

A peek into the future of mathematics from 2026

Abstract: This essay was written for the volume “Implementing Magnifica Humanitas”, aiming to record our state of mind in the turbulent times of the AI-driven cultural revolution in mathematics for future generations, with the somewhat optimistic outlook that the future generations will a) exist and b) care. In recent months, the mathematical community has been grappling with the new reality. Machines have reached and surpassed human mathematicians in problem-solving. Debates are intensifying, emotions run high, and many concerns are being voiced. The essay comprises my ideas and reflections, formed as a result of numerous conversations with mathematical friends, who are referenced in the text by their initials. This essay intentionally avoids all socioeconomic aspects of the science-AI interactions, since this topic requires a separate long discussion.

Many mathematicians have been arguing viciously that AI is incapable of producing a true breakthrough and its only power is synthesizing existing ideas and keeping an enormous amount of knowledge at its proverbial digital fingertips. This enables it to deduce a technical argument, to draw tools from multiple areas, but this does not enable it to exit the “convex hull of knowledge”. AI, in this view, lacks the spark of genius needed for a novel tool or a concept, capable of addressing numerous problems in a new light. A discussion of what constitutes a true breakthrough deserves an essay of its own. In my view, it is impossible to formulate an objective definition, and therefore I am cautiously skeptical of such claims.

But the fact remains: AI-written proofs are often difficult to follow. In the recent batch of solutions to major open problems presented by OpenAI, some ideas are truly striking in their elegance, while other papers appear as a mere sequence of implications brought to work by some unmotivated dark magic (as my friend LR aptly put it).

Back in the day, I used to polemicize with my friend KT about the best practices for presenting a mathematical proof. I used to argue that it is important to split a proof into a series of steps, each step revealing a clear phenomenon. This helps the reader and allows for potential reuse of the techniques. KT, a brilliant mathematician, merely shrugged. He didn’t mind writing up a seven-page technical proof of a proposition, deriving each successive claim from the preceding one, while meticulously maintaining a complex notation system. The writing style did not matter to the highly capable computer-like mind of KT.

I recalled these discussions when a friend shared an insight that made me wonder: maybe AI’s power and ability to juggle thousands of parameters at once, at enormous speed, simply prevent it from understanding what we, humans, find challenging? What if the bare bones of these unreadable mathematical AI proofs are manifestations of deep and novel theories? Perhaps unimaginable beauty is hidden from us by AI’s fundamentally different way of thinking?

Let us assume for a moment that the answer is “yes”. Then two possible action items await us. The first is a thorough human analysis of AI’s arguments, with the goal of unearthing true phenomena behind the apparent gibberish. Perhaps we need to come together in focused workshops aimed at building new theories inspired by all the new material that fell on our heads. Might we hope that OpenAI will fund these gatherings? The least they could do is to pour us a glass of wine at a workshop reception, to drown our sorrows in! In general, human mathematical work will be paramount in the near future, aimed at building and fine-tuning theories, explaining phenomena and closing the gaps. Some may find this exciting, while others may turn away. For years we took for granted that our bread is buttered as a result of the same activity that supplies us with the dopamine from intellectual discoveries. Will this continue?...

The second action item is to improve the AI problem-solving and presentation process. Perhaps a difficult problem should be fed into the most powerful frontier model. Then its solution should be presented to an AI agent with weaker computing power, with the request to simplify and break down the argument. An even weaker agent should take over afterward, and so on, until the agent’s brainpower is comparable to that of a human. This last agent might be able to finally present to us not only the solution, but the phenomena behind it, broken down in a human-digestible way. My own experiments with AI support this intuition.

I believe that an integral part of driving mathematical progress in a given direction will be discovering novel ways to program AI models. In fact, LLMs may be just the beginning: mathematics, by nature, does not live in the world of language. We do. One could imagine a neural network operating solely with abstract mathematical objects and statements. It would collaborate with an LLM at the input and output, while communicating with humans. This might make mathematical AI explorations substantially cheaper computationally. Many exciting prospects and challenging problems await on this route. Who knows, maybe an average arXiv paper in 2036 will constitute a novel mathematical theory developed through an engineering insight.

Overall, we mathematicians may have to become “renaissance men and women”, capable of moving freely between fields of study, working at the interface of theoretical mathematics and other sciences. If such tremendous AI-assisted progress is possible in mathematics thanks to its structure, perhaps humanity’s new challenge is to turn all knowledge into mathematics. In many ways, this process has been happening for decades in physics, chemistry and other disciplines. I believe that now this process will be expanded and accelerated enormously.

Might the opportunities for true human breakthroughs deep within mathematics become scarce? Possibly. But they will become ever more plentiful at the rapidly expanding boundary of mathematics. At its edges, new fields of study will be created. Robopsychology? Artificial neuroscience? Mathematical philosophy? Who knows what the future will bring. Mathematicians will carry the light of progress to the darkest corners of human knowledge, “fill full the mouth of famine, and bid the sickness cease”!

...But let us pull the breaks on this extropian train of thought racing towards the glorious tomorrow, and chug back to the present day. The miserable, miserable day of uncertainty...

— They took a plethora of excellent, viable research programs of numerous brilliant mathematicians and just ripped them apart with their bare hands. Now they are holding their enormous salt shaker, and shaking it, shaking it over the open wound of mathematics! — **BJ**

— They may have just broken our field. — **anonymous**

— What AI is doing now is filling out a puzzle. One day, it will finish. That is when mathematics will start over. I hope this happens soon. — **KT, July 2026**

— [...] more importantly, one should figure out what to do. I do not have concrete ideas yet, but maybe something involving the integration (human and the world + AI) — **KT, October 2026**

— In Italy we have an expression which sounds like: "There is no ground under my feet". This is how I feel. Doing mathematics has been the passion of my life, a shelter, and an antidote for many negative feelings. It has been the reason for traveling, visiting many places and meeting so many interesting people [...]. It shaped my life. I am afraid that this will change forever. — **AC**

— Studying mathematics fosters universal skills: analytical thinking, problem analysis, the ability to grasp new definitions and concepts, and the ability to understand a text and its implications. With such training, one can do (almost) anything. I truly believe that our training prepares us for life, and that the more people speak and think mathematically, the more their enjoyment and abilities will grow. Besides, mathematics is beautiful and artistic — and good for the soul. — **NF**

— There are things that offer a last chance to experience them. For instance, I managed to drive for a few years without GPS. It's not a skill I use today, but there is something nostalgic about the fact that I once knew how to do it. — **SR**

— I have been saying this for a long time now: AI still does not volunteer for protective presence. This is why I am here. — **AS**

— I have been working so hard trying to beat the machine, but I think it will be a losing battle. It was exhilarating to discover some beautiful things using AI, but I don't know how long we can keep it up. I feel exhausted [...], these are crazy times. We need to figure out what our purpose is in the age of AI. It is not possible to compete with it directly, but we need to find something it cannot do. — **MG**

— There are many things that human mathematicians still can do that AI cannot. Plotting crimes [...], sexual harassment, all sorts of things! — **LR**

— An avalanche is a bad thing. But it will cover you anyway. And I am not actually sure that it is a bad thing. — **DB**

— There is a lot of pressure to do things fast now and this is extremely unpleasant so I'm eagerly waiting for all problems that have been stated in the literature to be solved, so some of us may return to doing things in a normal rhythm. — **AE**

— Has anyone checked the OpenAI proofs yet? Surely it's all wrong! — **numerous voices.**

— Not everyone gets to be Brad Pitt. But someone still needs to do acting in TV shows. Our work remains necessary for the successful development of mathematics! — **MS**

— Use AI, the better public models, to expand your research areas. Less developed areas present more opportunities for devising a novel theory, and can potentially finesse the problem of competition. — **ML**

— Of course you will still be useful! True, [a famous mathematician] with ChatGPT can achieve the same progress that he would with your participation, but you are cheaper than the computer servers. — **FN**

... We might all be experiencing trauma at the moment. Such a radical and abrupt change has got to be traumatic regardless of whether or not we welcome it. I broke down into tears in class, while proving a basic result from calculus, as I was suddenly struck by its simple beauty. By the fragility of that beauty...

— What trauma? You should just drink more tea. From porcelain cups. Only porcelain, this is important. — **FN**

Do you hear the screeching, the shuddering, the echo of the thundering booms? That is our current value system colliding with the heartless reality. We need to adopt a new value system. One in which credit for the initial discovery of a mathematical argument is no longer a factor by which our success is judged. I feel a lot of relief bidding farewell to the agonistic nature of our profession.

— But how do we distinguish between job applicants? How do we evaluate grants? How do we award prizes? — **everyone.**

Well. Functions do not form a monoid with respect to the convolution operation. How do we handle this? We think out of the box and invent the delta function. Inventing a new value system can't be much harder than that!

Terence Tao has emphasized, and many have echoed, the necessity of retaining human understanding of mathematics as our core value. Human understanding should remain paramount, no matter what route we take from here into the future.

And regarding the immediate concerns for our job security: our position involves a lot more than merely solving mathematical problems. We are instrumental in facilitating education, disseminating knowledge and creating a fruitful environment where scientific progress originates. We exist so long as universities exist.

— And universities will exist forever, thanks to college football. And basketball. AI will never surpass Wembanyama! — **AK.**