The Year Math Changed Forever

A.I. is solving problems that stumped the field for decades. Mathematicians look to Terence Tao for guidance on their altered world.

By Rivka GalchenNovember 1, 2026

> “I have had the strangest week ever in my life,” Tao said, after OpenAI announced the solution to yet another problem.Photograph by Brian Van Lau for The New Yorker

A mathematician is a machine for turning coffee into theorems. This was a line often invoked by the Hungarian mathematician Paul Erdős, who was fuelled by coffee and amphetamines, slept little, travelled near-constantly, never married or had children, and published almost fifteen hundred papers in his lifetime, in collaboration with hundreds of other mathematicians. But Erdős was, in most ways, not machinelike. He called lecturing in mathematics “preaching,” woke friends at odd hours by asking, “Is your brain open?,” wore only silk underclothing on account of his sensitive skin, and claimed not to have learned how to butter toast until he was twenty-one. He gave away most of his earnings to charitable causes and to young mathematicians in need of funds for their education, and he offered bounties (sometimes ten dollars, sometimes a thousand) for solutions to mathematical problems he’d proposed. Mathematics was his life. Mathematicians were his family. It has been said that, even above his remarkable contributions to the mathematical literature, he helped the discipline most profoundly by turning people who might otherwise have become hedge-fund managers or F.B.I. agents or lost souls into mathematicians. When he died, in 1996, at the age of eighty-three, he left behind about a thousand problems. Solving an Erdős problem is a great honor, as is having a low “Erdős number,” a term that describes how many degrees of separation one is from having published work with him.

Terence Tao was ten years old when Erdős visited his home town of Adelaide, Australia, in 1985. Erdős loved children and called them epsilons. Tao, a mathematics prodigy, had started taking college-level courses at age nine. Erdős posed a problem for him and Tao to work on together. A photograph of their meeting, taken by Tao’s mother (who had been a math teacher before having kids), shows the young mathematician and the old one deep in thought, hands at

chins, looking at the notepad before them. “I wish I remembered more about the encounter,” Tao recently said. Erdős later sent the Tao family a note, handwritten on Bell Labs stationery, that, after brief wishes of a good New Year, reiterated the problem they had discussed: “Let $1 \leq a_1 < a_2 < \ldots a_{tn} \leq n$ be a sequence of integers . . .”

In May of 2023, the mathematician Thomas Bloom began gathering the known remaining unsolved Erdős problems on a website, erdosproblems.com. Their depth and difficulty vary, deliberately. Erdős described some of them as “marshmallows” and others as “acorns.” In a talk in February of this year, titled “Machine Assistance and the Future of Research Mathematics,” Tao quoted Erdős’s characterization of a marshmallow as “a tasty tidbit supplying a few moments of fleeting enjoyment,” and of an acorn as “requiring deep and subtle new insights from which a mighty oak can develop.”

The role that artificial intelligence will play in research mathematics has been talked about a fair amount in the past five years, and a fearsome, unbounded amount in the past five months. Tao—a professor of mathematics at the University of California, Los Angeles, and a founder, in 2025, of the Foundation for Science and AI Research—has been one of the most prominent voices in this discussion. This is in part because he is a venerated mathematician who won a Fields Medal, the highest honor in the discipline, at age thirty-one; in part because, like Erdős, he is especially collaborative and community-oriented; and in part because he was already thinking seriously and publicly about A.I. when many of his peers still thought, as Tao put it, “Oh, it’s a toy, it makes so many mistakes, it’s never going to be useful.” A.I. labs such as Google DeepMind, OpenAI, and Anthropic were trying to demonstrate otherwise. From their perspective, math problems are practical benchmarks to measure the capabilities of their products. Mathematical proofs can be digitized and objectively verified, and the field of mathematics is highly respected. Early on, A.I. tools were conspicuously bad at basic math. When OpenAI’s GPT-4 Turbo was asked to count the number of “L”s in “lollapalooza,” it answered “Five.” The tools have since improved dramatically, but even now L.L.M.s find difficult some tasks that we find easy, and vice versa. “The means by which an A.I. solves a problem is just so orthogonal to the way a human solves a problem,” Tao said, in a recent lecture. A.I. proofs often devote pages to what would be obvious to an undergraduate, then offer only a few lines on what to a human mathematician is a large, cloudy move.

In 2024, A.I. tools began performing well at the International Mathematical Olympiad, scoring at the silver-medal level and, in 2025, at the gold level. Only top high-school students and a handful of prodigies participate in the I.M.O.

(Tao won a bronze at age ten, a silver at age eleven, and a gold the next year. His longtime friend and mathematical collaborator Allen Knutson recalled how an ex-girlfriend who had been on Mexico's I.M.O. team told him about an annoying little kid with a stuffed animal who would come out of the exams saying, "Too easy"—it was Tao.) Then, in early 2026, mathematicians and math hobbyists using A.I. tools started solving some of the more marshmallowy Erdős problems. In January, GPT-5.2 Pro appeared to have solved Erdős Problem #728 largely on its own; Tao and others took on the necessary task of verifying the proof. Then more Erdős problems began to fall. Tao explained that some of these problems had remained unsolved on account of "an attention bottleneck," meaning that no one had given much thought to them; others were problems that had already been solved, but the solutions were not widely known, and the A.I. had effectively retrieved them. But, on May 20th, OpenAI published a proof of Erdős Problem #90, the unit-distance problem, a combinatorics problem that involves arranging points on a plane so that as many pairs as possible are spaced an equal distance apart. This was not a marshmallow. Top-level mathematicians had spent time on it, nudging it forward.

> *"It's O.K., but next time I'd like to see you wrestle with a little more self-doubt."*
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> Cartoon by Bruce Eric Kaplan

Then, there was the Navier-Stokes existence-and-smoothness problem. The problem has to do with how a set of equations that model the movement of fluids seems to imply solutions with infinite speed, which should be impossible. In 2000, the Clay Mathematics Institute, in Cambridge, Massachusetts, had announced seven Millennium Prize Problems, chosen and formulated by the institute's Scientific Advisory Board, each with a million-dollar award for solving it. The Millennium Prize Problems are acorn problems, and Navier-Stokes was one of them. On September 8th, OpenAI announced that it had solved it. Much of the mathematical community, which was already distressed, tipped over into existential crisis.

"I have had the strangest week ever in my life," Tao declared at the start of a talk he gave three days later, at Caltech. Usually, when lecturing, he appears in a collared shirt, tucked in. At this talk, he wore jeans and a black T-shirt. The shirt featured the Edo-era woodblock print "Under the Wave Off Kanagawa," a famed art work noted for its fractal-like patterning—the wave comprises smaller, similarly shaped waves, which themselves comprise yet smaller ones. "Ordinarily, I would use A.I. and create some fancy version of this," Tao said,

gesturing at the bare-bones graphic on the screen behind him. “I used PowerPoint,” he admitted, to laughter. He then described the current state of the field. Solutions were being published, often with little explanation or detail, relying on the good will and free labor of mathematicians to verify and illuminate them. A.I.-generated submissions were overwhelming mathematics journals and databases, and the field’s genteel ecosystem of people volunteering their time to referee submissions was collapsing under the weight of slop. Sometimes even the person submitting the paper did not understand it. Answers were being found, but, in math, answers are often not very important; the insights and inventions that arise while working toward an answer matter much more. “We have to slow down,” Tao said. “It’s insane, the pace.” During the Q. & A. portion of the talk, an audience member observed that A.I. has thus far been solving problems that already exist. Where did Tao think new problems would come from? *New* problems, Tao said, emerge from “the slow, deliberative process” of working toward a solution, “and this is what’s being destroyed.”

In another era of mathematics, which is to say, in April, I visited Tao at his office in the Mathematical Sciences Building at U.C.L.A. The building was connected through a mazelike series of corridors and stairs to Boelter Hall, where, in 1969, the first message was sent on *ARPANET*, the precursor to the internet. One of the hallways had a telephone booth. Tao’s office was spacious and mostly unadorned, with beige carpeting and a beige sofa, six blackboards mounted onto two long walls, and stacks and shelves with hundreds of books bearing titles such as “Advances in Analysis: The Legacy of Elias M. Stein,” “Number Theory Volume I: Tools and Diophantine Equations,” and “The Arithmetic of Elliptic Curves.” Near the light switch, there was a drawing of a toothy monster in a black suit and tie, next to a message in code (“LWKIRLCS,” part of it read) written on a sheet of paper. His oldest child had made it for him years ago. “I don’t think I remember how to decode it,” Tao said. None of his many prizes and honors were on display, but there was a wall hanging—made by the Mathematics Genealogy Project, of North Dakota State University—recording generations upon generations of who had studied under whom.

Tao is slim, wears his dark hair boyishly grown out, and has a gentle and calm demeanor. He is fifty-one but looks a decade younger. He rides a bike to work, and he has several tennis racquets in the corner of his office, though he said that he hasn’t really had time to play tennis in years, owing to his proliferating duties. “If you want to profile a mathematician, I’m maybe not a good example,” he told me. “I get to do math on Tuesdays and Thursdays. And sometimes on airplanes.” He lives with his wife, Laura, their two children, four cats, a dog, and three rabbits. The family had intended to give the oldest rabbit, Spumpkin, away to a friend, because Spumpkin was “traumatized by the traffic”

outside their house, Tao said. But that didn't work out, so Spumpkin is still with them, which is O.K.; Spumpkin and the oldest cat are close friends.

Many mathematical geniuses have been as celebrated for their eccentricity as for their work. Erdős is only one of many examples. The eighteenth-century Italian mathematician Maria Agnesi, who wrote an early textbook on calculus, gave away most of her money and abandoned mathematics to devote herself fully to theology. The logician Kurt Gödel, whose incompleteness theorems revealed that no mathematical system could express every mathematical truth, came to believe that doctors had a secret book in which they wrote honestly about medications, that the I.R.S. was after him, and that his friend who had died decades before was still alive in the Soviet Union. John Nash (famous for contributions to game theory), Grigori Perelman (famous for solving the Poincaré conjecture), and Alexander Grothendieck (famous for developing a new foundation for algebraic geometry) all dramatically withdrew from their social spheres. Tao does not fit this tradition. He is very much of the world, which is somewhat surprising, considering that, when he was two years old, he was reportedly found typing out a favorite children's story on his dad's typewriter.

As a kid, Tao imagined that what professional mathematicians did was solve problems assigned to them, sort of like homework. By age seventeen, he was a graduate student in the mathematics department at Princeton University, and still somewhat in the dark about what he was meant to do with his mathematical imagination. He played a lot of video games, easily completed his coursework, and almost failed the qualifying exam for his doctorate. Not all child prodigies go on to brilliant careers. Tao, however, went on to become one of the most revered mathematicians alive today, praised for his profound contributions to an astonishing range of subjects, from the study of numbers to the analysis of waves—a polymath of math.

The election of Donald Trump for a second term, in 2024, made Tao even busier. Federal funding for U.C.L.A.'s Institute for Pure and Applied Mathematics (*IPAM*), where he serves as the director of special projects, was frozen, as were National Science Foundation grants that supported his department's research, including his own. And, as the Trump Administration unrolled various anti-immigration orders, students and postdocs had visa troubles. Tao spent many months fund-raising among private donors to support the stipends and T.A. positions relied upon by his graduate students. Some of these donors were hedge funds and banks that had in the past offered him large sums to work for them. He had always declined, "but those connections were useful in that moment," he said.

One of the companies that offered funding to *IPAM* was OpenAI. Earlier this year, Tao was interviewed alongside an OpenAI executive, Mark Chen, in what the company called a fireside chat. In the interview, Tao expressed both hopes and concerns about A.I. in mathematics; OpenAI later used some of his bullish bits in a promotional video, which featured Tao saying that A.I. is "ready for prime time," and that it will reduce cognitive friction "down to zero." Tao has collaborated with researchers at Google DeepMind, and one of his projects was sponsored by the A.I. startup Math, Inc. For these reasons, among others, he was for a time portrayed as almost uncritically enthusiastic about the role of A.I. in math; in a June article in *Quanta Magazine*, he was described as an "evangelist."

> *"I think he's coming over to talk to me about a career change."*
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> Cartoon by Sarah Kempa

It is true that, for a few years now, Tao has suggested that the chalkboard-dominated field of mathematics might be overdue for change. He has expressed hope that A.I. could help make a "living spreadsheet" of mathematics, which could self-update as new mathematical discoveries are made; he has worked to develop open-source A.I. tools, in addition to helping organize events to encourage a collaborative approach to A.I. In 2024, he started the Equational Theories Project, which involved dozens of professional and amateur mathematicians who, with the assistance of A.I., tried to determine the truth or falsity of about twenty-two million mathematical implications of some forty-five hundred invented mathematical laws. He has spoken about how A.I. could enable even more large-scale collaborations. He would like mathematics to be able to ask questions more in the tradition of biologists' population studies ("What makes lemur populations rise and fall?") rather than case studies ("What can we say about this particular lemur and from there gain some insight into lemurs in general?").

Recently, though, Tao's muted optimism has given way to alarm. He has begun to speak in praise of cognitive friction, and has described A.I. companies as having "managed to optimize by removing all the humanity out of the process." In his office, he told me, "We have to actively experiment and figure out what works for us. Because otherwise what's going to happen is that the tech companies will release these products—you know, 'Here's my artificial scientist'—and there'll be no competing products." He doesn't advocate that mathematicians avoid using A.I. But, at his lecture at Caltech, he pointed out that the effect of A.I. on math followed what he called nonlinear dynamics. He went on, "Any kind of monotone, one-dimensional thinking—Oh, a little bit of

this is good, therefore a lot of it is going to be a lot better—one of the lessons of math is that most systems don't work like that." Human understanding needed to remain central. For example, with a proof written by a human, he noted, "you can talk to that person and say, 'What was your experience? What was your inspiration?' You have some insight into the process. They can give talks. And, years later, they'll still be in the community, and they can pass on their expertise to their students. They contribute to the whole ecosystem of mathematics."

In his office, Tao had compared the crisis that the mathematical community was facing to the transition that cities underwent when the horse and buggy was replaced with the car. "You need parts of the city that are still for pedestrians and parts that make sense for travelling by car. But you can't have the whole city designed to be optimal for cars," he said. "Because no one wants to live in that city." This was an analogy he used often in talks and interviews. In a more recent talk, he recalled his reliance on the analogy with a slide demarcating lanes for pedestrians and ones for automobiles. "This is where we want to go," he said. "But, unfortunately, this is sort of where we are now—" He advanced to a slide that depicted people running away in terror from what appeared to be autonomous machines.

Much of the math we learn as kids is mechanical, which may be why mathematics is sometimes misperceived as an unimaginative field. A more accurate understanding might come from recalling that Charles Dodgson, better known as Lewis Carroll, was a professional mathematician. In some ways, the writing of "Alice's Adventures in Wonderland" resembles mathematical research. Mechanical calculation, in this analogy, is the basics of composition: spelling, subject-verb agreement. But, in order to explore logic and whimsy and wonder and paradox, Carroll invented characters like the White Rabbit, the Cheshire Cat, and the Queen of Hearts, and situations like the Mad Tea Party and the Caucus Race. These characters and scenes are akin to the objects and techniques mathematicians invent as they explore mathematical ideas. When Andrew Wiles proved Fermat's Last Theorem, more than three hundred and fifty years after its initial postulation, mathematicians were thrilled, but not because of the answer, which wasn't surprising. (No, there are no positive whole numbers such that $a^n + b^n = c^n$ if $n > 2$.) What was wonderful about Wiles's proof was the mathematical techniques he'd developed along the way. That was what advanced mathematics.

But coming up with characters and story lines is challenging—which is probably why it's satisfying. I sat in on a meeting Tao had with his postdoctoral mentee, Iqra Altaf, who was working on a problem in geometric-measure theory. "Mathematically, the news is not good," Altaf said. She went to the

chalkboard and began writing out a counterexample to a conjecture she had thought would prove true. “Math is like a video game, or like ‘Groundhog Day,’ ” Tao said. “Every time you die, you come back.” En route to failure, you learn something that aids you in the next go-around. He quoted the Russian mathematician Vladimir Arnold, who once said, “Mathematics is the part of physics where experiments are cheap.” In another conversation, Tao compared learning mathematics to watching “Emily in Paris,” a show that he and his wife enjoyed. “It’s completely ridiculous fluff, but it’s also fun. You learn the tropes, and you can kind of see how it’s going to go,” he said. “But if you’re just given a synopsis of the plot, like, ‘Here’s the premise, and this is what happens’—that’s not the point.” And, if you want to learn how to write your own show, “then it’s not helpful at all.” Seeing scenes done poorly and done well, watching how plots are resolved even in formulaic shows—that’s how you learn to direct your own series. Among the crises that the arrival of A.I. has brought to mathematics, “the most urgent one is, How are we going to train our graduate students?” Tao said. It is a question that he has been asking for several years. The modest-sized problems that graduate students would once have spent months on—learning to think mathematically in the process—can now sometimes be solved by A.I. tools in hours.

On October 9th, Tao gave a talk (another!) hosted by the American Institute of Mathematics. Three days earlier, OpenAI had released three hundred and seventy-two additional results contributing to or solving open problems in mathematics. (OpenAI’s statement announcing the results briefly mentioned that four thousand problems had been tried, but that detail didn’t get much notice.) Tao started out by explaining that, when he had been invited to give the talk, a year earlier, the title of it had been “Machine Assisted Proof”—that was, in fact, the title on the posters advertising the event—but that “by this point the idea that machines could assist proof was maybe not quite as novel.” So he changed the title to “Math 2.0.”

> Tao was ten years old when Paul Erdős visited Tao’s home town, where they worked on a problem together.Photograph courtesy Terence Tao

Math 1.0—“math up to 2025,” Tao said—operated under the basic assumption of “proof scarcity.” Proofs were a sort of currency, central to publishing papers, winning prizes, and getting jobs. The landscape had now changed to one of proof abundance, which Tao compared to food abundance, when “you become a bit pickier about what food gets crammed into your mouth.” We would soon be living in a vast sea of low-quality A.I. proofs, with mathematicians left to fish

out what was worthwhile. Math 2.0 would follow from figuring out "how to actually integrate A.I. and humans" to "find a new frontier of tasks," only some of which would be problems.

During the Q. & A., a first-year graduate student at Caltech asked Tao what advice he would give to her generation. He hesitated. He blinked several times. He closed his eyes. "Get involved," he said. "In—um—you know, in policy. In general." He paused and then spoke more fluently: "Don't try to pretend A.I. doesn't exist. Actually learn what it can and can't do."

The mathematician Geordie Williamson, of the University of Sydney, in Australia, described one A.I.-assisted solution to me as "like this beautiful thing for the whole math community" and another as "like the weed killer Roundup being sprayed on a garden." Both results were published by Levent Alpöge, a mathematician at Anthropic. The beautiful thing concerned an eighty-seven-year-old problem, the Jacobian conjecture. We can think of the problem as having to do with the possibility of a one-to-one mapping from one shape to another. On July 19th, the day of the Spain-Argentina soccer game, Alpöge posted on X, "hello there the jacobian conjecture is false thanx to my close friend akhil"—a human—"for asking about it and my other close friend fable"—an A.I. model—"for working during the world cup final." Claude Fable 5 had produced a counterexample to the conjecture, much like how an ostrich is a counterexample to the conjecture that all birds can fly. Williamson said, "Within thirty-six hours, mathematicians had kind of understood where the counterexample comes from and why it's natural." A handful of mathematicians, including Tao, explored the proof, came to understand it—a process that I kept hearing mathematicians refer to as proof digestion—and reconstructed the algebraic geometry that underlay it. On July 21st, Tao posted the work on his blog, including the transcript of a conversation he'd had with ChatGPT as he looked into the details. By July 22nd, Semon Rezchikov, of Barnard College, had created a visualization of the counterexample using only high-school-level mathematics. The proof had opened up thinking, not decapitated it.

But then there was Williamson's Roundup story: On August 12th, Alpöge posted again, though it was not immediately clear what the new disclosure was about. "It was this crazy tweet, just a whole sequence of pluses and minuses. It looked like a secret code," Williamson told me. He soon recognized that it was the next in a series of what are called Hadamard matrices. The first few Hadamard matrices had been described in 1867, and the matrices have fascinated mathematicians ever since, with breakthroughs and new insights turning up every couple of decades or so, the most recent in 2004. At a talk not

long before, Williamson had been encouraging mathematicians to find the next one. Then there it was, on X. "At first, I was, like, Awesome," Williamson told me. But then he saw that Alpöge had posted more than just the next matrix—"also the one after that, and the one after that, and the one after that," he said. Typically, someone solving this kind of problem would be transparent about the methods used to get there; for years, mathematicians have been sharing their work freely on the open-access website arxiv.org. Such is not the M.O. of the A.I. companies. Anthropic did not release logs showing how the solutions were reached. Williamson said that he felt as if an entire garden of mathematics had been killed. "It was the nightmare scenario, like, 'Here's the answer, it's forty-two.' "

It was less than a month later that OpenAI made its Navier-Stokes announcement. The day before, Tristan Buckmaster, a professor at N.Y.U., posted a statement saying that he and Alpöge, working with the assistance of A.I., had made significant progress toward a solution. OpenAI, which spent millions of dollars' worth of compute to get there first, said that it had taken less than a week. In Buckmaster's statement, he voiced concern that OpenAI had accessed his work (he and Alpöge had used OpenAI's public Codex model, among other L.L.M.s), which the company denied. According to Buckmaster, Sébastien Bubeck, the head of the team at OpenAI that was behind the solution, had offered him authorship of their paper, on the condition that he agree not to include Alpöge. Buckmaster said no. When he threatened to make his interaction with OpenAI public, Bubeck apparently responded by asking, "Why would you ruin your career?"

An initial group of twenty-five Fields medallists, Tao among them, responded with an open letter noting that "solving problems is only a tool and proxy for achieving the primary goal of conceptual understanding and insight." Problem-solving and insight were decoupling, it observed. "The letter was correct to call out bad behavior," Williamson said. "But my broader sense is that I don't think mathematicians had been grappling as much as we should have been with the impending reality of A.I., and I think that is somewhat visible in the letter. It's a letter that reflects what was already a reality six months ago."

Socrates is said to have worried that writing would ruin our memories—and Socrates' crowd probably did remember longer stretches of the Odyssey than any of us do. But the Fields letter argued that the use of A.I. was not like merely off-loading the memorization of poems or phone numbers; it was more like off-loading, or bypassing, daydreaming and debating and thinking. It's not that humans will come to know too much too quickly but that they will understand less and less—eventually less than we understand now. "The most precious

resources of our profession are students and ideas, and these we nurture with great care," the letter said. Mathematics is a living discipline and an oral tradition, not just a written one. The symbol of the working mathematician is a chalkboard, representing knowledge that can be erased after it's understood because it is now in the mind.

The mathematical community has not reached a consensus on whether OpenAI has actually solved the Navier-Stokes problem, which has not yet been verified by humans. Charlie Fefferman, a professor at Princeton, wrote the description of the Navier-Stokes problem for the Clay Mathematics Institute. "I think it's probably correct," Fefferman told me. The A.I. relied on an approach that had been conceived by his former student Diego Córdoba and Córdoba's former student Luis Martínez-Zoroa. "And so, in addition to whatever other people felt, I felt personal joy at their achievement," Fefferman said.

Cartoon by Jason Adam Katzenstein

Fefferman, like Tao, was a child prodigy, an early winner of the Fields Medal, and a professor of mathematics by his early twenties. He is now seventy-seven. I asked him how he would describe what working on a math problem *feels* like. He told me that he had sometimes described it to non-mathematicians as playing chess with the Devil, "but you get to take back moves." The Devil is a much better chess player—"he crushes you again and again." But then you go back to the beginning. You experiment with different approaches. You're still crushed and don't understand why. "But eventually you hit on something," Fefferman said. "The whole time, there's this angel whispering in your ear things like 'No, no, pin his bishop!' " Initially, the angel's voice is too quiet to make out, but it gets louder. "And your ears get better." Until, finally, you win one match. And then you're back at the beginning. "That's something I love about being a mathematician," Fefferman said. "If you have a thousand dumb ideas and one really good one, you're a good mathematician. And that's not true in many walks of life."

Like everyone I spoke to, Fefferman said that no one knows, really, what will happen to mathematics. He sees both pessimistic and optimistic scenarios, and he suspects that the future will consist of a bit of each. In an optimistic scenario, he can envision A.I. broadening the kinds of questions that can be asked. He explained that sometimes you have a line of thinking that feels like it has only a five-per-cent chance of working out. You might say, "I don't want to think about this, since it will take me a lifetime to find out." "That's different from 'O.K., it has a five-per-cent chance of working, and it will take me two days to find out,' " Fefferman said. "I think people will become more courageous and more

imaginative and be freed." He said that mathematicians used to need both originality and technical power; he had known a very original mathematician who got lost teaching a freshman course. "I think that A.I. will take over power," Fefferman said. "It's natural for us mathematicians to feel anxiety. But I think there's a chance that A.I. will be a great accelerator of progress, and it will be our job to adjust to the new way of doing math."

"I thought the Fields medallists' letter was valuable," John Urschel, a mathematician at M.I.T., told me. "Though I understand that maybe it doesn't translate well outside of the mathematical community. I saw one person be, like, 'We're getting answers to cancer research too quickly, we must slow down for the sake of the field!' " Urschel is good friends with Alpöge, whom he remembers saying three or four years ago that A.I. was going to end math as they knew it. "I thought he had lost all sense," Urschel said.

A deep problem in what is called Gaussian elimination has captivated Urschel for years. During the course of a decade, he developed a research protocol that he was confident could solve it—eventually. But, as A.I.-assisted solutions to Erdős problems started going up online, he worried that he was running out of time. "So I began to rush ahead," he said. "I had a postdoc, Rikhav Shah, helping me." Within a week, Shah told Urschel that "he had heard rumors that compute power was being thrown behind problems in Gaussian elimination," and Shah thought that they should consider using A.I. Urschel agreed. "So I paid the two hundred dollars a month or whatever," he said, and they worked with GPT-5.6 Sol and Claude Fable 5.

Urschel walked me through the collaboration with A.I. "So first I asked it, 'Can you solve this?' And it said no, and also that it didn't think what I was telling it was even true," he recalled. "I said, 'O.K., here's this object that has these properties that you didn't believe existed.' " He went on to feed it steps from his research program. The "conversation" went back and forth, with Urschel pushing the A.I. along the axis of his research program, and the A.I. responding in an irksome, sycophantic tone. Urschel directed it to change its tone to be straightforward and honest. Eventually, something "popped out" that was correct but "very, very ugly."

Erdős described proofs that are particularly concise and beautiful—proofs that give you deep insight—as "straight from the Book," by which he meant the Book of God, though he doubted the existence of God, whom he called the S.F., for Supreme Fascist. Erdős's first mathematical publication, at age nineteen, was a proof of Chebyshev's theorem on prime numbers, which had already been proved. But Erdős produced a much simpler proof, one that was succinct and

revelatory. A.I. proofs (at least for now) tend to be nothing like straight-from-the-Book proofs. When Urschel looked at the A.I.-assisted proof, he said, "I thought, O.K., we can take this thing and with human work change it into this nice and intuitive thing." Urschel and Shah published their research, including a detailed endnote of which steps in the process were exclusively human-produced and which were assisted by A.I.

Urschel's program of research had brought about novel, important work. Shah would have a substantive publication behind him when seeking jobs. But Urschel did not feel celebratory. "Let me be clear. There was no fun in this for me," he said. "The fun was had before I gave it to this computer program. But talking to the A.I. about it—this is not fun." He recalled, as a kid, falling in love with logic puzzles. What he loved was being in the dark, trying to find his way forward. "The fun part was *not* understanding, and struggling to understand," he said. "Having all the solutions written down is the least fun part."

Mathematics "has been living a bit of a double life," he suggested, and the pressure from A.I. was making that visible. To people outside the discipline, the story is that math is important and that, even at its most abstract, it often ends up leading to all sorts of unexpected applications, like public-key cryptography and G.P.S. "This is the story one tells when one wants grant money," Urschel said. "But this story is not true. And it has never been true." Or, at least, it's mostly not true. Urschel postulated that every mathematician sees himself as being somewhere on a spectrum between scientist and artist. "I would say what I call the more scientist approach is being focussed on trying to push the frontier of things as far as we can as quickly as we can," he told me. "And the artist perspective is, Let me do something beautiful and enjoyable and manipulate these things, and the act of doing this is really, you know, a joyful thing."

Urschel has an unusual background for a mathematician. He played professional football for three years with the Baltimore Ravens, working toward his Ph.D. at M.I.T. at the same time. His wife is a writer for this magazine. I asked him what he planned to do next. "Well, we're gonna get a dog," he said. "And there's still lots of math to do in my area." Some of his students want to work with A.I., which he is O.K. with, and others don't, and he's O.K. with that, too. ("I have two A.I. vegans," he said.)

Tao also told me that the narrative of math as having practical importance was a half-truth, at best. Some of his own research has led to cheaper, faster MRI imaging; most of it has been about curiosity, wonder, and play. He told me a story about the mathematician John Conway, whom he knew at Princeton and whose office was crowded with what were, in essence, puzzles and toys. "I

remember once he wanted to learn how to see things in four dimensions," Tao said. "He reasoned that, since our eyes can really only see in two dimensions"—it's the distance between the eyes that produces parallax and lets us see as if our vision were three-dimensional—"he invented this weird periscope thing, a goggle thing with mirrors, so that the parallax would not just be horizontal but also vertical. He thought this would give him a way to visualize in four dimensions." Conway built the device and walked around in it, looking like a mad scientist. "But he said the only thing that it ever gave him was a headache," Tao told me.

Tao never solved the problem that Erdős shared with him in 1985. That was done by Hoi Nguyen and Van Vu, in 2010. But Tao did solve a different famous Erdős problem, one that had been formulated around 1930, known as the Erdős discrepancy problem. It was one of the Hungarian mathematician's favorite problems. He is said to have brought it up often, especially toward the end of his life. It can be thought of as a question about a series of coin flips, continuing on infinitely, and whether that series inevitably becomes "unbalanced" if you look at every second, or third, or any-number-distance entry in it. Another mathematician, James Grime, made the problem more accessible by translating it into a puzzle narrative, involving someone held captive between angry snakes in front of them and a precipitous cliff behind them. The coin flips are steps forward or back, and the question is whether it is possible to survive. You could Google the answer. Or you could play around with the problem first. ♦

An earlier version of this article misstated Tao's age when he began graduate school.