of engineers and engineering schools for decades."

I don't say, "I avoided engineers when I was your age because they had a lousy reputation—and not just for hanging vw Beetles from bridges."

I don't say, "It's tough to be a woman in engineering."

I don't tell her about the article I just read that claims women in engineering and math programs drop out five to one in comparison to their male counterparts.

I don't tell her about research out of a couple of U.S. universities that shows women in the open-source tech world; women's ideas have

more uptake than men's two to one. Unless people know they are women's—and then they are ignored.

I refuse to be the first person to sabotage her. I want to be. I really want to be. But I force myself to think about her earliest forays into engineering. As a toddler, she had an hour to herself each night after her sister went to sleep. She would lie on the floor with three separate sets of blocks she'd claimed as her own: a set of large, primary-colour foam shapes; some oversized Lego; and an odd assortment of wooden blocks that had made it through her parents' childhoods. She was content and studious. This was her magic hour. Her play and her work.

Annie didn't need any fancy pink Lego to let her know she could build stuff then and she doesn't need engineering-school recruitment posters with smiling girls wearing hard hats to know she can be an engineer. She was born one. As much as I'd like to, it's not up to me to kick over the dream she'd built brick by brick on that floor, at that IKEA desk, and with grease-stained hands. I just hope she remembers to play, and to leave a space for windows to let in the sun—and Rose—once in awhile.

I keep my mouth shut. Breathe a little easier when she turns down two schools with reputations as top engineering schools because they are equally well known as lousy places for women.

Still, because female engineering students are all the rage in academia we head across the country to talk with faculty in a small university. Annie meets a no-nonsense woman in a white lab coat who shows her around a cluttered, busy solar lab. Their conversation starts out stiff and official. Then they look at some dials and begin an intense discussion using words I can't pretend to understand. Their voices soften and they chat for a while longer.

"Take my card," she says to Annie in that straight-talking openness of a female mentor. Finally something I understand. "Call me when you get here and we will talk."

Annie and I have lunch with five male professors who joke embarrassedly about why there are no women faculty members at the table. They talk about those women, and to my daughter, like they are all equals in a way that can't be faked.

"Katherine is doing great solar stuff, you should meet her," one guy says over a beer.

"I already have, thank you."

I look at Annie from across the table, curious as ever, watching her play with the best blocks she can find to build her world.



"I got the job," she tells me on the phone a few months later. She's walking outside somewhere on that same small campus thousands of miles away. She's breathing hard as she speaks.

"All right!"

I wish I could remember what it is she was applying to do.

"The solar job," she adds for my benefit.

"The woman professor we met on our first visit?"

"Yes."

"What will you do?"

"I'll be testing a solar lamp."

"What? Really?"

"Yeah, a solar lamp. I'll measure how the angle of the light increases the density of the heat on a ..." She's lost me already.

"A solar lamp," I interrupt and laugh.

"Yessss, why?"

"Do you get your own goggles?"

"Yes."

"Tongs?"

"Yes."

"Gloves?"

"Yes."

"Shiny tinfoil?" I wonder to myself.

She believes she's doing science. I see only magic.

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The phone rings. It's Annie. I take a deep breath before I answer. She's in the last days of her second year in engineering and has had a rough couple of weeks. She's run up against the toughest part of any passion. The work: the tough, sometimes repetitive, sometimes soul-sucking work.

But today, there's a lilt in her voice that I only hear when she's looking forward again. When she's been startled. Amazed. Dazed by discovery.

"Hi Mom," she chimes. "I had an epiphany."

I'm in the backyard. Both my hands are deep in a clay pot while holding the receiver in the crook of my neck, my hands digging into last year's dirt to pull out a dead strawberry plant.

"Oh yeah?" I say, absentmindedly.

I try not to drift away, but it's the hottest day of spring here so far and I'm searching for somewhere to plant the flats of young beans and strawberries that are about to expire if I don't get them in the ground.

She starts into a story about how she locked herself out of her apartment and went to the library to pass the time. She searched for the bios of some of the scientists behind the equations she's studying. She came across a guy named Heaviside who invented something called operational calculus.

"The guy was a little wacky—but weren't they all?"

It turns out he hated to wait around for others to give their blessing to his ideas. That blessing is called a proof in the numbers business, I have learned. The best proofs are called elegant. They are defined as beautiful. They are art.

"He was on a raging train to knowledge that no one could stop. He didn't need any proof. He was just creating. He couldn't wait for others to approve. I really love that."

Yes, you do, I think.

This summer my daughter will work with a strong woman determined to harness the sun. Her head is full of the ideas of other female scientists—living and dead—she admires. And full of the ideas of guys like Heaviside: the nutcases, the freight trains, the artists.

She has found her people and I watch, curious from a growing distance. I am in my garden, on the other side of the country and I still need to connect. I ask her a question I have already posed several times but the answer never sticks.

"Hey, what's that equation again, the magical one that explains everything?"

I move to the vegetable garden at the bottom of our yard and open the black garbage bag of steer manure we got from a nearby farm. It steams in the early spring heat as I shovel it into the raised beds, full of multiplying earthworms, crawling insects, and a potato that has survived the winter.

This is the garden where I first heard P.K. Page read her poem "Planet Earth." It was late September 2001 and I had the radio on. Annie was a preschooler, pattering nearby. I had decided this was a better place for her and Rose than her kindergarten class.

I dropped my trowel and fell to my knees and cried that afternoon listening to Page's words. I cried for the beauty, for the mystery, for the near misses for our Earth. Annie put her arms around me and we watched the swallows swoop in unison in some kind of preplanned patterns. I think of that moment each spring as I turn the earth for the first time. And today I also think about the scientific equation, which Annie patiently explains to me—one more time—is the most elegant and beautiful in the universe.

"It's $e^{i\pi} + 1 = 0$," she says. "The one with the imaginary number."

She has told me how this equation is behind just about everything. It explains the curl of a fern and the curve of the universe. It's in the pull of the moon and the push of our hormones. In the dark matter we can't see and in music we can hear. It's everywhere.

And it's imaginary.

Magic.

At least, it certainly feels like a freight train full of crazy alchemy to me as I sit with my hands covered in the earth of this garden. Just like Heaviside, I don't need any proof. Nor does Annie, as she rages down her own tracks chasing after things others can't yet see—right past those of us fearful she may hit a brick wall.

The sun my daughter wants to harness beats down on me. She continues to explain imaginary numbers into my ear as I peek around the blackberry bushes where Rose used to hang out.

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