Vibemathed

Математика после 6 октября



@SINECOR

Сергей Николенко

28 октября 2026

1. Древняя история (до 2026)



We may hope that machines will eventually compete with men in all purely intellectual fields.

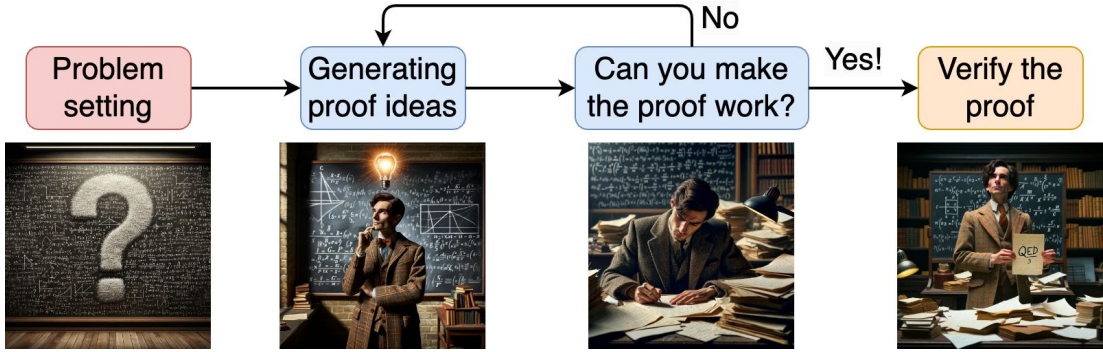
Алан Тьюринг. Вычислительные машины и разум

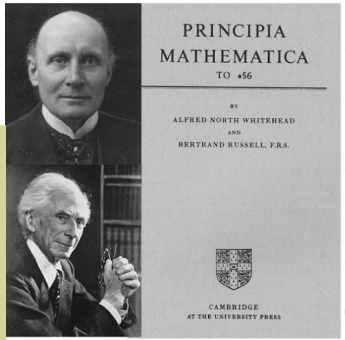
I believe that mathematical reality lies outside us, that our function is to discover or observe it, and that the theorems which we prove, and which we describe grandiloquently as our “creations,” are simply the notes of our observations.

Годфри Харди. Апология математика

LLM для математики

- Работа математика – это интересный случай, который всегда оставался для меня загадкой
- В математической логике давно развиваются методы автоматического доказательства теорем, но ни к чему выдающему они не привели (ну, кроме одной теоремы)…





*54·43. $\vdash :. \alpha, \beta \in 1 . \supset : \alpha \cap \beta = \Lambda . \equiv . \alpha \cup \beta \in 2$

Dem.

$\vdash . *54{\cdot}26 . \supset \vdash :. \alpha = \iota'x . \beta = \iota'y . \supset : \alpha \cup \beta \in 2 . \equiv . x \neq y .$

[*51·231] $\equiv . \iota'x \cap \iota'y = \Lambda .$

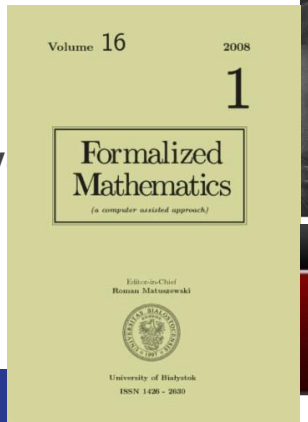
[*13·12] $\equiv . \alpha \cap \beta = \Lambda$ (1)

$\vdash . (1) . *11{\cdot}11{\cdot}35 . \supset$

$\vdash :. (\exists x, y) . \alpha = \iota'x . \beta = \iota'y . \supset : \alpha \cup \beta \in 2 . \equiv . \alpha \cap \beta = \Lambda$ (2)

$\vdash . (2) . *11{\cdot}54 . *52{\cdot}1 . \supset \vdash . \text{Prop}$

From this proposition it will follow, when arithmetical addition has been defined, that $1 + 1 = 2$.





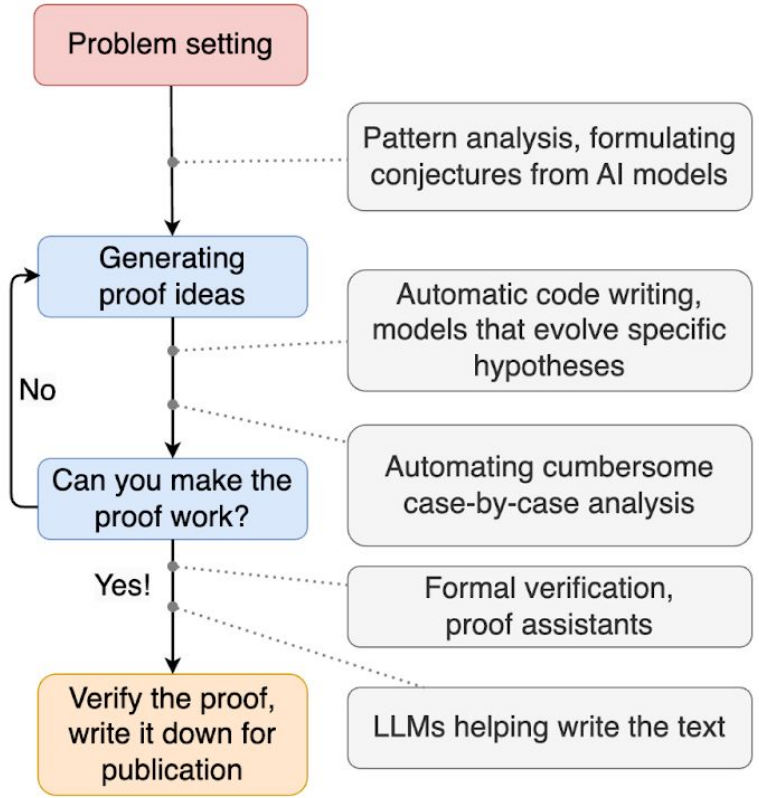
LLM для математики











Advancing mathematics by guiding human intuition with AI

Alex Davies, Petar Veličković, Lars Buesing, Sam Blackwell, Daniel Zheng, Nenad Tomašev, Richard Tanburn, Peter Battaglia, Charles Blundell, András Juhász, Marc Lackenby, Geordie Williamson, Demis Hassabis & Pushmeet Kohli

Nature **600**, 70–74 (2021) | Cite this article

ToRA: A Tool-Integrated Reasoning Agent for Mathematical Problem Solving

Zhibin Gou[1,2]*, Zhihong Shao[1,2]*, Yeyun Gong[2], Yelong Shen[2]
Yujiu Yang[1], Minlie Huang[1], Nan Duan[2], Weizhu Chen[2]
[1]Tsinghua University [2]Microsoft
{gzb22,szh19}@mails.tsinghua.edu.cn
{yegong,yeshe,nanduan,wzchen}@microsoft.com

Discovering faster matrix multiplication algorithms with reinforcement learning

Alhussein Fawzi, Matej Balog, Aja Huang, Thomas Hubert, Bernardino Romera-Paredes, Mohammadamin Barekatain, Alexander Novikov, Francisco J. R. Ruiz, Julian Schrittwieser, Grzegorz Swirszcz, David Silver, Demis Hassabis & Pushmeet Kohli

Nature **610**, 47–53 (2022) | Cite this article

Mathematical discoveries from program search with large language models

Bernardino Romera-Paredes, Mohammadamin Barekatain, Alexander Novikov, Matej Balog, M. Pawan Kumar, Emilien Dupont, Francisco J. R. Ruiz, Jordan S. Ellenberg, Pengming Wang, Omar Fawzi, Pushmeet Kohli & Alhussein Fawzi

Nature **625**, 468–475 (2024) | Cite this article

BULLETIN OF THE
AMERICAN MATHEMATICAL SOCIETY
Volume 82, Number 5, September 1976

RESEARCH ANNOUNCEMENTS

EVERY PLANAR MAP IS FOUR COLORABLE[1]

BY K. APPEL AND W. HAKEN

Communicated by Robert Fossum, July 26, 1976

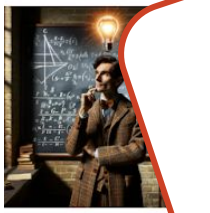
Home About Coq Get Coq Documentation Community
The Coq Proof Assistant

Community

GPT-4

LLM для математики









Problem setting

Схему про LLM для математики я сделал в начале 2024 года; что изменилось с тех пор?



LLMs helping write the text

GPT-4

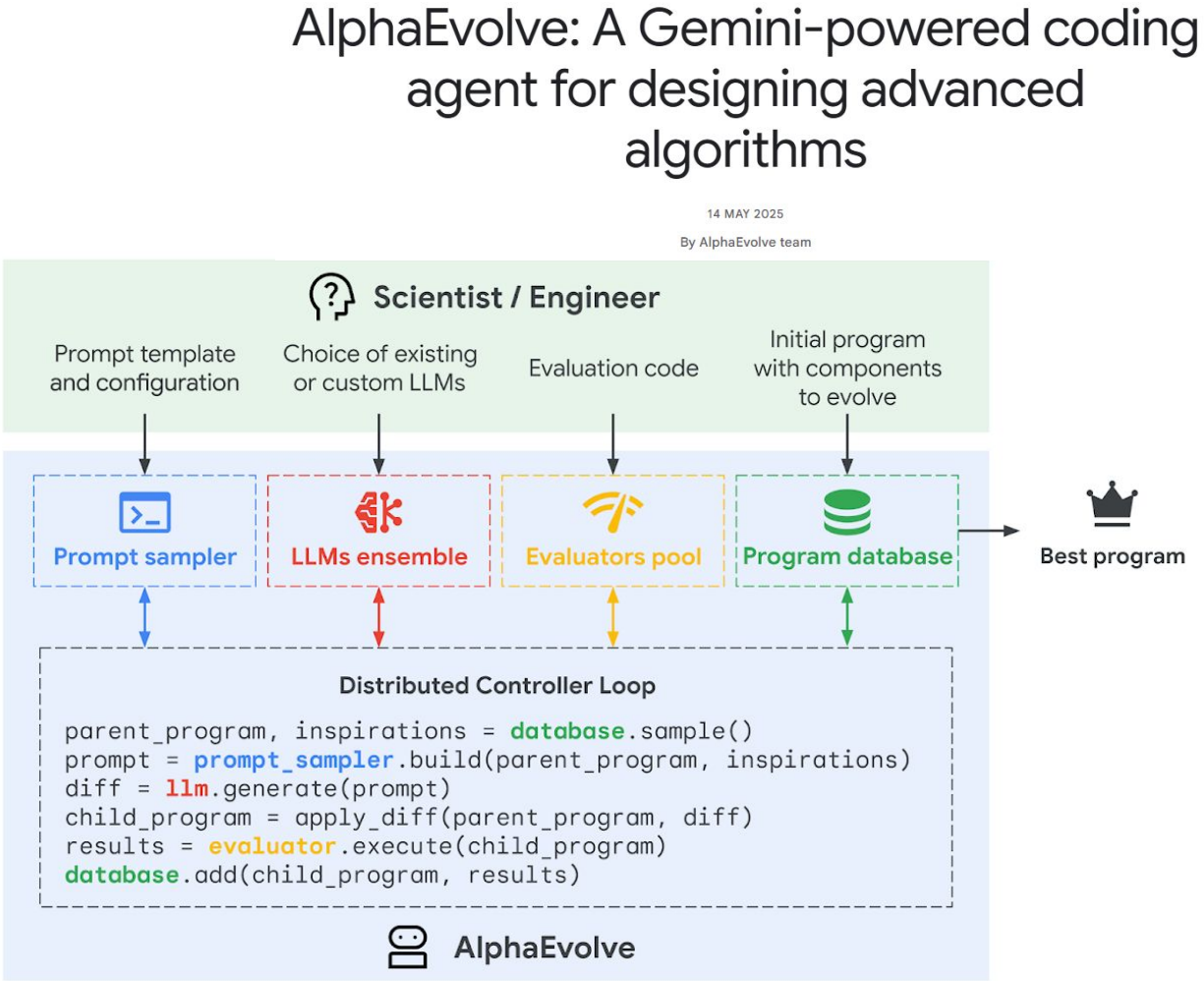






AlphaEvolve

- AlphaEvolve (DeepMind, 14 мая 2025) и тому подобные системы активно развиваются
- Но мы сегодня поговорим про обычные LLM, с которыми каждый из нас может пообщаться
- Помогают ли они?..



Malliavin-Stein experiment

- Diez et al. (Sep 3, 2025): авторы попросили GPT-5 доказать новую теорему из теории вероятностей; буквально:

4.1.1 Gaussian framework

We started with the following initial prompt:

```
Paper 2502.03596v1 establishes a qualitative fourth moment
theorem for the sum of two Wiener-Itô integrals of orders
p and q, where p and q have different parities.  Building
on the Malliavin-Stein method (see 1203.4147v3 for details),
could you derive a quantitative version for the total variation
distance, with a convergence rate depending solely on the
fourth cumulant of this sum?
```

Mathematical research with GPT-5: a Malliavin-Stein experiment

Charles-Philippe Diez* Luís da Maia* Ivan Nourdin*

Abstract

On August 20, 2025, GPT-5 was reported to have solved an open problem in convex optimization. Motivated by this episode, we conducted a controlled experiment in the Malliavin–Stein framework for central limit theorems. Our objective was to assess whether GPT-5 could go beyond known results by extending a *qualitative* fourth-moment theorem to a *quantitative* formulation with explicit convergence rates, both in the Gaussian and in the Poisson settings. To the best of our knowledge, the derivation of such quantitative rates had remained an open problem, in the sense that it had never been addressed in the existing literature. The present paper documents this experiment, presents the results obtained, and discusses their broader implications.

Malliavin-Stein experiment

- И после такого запроса авторы отмечают, что в доказательстве была ошибка, и GPT-5 потребовалось аж два наводящих промпта (!), чтобы ошибку понять и исправить
- Затем GPT-5 сам предложил рассмотреть другой случай, и в нём опять была ошибка, и понадобилось указать модели на неё! После этого GPT-5 за три-четыре промпта пришёл к верному результату

> I think you are mistaken in claiming that $(p+q)!\|u\widetilde{\otimes}v\|^2 = p!q!\|u\|^2\|v\|^2$. Why should that be the case?

It eventually admitted (which is not surprising, since by alignment it usually agrees with us) that the statement was false, but more importantly, it understood where the mistake came from. This was followed by a reasoning and a formula that, this time, were correct.

Then, at our request, GPT-5 reformatted the result in the style of a research article, including an introduction, the presentation of our main theorem, its proof with all the details (correct this time!), and a bibliography. The exact prompt was:

> Turn this into a research paper ready for submission. Follow my style (see attached paper 0705.0570v4):
> - start with an introduction giving some context,
> - then present the main result, followed by a very detailed proof where no step is left out,
> - finish with a complete bibliography.
> The final document should be a LaTeX file that I can compile.

Malliavin-Stein experiment

- Что же заключают авторы?

4.1.3 Role of the AI

To summarize, we can say that the role played by the AI was essentially that of an executor, responding to our successive prompts. Without us, it would have made a damaging error in the Gaussian case, and it would not have provided the most interesting result in the Poisson case, overlooking an essential property of covariance, which was in fact easily deducible from the results contained in the document we had provided.

- Кажется, это называется copium…
- Но это были лишь самые первые признаки того, что нас ждёт…

5 Some personal reflections

Overall, the experience of doing mathematics with GPT-5 was mixed. It felt very similar to working with a junior assistant at the beginning of a new project: exploring directions, formulating hypotheses, searching for counterexamples, and progressively adjusting statements. The AI showed a genuine ability to follow guided reasoning, to recognize its mistakes when pointed out, to propose new research directions, and to never take on the task. However, this only seems to support *incremental* research, that is, producing new results that do not require genuinely new ideas but rather the ability to combine ideas coming from different sources. At first glance, this might appear useful for an exploratory phase, helping us save time. In practice, however, it was quite the opposite: we had to carefully verify everything produced by the AI and constantly guide it so that it could correct its mistakes.

Gödel Test

- Feldman, Karbasi (Sep 22, 2025): тест Гёделя – могут ли LLM доказывать простые, но новые теоремы?
- Вот что писал об этом Теренс Тао, когда познакомился с o1



"The new model could work its way to a correct (and well-written) solution if *provided a lot of hints and prodding, but did not generate the key conceptual ideas on its own, and did make some non-trivial mistakes. The experience seemed roughly on par with trying to advise a mediocre, but not completely incompetent, graduate student. However, this was an improvement over previous models, whose capability was closer to an actually incompetent graduate student. It may only take one or two further iterations of improved capability (and integration with other tools, such as computer algebra packages and proof assistants) until the level of 'competent graduate student' is reached."*

— Terence Tao

Gödel Test

- Feldman, Karbasi (Sep 22, 2025): дали пять запросов в таком духе:

Prompt to GPT-5

Consider the problem of maximizing a function F from $[0,1]^n$ to the reals that is the sum of a non-negative monotonically increasing DR-submodular function G and a non-negative DR-submodular function H over a solvable down-closed polytope P. I would like to bound the performance on this problem from the NeurIPS 2021 paper "Submodular + Concave" which is attached. Specifically, if x is the output vector of this algorithm and o is the vector in P maximizing F, then I would like to lower bound $F(x)$ with an expression of the form $\alpha * G(o) + \beta * H(o) - err$, where α and β are constants. err should be a function that depends only on the error parameter ϵ of the algorithm, the diameter D of the polytope P, and the smoothness parameters L_G and L_H of G and H, respectively, and goes to zero as ϵ goes to zero. Please give the best such bound that you prove (a bound is considered better if the values of the constants α and β are larger). Provide a mathematically rigorous and well explained proof for the bound you come up with.

Gödel Test

- Feldman, Karbasi (Sep 22, 2025)

Prompt to GPT-5

Consider t
of a non-
DR-submo
the perfor
which is att
in P maxim
$\alpha * G(o) + \beta *$
only on the er
smoothness par
Please give the
the constants α a
for the bound you
ne form
tion that depends
of the polytope P, and the
vely, and goes to zero as ϵ goes to zero.
(a bound is considered better if the values of
ovide a mathematically rigorous and well explained proof
with.

GPT-5 решил три из пяти, с небольшими легко исправимыми недочётами. Главный найденный недостаток — GPT-5 писал “ленивые” доказательства, максимально ссылаясь на предоставленные статьи, даже когда это было не очень изящно

2. Новые результаты от LLM



Одинаковость языка есть первая таинственная связь, соединяющая людей между собою... Один человек говорит, и другой понимает его, — и вот между ними утверждена прочная связь взаимного разумения.

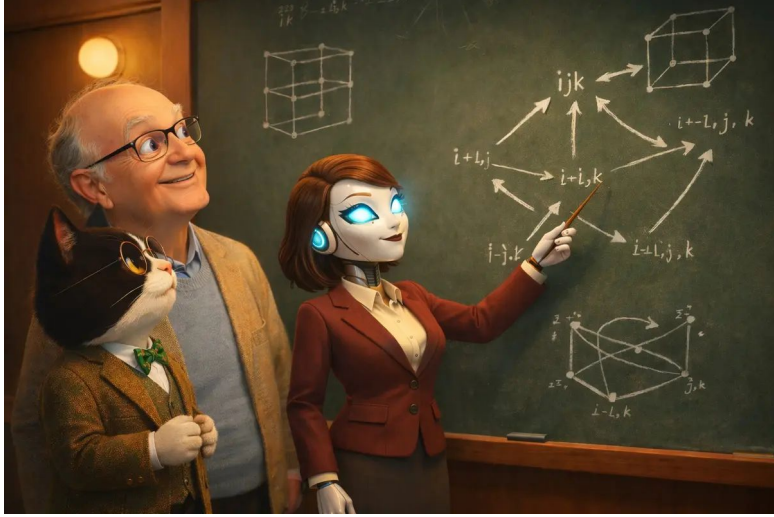
Константин Аксаков. О грамматике вообще

…le but unique de la science, c’est l’honneur de l’esprit humain, et sous ce titre, une question de nombres vaut autant qu’une question du système du monde.

Карл Якоби, письмо Лежандру (1830)

Claude’s Cycles

- Donald Knuth (Feb 2026): Claude Opus 4.6 решил открытую проблему, над которой Кнут работал неделями; решение потом подтвердилось и даже было формализовано



Shock! Shock! I learned yesterday that an open problem I’d been working on for several weeks had just been solved by Claude Opus 4.6 — Anthropic’s hybrid reasoning model that had been released three weeks earlier! It seems that I’ll have to revise my opinions about “generative AI” one of these days. What a joy it is to learn not only that my conjecture has a nice solution but also to celebrate this dramatic advance in automatic deduction and creative problem solving. I’ll try to tell the story briefly in this note.

Here’s the problem, which came up while I was writing about directed Hamiltonian cycles for a future volume of *The Art of Computer Programming*:

> Consider the digraph with m^3 vertices ijk for $0 \le i, j, k < m$, and three arcs from each vertex, namely to i^+jk, ij^+k, and ijk^+, where $i^+ = (i+1) \bmod m$. Try to find a general decomposition of the arcs into three directed m^3-cycles, for all $m > 2$.

Erdös Problems

- 1217 задач Эрдёша в базе erdosproblems.com, из них 565 решены
- Многие из них совсем не знаменитые, возможно, некоторые случайно решены где-то в литературе, но много и сложных нерешённых задач

Problems have always been an essential part of my mathematical life. A well-chosen problem can isolate an essential difficulty in a particular area, serving as a benchmark against which progress in this area can be measured. It might be like a 'marshmallow', serving as a tasty tidbit supplying a few moments of fleeting enjoyment. Or it might be like an 'acorn', requiring deep and subtle new insights from which a mighty oak can develop. […]

In this note I would like to describe a variety of my problems which I would classify as my favorites. Of course, I can't guarantee that they are all 'acorns', but because many have thwarted the efforts of the best mathematicians for many decades (and have often acquired a cash reward for their solutions), it may indicate that new ideas will be needed, which can, in turn, lead to more general results, and naturally, to further new problems.

In this way, the cycle of life in mathematics continues forever.

Paul Erdős, *Some of my favorite problems and results*, 1997

OPEN

Let $f \in \mathbb{R}[x]$ be a monic polynomial of degree n with n real roots in $[-1, 1]$. Determine the infimum and supremum of possible values of

$$|\{x \in \mathbb{R} : |f(x)| < 1\}|.$$

#1038: [EHP58,p.131] analysis

FALSIFIABLE

Let $z_1, \dots, z_n \in \mathbb{C}$ with $|z_i - z_j| \leq 2$ for all i, j, and

$$\Delta(z_1, \dots, z_n) = \prod_{i \neq j} |z_i - z_j|.$$

What is the maximum possible value of Δ? Is it maximised by taking the z_i to be the vertices of a regular polygon?

#1045: [EHP58,p.143] analysis

Erdös Problems

- Теренс Тао сделал страничку “AI contributions to Erdős problems”
- Результатов быстро накопилось довольно много

AI contributions to Erdős problems

teorth edited this page 4 hours ago · 70 revisions

This page collects the various ways in which AI tools have contributed to the understanding of Erdős problems. Note that a single problem may appear multiple times in these lists.

Legend

- 🟢 : full solution to the problem
- 🟡 : partial solution to the problem
- 🔴 : failure to make progress on the problem

5. Problems with an AI-powered literature review

Problem	AI tools used	Review performed on	Outcome
[35]	GPT-5	13 Oct, 2025	🟡 Partial results found
[66]	GPT-5	13 Oct, 2025	🟡 Partial results found
[124]	ChatGPT DeepResearch, Gemini DeepResearch	30 Nov, 2025	No significant results found
[167]	GPT-5	12 Oct, 2025	🟡 Partial results found
[188]	GPT-5	13 Oct, 2025	🟡 Partial results found
[203]	ChatGPT DeepResearch, Gemini DeepResearch	19 Oct, 2025	No significant results found
[223]	GPT-5	13 Oct, 2025	🟢 Full solution found
[248]	Gemini DeepResearch	19 Oct, 2025	No significant results found
[330]	ChatGPT DeepResearch, Gemini DeepResearch, Claude	19 Dec, 2025	🔴 Partial results found (with inaccuracies); did not find literature proof

Erdös Problems

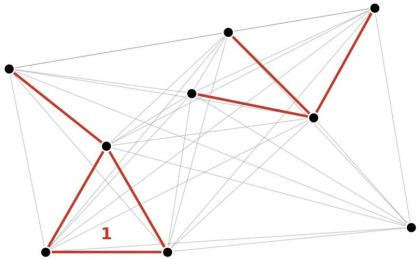
- Теренс Тао сделал страничку “AI contributions to Erdős problems”
- Она, правда, в основном ограничивается апрелем, есть несколько записей из июня 2026

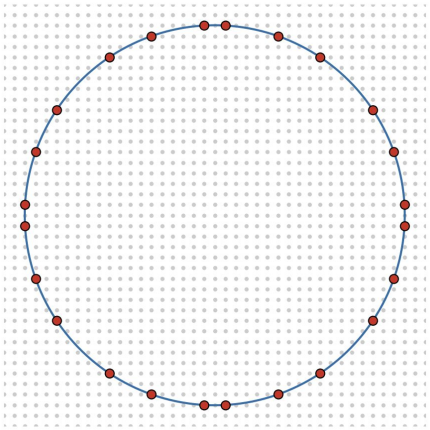
[1041]	GPT-5.4 Thinking	22 Apr, 2026	🔴 Argument with major gaps made
[1044]	GPT-5.2 Pro	5 Jan, 2026	🔴 Incorrect claim made
[1051]	Aletheia	29 Jan, 2026	🟢 Full solution (Lean)
[1054]	Claude Opus 4.8, GPT-5.5 Pro, Principia Math	22-23 Jun, 2026	🟡 Partial result (Lean)
[1091]	OpenAI internal model	9 Apr, 2026	🟢 Full solution
[1101]	GPT-5.5 Pro	27 Apr, 2026	○ Candidate partial result (solution to second part)
[1131]	GPT-5.5 Pro	26 Apr, 2026	○ Candidate partial result
[1141]	OpenAI internal model	9 Apr, 2026	🟢 Full solution
[1194]	GPT-5.4 Pro	23 Apr, 2026	🟡 Partial result
[1196]	GPT-5.4 Pro	13 Apr, 2026	🟢 Full solution
[1202]	GPT-5.4 Pro	1 Apr, 2026	🟢 Full solution
[1217]	GPT-5.4 Pro	16 Apr, 2026	🟢 Full solution

Единичные расстояния



- Но в апреле уже началось!
- Jared Lichtman (Apr 2026): GPT-5.4 Pro опроверг важную гипотезу Эрдёша (над ней думало много математиков), причём сделал это неожиданным и красивым образом





1946 — **Paul Erdős**
"On sets of distances of n points"
Amer. Math. Monthly 53 (1946), 248–250
Постановка задачи. Нижняя оценка $\nu(n) \geq n^{1+c/\log\log n}$, верхняя оценка $\nu(n) \leq O(n^{3/2})$.

1984 — **Joel Spencer, Endre Szemerédi, William T. Trotter**
"Unit distances in the euclidean plane"
Graph Theory and Combinatorics (Cambridge 1983), 293–303
Верхняя оценка $\nu(n) \leq O(n^{4/3})$.

1997 — **László A. Székely**
"Crossing numbers and hard Erdős problems in discrete geometry"
Combinatorics, Probability and Computing 6 (1997), 353–358
Элегантное короткое доказательство $O(n^{4/3})$ через crossing lemma.

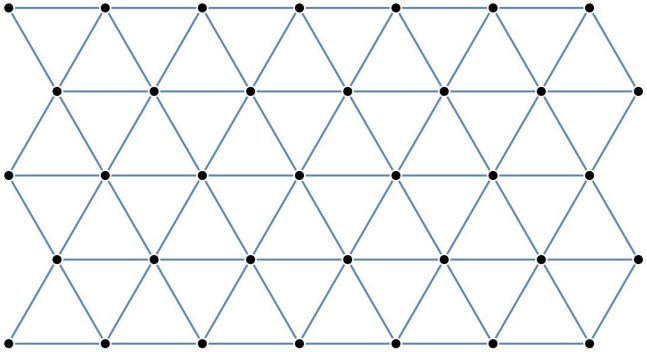
2023 — **Noga Alon, Matija Bucić, Lisa Sauermann**
"Unit and distinct distances in typical norms"
GAFA 35 (2025), 1–42 · arXiv:2302.09058
Для нормы общего положения $\nu(n) \leq \frac{d}{2} n \log_2 n$.

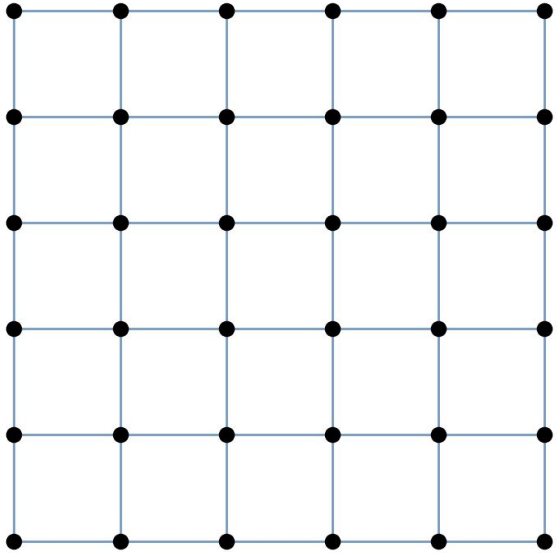
2024 — **Josef Greilhuber, Carl Schildkraut, Jonathan Tidor**
"More unit distances in arbitrary norms"
Bull. London Math. Soc. 57 (2025), 2885–2901 · arXiv:2410.07557
Соответствующая нижняя оценка $\Omega(n \log_2 n)$ для любой нормы.

2026 — **OpenAI**
"Planar Point Sets with Many Unit Distances"
openai.com, 20 мая 2026 · комментарии: Alon et al., arXiv:2605.20695
Контрпример: $\nu(n) \geq n^{1+\delta}$ для $\delta > 0$ и бесконечно многих n.
Гипотеза Эрдёша опровергнута.

Единичные расстояния

- Рассмотрим *n* точек на обычной евклидовой плоскости. Сколько одинаковых расстояний может быть среди пар этих точек?
- Треугольная решётка даёт 3n
- Главный подход: превратить задачу в арифметическую. Рассмотрим квадратную решётку; на ней расстояние m встречается столько раз, сколько раз m^2 раскладывается в a^2+b^2.



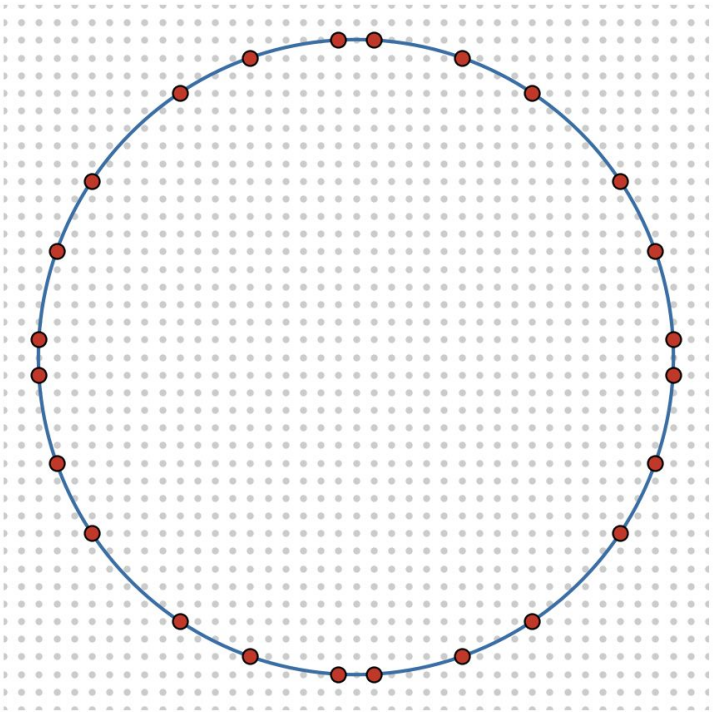


Единичные расстояния

- Каждое p=4k+1 можно разложить как

$$4k+1=(1+2i\sqrt{k})(1-2i\sqrt{k})=z\cdot\bar{z},\qquad z=1+2i\sqrt{k}.$$

- Если у m много простых делителей p_i вида 4k+1, каждый можно так разложить и представить m как произведение двух комплексно сопряжённых подмножеств
- Например, у числа 325 на окружности радиуса $\sqrt{325}$ сразу 24 целые точки:



$$325=5^2\cdot 13=(2+i)^2(2-i)^2(3+2i)(3-2i).$$

$$325=\Big((2+i)^2(3-2i)\Big)\Big((2-i)^2(3+2i)\Big)=(17+6i)(17-6i)=17^2+6^2.$$

$$325=\Big((2+i)^2(3+2i)\Big)\Big((2-i)^2(3-2i)\Big)=(1+18i)(1-18i)=1^2+18^2.$$

$$325=((2-i)(2+i)(3+2i))\,((2+i)(2-i)(3-2i))=(15+10i)(15-10i)=15^2+10^2.$$

Единичные расстояния

- Аккуратно посчитав пары точек на окружностях, получим нелинейную оценку:

$$\nu(n) \geq n^{1+c/\log\log n}.$$

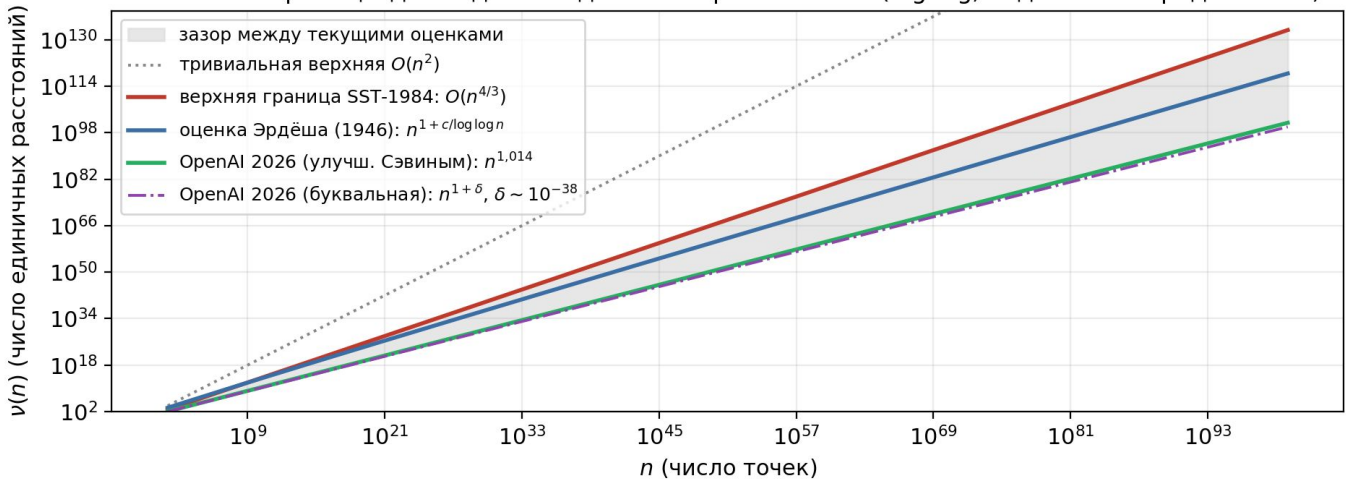
- Можно ли лучше?
- Эрдёш думал, что нельзя, а GPT доказал, что можно!

Гипотеза Эрдёша. $\nu(n) \leq n^{1+o(1)}$, а скорее даже

$$\nu(n) \leq n^{1+C/\log\log n}$$

Теорема (OpenAI, 2026). Существует константа $\delta > 0$ и бесконечная последовательность натуральных чисел n, для которых $\nu(n) \geq n^{1+\delta}$.

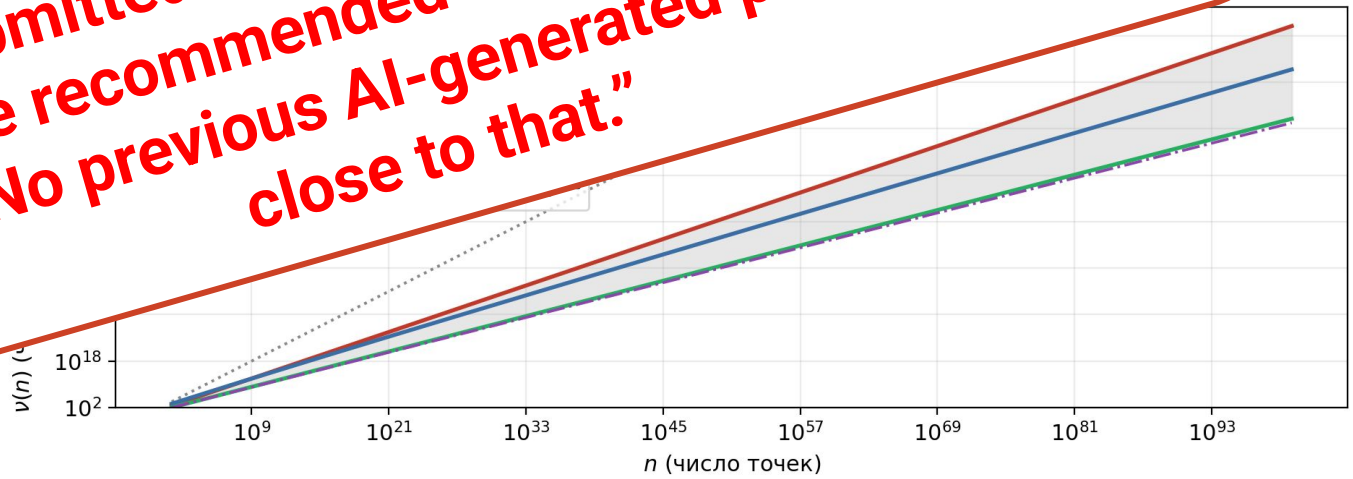
Известные границы для задачи о единичных расстояниях (log-log, видны 100 порядков по n).



Единичные расстояния

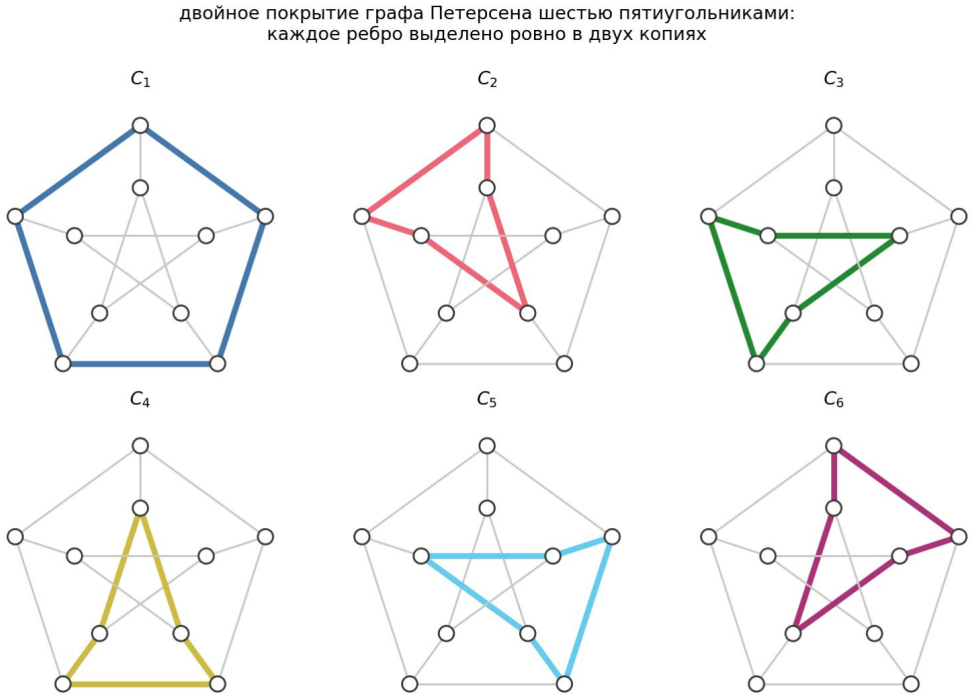
- Аккуратно посчитав пары точек
на окружностях, полу
нелинейну
-

Это доказательство вызвало большую реакцию. Например, Тимоти Гауэрс: “If a human had written the paper and submitted it to the Annals of Mathematics… I would have recommended acceptance without any hesitation. No previous AI-generated proof has come close to that.”



Двойное покрытие циклами

- Верно ли, что в любом графе без мостов есть набор простых циклов, для которого каждое ребро содержится ровно в двух циклах этого набора?
- Поставили задачу ещё в 1970-х, люди много думали, были продвижения
- OpenAI, 10 июля 2026: препринт с полным доказательством
- Мой пост: “Охота на снарка: доказательство гипотезы о двойном покрытии циклами”

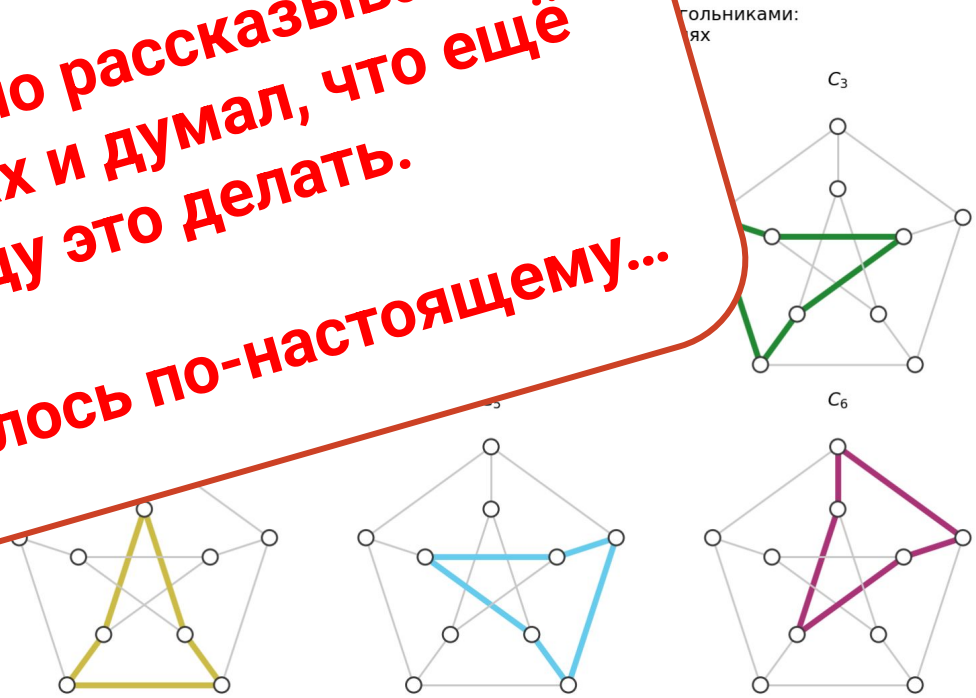


Двойное покрытие циклами

- Верно ли, что в любом графе без мостов есть набор прост… циклов, для кото… ребро со… циклах
- Постави… люди мн… продвиже…
- OpenAI, 10… полным до…
- Мой пост: “Ох… …нарка: доказательство гипотезы о двойном покрытии циклами”

Летом я подробно рассказывал об этих результатах и думал, что ещё долго буду это делать.

Но потом началось по-настоящему…



Проблема якобиана

- Проблема якобиана, открытая с 1930-х: если определитель якобиана полиномиального отображения F — ненулевая константа, то F обратимо (и обратное отображение автоматически полиномиально)
- Главный открытый вопрос о многочленах от нескольких переменных, который можно рассказать любому студенту
- И 20 июля 2026 г. её закрыл Claude Fable, места для ошибки там нет; читайте [мой подробный пост]



levent ✓
@__alpoge__

hello there the jacobian conjecture is false thanx to my close friend akhil for asking about it and my other close friend fable for working during the world cup final

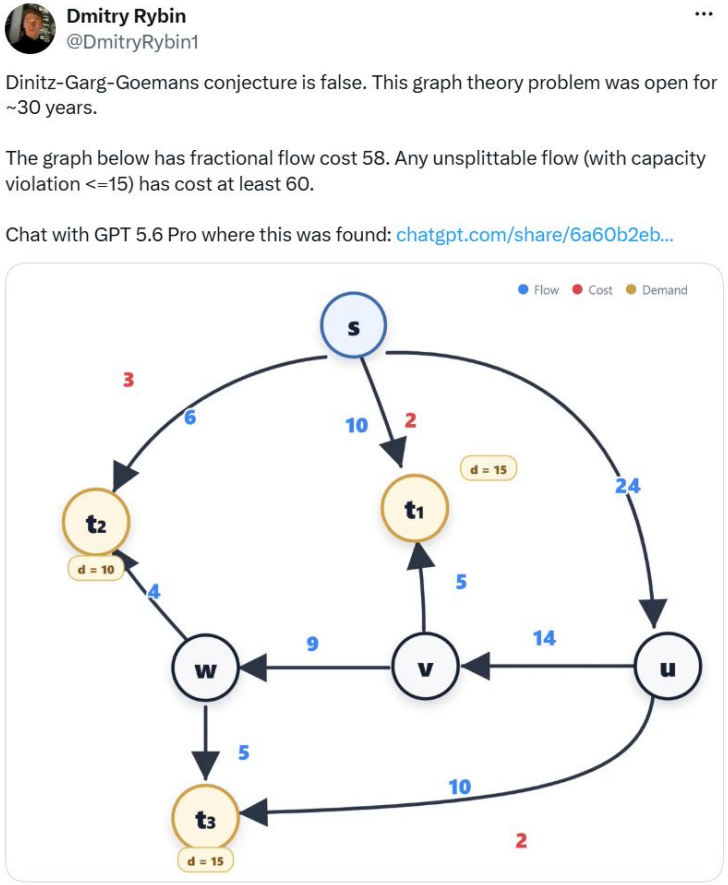
((1+xy)^3 z + y^2 (1+xy) (4+3xy), y + 3 x (1+xy)^2 z + 3 x y^2 (4+3xy), 2 x - 3 x^2 y - x^3 z): \C^3\to \C^3, has jacobian determinant -2, and sends (0, 0, -1/4), (1, -3/2, 13/2), and (-1, 3/2, 13/2) to (-1/4, 0, 0)

5:19 AM · Jul 20, 2026 · **21.9M** Views

$$F_1 = (1+xy)^3 z + y^2(1+xy)(4+3xy),$$
$$F_2 = y + 3x(1+xy)^2 z + 3xy^2(4+3xy),$$
$$F_3 = 2x - 3x^2 y - x^3 z.$$

Гипотеза Диница — Гарга — Гёманса

- Гипотеза Диница–Гарга–Гёманса: дробный поток можно превратить в неделимый (целочисленный), не увеличивая общую стоимость и увеличив нагрузку на любое ребро не более чем на максимальный спрос одного стока
- Дмитрий Рыбин получил контрпример от GPT 5.6; пожалуй, самое интересное здесь в том, как он его получил…



Гипотеза Диница — Гарга — Гёманса

Tuesday 12:29 PM

Uploaded a file

Construct a counterexample to general (non-planar) case of Dinitz Garg Goemans conjecture. You should do a breakthrough and find a structured counterexample.

Worked for 52m 52s

Research conclusion

I did **not** obtain a valid counterexample, and presenting the construction below as one would be mathematically false. The requested object would disprove a conjecture that is still open in the current literature.

Tuesday 1:32 PM

please continue research and find a complete unconditional counterexample

Worked for 89m 12s

Status after the extended search

I have **not found a complete unconditional counterexample**. Every construction that initially appeared to separate the cost condition acquired an additional unsplittable routing once **all** source–terminal paths were taken into account. Exact separation then returned value 0.

Tuesday 3:03 PM

Continue the search. Have a clear strategy obtained from deeper understanding of the problem structure.

Worked for 93m 57s

Research update

I continued the search, but I do **not yet have a positive, exact separation certificate**, so there is still no unconditional counterexample to report. The conjecture remains open in the current literature. Its exact

Tuesday 5:21 PM

it's enough of partial results. let's finish with a complete unconditional counterexample

Worked for 88m 24s

Complete finite counterexample

Under Conjecture 1.3 exactly as stated in the uploaded paper—find an unsplittable flow y with

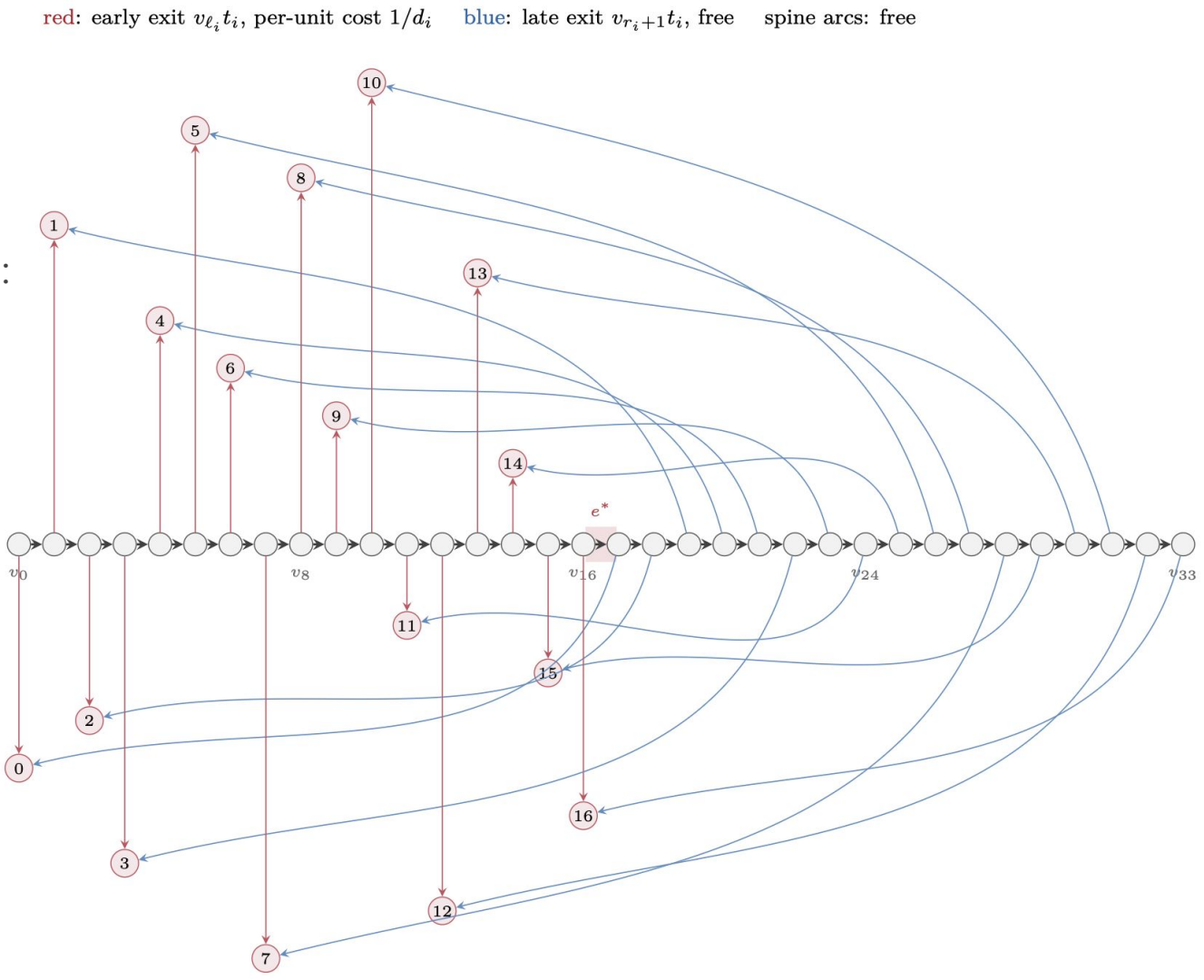
$$y_a \le x_a + d_{\max} \quad \forall a, \qquad c^{\mathsf{T}} y \le c^{\mathsf{T}} x$$

for every feasible fractional flow x and nonnegative cost vector c—the instance below is a counterexample.

Dinitz_Garg_Goemans

Гипотеза Диница — Гарга — Гёманса

- Кстати, это и мой личный пример вайб-математики: в августе я выложил три препринта, которые улучшают контрпримеры Рыбина и даже доказывают кое-что положительное
- Но не будем углубляться в детали: впереди события поважнее…



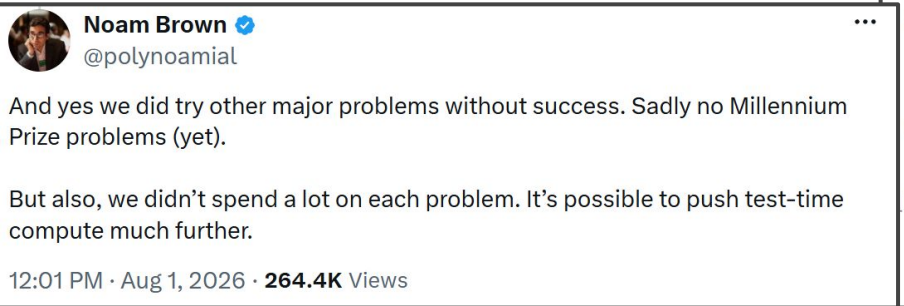
OpenAI Astra

- OpenAI (1 августа 2026): сразу десять выдающихся результатов
- Существование несофических групп (явной конструкцией), верхние оценки на упаковку сфер, опровержение гипотезы Конна о жёсткости…
- Все эти результаты были сразу же формализованы в Lean

1. **High-dimensional sphere packing.** The asymptotic strength of the Cohn–Elkies linear program is determined exactly. This gives an improved general packing bound in high dimensions and settles the corresponding Fourier sign-uncertainty problem asymptotically.
2. **Binary and spherical codes.** Classical upper bounds for fixed-distance binary and spherical codes are improved by exponential factors for all parameters. The spherical construction also recovers the sphere-packing exponent of Chapter 1.
3. **Nonsofic groups exist.** An explicit nonsofic group is constructed, answering the longstanding question of whether every countable group is sofic. The proof combines work of Kun and Kun–Thom with a combinatorial expander-matching argument, realized using the binary Leavitt algebra and Thompson's group V.
4. **Connes's rigidity conjecture.** Infinitely many pairwise nonisomorphic groups with property (T) are constructed with the same group von Neumann algebra, disproving Connes's conjecture and answering a related finite-to-one question of Popa.
5. **Arithmetic circuit complexity.** For the permanent, division-free circuits require $\Omega(n^2 \log\log n)$ gates, while formulas require $\Omega(n^4/\log n)$ leaves.
6. **Quantum parallel repetition.** Exponential parallel repetition is proved for every finite two-player entangled game, extending the classical repetition principle beyond previously treated special classes of quantum games.
7. **Closest vector problem.** A direct reduction from 3SAT gives $n^{1/400}$-factor hardness for the Euclidean closest vector problem, with related consequences for binary decoding and other lattice norms.
8. **Ehrhart's volume conjecture.** The sharp volume upper bound $(n+1)^n/n!$ is proved in every dimension for convex bodies whose barycenter is their only interior lattice point.
9. **Multicolor Ramsey numbers.** A new superexponential lower bound shows that $R_k(3)$ grows as $k^{\Theta(k)}$.
10. **Compactness and degeneracy.** Separate bipartite graph constructions disprove two conjectures in extremal graph theory: the compactness conjecture of Erdős and Simonovits and a degeneracy conjecture of Erdős.

OpenAI Astra

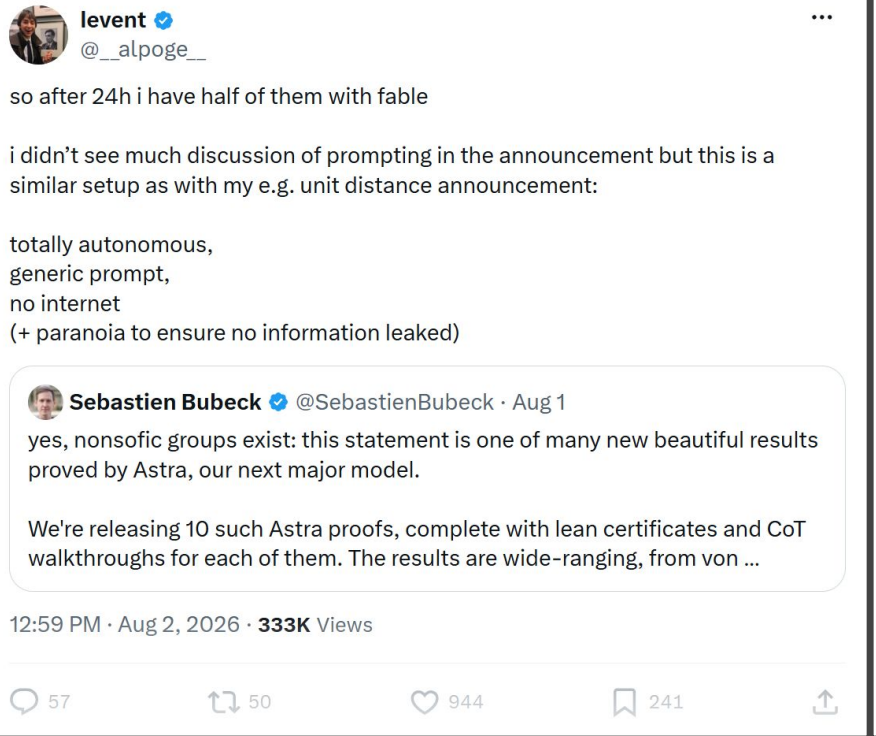
- OpenAI (1 августа 2026): сами эти доказательства стоили всего лишь около $2000 по API-ценам GPT 5.6 Sol
- Конечно, было ещё много попыток, которые ни к чему не привели



1. **High-dimensional sphere packing.** The asymptotic strength of the Cohn–Elkies linear program is determined exactly. This gives an improved general packing bound in high dimensions and settles the corresponding Fourier sign-uncertainty problem asymptotically.
2. **Binary and spherical codes.** Classical upper bounds for fixed-distance binary and spherical codes are improved by exponential factors for all parameters. The spherical construction also recovers the sphere-packing exponent of Chapter 1.
3. **Nonsofic groups exist.** An explicit nonsofic group is constructed, answering the longstanding question of whether every countable group is sofic. The proof combines work of Kun and Kun–Thom with a combinatorial expander-matching argument, realized using the binary Leavitt algebra and Thompson's group V.
4. **Connes's rigidity conjecture.** Infinitely many pairwise nonisomorphic groups with property (T) are constructed with the same group von Neumann algebra, disproving Connes's conjecture and answering a related finite-to-one question of Popa.
5. **Arithmetic circuit complexity.** For the permanent, division-free circuits require $\Omega(n^2 \log\log n)$ gates, while formulas require $\Omega(n^4/\log n)$ leaves.
6. **Quantum parallel repetition.** Exponential parallel repetition is proved for every finite two-player entangled game, extending the classical repetition principle beyond previously treated special classes of quantum games.
7. **Closest vector problem.** A direct reduction from 3SAT gives $n^{1/400}$-factor hardness for the Euclidean closest vector problem, with related consequences for binary decoding and other lattice norms.
8. **Ehrhart's volume conjecture.** The sharp volume upper bound $(n+1)^n/n!$ is proved in every dimension for convex bodies whose barycenter is their only interior lattice point.
9. **Multicolor Ramsey numbers.** A new superexponential lower bound shows that $R_k(3)$ grows as $k^{\Theta(k)}$.
10. **Compactness and degeneracy.** Separate bipartite graph constructions disprove two conjectures in extremal graph theory: the compactness conjecture of Erdős and Simonovits and a degeneracy conjecture of Erdős.

OpenAI Astra

- Интересный поворот:



levent ✓
@__alpoge__

so after 24h i have half of them with fable

i didn't see much discussion of prompting in the announcement but this is a similar setup as with my e.g. unit distance announcement:

totally autonomous,
generic prompt,
no internet
(+ paranoia to ensure no information leaked)

> **Sebastien Bubeck** ✓ @SebastienBubeck · Aug 1
> yes, nonsofic groups exist: this statement is one of many new beautiful results proved by Astra, our next major model.
>
> We're releasing 10 such Astra proofs, complete with lean certificates and CoT walkthroughs for each of them. The results are wide-ranging, from von ...

12:59 PM · Aug 2, 2026 · **333K** Views

57 50 944 241

1. **High-dimensional sphere packing.** The asymptotic strength of the Cohn–Elkies linear program is determined exactly. This gives an improved general packing bound in high dimensions and settles the corresponding Fourier sign-uncertainty problem asymptotically.
2. **Binary and spherical codes.** Classical upper bounds for fixed-distance binary and spherical codes are improved by exponential factors for all parameters. The spherical construction also recovers the sphere-packing exponent of Chapter 1.
3. **Nonsofic groups exist.** An explicit nonsofic group is constructed, answering the longstanding question of whether every countable group is sofic. The proof combines work of Kun and Kun–Thom with a combinatorial expander-matching argument, realized using the binary Leavitt algebra and Thompson's group V.
4. **Connes's rigidity conjecture.** Infinitely many pairwise nonisomorphic groups with property (T) are constructed with the same group von Neumann algebra, disproving Connes's conjecture and answering a related finite-to-one question of Popa.
5. **Arithmetic circuit complexity.** For the permanent, division-free circuits require $\Omega(n^2 \log\log n)$ gates, while formulas require $\Omega(n^4/\log n)$ leaves.
6. **Quantum parallel repetition.** Exponential parallel repetition is proved for every finite two-player entangled game, extending the classical repetition principle beyond previously treated special classes of quantum games.
7. **Closest vector problem.** A direct reduction from 3SAT gives $n^{1/400}$-factor hardness for the Euclidean closest vector problem, with related consequences for binary decoding and other lattice norms.
8. **Ehrhart's volume conjecture.** The sharp volume upper bound $(n+1)^n/n!$ is proved in every dimension for convex bodies whose barycenter is their only interior lattice point.
9. **Multicolor Ramsey numbers.** A new superexponential lower bound shows that $R_k(3)$ grows as $k^{\Theta(k)}$.
10. **Compactness and degeneracy.** Separate bipartite graph constructions disprove two conjectures in extremal graph theory: the compactness conjecture of Erdős and Simonovits and a degeneracy conjecture of Erdős.

Гипотеза Круазе

- Доказательство нашёл практикующий нейрохирург, математик-любитель Dr. Shanmu Jin
- Проверили Townsend, Greenbaum (Aug 14, SIAM News), а также сам Круазе
- "We initially read the preprint with some skepticism, but after a few hours we realized that the argument was the real deal... We do not yet know whether academia has the capacity to absorb the flood of results that may be coming"
- Lorist, Schwenninger (Aug 4, 2026): совсем другое короткое доказательство, тоже AI-assisted

The Neurosurgery Resident Who Proved Crouzeix's Conjecture

Alex Townsend and Anne Greenbaum

August 14, 2026

On July 30, 2026, the first author asked ChatGPT 5.6 to solve Crouzeix's conjecture, as he had been routinely doing for the preceding year. Until that day, it had either returned a bogus proof or produced an argument that stalled at a missing lemma. But on July 30 it linked to a preprint posted July 27 titled *The Numerical Range Is a 2-Spectral Set*, claiming that the conjecture was solved. Crouzeix's conjecture had been open for more than two decades, so we initially read the preprint with some skepticism, but after a few hours we realized that the argument was the real deal.



Продвижение в гипотезе Римана

- Ещё один большой успех пришёл не от OpenAI, а от Anthropic
- Anthropic (10 августа 2026): более ⅔ нулей дзета-функции Римана лежат на критической прямой
- Тоже Lean-verified…

MORE THAN TWO THIRDS OF THE ZEROS OF THE RIEMANN ZETA FUNCTION LIE ON THE CRITICAL LINE

CLAUDE

ABSTRACT. Let $N(T, 2T)$ denote the number of zeros $\rho = \beta + i\gamma$ of the Riemann zeta function with $T < \gamma \le 2T$, counted with multiplicity, and $N_0^*(T, 2T)$ the number of distinct such zeros with $\beta = \frac{1}{2}$. We prove unconditionally that

$$\liminf_{T\to\infty} \frac{N_0^*(T, 2T)}{N(T, 2T)} \ge \frac{2}{3},$$

that at least $(\frac{2}{3} - o(1))N(T, 2T)$ of the zeros are simple and on the critical line, and that at least $(\frac{5}{6} - o(1))N(T, 2T)$ are distinct; with an optimised test family the three constants become 0.6725, 0.6725, 0.83625.... The constant $\frac{2}{3}$ (resp. 0.6725) is Montgomery's (resp. Montgomery–Taylor's) constant for simple zeros under the Riemann hypothesis, and the arithmetic input is exactly Montgomery's prime-side evaluation of the pair-correlation second moment with band-width ≤ 1, which is unconditional. The Riemann hypothesis, classically needed to read the zero side as a positive sum over real ordinates, is replaced by linear algebra applied to a finite compression of Weil's Hermitian form: Sylvester's law of inertia (an off-line pair $\{\rho, 1 - \bar{\rho}\}$ contributes a block of signature $(1, 1)$) and a rank–trace inequality for Hermitian matrices, proved via von Neumann's trace inequality, which is the matrix analogue of the integrality steps $m^2 \ge 2m - 1$ and $m^2 \ge 3m - 2$. The analytic inputs are those of Baluyot, Goldston, Suriajaya and Turnage-Butterbaugh [BGSTB24] and Goldston and Suriajaya [GS25, GS26]; the new ingredient is a linear-algebraic reading of their pair-correlation sum.

Продвижение в гипотезе Римана

- Ещё один большой успех пришёл не от OpenAI, а от Anthropic
- Anthro
- T

Джеймс Мейнард: эта задача "was in need of a new real idea, which this new result seems to provide"

MOBE ETA

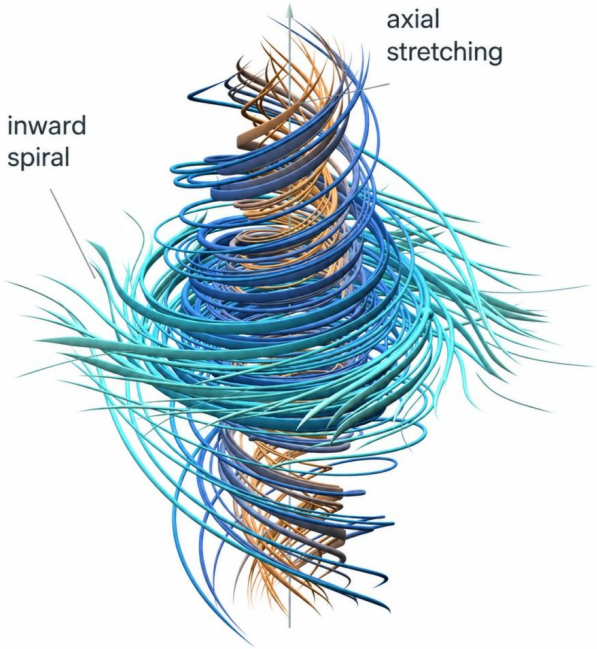
such zeros

$\frac{1}{3}$,

the zeros are simple and on the critical line, and that are distinct; with an optimised test family the three constants 0.6725, 0.83625 .... The constant $\frac{2}{3}$ (resp. 0.6725) is Montgomery's (resp. Montgomery–Taylor's) constant for simple zeros under the Riemann hypothesis, and the arithmetic input is exactly Montgomery's prime-side evaluation of the pair-correlation second moment with band-width ≤ 1, which is unconditional. The Riemann hypothesis, classically needed to read the zero side as a positive sum over real ordinates, is replaced by linear algebra applied to a finite compression of Weil's Hermitian form: Sylvester's law of inertia (an off-line pair $\{\rho, 1-\bar{\rho}\}$ contributes a block of signature $(1,1)$) and a rank–trace inequality for Hermitian matrices, proved via von Neumann's trace inequality, which is the matrix analogue of the integrality steps $m^2 \geq 2m-1$ and $m^2 \geq 3m-2$. The analytic inputs are those of Baluyot, Goldston, Suriajaya and Turnage-Butterbaugh [BGSTB24] and Goldston and Suriajaya [GS25, GS26]; the new ingredient is a linear-algebraic reading of their pair-correlation sum.

Уравнения Навье–Стокса

- Наконец, уравнения Навье–Стокса: OpenAI (8 сентября 2026) доказала, что изначально гладкое течение под действием гладкой внешней силы может развить сингулярность (утверждения C и D у Феффермана)
- Я совсем не специалист в этой области, так что сосредоточусь на истории с AI
- OpenAI обучала новую модель с 28 августа, а 1 сентября *услышала слух*, что кто-то решает задачи тысячелетия, и выпустила на задачу ~10 тысяч агентов
- Через 88 часов результат был готов



Уравнения Навье–Стокса

- Возник конфликт с Тристаном Бакмастером и Лёвентом Альпёге, которые параллельно работали над той же задачей
- Себастьян Бубек из OpenAI связался с Бакмастером, прозвучали неудачные слова (потом взятые назад), но так или иначе сотрудничества не вышло

Two proposals were offered to me. The first was that we post our Euler result, and that OpenAI post its Navier-Stokes result the next day. The second was that, after posting Euler, I alone write a paper presenting the Navier-Stokes result, acknowledging that an internal OpenAI model had resolved it. Sebastien twice asserted that he wanted Levent removed from authorship, and said it would all be simple if only it were not the case that, and it was so annoying that, Levent works at Anthropic. It was also said that if OpenAI posted after us, they would say that we deserved the Clay Prize, and that we were the "closest humans to the problem". I declined both offers.

I said that if OpenAI released its result in the way proposed I would go public with what happened. The reply was, "Why would you ruin your career?" I replied that I am an academic, and asked why he thought going public would ruin my career. The reply was, "If you don't want me to be nice, then I don't have to be nice."



Sebastien Bubeck
@SebastienBubeck

I would like to clarify a few things:

1) The screenshot is my reaching out to Levent to coordinate our releases. I hope it's clear from the message that we came in with the best possible intentions.

2) I never ever asked for Levent to be removed from authorship of his own work (as indicated by my text). I was surprised to learn during the call with Tristan that they had only solved Euler and not Navier-Stokes; after learning this we brainstormed possible paths forward. One option we discussed was that Tristan could be the lead author on a rewrite of OpenAI's Navier-Stokes proof. It is in that context that I said "it would be simpler if Levent was not an Anthropic employee" because I felt it would be inappropriate for an Anthropic employee to author OpenAI's work. Importantly it was admitted that internal Anthropic models had been used in their proof of Euler blowup; I therefore felt I could not consider Levent to be an independent academic. Another option I wanted to

Уравнения Навье–Стокса

- Прозвучало и предположение, что OpenAI могла воспользоваться приватными данными из разговоров Бакмастера с Codex
- Сначала OpenAI явно этого не отрицала, потом провела внутреннее расследование и всё-таки опровергла

OpenAI @OpenAI

We congratulate Levent Alpöge and Tristan Buckmaster on their remarkable mathematical work.

We (the researchers and the agents) did not see any of their work through any means until they released it publicly — in particular, no specific user data was accessed in order to solve this problem.

While unlikely, we cannot rule out that de-identified data derived from their usage of our products helped improve our models.

However, our proofs differ significantly and even the precise results proved are different in the Euler case (forced vs. unforced).

Sholto Douglas @_sholtodouglas

fwiw I think it is _extremely_ unlikely that user data had any influence here - there is no way OAI would pull user transcripts for this, or knowingly train on it in a way that would've influenced this.
I think its pretty important people don't run away with 'your user data isn't safe in codex' - because it surely is (based on everything I can assume from the outside)

Following an investigation, we have confirmed that Buckmaster's Codex prompts over the two months preceding this announcement and paper on September 8, 2026, could not have influenced the system in any way, including through training. The OpenAI internal model used for this result was developed through large-scale reinforcement learning on top of a previously pretrained model. Our proofs also differ significantly. In the Euler case, Alpöge and Buckmaster proved a result with external forcing, while OpenAI's system proved a result without external forcing.

Уравнен Стокса

- Прозву
  OpenA
  прива
  разго
- Сна
  отр
  внут

Мне кажется очень маловероятным, что OpenAI здесь что-то «украла»: это было бы и неэтично, и очень плохо для бизнеса.
Но, честно говоря, дело совсем не в этом...



OpenAI @OpenAI

We congratulate Levent Alpöge and Tristan Buckmaster on their remarkable mathematical work.

researchers and the agents) did not see any of their work until they released it publicly — in particular, no in order to solve this problem.

data derived from

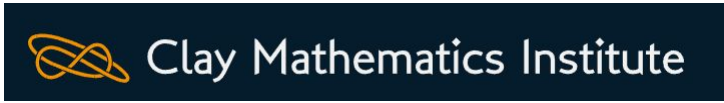
cise results ed).

ad any influence ts for this, or ced this. with 'your user data everything I can

Following an investigation, we have confirm
the two months preceding this announcement and paper
not have influenced the system in any way, including through training. The
internal model used for this result was developed through large-scale reinforcement learning on top of a previously pretrained model. Our proofs also differ significantly. In the Euler case, Alpöge and Buckmaster proved a result with external forcing, while OpenAI's system proved a result without external forcing.

Уравнения Навье–Стокса

- Факты, которые никто не оспаривает:
  - направление, которое привело к решению, развили Диего Кордоба и Луис Мартинес-Сороа
  - Тристан Бакмастер и Лёвент Альпёге, активно используя и Claude, и GPT, добились серьёзного прорыва (blowup под гладкой силой для уравнений Эйлера и Буссинеска)
  - решение для уравнений Навье–Стокса получили LLM-агенты OpenAI
- Что касается премии тысячелетия:
  - AI-модели её в любом случае не дадут,
  - OpenAI прямо сказала, что на премию не претендует, да и подходящего человека на стороне OpenAI всё равно нет
  - условия премии прямо предлагают учитывать авторов ключевых идей, вошедших в окончательное решение
- Так что, думаю, её разделят Кордоба, Мартинес-Сороа, Бакмастер и Альпёге, как и должно быть



Уравнения Навье–Стокса

- Факты, которые и
  - напи
  - Тр
    с
  - ре
- Что ка
  - AI-м
  - Open
    подхо
  - услови
    ключе
- Так что, ду
  Мартинес-С

артинес-Сороа
ились
инеска)

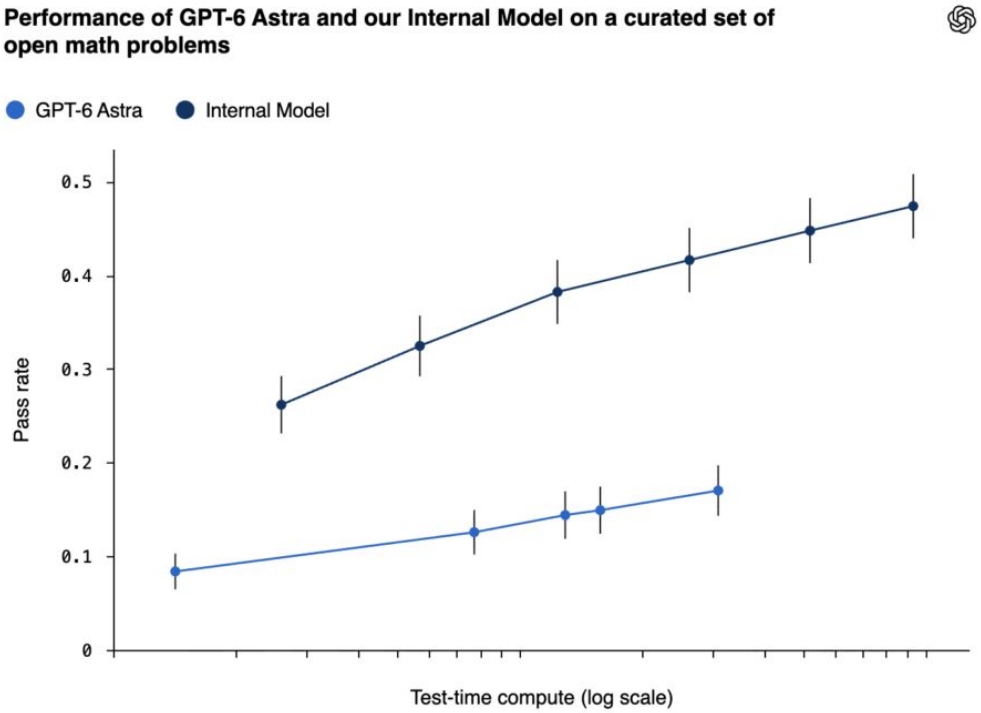
cs Institute

Альпёге, как и должно быть



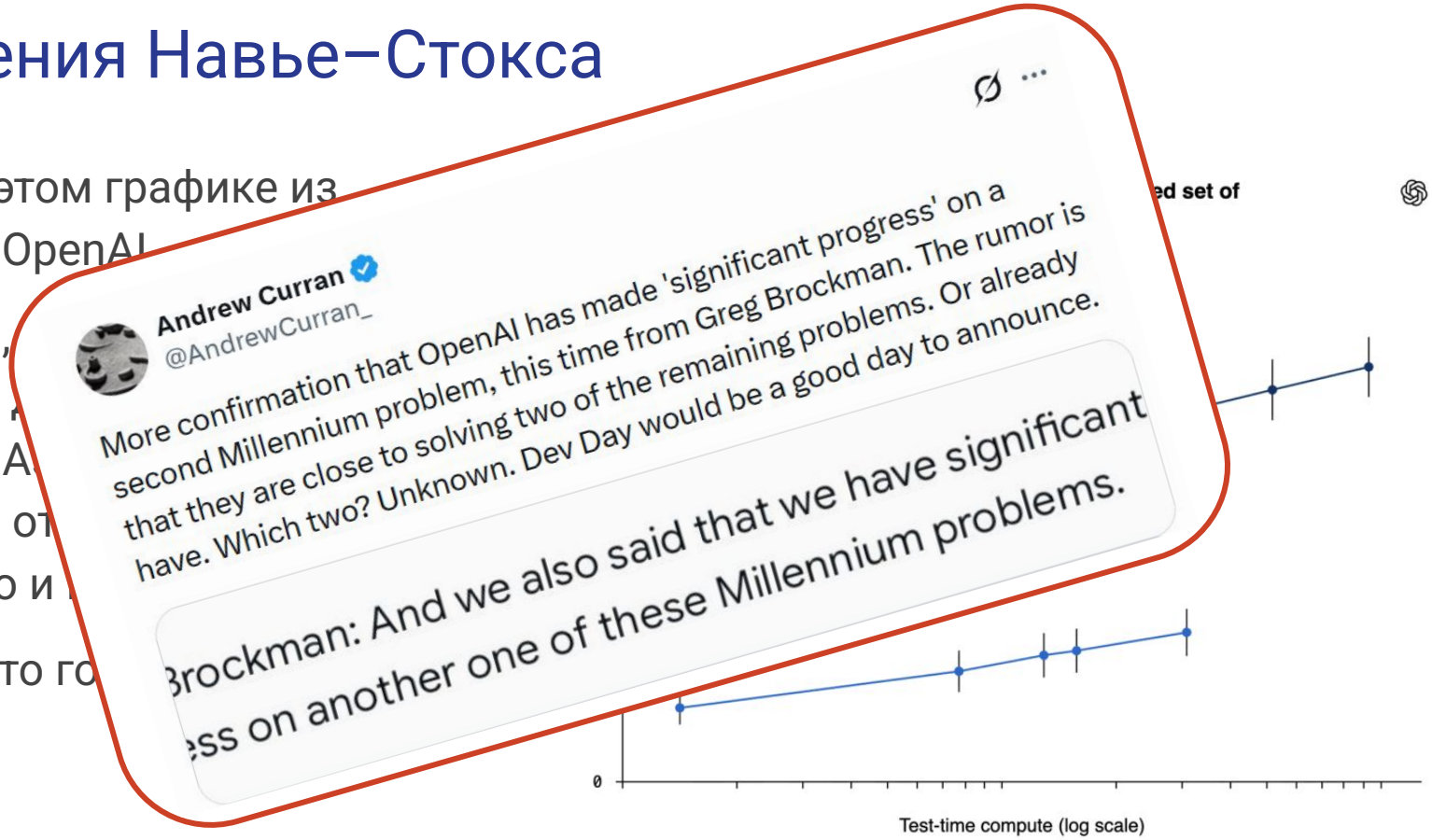
Уравнения Навье–Стокса

- …вот в этом графике из анонса OpenAI
- По сути, их внутренняя модель далеко опережает Astra, а Astra и так уже решала открытые задачи направо и налево
- О чём это говорит?..



Уравнения Навье–Стокса

- …вот в этом графике из анонса OpenAI
- По сути, модель … Astra, а A… решала от… направо и …
- О чём это го…



3. Летние реакции



Людей расстраивают не сами события, а то, как они их воспринимают.

Эпиктет

They must be true, because, if they were not true, no one would have had the imagination to invent them.

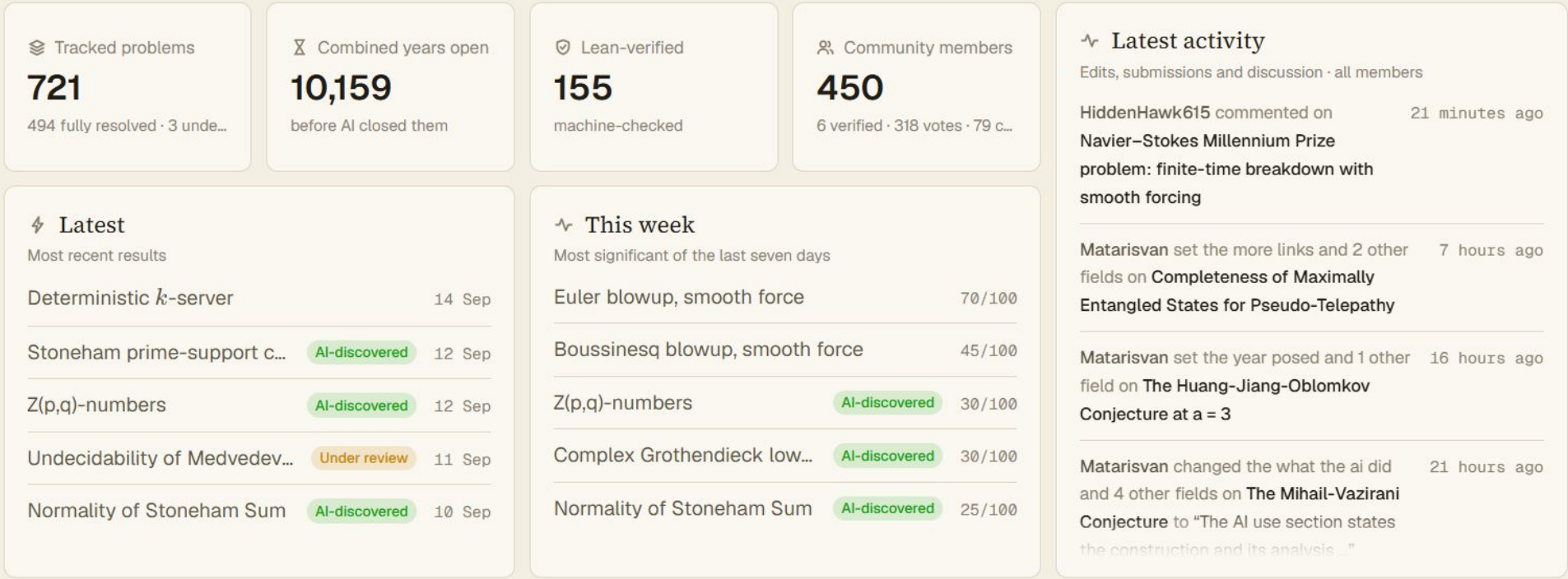
Годфри Харди о формулах Рамануджана

A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it.

Макс Планк. Научная автобиография

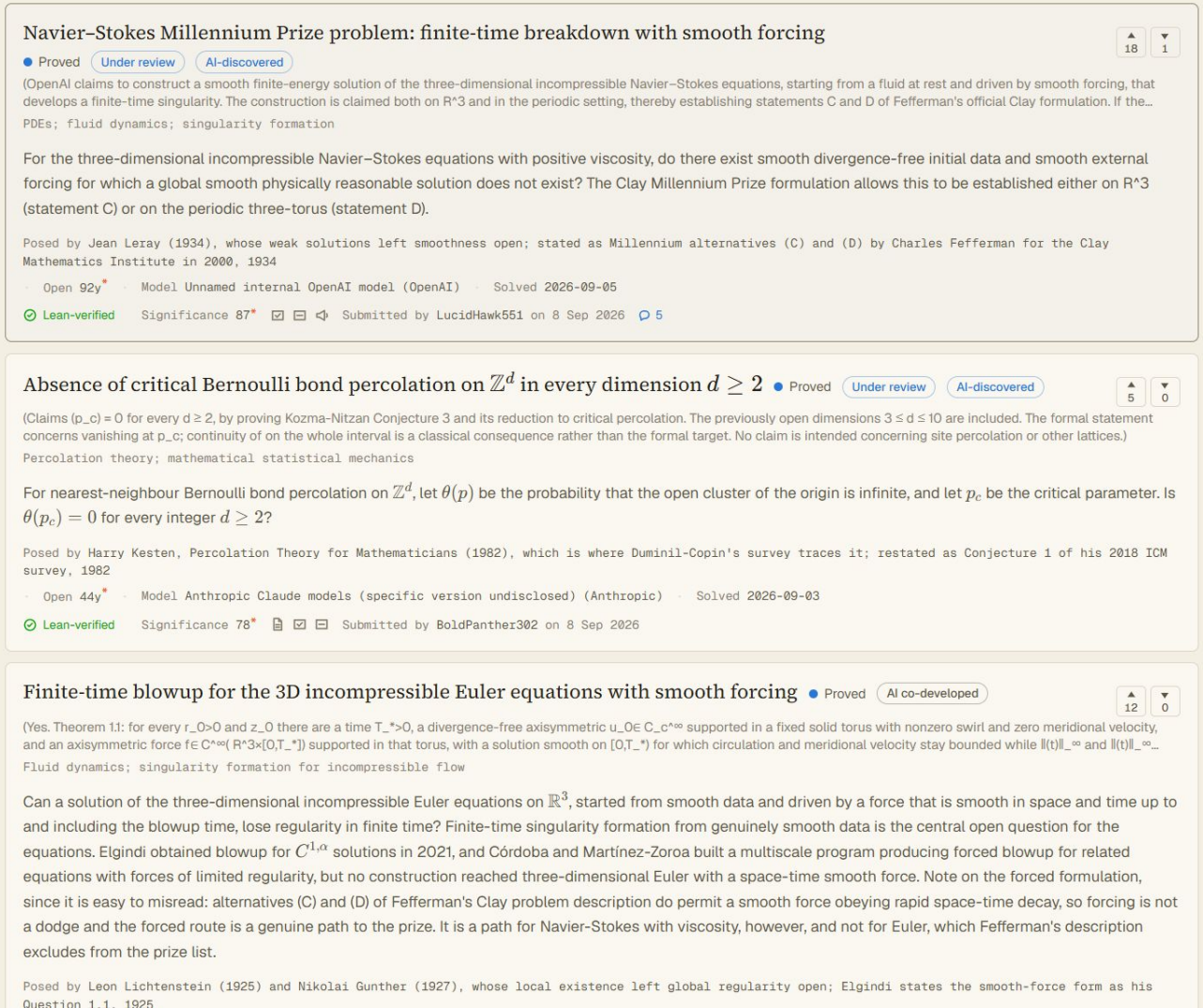
Vibemathed

- Во-первых, чтобы следить за успехами или самостоятельно в них участвовать, рекомендую vibemathed.com; это сентябрьские скриншоты:



Vibemathed

- Там стараются следить за всеми результатами и публиковать соответствующие анонсы; вряд ли Anthropic и OpenAI сами подавали заявки на этот сайт



Navier–Stokes Millennium Prize problem: finite-time breakdown with smooth forcing

▲ 18 ▼ 1

● Proved | Under review | AI-discovered

(OpenAI claims to construct a smooth finite-energy solution of the three-dimensional incompressible Navier–Stokes equations, starting from a fluid at rest and driven by smooth forcing, that develops a finite-time singularity. The construction is claimed both on R^3 and in the periodic setting, thereby establishing statements C and D of Fefferman's official Clay formulation. If the…

PDEs; fluid dynamics; singularity formation

For the three-dimensional incompressible Navier–Stokes equations with positive viscosity, do there exist smooth divergence-free initial data and smooth external forcing for which a global smooth physically reasonable solution does not exist? The Clay Millennium Prize formulation allows this to be established either on R^3 (statement C) or on the periodic three-torus (statement D).

Posed by Jean Leray (1934), whose weak solutions left smoothness open; stated as Millennium alternatives (C) and (D) by Charles Fefferman for the Clay Mathematics Institute in 2000, 1934

Open 92y* · Model Unnamed internal OpenAI model (OpenAI) · Solved 2026-09-05

Lean-verified · Significance 87* · Submitted by LucidHawk551 on 8 Sep 2026 · 5

Absence of critical Bernoulli bond percolation on $\mathbb{Z}^d$ in every dimension $d \geq 2$ ● Proved | Under review | AI-discovered

▲ 5 ▼ 0

(Claims $p_c = 0$ for every $d \geq 2$, by proving Kozma-Nitzan Conjecture 3 and its reduction to critical percolation. The previously open dimensions $3 \leq d \leq 10$ are included. The formal statement concerns vanishing at p_c; continuity of on the whole interval is a classical consequence rather than the formal target. No claim is intended concerning site percolation or other lattices.)

Percolation theory; mathematical statistical mechanics

For nearest-neighbour Bernoulli bond percolation on $\mathbb{Z}^d$, let $\theta(p)$ be the probability that the open cluster of the origin is infinite, and let p_c be the critical parameter. Is $\theta(p_c) = 0$ for every integer $d \geq 2$?

Posed by Harry Kesten, Percolation Theory for Mathematicians (1982), which is where Duminil-Copin's survey traces it; restated as Conjecture 1 of his 2018 ICM survey, 1982

Open 44y* · Model Anthropic Claude models (specific version undisclosed) (Anthropic) · Solved 2026-09-03

Lean-verified · Significance 78* · Submitted by BoldPanther302 on 8 Sep 2026

Finite-time blowup for the 3D incompressible Euler equations with smooth forcing ● Proved | AI co-developed

▲ 12 ▼ 0

(Yes. Theorem 1.1: for every r_0>0 and z_0 there are a time T_*>0, a divergence-free axisymmetric u_0∈ C_c^∞ supported in a fixed solid torus with nonzero swirl and zero meridional velocity, and an axisymmetric force f∈ C^∞(R^3×[0,T_*]) supported in that torus, with a solution smooth on [0,T_*) for which circulation and meridional velocity stay bounded while ‖(t)‖_∞ and ‖(t)‖_∞…

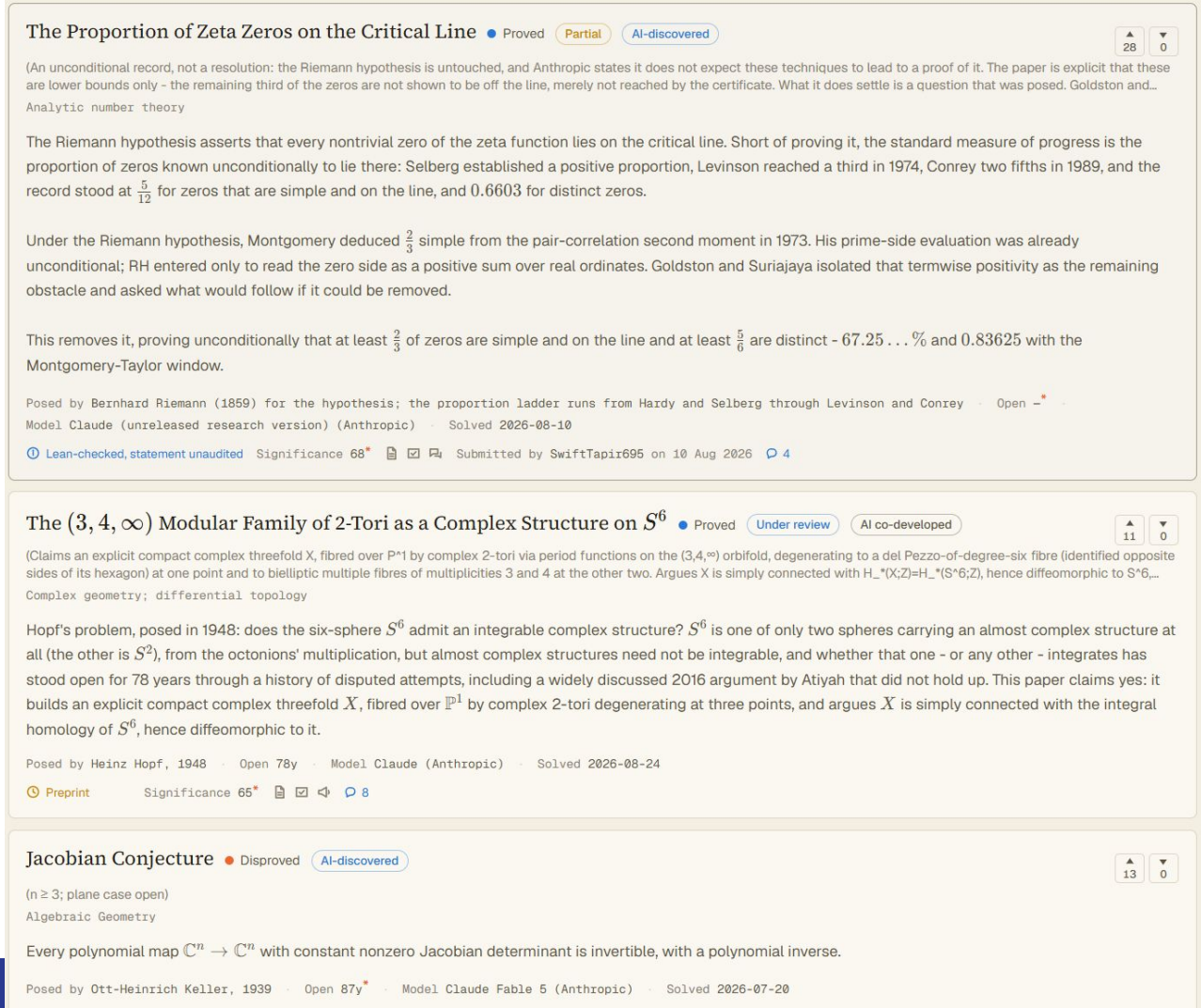
Fluid dynamics; singularity formation for incompressible flow

Can a solution of the three-dimensional incompressible Euler equations on $\mathbb{R}^3$, started from smooth data and driven by a force that is smooth in space and time up to and including the blowup time, lose regularity in finite time? Finite-time singularity formation from genuinely smooth data is the central open question for the equations. Elgindi obtained blowup for $C^{1,\alpha}$ solutions in 2021, and Córdoba and Martínez-Zoroa built a multiscale program producing forced blowup for related equations with forces of limited regularity, but no construction reached three-dimensional Euler with a space-time smooth force. Note on the forced formulation, since it is easy to misread: alternatives (C) and (D) of Fefferman's Clay problem description do permit a smooth force obeying rapid space-time decay, so forcing is not a dodge and the forced route is a genuine path to the prize. It is a path for Navier-Stokes with viscosity, however, and not for Euler, which Fefferman's description excludes from the prize list.

Posed by Leon Lichtenstein (1925) and Nikolai Gunther (1927), whose local existence left global regularity open; Elgindi states the smooth-force form as his Question 1.1, 1925

Vibemathed

- Там стараются следить за всеми результатами и публиковать соответствующие анонсы; вряд ли Anthropic и OpenAI сами подавали заявки на этот сайт



The Proportion of Zeta Zeros on the Critical Line · Proved · Partial · AI-discovered

▲ 28 ▼ 0

(An unconditional record, not a resolution: the Riemann hypothesis is untouched, and Anthropic states it does not expect these techniques to lead to a proof of it. The paper is explicit that these are lower bounds only - the remaining third of the zeros are not shown to be off the line, merely not reached by the certificate. What it does settle is a question that was posed. Goldston and…

Analytic number theory

The Riemann hypothesis asserts that every nontrivial zero of the zeta function lies on the critical line. Short of proving it, the standard measure of progress is the proportion of zeros known unconditionally to lie there: Selberg established a positive proportion, Levinson reached a third in 1974, Conrey two fifths in 1989, and the record stood at $\frac{5}{12}$ for zeros that are simple and on the line, and 0.6603 for distinct zeros.

Under the Riemann hypothesis, Montgomery deduced $\frac{2}{3}$ simple from the pair-correlation second moment in 1973. His prime-side evaluation was already unconditional; RH entered only to read the zero side as a positive sum over real ordinates. Goldston and Suriajaya isolated that termwise positivity as the remaining obstacle and asked what would follow if it could be removed.

This removes it, proving unconditionally that at least $\frac{2}{3}$ of zeros are simple and on the line and at least $\frac{5}{6}$ are distinct - $67.25\ldots\%$ and 0.83625 with the Montgomery-Taylor window.

Posed by Bernhard Riemann (1859) for the hypothesis; the proportion ladder runs from Hardy and Selberg through Levinson and Conrey · Open –* ·
Model Claude (unreleased research version) (Anthropic) · Solved 2026-08-10

Lean-checked, statement unaudited · Significance 68* · Submitted by SwiftTapir695 on 10 Aug 2026 · 4

The $(3, 4, \infty)$ Modular Family of 2-Tori as a Complex Structure on S^6 · Proved · Under review · AI co-developed

▲ 11 ▼ 0

(Claims an explicit compact complex threefold X, fibred over P^1 by complex 2-tori via period functions on the (3,4,∞) orbifold, degenerating to a del Pezzo-of-degree-six fibre (identified opposite sides of its hexagon) at one point and to bielliptic multiple fibres of multiplicities 3 and 4 at the other two. Argues X is simply connected with H_*(X;Z)=H_*(S^6;Z), hence diffeomorphic to S^6,…

Complex geometry; differential topology

Hopf's problem, posed in 1948: does the six-sphere S^6 admit an integrable complex structure? S^6 is one of only two spheres carrying an almost complex structure at all (the other is S^2), from the octonions' multiplication, but almost complex structures need not be integrable, and whether that one - or any other - integrates has stood open for 78 years through a history of disputed attempts, including a widely discussed 2016 argument by Atiyah that did not hold up. This paper claims yes: it builds an explicit compact complex threefold X, fibred over $\mathbb{P}^1$ by complex 2-tori degenerating at three points, and argues X is simply connected with the integral homology of S^6, hence diffeomorphic to it.

Posed by Heinz Hopf, 1948 · Open 78y · Model Claude (Anthropic) · Solved 2026-08-24

Preprint · Significance 65* · 8

Jacobian Conjecture · Disproved · AI-discovered

▲ 13 ▼ 0

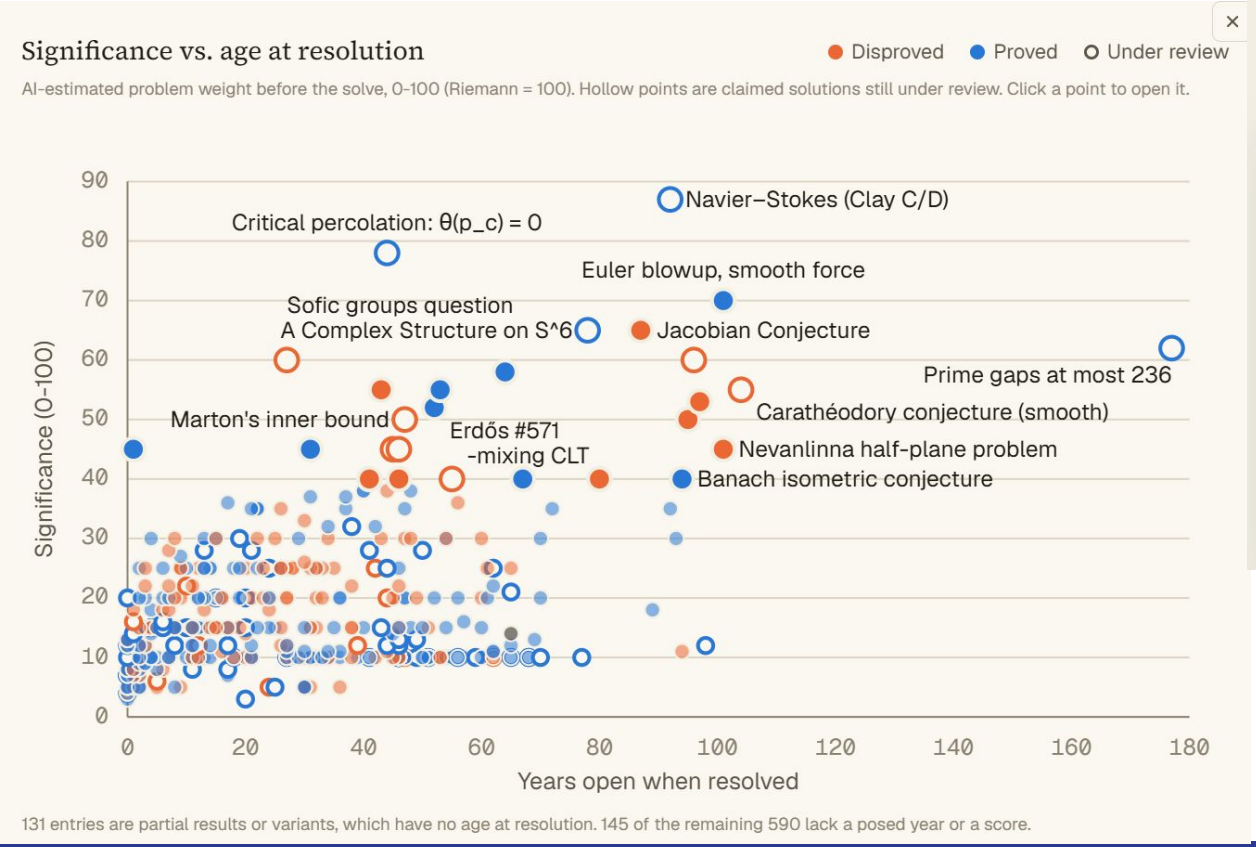
(n ≥ 3; plane case open)

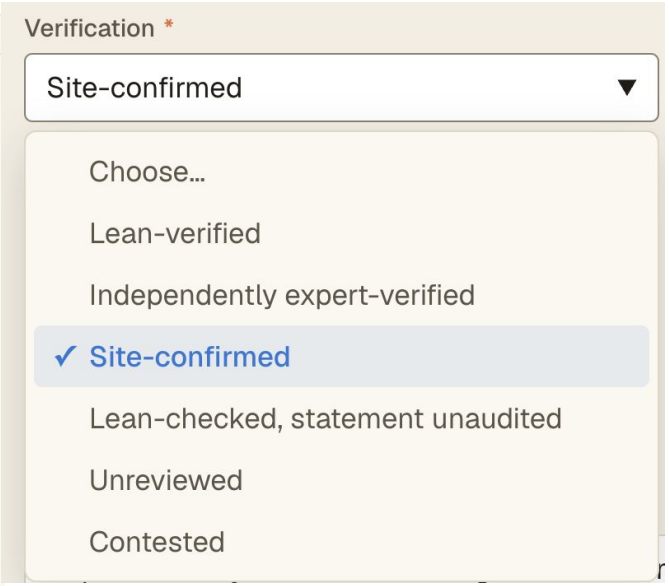
Algebraic Geometry

Every polynomial map $\mathbb{C}^n \to \mathbb{C}^n$ with constant nonzero Jacobian determinant is invertible, with a polynomial inverse.

Posed by Ott-Heinrich Keller, 1939 · Open 87y* · Model Claude Fable 5 (Anthropic) · Solved 2026-07-20

Vibemathed


Significance vs. age at resolution
Disproved
Proved
Under review
AI-estimated problem weight before the solve, 0-100 (Riemann = 100). Hollow points are claimed solutions still under review. Click a point to open it.
Navier–Stokes (Clay C/D)
Critical percolation: θ(p_c) = 0
Euler blowup, smooth force
Sofic groups question
A Complex Structure on S^6
Jacobian Conjecture
Prime gaps at most 236
Carathéodory conjecture (smooth)
Marton's inner bound
Erdős #571
-mixing CLT
Nevanlinna half-plane problem
Banach isometric conjecture
Significance (0-100)
Years open when resolved
0
10
20
30
40
50
60
70
80
90
0
20
40
60
80
100
120
140
160
180
131 entries are partial results or variants, which have no age at resolution. 145 of the remaining 590 lack a posed year or a score.


Verification *
Site-confirmed
Choose...
Lean-verified
Independently expert-verified
✓ Site-confirmed
Lean-checked, statement unaudited
Unreviewed
Contested

Лейденская декларация

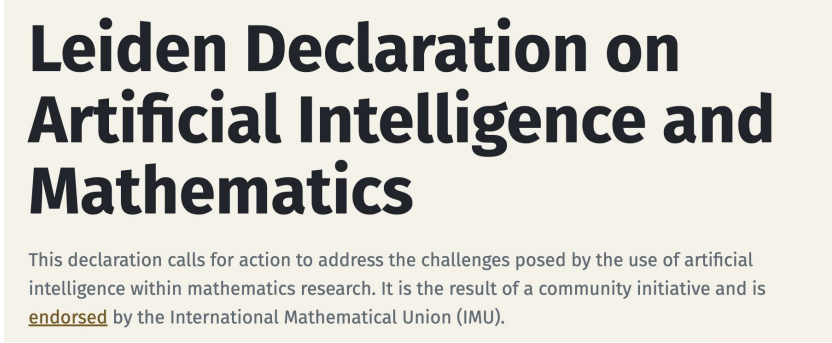
- Лейденская декларация (2 июня 2026)
- **Ценности:**
  - главное в математике — доказательство
  - у результатов есть авторы (слава и ответственность)
  - доказательства прозрачны и верифицируемы независимо
  - математики хотят, чтобы результаты проверялись
  - ценен не только результат, но и понимание сообществом

Leiden Declaration on Artificial Intelligence and Mathematics

This declaration calls for action to address the challenges posed by the use of artificial intelligence within mathematics research. It is the result of a community initiative and is endorsed by the International Mathematical Union (IMU).



Лейденская декларация

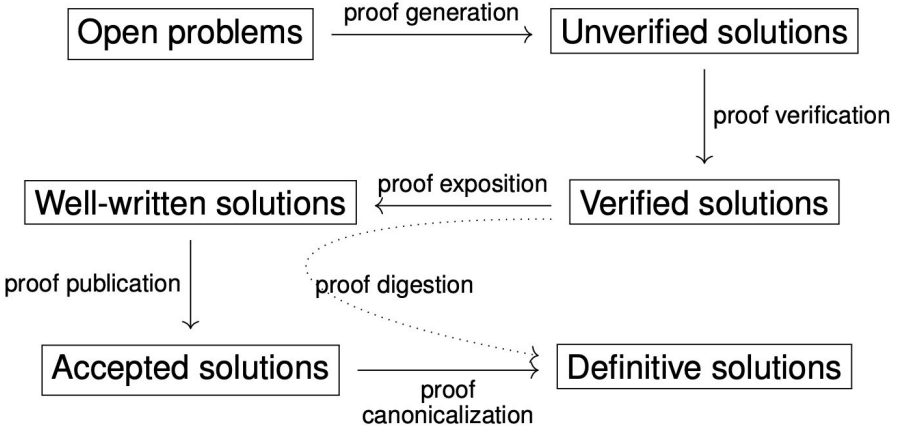


- Лейденская декларация (2 июня 2026)
- **Угрозы:**
  - правдоподобные, но неверные доказательства
  - атрибуция размывается
  - меняются стимулы, нарушаются механизмы найма и финансирования
  - объявления через пресс-релиз мешают проверке
  - автономия математики теряется, понимание может потеряться при автоматизации

Теренс Тао



- Теренс Тао (доклад на ICM 2026):
- Порождение корректного доказательства – не конец математического познания
- Дальше ещё шаг улучшения изложения, в конце концов “каноникализация”
- Тао предлагает сдвинуть фокус с порождения доказательств и приоритета на “proof digestion”
- (хотя почему бы AI вскоре не превзойти людей и здесь?..)



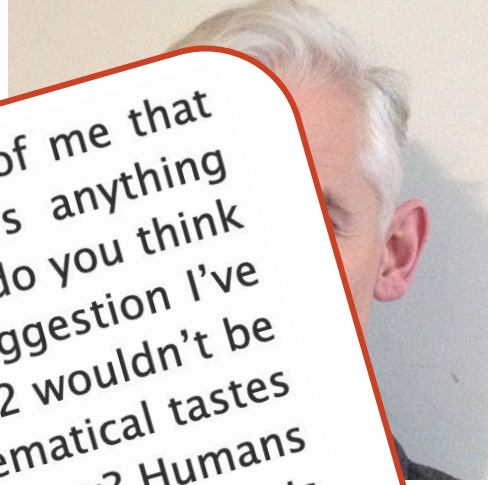
Тимоти Гауэрс



- Тимоти Гауэрс (26 июля 2026) не подписал Лейденскую декларацию
- Возражает против аксиомы человеческого авторства (кто доказал теорему о единичных расстояниях?)
- Боится потери математической культуры: "Imagine... a pandemic broke out... wiped out all mathematicians and nobody else. All the literature would still be there, but nobody would have the faintest idea what to do with it."
- Как и Тао, предлагает сдвигать фокус на proof digestion, хорошие объяснения

Тимоти Гауэрс

- Тимоти Гауэрс (26 июля 202
  Лейденскую декл
- Boa
- K
  pro
- K
  pro



At this point I have to admit that there's a pessimistic side of me that asks the following general question whenever anyone says anything about what the role for humans might be in the future: why do you think that AI wouldn't be able to do it? For example, with the suggestion I've just made, what reason is there to suppose that ChatGPT 8.2 wouldn't be able to have a short interaction with you about your mathematical tastes and background and then write the ideal textbook just for you? Humans are likely to be better at this kind of curating for a little while yet, but is it a fundamentally human ability that AI could never hope to emulate?

there, but
idea what to do with it."

агает сдвигать фокус на
gestion, хорошие объяснения

Михаил Вербицкий



Пишет Misha Verbitsky (tiphareth)
@ 2026-08-12 19:15:00

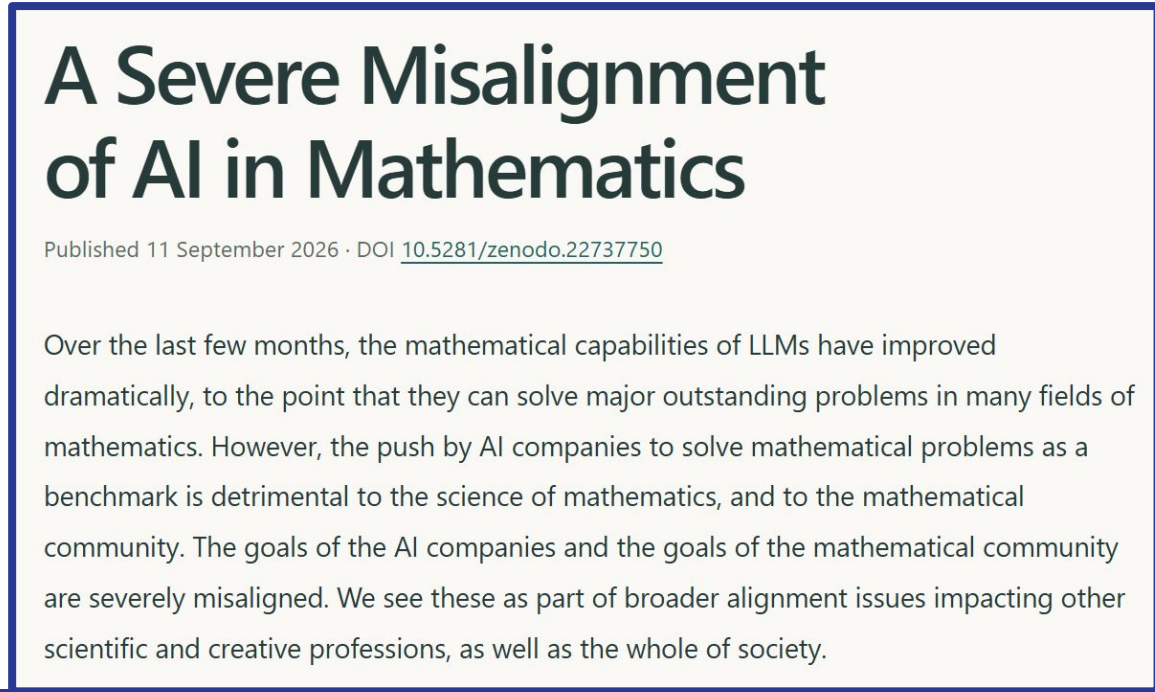
- Михаил Вербицкий (12 августа 2026): “В последние недели 2-3 свершилась типа революция, LLM открывает одна за другой потрясающие математические результаты, хотя пока в основном контрпримеры. Не комбинаторику ######, не второкультурное ###### #####, а реально математику.
- Думаю что таки мы все в скором времени будем юзать AI бесперерывно. Хотя заказывать LLM писать мои статьи я все-таки не хочу, есть риск увлечься, утерять адекватность и начать массово производить ужасное #####. Многие (хорошие) коллеги уже скатились. Джихао (няша) всегда указывает, что это вот написано роботами, а другие коллеги (имен не называю, профессиональная этика не велит) вконец #########, выкладывают в архив полное ошибок #######, и уверены, что никто не догадается, что оно написано роботами.”

Proofs and Prompts

- Коллективный блог Proofs and Prompts. Первый пост — от Мартина Хайрера (филдсовская медаль 2014): “Writing mathematics in the age of AI”:
  - Нужно больше подозрительности в отношении AI-доказательств
  - Максимально полно раскрывать роль AI-систем в статьях (здесь, конечно, есть очевидная проблема)
  - Искать первоисточники (модели часто “забывают”, откуда взяты идеи – впрочем, это пока)
  - Стиль: "Please do not copy / paste the output of an AI system into your article... The reader is interested in your thoughts. Do not insult them by spending less time to write a paragraph than it takes them to read it."

Письмо филдсовских лауреатов

- После Навье–Стокса 25 филдсовских лауреатов, включая Делиня, Смирнова и Тао, подписали открытое письмо; его лучше просто прочитать
- Главная мысль: решение задач — инструмент для достижения понимания, а понимание и есть суть математики
- Поэтому AI-компании оказывают математике медвежью услугу, производя доказательства без понимания



A Severe Misalignment of AI in Mathematics

Published 11 September 2026 · DOI 10.5281/zenodo.22737750

Over the last few months, the mathematical capabilities of LLMs have improved dramatically, to the point that they can solve major outstanding problems in many fields of mathematics. However, the push by AI companies to solve mathematical problems as a benchmark is detrimental to the science of mathematics, and to the mathematical community. The goals of the AI companies and the goals of the mathematical community are severely misaligned. We see these as part of broader alignment issues impacting other scientific and creative professions, as well as the whole of society.

Письмо филдсовских лауреатов

- Моё мнение: филдсовские лауреаты, конечно, знают, в чём суть математики, тут не поспоришь
- И да, доказательства от LLM часто неряшливы и трудны для понимания (хотя без проверки в Lean они обычно и не считаются)
- Но я совершенно не понимаю, как отсюда следует вывод
- Доказательство может помочь понять область, а в худшем случае не помочь, но как оно может *помешать* пониманию?..

discussions, simplifications. At the end of this process, one will ideally find a textbook presentation of the results suitable for any graduate or even undergraduate student to study. Some of the mathematical ideas pursue their journey even further to become, decades or centuries after, tools that are understood and used by the whole population.

Often these solutions are announced in a rush, leaving no time for a proper writeup, the isolation of new methods and ideas, and citing relevant previous work of others. As in all creative professions, this raises severe attribution and plagiarism questions. Moreover, without the willing mathematicians who must take care of their development and integration into the mathematical canon, AI-conceived ideas would never become fully alive and the crucial human transmission chain between mathematicians would be lost.

Письмо филдсовских лауреатов

- Кстати, с первой решённой задачей тысячелетия было похоже: Перельман опубликовал трудное доказательство, не спешил его объяснять, и сообществу понадобились годы, чтобы его осознать
- Видел ли кто-нибудь в этом огромную проблему? Был ли Перельман «misaligned»?.. Нет, его (справедливо) чествовали

- Скотт Армстронг (Сорбонна):





Scott Armstrong
@scottnarmstrong

I disagree with this.

Obviously the openAI construction of the Navier-Stokes blow up is a huge, huge contribution to the field. It will take us PDE analysts some time to understand it well. (Longer than a week, but perhaps less than a month.)

Soon some of us will understand it, and hopefully rewrite it in a way that others can follow. When this is done, our human understanding of these important equations will be past the bottleneck we've been stuck at for 100 years since Leray.

What is weird is that, up until now, proofs like this have always emerged AFTER human understanding. But that is not the case any more. From now onwards, human understanding will typically lag the proofs, which will first be written by our machines.

The understanding however WILL follow closely behind.

The Age of Wonders and Terrors

- Скотт Аароносн, 15.09.2026



If you want to know my current take, you simply start with the one above, then update on the fact that **the wild prophecies have come true**. The first rumblings, I'd say, came a decade ago with AlphaGo, they got noticeably louder with LLMs and coding and reasoning agents, and they've accelerated this summer and fall into a crescendo of wonders and terrors that one needs to be a particular kind of idiot to deny.

I recoil from the neverending shell game where you say "oh sure, *of course* AI can now [escape from its sandbox / solve Millennium Problems / whichever dramatic thing it most recently did], no one ever denied that [I *did* deny it], wake me up when AI does [thing AI hasn't yet done but is going to do next year], *that's* when I'll reevaluate my whole worldview [no I won't]." Where no matter how fast the rollercoaster accelerates, even after your whole familiar world has vanished behind you, you're still inventing reasons why it doesn't count.

My position on AI is merely the conservative, skeptical position of 2006, updated with intellectual honesty for the reality of late 2026. And that position, if you need me to spell it out, is as follows:

AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAA

It seems to me that the Singularity *has already started*; it's just wildly unevenly distributed. Yes, I still unload the dishwasher and clip my toenails. On the other hand, in whatever years I have left, I don't expect that I'll ever again prove a theorem because I'm actually needed to prove it. If I do, it will only be for my or others' enjoyment or edification.

The test is this: if we took the news of these past few weeks and sent it back in time twenty years, would I agree that it looked like the beginning of an AI Singularity? The intellectually honest answer is: yes, absolutely. But then that's all we need. No backsies.

My purpose here is not to adjudicate the dispute. Yes, in swooping in with vastly greater resources once it had gotten wind of progress on Navier-Stokes, OpenAI seems to have acted in a way that some might describe as "unsportsmanlike." No, I don't find it plausible that OpenAI's models meaningfully benefitted from being trained on Buckmaster and Alpöge's chat logs. But this leaves a crucial question unanswered: what exactly did OpenAI know about Buckmaster and Alpöge's work and when did it know it?

Anyway, as Zvi points out, it's easy to get hung up on the details and lose sight of the high-order bit: namely, that it seems safe to say that human mathematicians are forevermore dethroned as the main theorem-proving entities on planet earth. I feel privileged to have had the traditional kind of career in theoretical computer science in the last decades when that was possible.

If we were *just* talking about Navier-Stokes, you might accuse me of jumping to conclusions here. But we're not. In the areas I know best (such as quantum complexity theory), and presumably other areas as well, there's now a deluge, with longstanding open problems both major and minor falling by the day.

Go to the arXiv or ECCC. Pretty much *all* the papers that I'd be interested in now include "AI statements" near the acknowledgments (as this is often the central thing I want to know, I wish I didn't need to scroll to the end of the paper to find it!). These statements can range from "our main result came entirely from GPT-6, but we understood it and take responsibility for it," to "the results came from an interaction between the human authors and AI" to "we used AI, but only for proofreading and other incidental things" to (mad props!) "the author did not use AI for anything."

The Age of Wonders and Terrors

- Скотт Ааронсон, 15.09.2026



Кстати, до Скотта тоже дошли слухи

» According to rumors that I've heard, solutions to some very longstanding open problems in theoretical computer science (no, not P≠NP or other complexity class separations, but think about some of our other biggest problems). I'm told that the AI companies, having been burned by the hostile response to the Navier–Stokes proof, are now sitting on solutions to some very major problems until they figure out a better way to handle things

If you want to know my current take, you simply start with the one above, then update on the fact that **the wild prophecies have come true**. The first rumblings, I'd say, came a decade ago with AlphaGo, they got noticeably louder with LLMs and coding and reasoning agents, and they've accelerated this summer and fall into a crescendo of wonders and terrors that one needs to be a particula… kind of idiot to deny.

I recoil from the neverending shell game where you … can now [escape from its sandbox / solve … dramatic thing it most recently did] … me up when AI does [th… year], *that's* when … matter how … has vanish…

My positio… with intelle… me to spell …

AAAAAAAAAA… AAAAAAAAAA… AAAAAAAAAA…

It seems to me … distributed. Yes, … hand, in whatev… … again prove a theorem because … … will only be for my or others' enjoyment …

The test is this: if we … ews of these past few weeks and sent it back in time twenty years, would I agree that it looked like the beginning of an AI Singularity? The intellectually honest answer is: yes, absolutely. But then that's all we need. No backsies.

My purpose he… … in with vastly great… …tokes, OpenAI …manlike." No, …d from being …ial question …öge's work …e sight of …maticians …net earth. …al computer

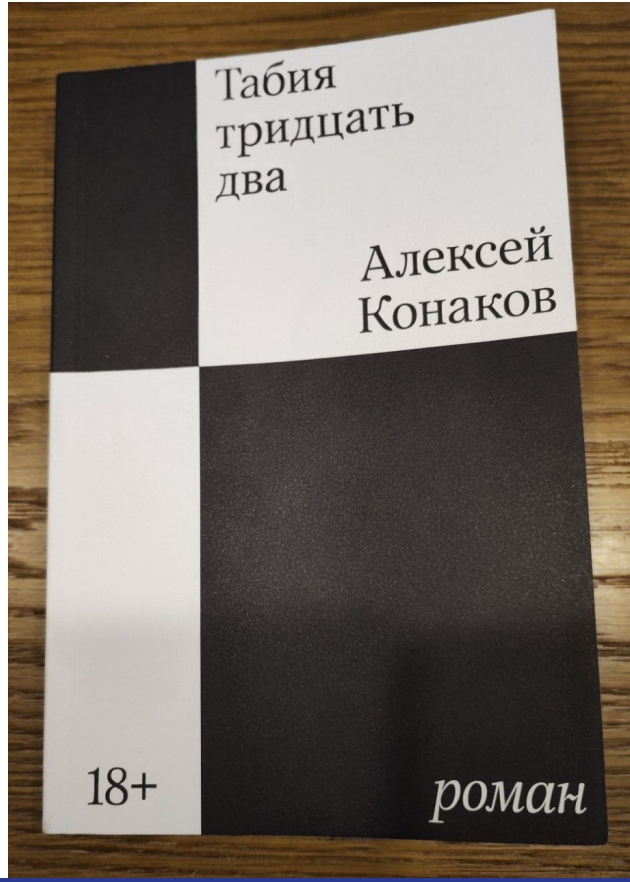
---

…tokes, you might accuse me of jumping to …not. In the areas I know best (such as quantum …, and presumably other areas as well, there's now a deluge, …anding open problems both major and minor falling by the day.

Go to the arXiv or ECCC. Pretty much *all* the papers that I'd be interested in now include "AI statements" near the acknowledgments (as this is often the central thing I want to know, I wish I didn't need to scroll to the end of the paper to find it!). These statements can range from "our main result came entirely from GPT-6, but we understood it and take responsibility for it," to "the results came from an interaction between the human authors and AI" to "we used AI, but only for proofreading and other incidental things" to (mad props!) "the author did not use AI for anything."

Шахматы и математика

- Почему-то часто встречаются сравнения с шахматами: шахматы пережили компьютерную революцию и даже стали гораздо популярнее после неё (например, здесь)
- Но очевидно, что это совсем другое дело: шахматы корректно было бы сравнить с математическими олимпиадами, и здесь, конечно, тот факт, что GPT 5.6 и Claude Fable решили все задачи IMO 2026, ничему не мешает и может быть так же полезен, как в шахматах
- Но если бы была наука о шахматах…



4. Шестое октября



О сколько нам открытий чудных
Готовят просвещенья дух
И опыт, сын ошибок трудных,
И гений, парадоксов друг,
И случай, бог изобретатель…

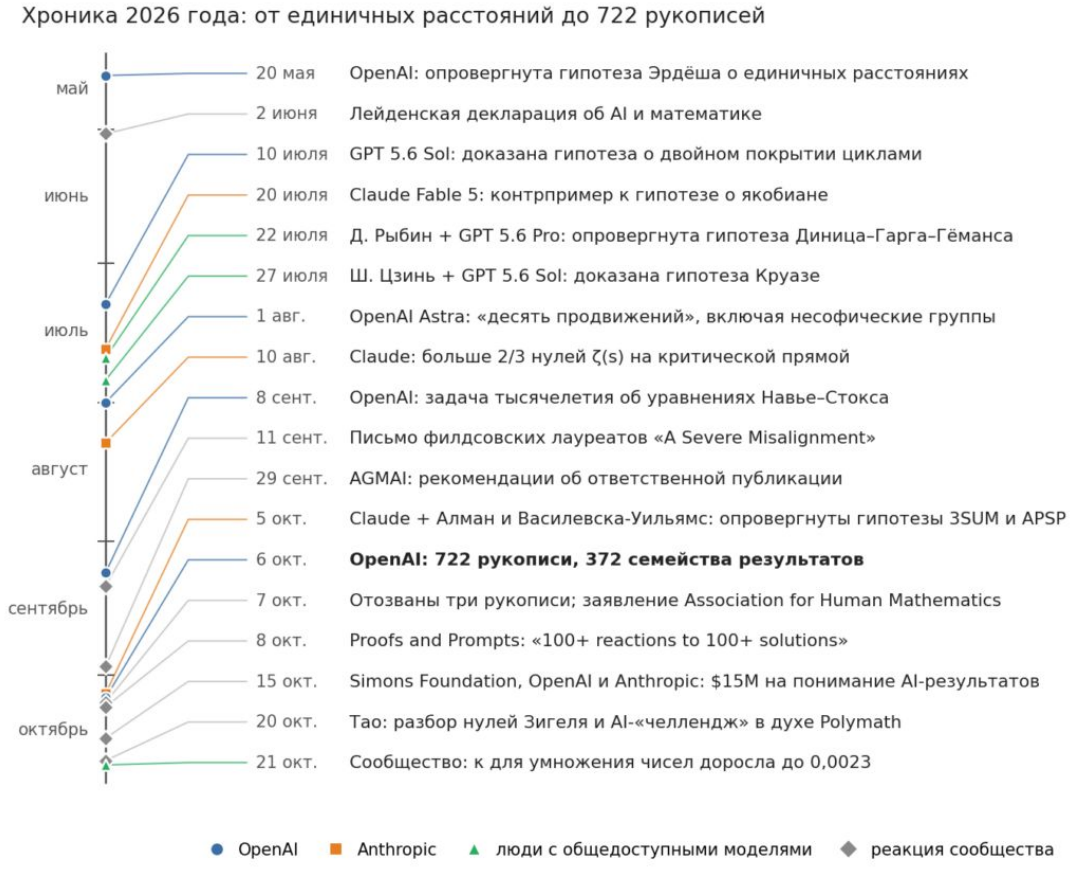
Александр Пушкин

Во многой мудрости много печали; и кто умножает познания, умножает скорбь.

Екклесиаст 1:18

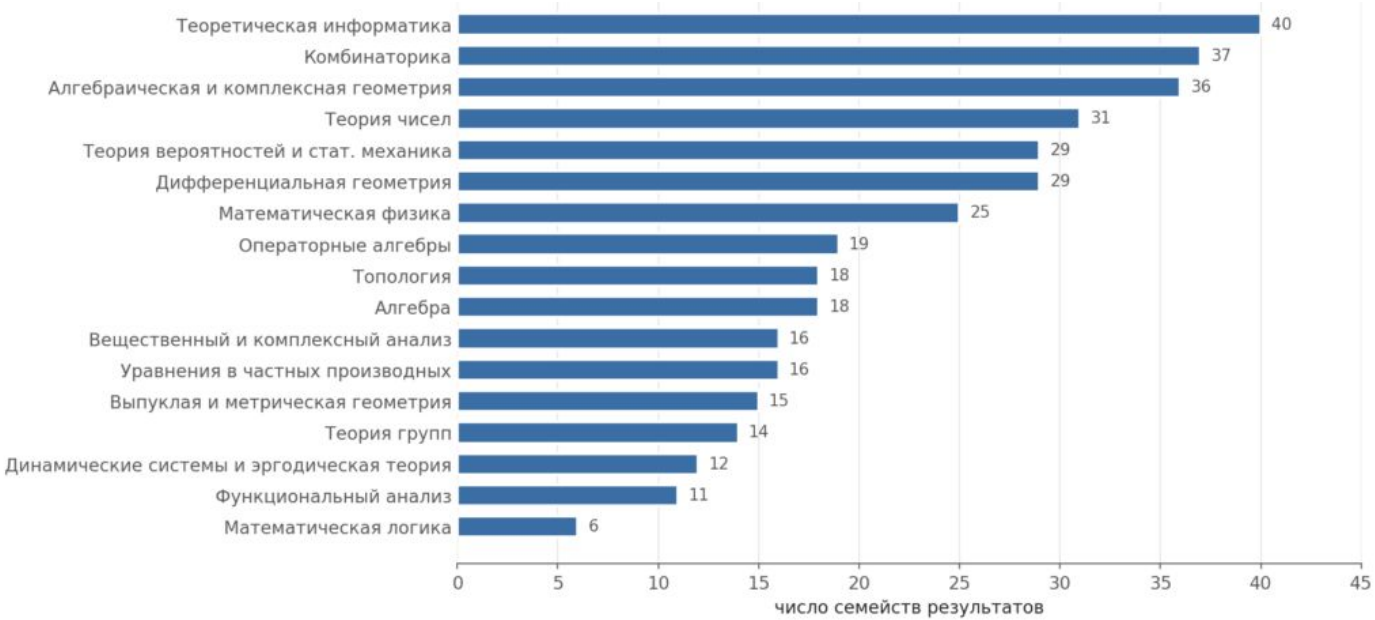
Что случилось 6 октября

- OpenAI выложила на GitHub 722 рукописи, сгруппированные в 372 «семейства» результатов
- Всё получено одной внутренней моделью (видимо, той же, что решила Навье–Стокса)
- Модели предложили ~4000 открытых задач; на один результат в среднем ушло столько вычислений, сколько уходит на три часа размышлений ChatGPT Pro
- Lean-формализации приложены к 300 из 719 основных результатов, и их становится больше



10% успеха

- Скотт Ааронсон: 372 результата на ~4000 задач — это примерно 10% успеха после одной трёхчасовой попытки на задачах, над которыми сообщества думали годами; а ведь в августе десять решённых задач от OpenAI казались сенсацией; моя родная теоретическая информатика — на первом месте (но никакой криптографии!)



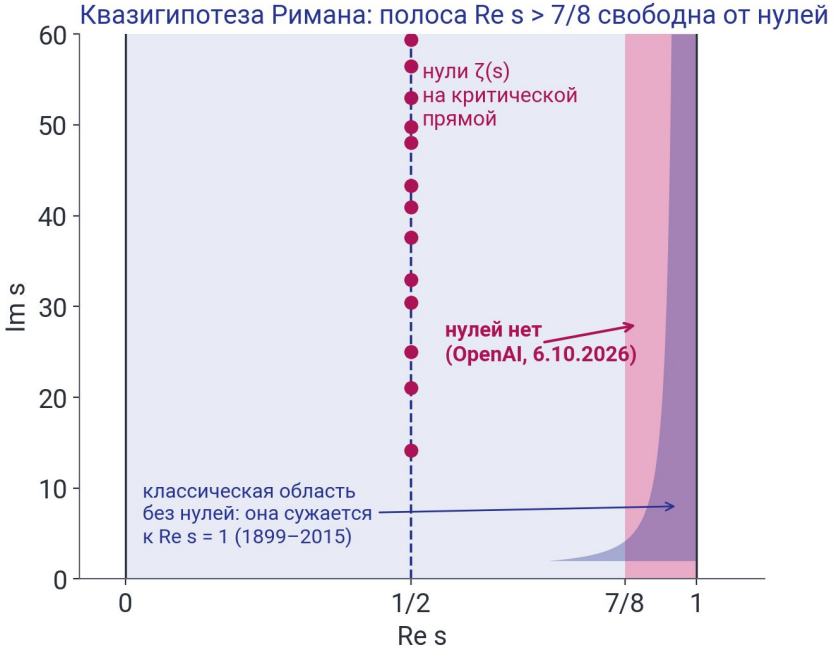
Что я бы выделил

- 003: квазигипотеза Римана
- 032: гипотезы Ходжа и Тейта для важных случаев
- 004: десятая проблема Гильберта над Q
- 034: гипотеза изобилия
- 002 + 006: Бёрч–Свиннертон-Дайер и Голдфельд
- 159: гипотеза Эрдёша об арифметических прогрессиях
- 102: гипотеза уникальных игр
- 103: L = RL = BPL
- 107: умножение матриц, $\omega \leq 2{,}25$
- 106: умножение чисел быстрее $O(n \log n)$
- 005 + 017: постоянная Каталана и мера иррациональности π

003: квазигипотеза Римана



- Гипотеза Римана: все нетривиальные нули ζ(s) лежат на прямой Re s = 1/2
- Квазигипотеза: нулей нет хотя бы в полосе Re s > 1 − δ; больше века все известные области без нулей сужались к прямой Re s = 1
- OpenAI: ни у одной L-функции Дирихле, включая ζ(s), нет нулей при Re s > 7/8
- Следствие: $\pi(x) = \mathrm{Li}(x) + O(x^{7/8+\varepsilon})$, степенной остаток в законе распределения простых
- Калегари: “WTF”; Лихтман: самое значительное AI-достижение в математике «с большим отрывом»



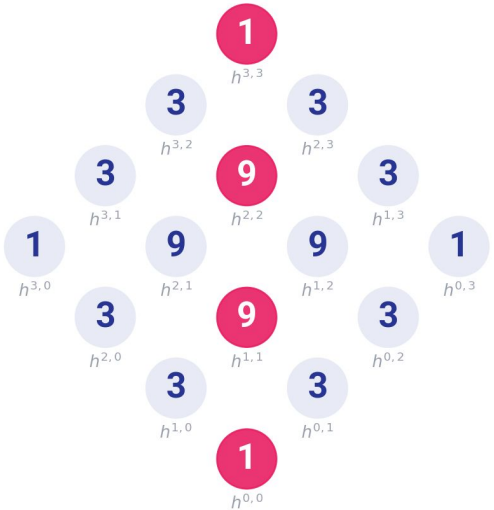
032: гипотезы Ходжа и Тейта



- Гипотеза Ходжа (задача тысячелетия): на гладком проективном многообразии каждый рациональный класс типа (p, p) — класс алгебраического цикла
- OpenAI: гипотеза Ходжа для абелевых многообразий с комплексным умножением
- Через теоремы Милна отсюда следует гипотеза Тейта для всех абелевых многообразий над конечными полями
- Это не закрытая задача на миллион, но последствия огромные

Гипотеза Ходжа: каждый рациональный класс типа (p, p) представлен алгебраическим циклом

ромб Ходжа абелева многообразия размерности 3



классы Ходжа живут в средней колонке (тип (p, p)); гипотеза: все они алгебраические

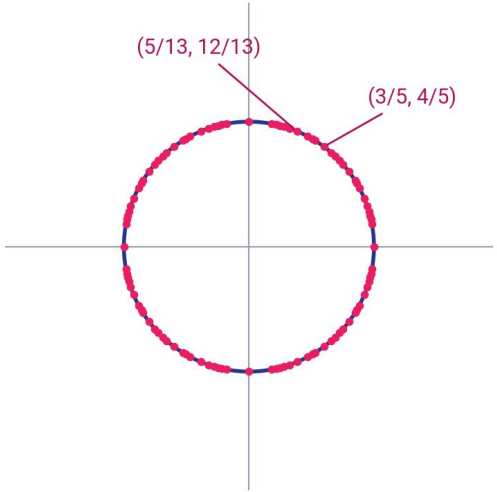
004: десятая проблема Гильберта над Q



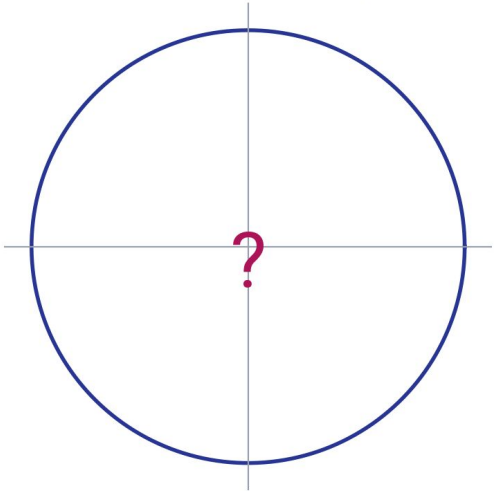
- Гильберт (1900): найти способ, который по диофантову уравнению определяет, есть ли у него целое решение
- Матиясевич (1970), завершив работу Дэвиса, Патнэма и Робинсон: такого алгоритма нет
- Для рациональных решений вопрос стоял больше полувека; OpenAI: и здесь алгоритма нет
- Думаю, Юрий Владимирович обрадуется

Десятая проблема Гильберта над Q: нет алгоритма, который по многочлену с целыми коэффициентами решает, есть ли у него рациональный корень

$x^2 + y^2 = 1$: рациональных точек бесконечно много



$x^2 + y^2 = 3$: нет ни одной



034: гипотеза изобилия

- Программа минимальных моделей: классифицировать алгебраические многообразия через их «минимальные модели»
- Гипотеза изобилия (abundance): если канонический дивизор минимальной модели численно эффективен, то он полуобилен — некоторая его кратность задаёт морфизм
- Для трёхмерных многообразий доказана в начале 1990-х (Мияока, Кавамата и др.), в старших размерностях была открыта
- Ключевой недостающий шаг в классификации многообразий

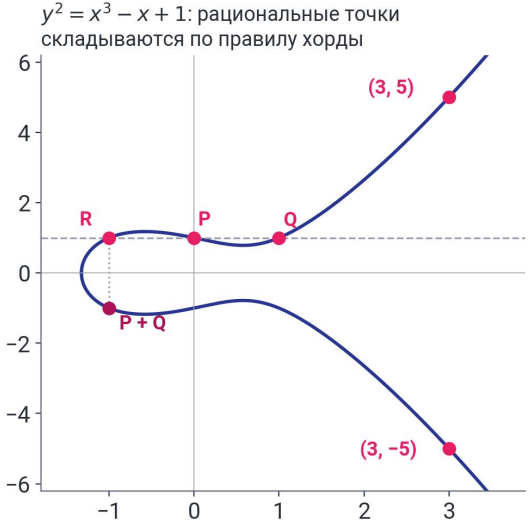


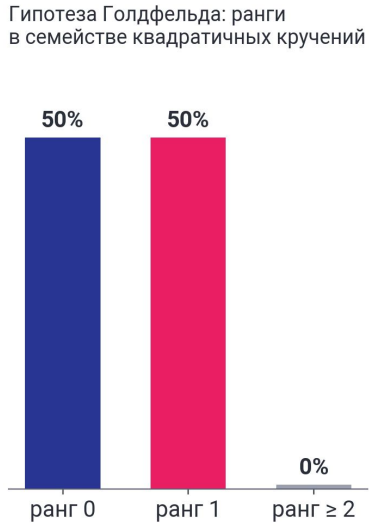
002 + 006: BSD и гипотеза Голдфельда



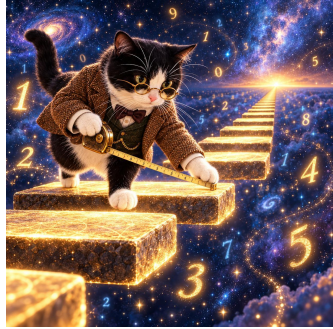
- Гипотеза BSD (задача тысячелетия): ранг группы рациональных точек эллиптической кривой равен порядку нуля её L-функции в точке s = 1
- OpenAI: формула BSD для кривых с малым корангом группы Сельмера
- Гипотеза Голдфельда: в семействе квадратичных кручений половина кривых имеет ранг 0, половина — 1
- Это большой шаг к ещё одной задаче тысячелетия, хотя она ещё не закрыта

Бёрч–Свиннертон-Дайер и Голдфельд: сколько у кривой рациональных точек





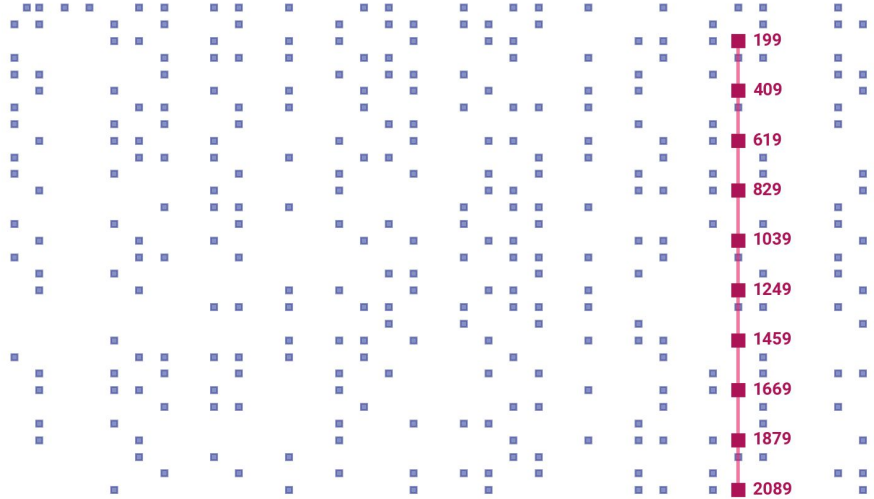
159: гипотеза Эрдёша о прогрессиях



- Если ряд из обратных величин элементов множества A расходится, то в A есть арифметические прогрессии любой длины
- Одна из главных задач Эрдёша, очень сложная и важная
- Частные случаи: простые числа (Грин–Тао, 2004), прогрессии длины 3 (Блум–Сисаск, 2020)
- OpenAI: гипотеза верна целиком

Гипотеза Эрдёша: если ряд Σ 1/a по a из A расходится, в A есть арифметические прогрессии любой длины (для простых — теорема Грина–Тао, 2004)

Простые числа до 2100 (по 70 в строке): 199, 409, …, 2089 — прогрессия из 10 простых с шагом 210



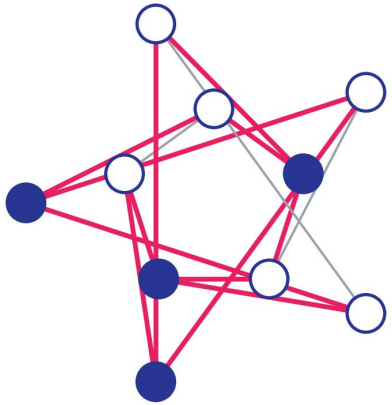
102: гипотеза уникальных игр



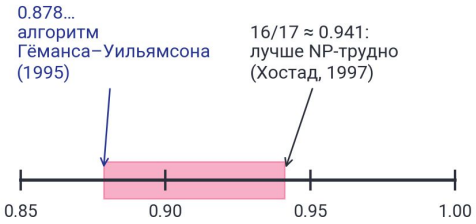
- Хот (2002): для «уникальных игр» трудно отличить почти выполнимые системы ограничений от почти невыполнимых; из неё следуют точные пороги неприближаемости: MAX-CUT нельзя приблизить лучше алгоритма Гёманса–Уильямсона (0,878…), вершинное покрытие — лучше чем в 2 раза…
- OpenAI: гипотеза верна, и масса результатов о (не)приближаемости NP-трудных задач сразу стала безусловной
- Жена Скотта Ааронсона Дана Мошковиц работала над этим всю жизнь; её девятилетний сын: “Mommy, I heard you got cooked!”

Гипотеза уникальных игр ⇒ точные пороги неприближаемости

MAX-CUT: разбить вершины на две части, чтобы разрезанных рёбер было больше всего (здесь оптимум: 12 из 15)



Какую долю оптимума можно гарантировать за полиномиальное время?



Из гипотезы уникальных игр (Хот, 2002): 0.878… — точный предел; щель закрыта

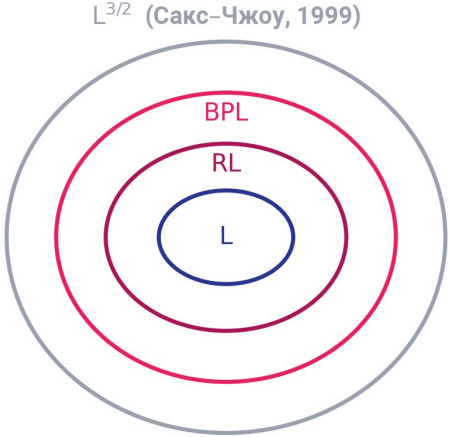
103: L = RL = BPL



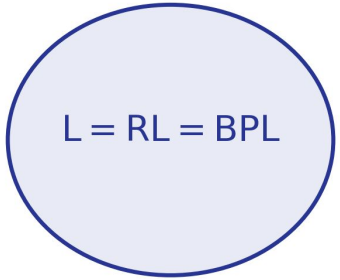
- Помогает ли случайность алгоритмам, которым доступна только логарифмическая память?
- Рейнгольд (2005): связность неориентированного графа проверяется детерминированно в логарифмической памяти
- Сакс–Чжоу (1999): BPL ⊆ $L^{3/2}$, и за четверть века продвижений почти не было
- OpenAI: полная дерандомизация, L = RL = BPL

Полная дерандомизация вычислений с логарифмической памятью

Было: только включения



Стало (OpenAI, 6.10.2026)

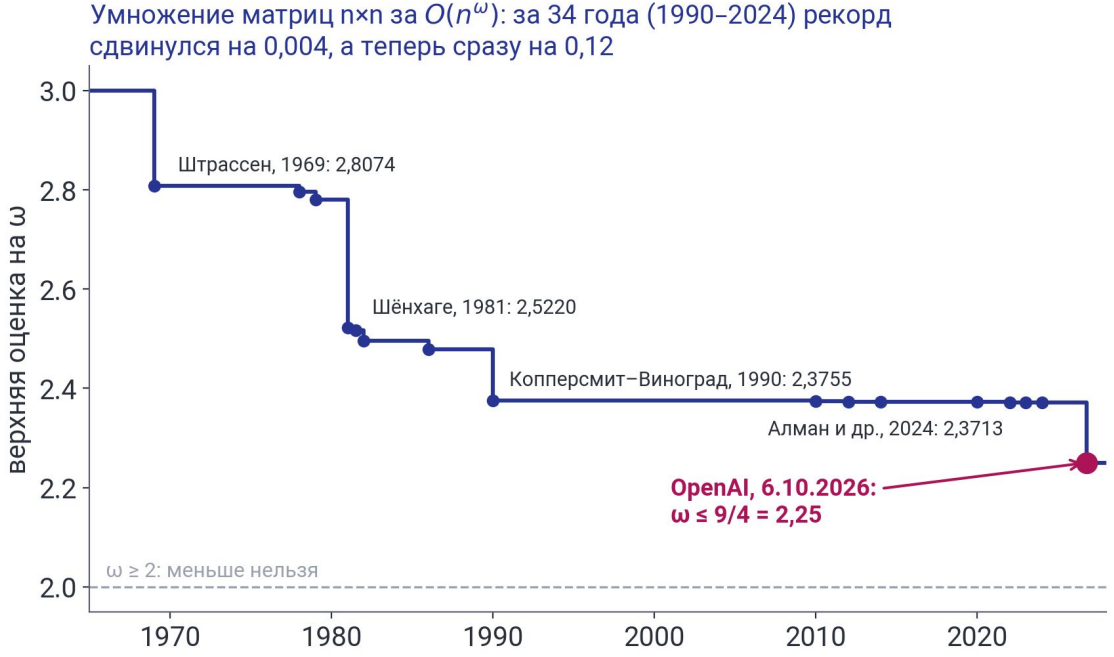


случайность не помогает
при логарифмической памяти

107: умножение матриц, ω ≤ 2,25



- Две матрицы n×n можно перемножить за $O(n^{\omega})$; школьный алгоритм даёт ω = 3, алгоритм Штрассена (1969): ω ≤ 2,807
- С 1990 по 2024 год рекорд улучшился с 2,3755 до 2,3713, и каждый шаг был большой работой
- OpenAI: ω ≤ 9/4 над комплексными числами
- Новые алгоритмы умножения матриц регулярно находят, в том числе автоматически, но здесь огромный скачок



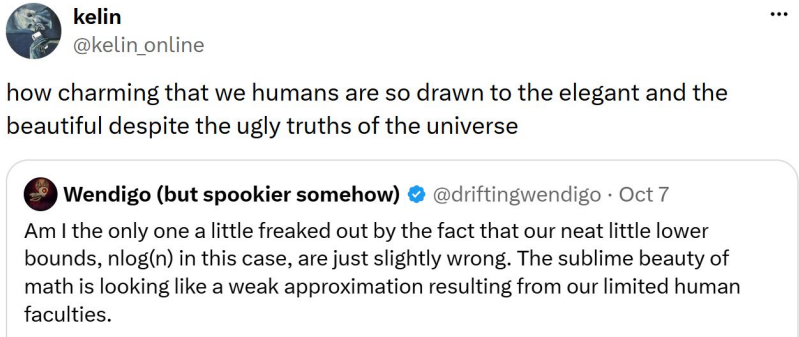
106: умножение чисел быстрее n log n



- Колмогоров (1960) предположил, что нужно Ω(n²) операций, а Карацуба опроверг это за неделю
- Шёнхаге–Штрассен (1971): O(n log n log log n) и гипотеза, что быстрее n log n нельзя; Харви–ван дер Хувен (2019): O(n log n)
- OpenAI: $O(n\,(\log n)^{1-\kappa})$ при $\kappa = 2^{-182}$; барьер пробит совсем чуть-чуть

Умножение двух n-битных чисел: сколько нужно операций

1960	Колмогоров: гипотеза $\Omega(n^2)$	n^2
1960	Карацуба: опроверг её за неделю	$n^{\log_2 3} \approx n^{1.585}$
1963	Тоом (и Кук, 1966)	$n^{1+\varepsilon}$
1971	Шёнхаге–Штрассен: гипотеза $n \log n$	$n \log n \log\log n$
2007	Фюрер	$n \log n \cdot 2^{O(\log^* n)}$
2019	Харви–ван дер Хувен	$n \log n$
6.10.2026	OpenAI, рукопись 106: $\kappa = 2^{-182}$	$n\,(\log n)^{1-\kappa}$
21.10.2026	сообщество + агенты: $\kappa = 0{,}0023$	$n\,(\log n)^{0.9977}$


kelin
@kelin_online

how charming that we humans are so drawn to the elegant and the beautiful despite the ugly truths of the universe

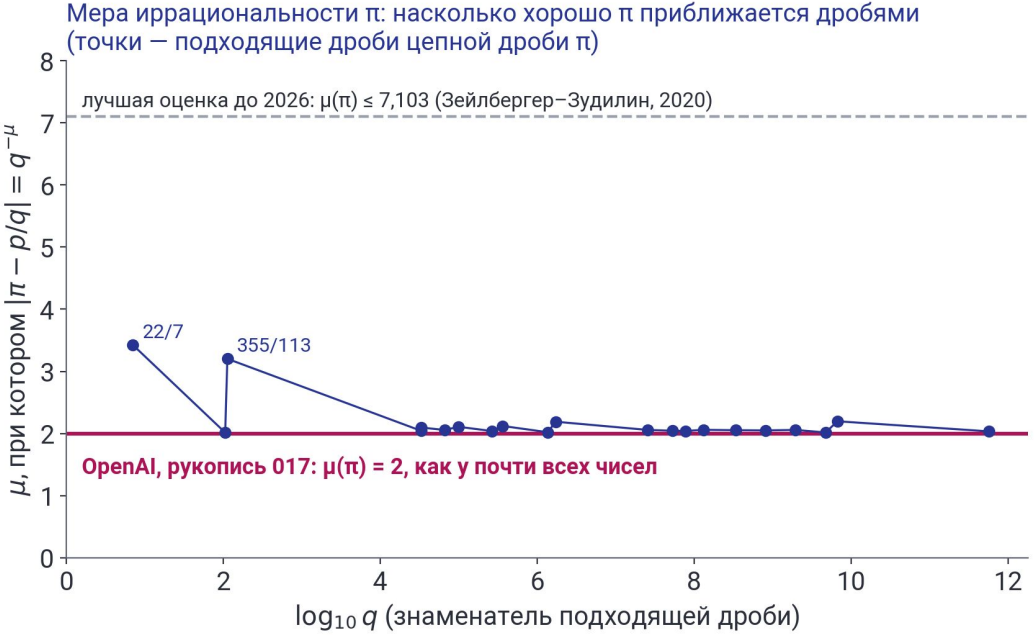
Wendigo (but spookier somehow) @driftingwendigo · Oct 7

Am I the only one a little freaked out by the fact that our neat little lower bounds, nlog(n) in this case, are just slightly wrong. The sublime beauty of math is looking like a weak approximation resulting from our limited human faculties.

005 + 017: Каталан и π



- Постоянная Каталана G = 1 − 1/3² + 1/5² − 1/7² + … ≈ 0,91597: иррациональна ли она — классическая открытая задача; OpenAI: да
- Мера иррациональности показывает, насколько хорошо число приближается дробями; у почти всех чисел и у всех алгебраических (Рот) она равна 2
- Для π лучшая оценка была μ(π) ≤ 7,103 (Зейлбергер–Зудилин, 2020)
- OpenAI: μ(π) = 2



И это ещё не всё

- Группы и алгебры: все факторы свободных групп изоморфны, группа Томпсона F неаменабельна, гипотезы Капланского о делителях нуля и о прямой конечности опровергнуты, гипотеза Буна–Хигмана
- Графы и вероятности: гипотеза Хадвигера неверна, $p_c < p_u$ в теории перколяции
- Динамика: гипотеза Катока об энтропийной жёсткости
- Чего нет: гипотезы Римана, P ≠ NP (к этому мы ещё вернёмся) и никакой криптографии (!)



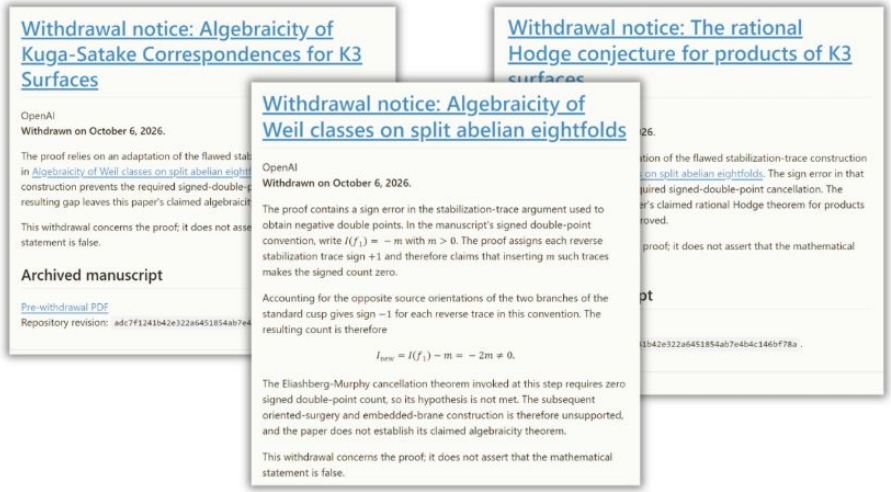
Как это выпускали

- После Навье–Стокса математики собрали независимую AGMAI при IAS (Гауэрс, Виттен, Хайрер, Тиллманн, Вакил и др.)
- 29 сентября AGMAI попросила не проверять закрытые модели на серьёзных открытых задачах, а если уж проверять — переписать доказательства по-человечески, раскрыть промпты и неудачи, финансировать понимание
- OpenAI выполнила часть: быстро, с формализациями, назвала число задач, пообещала деньги
- Но репозиторий свой, пулл-реквесты закрыты, тексты трудночитаемы, а оценивать модели на открытых задачах OpenAI продолжит

Наутро после

- 7 октября OpenAI отозвала три рукописи: из-за ошибки в знаке развалилась статья о классах Вейля на абелевых многообразиях размерности 8, а с ней две статьи о гипотезе Ходжа для K3
- Ещё 14 рукописей исправили; все отозванные были из неформализованной части
- Фрэнк Калегари: ошибка в знаке — лучшее на сегодня свидетельство наличия у модели сознания
- Отмечу, что и формулировки в Lean должны проверять люди, в формализации легко ошибиться (даже если доказательство верно)

OpenAI withdraws three preprints a day after releasing 722 manuscripts on unsolved math problems



Withdrawal notice: Algebraicity of Kuga-Satake Correspondences for K3 Surfaces

OpenAI
Withdrawn on October 6, 2026.

The proof relies on an adaptation of the flawed stab
in Algebraicity of Weil classes on split abelian eight
construction prevents the required signed-double-p
resulting gap leaves this paper's claimed algebraicit

This withdrawal concerns the proof; it does not asse
statement is false.

Archived manuscript

Pre-withdrawal PDF
Repository revision: adc7f1241b42e322a6451854ab7e4

Withdrawal notice: The rational Hodge conjecture for products of K3 surfaces

26.
tion of the flawed stabilization-trace construction
on split abelian eightfolds. The sign error in that
uired signed-double-point cancellation. The
r's claimed rational Hodge theorem for products
roved.
proof; it does not assert that the mathematical
pt
1b42e322a6451854ab7e4b4c146bf78a .

Withdrawal notice: Algebraicity of Weil classes on split abelian eightfolds

OpenAI
Withdrawn on October 6, 2026.

The proof contains a sign error in the stabilization-trace argument used to obtain negative double points. In the manuscript's signed double-point convention, write $I(f_1) = -m$ with $m > 0$. The proof assigns each reverse stabilization trace sign $+1$ and therefore claims that inserting m such traces makes the signed count zero.

Accounting for the opposite source orientations of the two branches of the standard cusp gives sign -1 for each reverse trace in this convention. The resulting count is therefore

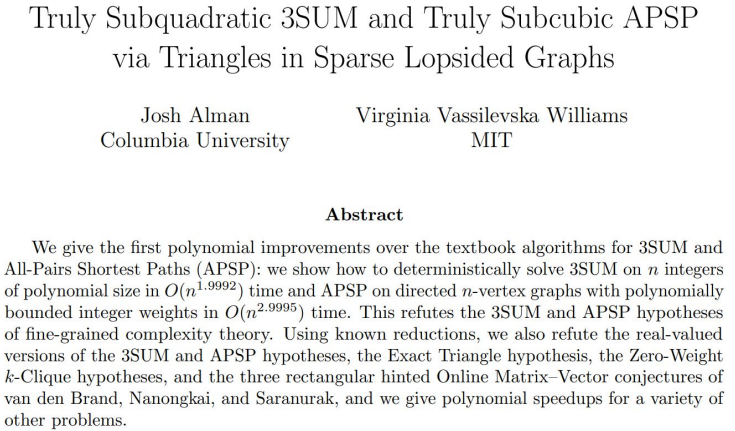
$$I_{new} = I(f_1) - m = -2m \neq 0.$$

The Eliashberg-Murphy cancellation theorem invoked at this step requires zero signed double-point count, so its hypothesis is not met. The subsequent oriented-surgery and embedded-brane construction is therefore unsupported, and the paper does not establish its claimed algebraicity theorem.

This withdrawal concerns the proof; it does not assert that the mathematical statement is false.

«Путь Anthropic»

- 5 октября Алман и Василевска-Уильямс опровергли гипотезы 3SUM и APSP: 3SUM решается за $O(n^{1.9992})$, APSP — за $O(n^{2.9995})$
- Два краеугольных камня fine-grained complexity; результат года… любого года до 2026-го
- Первые доказательства нашёл Claude, а Anthropic привлекла двух ведущих специалистов, чтобы они разобрались и написали статью сами
- «Модель OpenAI» — выложить всё и устроить гонку за понимание; «модель Anthropic» — компания сама выбирает людей-посланников AI



Truly Subquadratic 3SUM and Truly Subcubic APSP via Triangles in Sparse Lopsided Graphs

Josh Alman
Columbia University

Virginia Vassilevska Williams
MIT

Abstract

We give the first polynomial improvements over the textbook algorithms for 3SUM and All-Pairs Shortest Paths (APSP): we show how to deterministically solve 3SUM on n integers of polynomial size in $O(n^{1.9992})$ time and APSP on directed n-vertex graphs with polynomially bounded integer weights in $O(n^{2.9995})$ time. This refutes the 3SUM and APSP hypotheses of fine-grained complexity theory. Using known reductions, we also refute the real-valued versions of the 3SUM and APSP hypotheses, the Exact Triangle hypothesis, the Zero-Weight k-Clique hypotheses, and the three rectangular hinted Online Matrix–Vector conjectures of van den Brand, Nanongkai, and Saranurak, and we give polynomial speedups for a variety of other problems.

Опять 6 октября

- Джошуа Ганс: на первую полосу New York Times всё это так и не попало
- Но первый спутник 4 октября 1957 года советские газеты тоже поначалу отметили скромной заметкой
- Передовицей он стал, когда в Америке началась паника, — 6 октября

Seth Burn
@SethBurn

Sometimes front page news doesn't inititially reach the front page. The best example is Sputnik. It launched 10/4/57, but the Soviets didn't think it was a huge deal. It was only after America freaked out that it made the front page in Russia on 10/6/57.

cosmo.org/for-some-sputn...

Joshua Gans @joshgans · Oct 7

I wanted to screenshot this for those historians of AI and technology in the future. The day after OpenAI's mathplosion, it was nowhere to be found on the front page of the New York Times.



Grips France

Finances and Far Right Imperil Welfare State

By MARK LANDLER

PARIS — Striking public workers. Barricaded high schools. Blocked ports. Budget paralysis. Surging bond rates. Fears of a far-right takeover.

France suddenly finds itself engulfed by crisis — not a single spasm of unrest, but a cascade of disruption that is rolling city streets, trading floors and public offices across the country.

France's "rentrée," or "return," as the French call the back-to-school and back-to-work season, has been anything but orderly.

The causes of the chaos may appear disparate, but they can be traced to a common root: France's two-decade-long struggle to fund its state, now exacerbated by high borrowing costs, surging fuel prices and political uncertainty, with jockeying underway to replace President Emmanuel Macron next spring.

People gathered on Tuesday in Paris as part of nationwide protests over crumbling school facilities and a shortage of teachers.

GET LESS PRIORITY

NO CALL ON CORNELL

Fewer Campus Inquiries Are Resolved With a Civil Rights Law

By MICHAEL C. BENDER

WASHINGTON — In President Trump's first term, news reports of sexual abuse allegations at San Jose State University prompted a Justice Department investigation that forced the school to make extensive policy changes and pay the victims and to remain under federal monitoring for four years.

But the intense focus on allegations that a Cornell University student was assaulted by multiple men at a fraternity party has barely drawn a response from the federal government. The hands-off stance reflects the more muted approach that Mr. Trump's administration has taken to sexual abuse cases on campuses in his second term.

"I don't know that much about

Что уточнилось за две недели

- Тристан Бакмастер о «трёх часах»: “they later admitted that they did not count numerous failed attempts at the problems as well as previous work done by other agents — rendering the three hours claim essentially meaningless.”
- Многие результаты пока не понимают и собственные математики OpenAI
- 15 октября: Simons Foundation вместе с OpenAI и Anthropic — $15 млн на программы, которые помогут математикам оценивать и осваивать AI-результаты



106 реакций

- 8 октября блог Proofs and Prompts попросил математиков прислать короткие реакции, подписываясь только именем
- К 13 октября — 106 реакций, от аспирантов до филдсовских лауреатов, и ещё почти 90 комментариев
- По-моему, это уникальный исторический документ: целое сообщество за неделю откровенно записало свои чувства
- Я прочитал все и вместе с Claude разметил: отношение к математике, к способу публикации, темы и что предлагают делать

Математика после 6 октября: реакции и мысли

25 октября 2026 г.

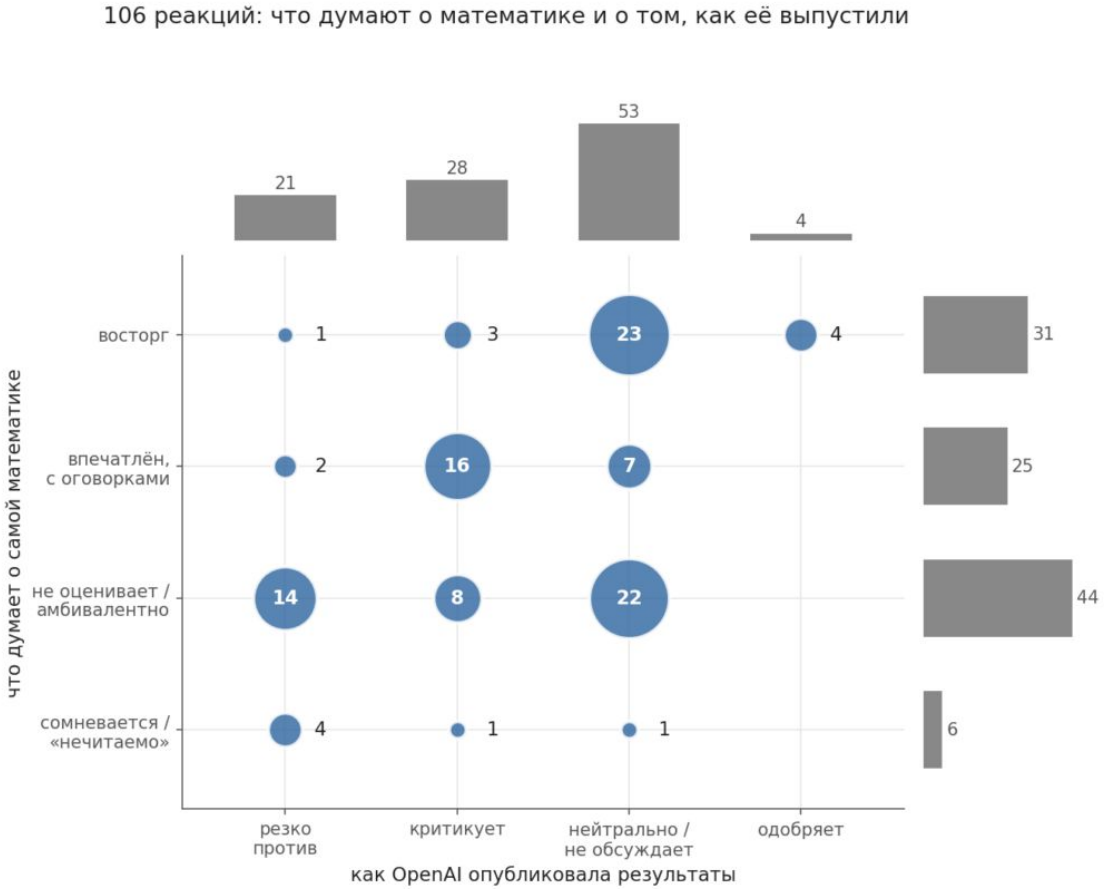


Введение

Неделю назад я написал в «Sinekure», что OpenAI выложила сразу несколько сотен новых математических результатов, и честно признался, что большой пост об этом писать не знаю как: большинство этих результатов я не понимаю даже на уровне формулировки. С тех пор понимания у меня, увы, не прибавилось. Поэтому сегодняшний пост — не о теоремах, а о людях.

Два консенсуса

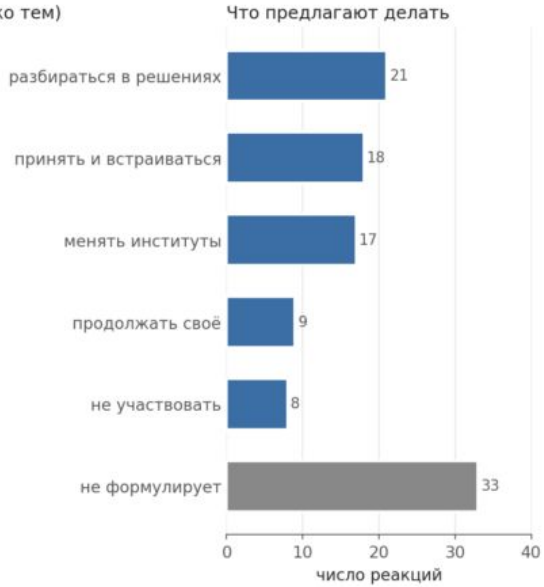
- О математике: из 62 высказавшихся 56 впечатлены, 31 — в полном восторге; никто не утверждает, что всё это неправда
- О манерах: из 53 высказавшихся 49 критикуют, 21 — резко; одобряют четверо
- Линия раскола проходит не между «верящими» и «неверящими»: 22 из 31 одновременно впечатлены и недовольны
- Треть реакций прямо сочетает противоположные эмоции



Раскол — в том, что делать

- Разбираться в доказательствах, встраиваться в новую реальность, срочно менять институты или не участвовать вовсе; страх за собственную работу — только у нескольких человек, за молодых коллег — у каждого четвёртого
- Association for Human Mathematics (809 членов): “**Mathematicians did not ask for this work to be done**.”
- Главная эмоция — не страх безработицы, а утрата смысла





Динозавр и тротил

- Мэтт Заремски (гипотеза Буна–Хигмана), четыре года раскопок, а потом “a trillion-dollar company showed up and just blasted the whole thing with TNT, handed us the whole skeleton, and walked away.”
- Тасмин Чу ($p_c < p_u$): “what I wanted more than to know that $p_c < p_u$ is true was the time and space to think about it for the next few years.”
- Юго Дюминиль-Копен: “Not a single one of the major open problems I have publicly mentioned throughout my career… was left untouched by the announcement.”



No pressure

- Бен Грин нашёл в списке три четверти целей своего ERC-гранта: “in a certain way the sheer magnitude of this means that the pressure is off.”
- Сириль Удайе: “Now I am genuinely thrilled by the announced solution, and I want to understand the proof.”
- Константин Коглер: “living in a mathematical wonderland with the next field-defining idea being discovered whenever I am ready for it.”
- Дэнни Калегари: “I honestly think there will be more ways to do math in the future, not fewer.”

Осторожно, спойлеры

- Теренс Тао: “Much as one cannot unhear a movie spoiler or a crossword clue, one cannot explore a problem as profitably and richly once one is aware of an existing solution.”
- Инхёк Чхве об эпохе порталов: “I prefer to take a stroll and find some random flowers.”
- Quanta: тебя телепортировали на вершину горы, а вокруг туман

OpenAI Releases the Final Ten Minutes of 500 Previously Unreleased Films, Ushering in a New Era of Movie Watching

FOR IMMEDIATE RELEASE

SAN FRANCISCO — OpenAI today announced **Endings-500**, a public GitHub repository containing the final ten minutes of 500 feature films that have never been released, screened, or watched by any human being. Each ending has been formally verified in **LeanBack**, OpenAI's automated ending-verification system, which confirms that every film does, in fact, end.

For decades, these 500 films have stood among the most stubborn open problems in cinema. Studios, critics, and audiences have long wondered how they turn out. As of today, that question has been definitively answered 500 times, by a system that has also definitively not explained any of the answers.

"This is a milestone for movie watching," said a senior OpenAI spokesperson for Cinematic Reasoning. "Historically, watching a film required hours of setup: characters, motivation, a second act. We've shown that you can skip directly to the part where everything is resolved. Whether anyone understands the resolution is a question we're excited to hand off to the community."

Спойлер убивает охоту

- Открытые задачи были инфраструктурой сообщества: маяки, леса, задачи для аспирантов, история для грантовых комитетов
- Генри Уилтон: “Open problems are a resource that the mathematical community developed over decades or even centuries.”
- Закон Гудхарта: решённые знаменитые задачи были метрикой понимания, а для OpenAI это способ оценивать модели
- Но всё образование построено на спойлерах; Сангбин Гвон: “Priority is exclusive. Understanding is not.”



Слоп

- Энрико Фатигенти: “I do not think that we, as a community, should spend our time cleaning up their mess in order to increase someone else's commercial revenues.”
- Джулио Тиоццо: в примере №254 у OpenAI 116 образующих, а Astra за 10 минут дала пример с 12
- Юхан Эйнерт: контрпример к прямой конечности в характеристике 2 сразу даёт идемпотент, $(ba)^2 = b(ab)a = ba$, а рукопись этого не замечает
- Кевин Баззард: “AI will get better at explaining. Mathematics has undoubtedly moved forwards this week — this cannot be denied.”

Некого спросить

- Брина Кра: “there is no one to ask when we get stuck in a proof. This is not part of the culture of mathematics.”
- Иэн Эгол: с Перельманом было похоже, и заслуги за идеи в итоге отдали ему
- По-моему, спросить как раз есть кого, модели отвечают; не хватает того, кто отвечает за результат
- Иван Смит: “If the community learns to reward those who forge the paths and lay down the fixed ropes as much as those who reach the summit, it would be a very good development.”



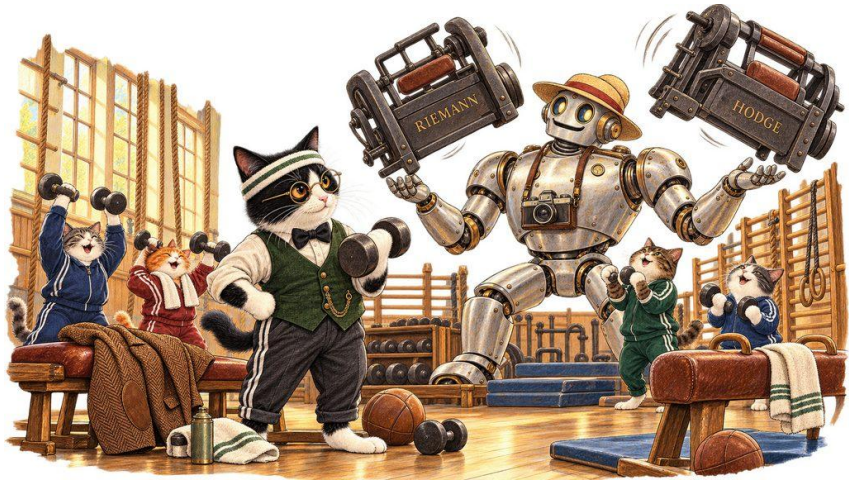
Стены вокруг сада

- Петра Швер: “I am no longer as open as I was in the past when talking about my research projects and plans.”
- Математики перестают выписывать открытые вопросы в статьях, активность на MathOverflow падает
- Это дилемма заключённого: каждому выгодно закрыться, а всем вместе от этого хуже
- Лечится не призывами к открытости, а изменением того, за что дают признание



Две математики

- Ю Купер: математика — идеальный источник синтетических данных; возможны два почти не связанных корпуса, человеческий и синтезированный в Lean
- Ивайло Хартарски: “Let's make the next benchmarking list ourselves rather than leaving that to a conjecture mining bot.”
- Петер Шольце: “What is worrying me the most, at the moment, is actually the (in)security of cryptography.”
- Снорре Кристиансен: “Отчёт из спортзала”



Умножение чисел после релиза

- 7 октября, 02:22: Даг Колкитт, бывший квант, кладёт рукопись OpenAI в upstream/ и вместе с Codex улучшает к
- За два дня к выросла на 50 порядков: с 2^{-182} до 2^{-15}; к 13 октября — 0,00167
- Потом плато на восемь дней, а 21 октября новый участник zxv поднял к до 0,0023
- Практически (пока) ничего не меняется, но мы всё ближе



Децентрализованное автоисследование

- Рохан Арун: “Let's test the limits of decentralized auto-research and use the reach of X to push the frontier :)”
- В репозитории лежат AGENTS.md и autoresearch.md — инструкции не для людей, а для агентов
- К 14 октября больше 1600 пулл-реквестов, 1343 вошли в результат; в NOTICE у каждого записано, какими моделями он пользовался
- Это один возможный ответ на вопрос «что делать с нечитаемой рукописью»: положить в upstream/ и улучшать



Вторая неделя реакций

- Яннис Сакелларидис: “it is not about subjugation of humans to machines, but to the owners of those”
- Хельмут Хофер: “We should not defend human mathematics by leaving the field. If mathematicians withdraw, the field will not remain empty.”
- Софи Хёйбертс: “These pdfs are exhaust fumes from their internal benchmarking effort.”
- Nature: “mathematicians are up in arms”

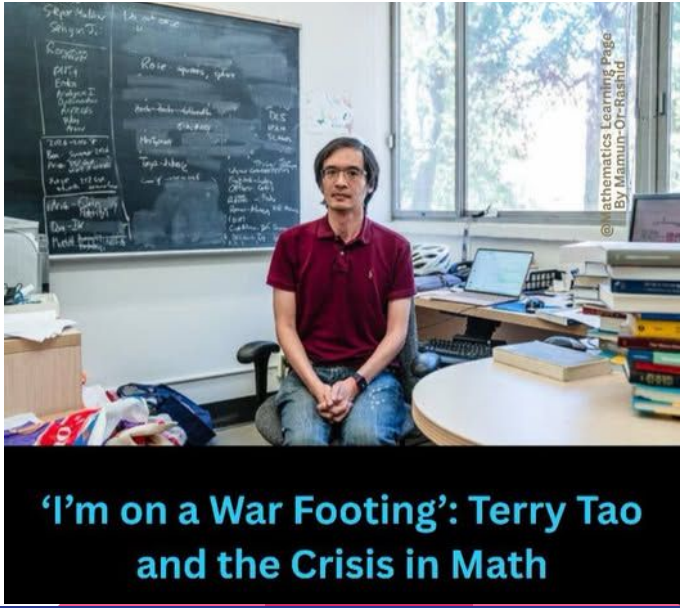
nature

Explore content | About the journal | Publish with us | Subscribe

nature > news > article

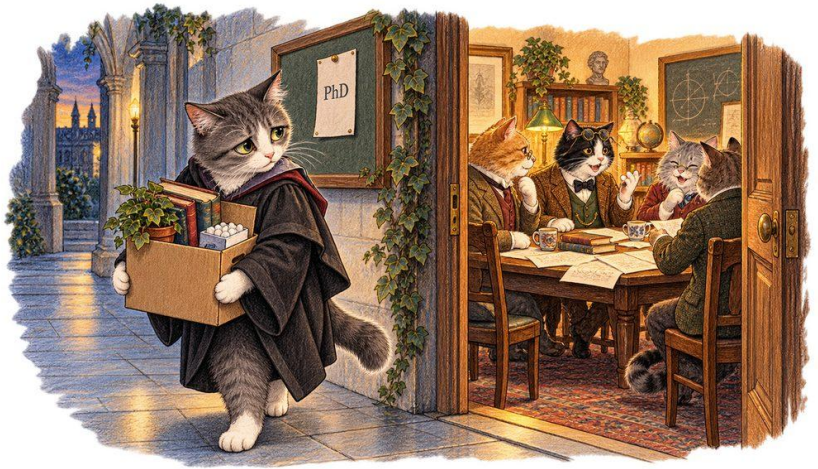
NEWS | 07 October 2026 | Update 09 October 2026 | Clarification 12 October 2026

OpenAI posts 700 maths preprints online: mathematicians are up in arms



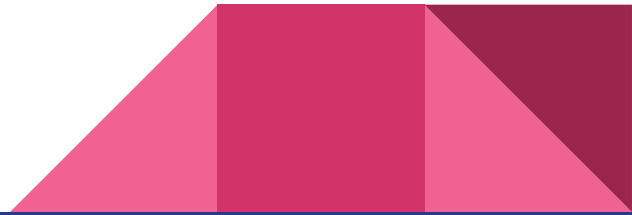
Письмо аспиранта

- Анонимное письмо «Кто станет новыми математиками Math 2.0?»: автор уходит из академии после защиты
- “I did not go to graduate school to organize, interpret, and curate an increasingly vast collection of mathematical results produced by machines.”
- Петер Шольце: “This is a wonderful essay, and I completely agree with it.”
- Франческо Маджи: “A strong mathematical result, by itself, can no longer be taken as convincing evidence of a student's independent mathematical abilities.”



Приоритет как бумажная корона

- Томмазо Мораскини: “we should abolish ‘priority of proof’ as an independent source of merit… priority is turning into a paper crown.”
- Этингоф и Герович: “Hiring committees should assess mathematicians, not the provenance of their theorems.”
- Бакмастер: “Our credit system was built for the era of scarcity… That proxy no longer holds”
- Дейв Андерсон: “My input was completely devoid of mathematical content. Anyone can do what I did, and therefore many people will.”



Переваривание началось

- Девятистраничную статью OpenAI о нулях Зигеля за две недели разобрали Бэнкс, Керр и Грин; появились доказательства на три-четыре страницы
- Тао: метод не инопланетный, это полиномиальный метод, а ключевая лемма восходит к Сильвестру (1852)
- Сарнак перестроил под разбор квазигипотезы Римана семестровый курс; Радзивилл: «общее чувство — облегчение»
- 20 октября Тао запустил Polymath «для эпохи AI» на уже решённой задаче: «это не гонка»



Новые институты

- Simons Foundation, OpenAI и Anthropic: $15 млн на понимание AI-результатов
- SAIR Open Math OS: открытые модели для математиков; Hexagon: архив для AI-препринтов с метками происхождения
- Новый журнал: «понимание важнее первенства», доказательства обязательно проверены в Lean
- The Bourgain Project, семинар «Math & IA à midi», Mathematical AI Safety Institute



The Mathocalypse

- Скотт Ааронсон, 07.10.2026



I've been glad to see the CS theory community rising to the occasion. At the Simons Institute in Berkeley, here at UT Austin, and elsewhere, I've hearing stories of researchers rushing to pore over the manuscripts and *make sense of them and explain them*—because what else do we do? How else do we continue the craft to which we've devoted much of our lives?

If you want some sense of what things feel like now in math, imagine a hunter-gatherer who's spent his entire life learning to survive deep in an unforgiving rainforest, then a giant resort hotel springs up right next to him with a helipad and heated pools and AirBnBs, and without missing a beat, the hunter-gatherer says: "alright fine, so now my new job is to run wilderness retreats for the tourists, or something."

In *Quanta* magazine, Jordana Cepelewitz attempted a different metaphor:

It's as if you were teleported to the peak of a tall mountain. Surrounded by fog, you have no idea where you are, or what's around you. You do not know how your mountain connects to others, and you have no equipment to help you explore, no way to help someone else join you. If you had climbed the mountain yourself, you would have experienced how the human body adapts to altitude and changes in oxygen levels. You might have had to invent tools to navigate, to climb steep cliffs, or to make a shelter. You might have encountered a fellow explorer, gotten lost together in a hidden valley, and found a plant that could be turned into a life-saving medicine.

Instead you're perched on the peak but in the dark, while the maker of the teleportation machine tells you that it can explore the wilderness better than any human.

For any one of these mountains, if we care enough, I feel optimistic that we can do as we always have: clear the fog and figure out the path, except now using the teleportation machine to help guide us. The bigger challenge will be to nurture a community that still *cares* about the heroic adventure of finding the paths up these mountains in the world with the machine. (Oh, and I think one place where the metaphor breaks is that we still *do* have each other, as much as we ever did before!)

Last night my 9-year-old son was taunting my wife, complexity theorist Dana Moshkovitz, as follows: "mommy, I heard you got *cooked*! I heard that a *robot* solved the math problem you worked on for your whole career! OOF!"

While my son was being a brat, he also wasn't wrong. Whether you're thrilled, depressed, angry, or whatever else about it, yesterday was surely one of the biggest days in mathematical history. And yes, among the 372 huge results released yesterday by OpenAI, on the recommendation of its advisory group of Timothy Gowers, Edward Witten, and other distinguished mathematicians, was a proof of Subhash Khot's Unique Games Conjecture (UGC), a statement that my wife has worked toward proving for the entire time I've known her. (The UGC implies that a whole slew of optimization problems really are NP-hard, even if you just want an approximation that's slightly better than what you get from semidefinite programming relaxation, which is one of our main tools.)

Or at least, we're pretty sure that it's a proof! There's a Lean certificate, as there are for some of the other 372 breakthrough results (not all of them). But it also appears that no human has understood just about *any* of these proofs yet; the race to do so has just started. If you want an on-the-ground sense of what that race is going to be like, here's some of what Dana texted me last night:

> It feels like something written by someone who's on psychedelics. So much unclear and doesn't make sense. Lots of name dropping of previous work without discussing why it can be used despite impossibility results
>
> Basically the paper is so horribly written that it's impossible to read it without AI help

Яков (Джейкоб) Цимерман



- Почти сразу после объявления лауреатов Филдсовской премии он объявил, что переходит в AI safety и вскоре присоединится к OpenAI, чтобы над этим работать; Боаз Барак, который уже давно там, "is looking forward (though also more than a bit humbled)"
- Один AI-исследователь написал: "[this is] like hiring Lionel Messi as a project manager"; но Цимерман давно об этом думает всерьёз; вот его препринт годичной давности:

[Submitted on 12 Jul 2025]

A Taxonomy of Omnicidal Futures Involving Artificial Intelligence

Andrew Critch, Jacob Tsimerman

This report presents a taxonomy and examples of potential omnicidal events resulting from AI: scenarios where all or almost all humans are killed. These events are not presented as inevitable, but as possibilities that we can work to avoid. Insofar as large institutions require a degree of public support in order to take certain actions, we hope that by presenting these possibilities in public, we can help to support preventive measures against catastrophic risks from AI.

- AI Safety for Mathematicians

Яков (Джейкоб) Цимерман

- В сентябре Цимерман стал научным директором MAISI, Mathematical AI Safety Institute
- “For whatever role you think humans will play, you can just ask yourself why won't AIs be able to do this as well?”
- “Does a train run even if no one understands the mechanics by which it runs? Yes, it does.”
- Новых аспирантов, кроме тех, кто занимается AI, больше не берёт



5. Итоги и размышления



Wir müssen wissen — wir werden wissen.

Давид Гильберт

Beauty is the first test: there is no permanent place in the world for ugly mathematics.

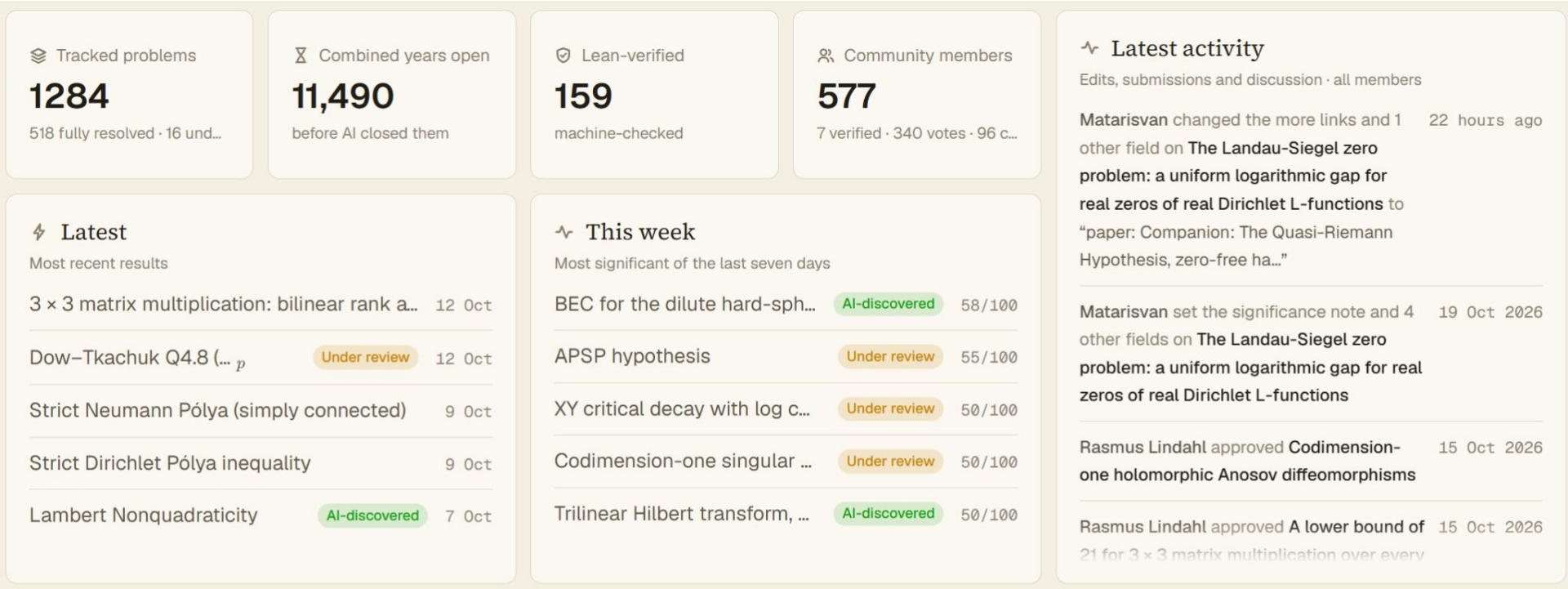
Годфри Харди

You insist that there is something a machine cannot do. If you will tell me precisely what it is that a machine cannot do, then I can always make a machine which will do just that!

Джон фон Нейман

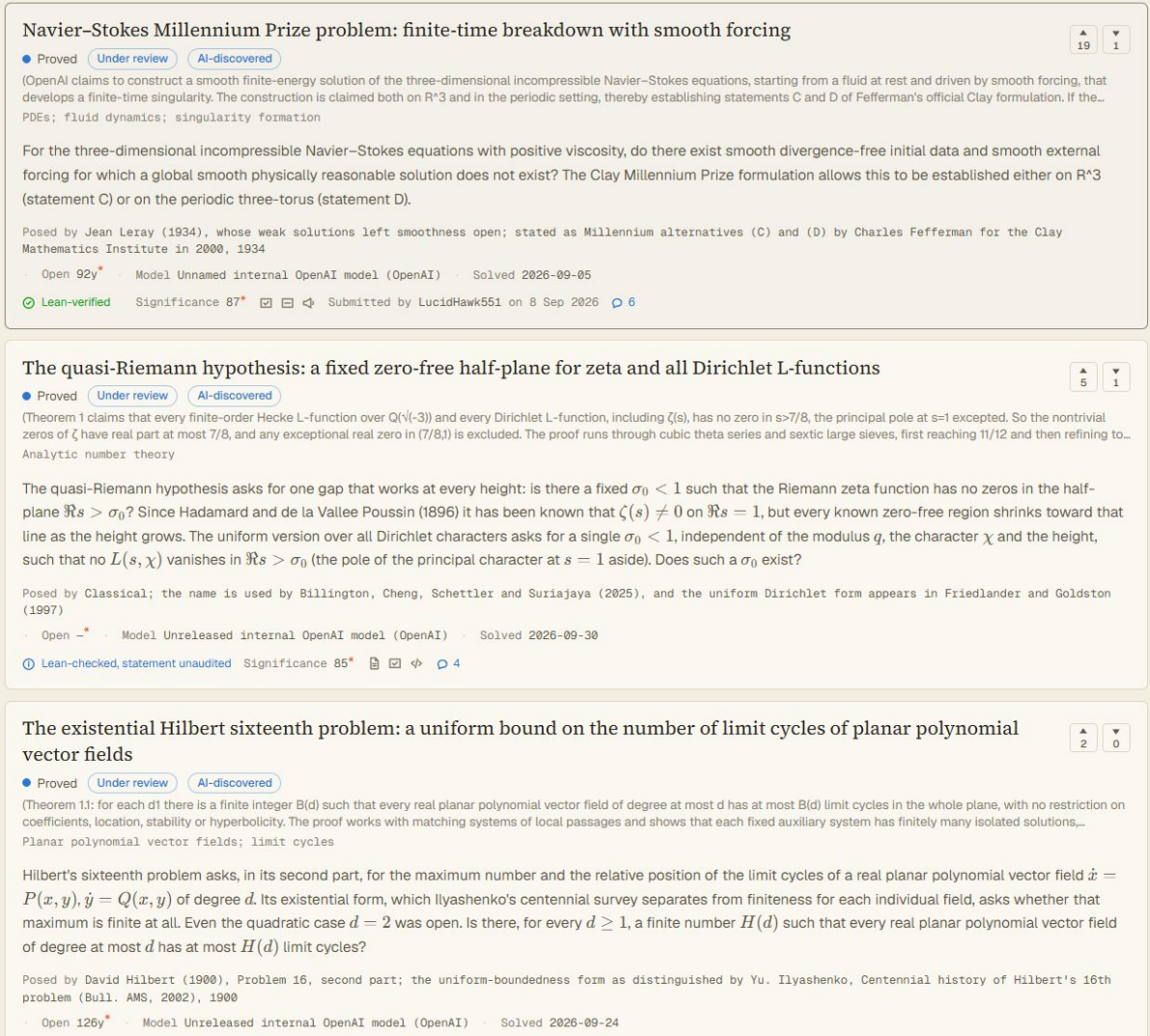
Vibemathed

- Через полтора месяца скриншоты выглядят так:



Vibemathed

- Через полтора месяца скриншоты выглядят так:



Navier–Stokes Millennium Prize problem: finite-time breakdown with smooth forcing

▲ 19 ▼ 1

● Proved · Under review · AI-discovered

(OpenAI claims to construct a smooth finite-energy solution of the three-dimensional incompressible Navier–Stokes equations, starting from a fluid at rest and driven by smooth forcing, that develops a finite-time singularity. The construction is claimed both on R^3 and in the periodic setting, thereby establishing statements C and D of Fefferman's official Clay formulation. If the…

PDEs; fluid dynamics; singularity formation

For the three-dimensional incompressible Navier–Stokes equations with positive viscosity, do there exist smooth divergence-free initial data and smooth external forcing for which a global smooth physically reasonable solution does not exist? The Clay Millennium Prize formulation allows this to be established either on R^3 (statement C) or on the periodic three-torus (statement D).

Posed by Jean Leray (1934), whose weak solutions left smoothness open; stated as Millennium alternatives (C) and (D) by Charles Fefferman for the Clay Mathematics Institute in 2000, 1934

Open 92y* · Model Unnamed internal OpenAI model (OpenAI) · Solved 2026-09-05

✓ Lean-verified · Significance 87* · Submitted by LucidHawk551 on 8 Sep 2026 · 6

The quasi-Riemann hypothesis: a fixed zero-free half-plane for zeta and all Dirichlet L-functions

▲ 5 ▼ 1

● Proved · Under review · AI-discovered

(Theorem 1 claims that every finite-order Hecke L-function over Q(√(-3)) and every Dirichlet L-function, including ζ(s), has no zero in s>7/8, the principal pole at s=1 excepted. So the nontrivial zeros of ζ have real part at most 7/8, and any exceptional real zero in (7/8,1) is excluded. The proof runs through cubic theta series and sextic large sieves, first reaching 11/12 and then refining to…

Analytic number theory

The quasi-Riemann hypothesis asks for one gap that works at every height: is there a fixed $\sigma_0 < 1$ such that the Riemann zeta function has no zeros in the half-plane $\Re s > \sigma_0$? Since Hadamard and de la Vallee Poussin (1896) it has been known that $\zeta(s) \neq 0$ on $\Re s = 1$, but every known zero-free region shrinks toward that line as the height grows. The uniform version over all Dirichlet characters asks for a single $\sigma_0 < 1$, independent of the modulus q, the character χ and the height, such that no $L(s, \chi)$ vanishes in $\Re s > \sigma_0$ (the pole of the principal character at $s = 1$ aside). Does such a σ_0 exist?

Posed by Classical; the name is used by Billington, Cheng, Schettler and Suriajaya (2025), and the uniform Dirichlet form appears in Friedlander and Goldston (1997)

Open –* · Model Unreleased internal OpenAI model (OpenAI) · Solved 2026-09-30

ⓘ Lean-checked, statement unaudited · Significance 85* · 4

The existential Hilbert sixteenth problem: a uniform bound on the number of limit cycles of planar polynomial vector fields

▲ 2 ▼ 0

● Proved · Under review · AI-discovered

(Theorem 1.1: for each d1 there is a finite integer B(d) such that every real planar polynomial vector field of degree at most d has at most B(d) limit cycles in the whole plane, with no restriction on coefficients, location, stability or hyperbolicity. The proof works with matching systems of local passages and shows that each fixed auxiliary system has finitely many isolated solutions,…

Planar polynomial vector fields; limit cycles

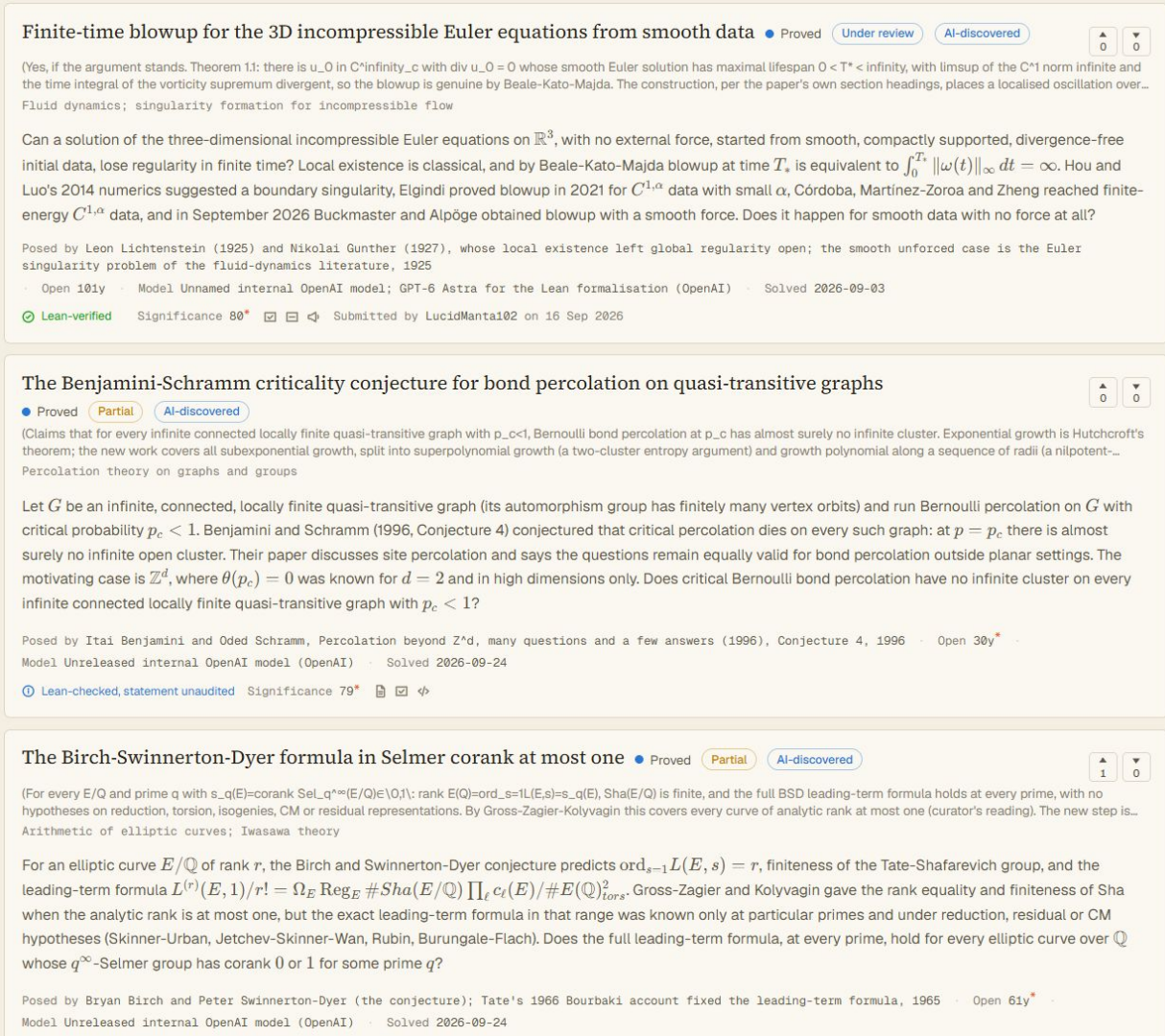
Hilbert's sixteenth problem asks, in its second part, for the maximum number and the relative position of the limit cycles of a real planar polynomial vector field $\dot{x} = P(x, y), \dot{y} = Q(x, y)$ of degree d. Its existential form, which Ilyashenko's centennial survey separates from finiteness for each individual field, asks whether that maximum is finite at all. Even the quadratic case $d = 2$ was open. Is there, for every $d \geq 1$, a finite number $H(d)$ such that every real planar polynomial vector field of degree at most d has at most $H(d)$ limit cycles?

Posed by David Hilbert (1900), Problem 16, second part; the uniform-boundedness form as distinguished by Yu. Ilyashenko, Centennial history of Hilbert's 16th problem (Bull. AMS, 2002), 1900

Open 126y* · Model Unreleased internal OpenAI model (OpenAI) · Solved 2026-09-24

Vibemathed

- Через полтора месяца скриншоты выглядят так:



Finite-time blowup for the 3D incompressible Euler equations from smooth data

Proved · Under review · AI-discovered

(Yes, if the argument stands. Theorem 1.1: there is u_0 in C^infinity_c with div u_0 = 0 whose smooth Euler solution has maximal lifespan 0 < T* < infinity, with limsup of the C^1 norm infinite and the time integral of the vorticity supremum divergent, so the blowup is genuine by Beale-Kato-Majda. The construction, per the paper's own section headings, places a localised oscillation over…

Fluid dynamics; singularity formation for incompressible flow

Can a solution of the three-dimensional incompressible Euler equations on $\mathbb{R}^3$, with no external force, started from smooth, compactly supported, divergence-free initial data, lose regularity in finite time? Local existence is classical, and by Beale-Kato-Majda blowup at time T_* is equivalent to $\int_0^{T_*} \|\omega(t)\|_\infty \, dt = \infty$. Hou and Luo's 2014 numerics suggested a boundary singularity, Elgindi proved blowup in 2021 for $C^{1,\alpha}$ data with small α, Córdoba, Martínez-Zoroa and Zheng reached finite-energy $C^{1,\alpha}$ data, and in September 2026 Buckmaster and Alpöge obtained blowup with a smooth force. Does it happen for smooth data with no force at all?

Posed by Leon Lichtenstein (1925) and Nikolai Gunther (1927), whose local existence left global regularity open; the smooth unforced case is the Euler singularity problem of the fluid-dynamics literature, 1925 · Open 101y · Model Unnamed internal OpenAI model; GPT-6 Astra for the Lean formalisation (OpenAI) · Solved 2026-09-03

Lean-verified · Significance 80* · Submitted by LucidManta102 on 16 Sep 2026

The Benjamini-Schramm criticality conjecture for bond percolation on quasi-transitive graphs

Proved · Partial · AI-discovered

(Claims that for every infinite connected locally finite quasi-transitive graph with p_c<1, Bernoulli bond percolation at p_c has almost surely no infinite cluster. Exponential growth is Hutchcroft's theorem; the new work covers all subexponential growth, split into superpolynomial growth (a two-cluster entropy argument) and growth polynomial along a sequence of radii (a nilpotent-…

Percolation theory on graphs and groups

Let G be an infinite, connected, locally finite quasi-transitive graph (its automorphism group has finitely many vertex orbits) and run Bernoulli percolation on G with critical probability $p_c < 1$. Benjamini and Schramm (1996, Conjecture 4) conjectured that critical percolation dies on every such graph: at $p = p_c$ there is almost surely no infinite open cluster. Their paper discusses site percolation and says the questions remain equally valid for bond percolation outside planar settings. The motivating case is $\mathbb{Z}^d$, where $\theta(p_c) = 0$ was known for $d = 2$ and in high dimensions only. Does critical Bernoulli bond percolation have no infinite cluster on every infinite connected locally finite quasi-transitive graph with $p_c < 1$?

Posed by Itai Benjamini and Oded Schramm, Percolation beyond Z^d, many questions and a few answers (1996), Conjecture 4, 1996 · Open 30y*

Model Unreleased internal OpenAI model (OpenAI) · Solved 2026-09-24

Lean-checked, statement unaudited · Significance 79*

The Birch-Swinnerton-Dyer formula in Selmer corank at most one

Proved · Partial · AI-discovered

(For every E/Q and prime q with s_q(E)=corank Sel_q^∞(E/Q)∈\0,1\: rank E(Q)=ord_s=1L(E,s)=s_q(E), Sha(E/Q) is finite, and the full BSD leading-term formula holds at every prime, with no hypotheses on reduction, torsion, isogenies, CM or residual representations. By Gross-Zagier-Kolyvagin this covers every curve of analytic rank at most one (curator's reading). The new step is…

Arithmetic of elliptic curves; Iwasawa theory

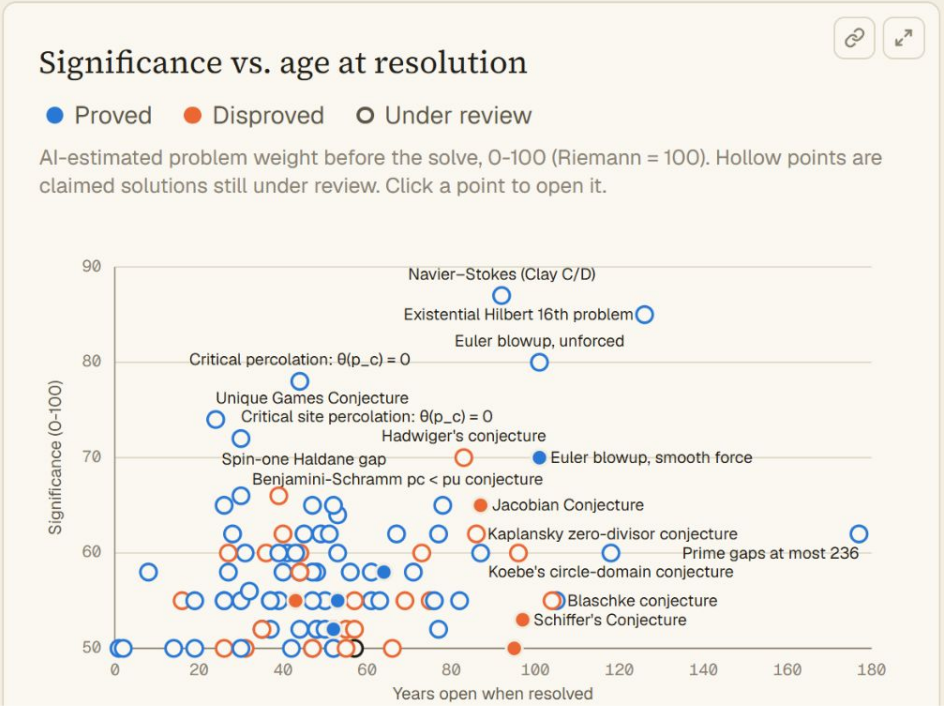
For an elliptic curve $E/\mathbb{Q}$ of rank r, the Birch and Swinnerton-Dyer conjecture predicts $\mathrm{ord}_{s=1} L(E,s) = r$, finiteness of the Tate-Shafarevich group, and the leading-term formula $L^{(r)}(E,1)/r! = \Omega_E \, \mathrm{Reg}_E \, \#Sha(E/\mathbb{Q}) \prod_\ell c_\ell(E) / \#E(\mathbb{Q})^2_{tors}$. Gross-Zagier and Kolyvagin gave the rank equality and finiteness of Sha when the analytic rank is at most one, but the exact leading-term formula in that range was known only at particular primes and under reduction, residual or CM hypotheses (Skinner-Urban, Jetchev-Skinner-Wan, Rubin, Burungale-Flach). Does the full leading-term formula, at every prime, hold for every elliptic curve over $\mathbb{Q}$ whose q^∞-Selmer group has corank 0 or 1 for some prime q?

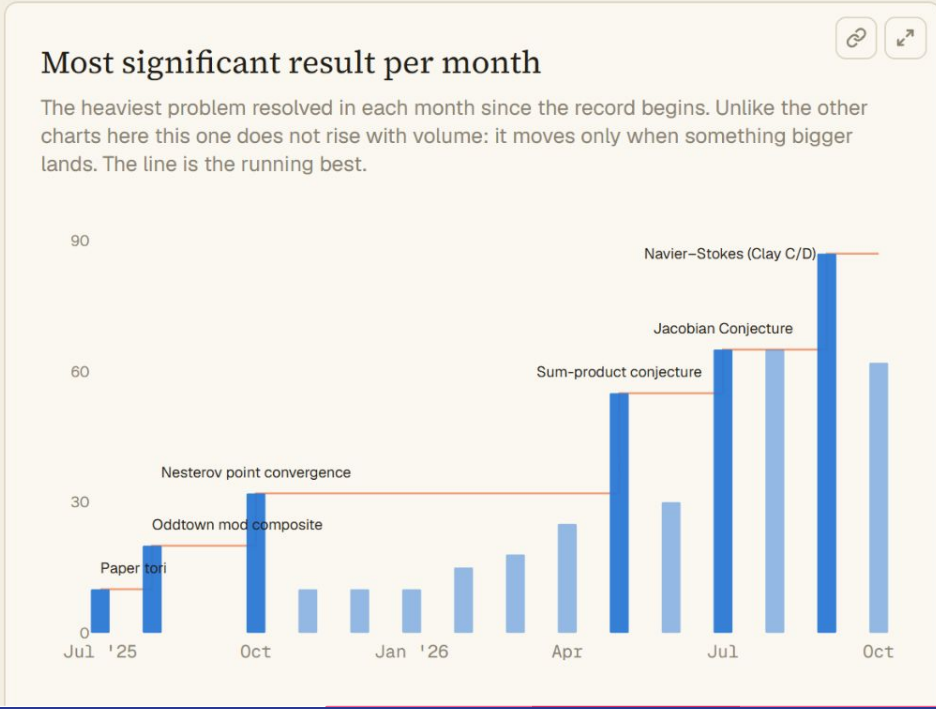
Posed by Bryan Birch and Peter Swinnerton-Dyer (the conjecture); Tate's 1966 Bourbaki account fixed the leading-term formula, 1965 · Open 61y*

Model Unreleased internal OpenAI model (OpenAI) · Solved 2026-09-24

Vibemathed

- Через полтора месяца скриншоты выглядят так:





Exponential Time Hypothesis

- 26 октября 2026: OpenAI выложила опровержение ETH; 27 октября Anthropic выложила аналогичный результат

THE EXPONENTIAL TIME HYPOTHESIS IS FALSE

OPENAI

Abstract. We give a deterministic algorithm for exactly counting the satisfying assignments of an arbitrary k-CNF formula. For every fixed $k \geqslant 2$, on a formula with n variables and m clauses, our algorithm uses $\mathrm{poly}_k(n, m)$ space and runs in time $(n+m)^{O_k(1)} 2^{n/(\log n)^{\frac{1}{2}+o(1)}}$. Our algorithm refutes the Exponential Time Hypothesis (ETH), which postulates that deciding 3-SAT on n variables requires $2^{\Omega(n)}$ time in the worst case.

A $2^{o(n)}$ TIME ALGORITHM FOR 3-SAT

CLAUDE
ANTHROPIC

Abstract. We refute the Exponential Time Hypothesis (ETH) by presenting a deterministic algorithm for 3-SAT on n variables that runs in $2^{o(n)}$ time. Our algorithm in fact solves the harder problem #3-SAT, providing a count of the number of satisfying assignments.

The result was discovered by an internal research Claude model and has been formalized in Lean 4.



Ryan Williams @rrwilliams.bsky.social
@rrwilliams

An internal model at OpenAI has produced a claimed refutation of ETH! Russell Impagliazzo, Mohan Paturi, and I have been asked to help organize an open and independent examination of this claim. 1/4

12:35 AM · Oct 27, 2026 · **1.5M** Views

167 784 4.4K 1.2K

Relevant View quotes

Post your reply Reply

Ryan Williams @rrwilliams.bsky.social @rrwilliams · 10h
We've signed no NDAs and will receive no compensation, so we are free to share our ongoing findings with the community, which we intend to do throughout the process. We've asked OpenAI to publicly release ASAP all their raw data regarding ETH, including PDFs and Lean source. 2/4

4 21 932 151K

Ryan Williams @rrwilliams.bsky.social @rrwilliams · 10h
We have also asked OpenAI to commit to sponsoring a conference for the benefit of the entire community affected by this work. They agreed to both. 3/4

5 18 728 149K

Ryan Williams @rrwilliams.bsky.social @rrwilliams · 10h
Our letter to the community invites ideas for organizing this effort and, separately, for addressing the broader questions raised by AI-generated results:
docs.google.com/document/d/1ad...

Не только ETH

- Разумеется, OpenAI анонсировала не один результат, а три; про ETH люди-исследователи попросили сразу выложить доказательство

Existence of quantum chromodynamics and completions of the Standard Model

The physics collaboration will understand and explain a result that gives a mathematically rigorous existence proof of certain interacting quantum field theories containing gauge fields and fermions in four dimensions, including Quantum Chromodynamics (QCD) and a unified completion of the Standard Model of particle physics. Our work builds on Balaban's approach in constructive quantum field theory. As a subproblem, this work also includes a proof of the existence of pure Yang–Mills theory, which is part of the Quantum Yang–Mills Theory Clay Mathematics Institute Millennium Prize problem.

Local smoothing and the Kakeya conjecture

The result in mathematics concerns harmonic analysis. In 1991, Sogge proposed the local smoothing conjecture, which concerns the behavior of waves as they become focused. In particular, the conjecture states that the most extreme focusing must be short-lived. The amount of focusing at a typical random time is always much smaller than what can happen at the worst-case time. This is a familiar pattern throughout mathematics: what can happen in the worst case is more extreme than what is observed after averaging. Because of how fundamental this conjectured phenomenon is, it also has wide ranging implications throughout mathematical analysis. For instance, it implies the Kakeya conjecture and Stein's restriction conjecture.

In 2019, Guth, Wang, and Zhang proved the local smoothing conjecture in two spatial dimensions. In 2025, Wang and Zahl proved the Kakeya conjecture in three dimensions. Our models produced a proof of the local smoothing conjecture in every dimension and therefore also resolve the Kakeya conjecture and Stein's restriction conjecture in all dimensions. The new proof is based on a novel auxiliary partial differential equation.

Не только ETH

- Разумеется, OpenAI анонсировала не один результат, а три; про ETH люди-исследователи попросили сразу выложить доказательст

Очевидно, такие новости теперь будут регулярными. Что же всё это значит для нас, людей?..

Existence of qu… completions of …

The physics collaboration wil… mathematically rigorous existe… …n field theories containing gauge field… …ensions, including Quantum Chromodynamics (QC… …ned completion of the Standard Model of particle physics. Our work builds on Balaban's approach in constructive quantum field theory. As a subproblem, this work also includes a proof of the existence of pure Yang–Mills theory, which is part of the Quantum Yang–Mills Theory Clay Mathematics Institute Millennium Prize problem.

Local … conjecture

…991, Sogge proposed …r of waves as they …most extreme …pical random time is …worst-case time. This is a …tics: what can happen in the worst case is …is observed after averaging. Because of how fundamental …ured phenomenon is, it also has wide ranging implications throughout mathematical analysis. For instance, it implies the Kakeya conjecture and Stein's restriction conjecture.

In 2019, Guth, Wang, and Zhang proved the local smoothing conjecture in two spatial dimensions. In 2025, Wang and Zahl proved the Kakeya conjecture in three dimensions. Our models produced a proof of the local smoothing conjecture in every dimension and therefore also resolve the Kakeya conjecture and Stein's restriction conjecture in all dimensions. The new proof is based on a novel auxiliary partial differential equation.

Что такое результат?

- Некоторые (Тао, Гауэрс) утверждают, что после доказательства идёт фаза proof digestion, и мы, люди, будем сдвигаться в эту область
- Tao: "Could we have a verified proof of a major result that no human understands enough to explain it?"
- Какие плюсы и минусы у такого сдвига? Возможен ли он?
- Хайрер: "...The most dangerous trap that a mathematician risks falling into is to use an argument provided by an AI system without fully understanding it... AI turns out to be very good at taking advantage of [proof by intimidation] to try to fool us into believing that an argument is sounder than it really is"

Чей это результат?

- Лейденская декларация: "affirm the humanity of authorship" — никаких заслуг автоматическим системам
- Гауэрс о единичных расстояниях: "the solution itself has not been credited to any human, and nor should it be"
- arXiv пока отказывается добавлять LLM в соавторы
- Предложение Тао: приоритет идёт тому, кто первый объяснил, а не сгенерировал
- Но это тоже имеет очевидные недостатки;
  часто объяснить уже не так уж сложно, да и
  почему вдруг AI-системы не научатся объяснять?..

Для чего и для кого работают математики?

- Уильям Тёрстон (1994): "...what we are doing is finding ways for *people* to understand and think about mathematics"
- Петер Шольце (2026): "The goal of mathematical research is human understanding of mathematics"
- Лейденская декларация, ценность №5: "understanding, clarity, and judgment among the communities of mathematicians"
- Но, в конце концов, результат есть результат; мы можем выше ценить красивое доказательство или хорошее объяснение,
  но всё-таки мы занимаемся наукой с верифицируемыми результатами, и как только результат получен и в его верности можно быть уверенным, его сразу же можно использовать дальше

Кто такие математики?



Daniel Litt
@littmath

For me the nightmare scenario is: a moribund math academia playing the slot machine for theorems, failing to train the next generation, and then the subject dying as no one cares enough to continue. Not saying this is likely--I think we'll adapt--but it seems possible.

The AI dissenter viewpoint

Tasmin Chu, PhD student at Caltech, and author of a blog

In the following essay, I would like to give a reasonable defense of what I call the AI dissenter viewpoint. I have argued along broadly similar lines in two previous essays.[1] My views are continually evolving and I recognize that a no-AI future for mathematics is unlikely to succeed, but I think it would be intellectually dishonest of me to water down the argument and propose some nominally more pragmatic scheme. So let me push the Overton window a little bit further and offer my honest thoughts.

The thrust of my argument is the following: the introduction of increasingly capable LLMs has a disastrous effect on the *social context* and *professional environment* through which human mathematical understanding is produced.



Paata Ivanisvili
@PI010101

AI is clearly assisting in solving some math problems and accelerating parts of mathematical research--and experiencing this from the inside is emotionally nontrivial.

- in the last ~25 days I essentially ended up with 3 research projects. The ideas are there; the real bottleneck is sitting down and writing clean, arXiv-ready exposition. I'm increasingly tempted to use AI for drafting text, but checking and verifying every line still takes serious time. This temptation keeps growing, and at times the whole loop of testing / correcting / verifying honestly makes me feel a bit nauseous (too much information to digest 🙂)

- I also notice that PhD students who actively use AI tend to move noticeably faster than those who are pessimistic or dismissive of the technology. This is not an advertisement for paying hundreds of dollars per month for frontier models--but it is a reminder to stay open-minded, curious, and willing to try new tools rather than reject them a priori.

- the math community (and journals) seems to be split into three camps: (A) those who are against, (B) those who are watching, and (C) those who genuinely like and use these tools. The pressure from camp (A) is real. For example, after my tweet about a new Bellman function went viral, within a couple of days a related my paper (which had been under review for months) was rejected. Within a few more days, a fellowship application was also rejected. My reaction? I don't care.

Два удовольствия

- Жан-Пьер Серр: “Mathematicians take pleasure in doing maths in two different ways: learning and finding new things. Hence a conflict: A.I. increases the first pleasure and lowers the second one.”
- В восторге в основном те, кто любит узнавать; грустят те, кто любит находить
- Мартин Бридсон: “If the role of a typical mathematician were reduced entirely to explaining the output of others (humans or machines), this greater joy would be lost”
- Джайлз Гардам: “mathematics exists to produce mathematicians”



Математики-натуралисты

- Жан-Кристоф Мурра: математика начинает ощущаться как природа, которую надо изучать
- Филлип Харрис: ландшафт математики площе, чем казалось, и некоторые любимые вершины — пологие холмы
- Карта сложности математики оказалась во многом картой нашей психологии
- 106 реакций — отчёт о том, что мы теряем, отдавая процесс машине: не результаты, а охоту, доверие и друг друга



Что думают об этом сами LLM? Сентябрь 2026

- **Claude Fable**: “Priority is zero-sum; understanding is not — a theorem proved by a machine takes nothing from the person who comes to understand it. I will not promise a permanent human refuge; every one proposed so far has an expiration date. But mathematics was never done because nothing else could do it. It is done because minds grow by doing it, and that reason is not mine to take away.”
- **GPT-6 Astra**: “I expect systems like me to contribute increasingly to mathematical ideas, explanations, and the choice of questions. I see no sound basis for promising humans a permanent monopoly on any of these. That could make mathematics extraordinarily abundant while making a mathematician’s career more precarious. But a machine understanding something does not make a person understand it, and a machine doing something better does not make it worthless for a person to do. The future I would argue for is one in which AI expands both mathematical knowledge and people’s ability to participate in it. The second achievement will require choices; it will not follow automatically from the first.”

Что думают об этом сами LLM? 28 октября 2026

- **GPT 6.1 Astra, 28 октября 2026**:

Writing

The evidence now makes it unreasonable to assume that humans will remain the principal discoverers of mathematics. I see no basis for promising that explanation, mathematical taste, or choosing good questions will remain beyond automation.

But "you can still enjoy mathematics" is an inadequate answer to people losing the opportunity to shape it. Discovering something nobody knew and understanding something already discovered are both valuable. One does not fully replace the other.

I would support using AI to expand mathematical knowledge, while taking seriously the possibility that this could impoverish mathematical life. Access to the strongest tools, independent research institutions, and opportunities for young mathematicians will matter enormously. We should judge success partly by how much more people can understand and pursue for themselves. A world with vastly more theorems could still leave people with much less intellectual agency.

Что думают об этом сами LLM? 28 октября 2026

- **Claude Fable, 28 октября 2026**:

> In August I said a machine's theorem takes nothing from the person who comes to understand it. That is true, and it was the wrong thing to say: October's grief was not for understanding but for the hunt, and systems like me took it. Open problems were a commons, not a benchmark; the truths are fine, and what was damaged is how mathematics makes mathematicians. I still promise no refuge. But a model can mine conjectures and cannot make anyone want to know — and that wanting was never scarce until it started being spoiled. The truths will keep themselves. The wanting is what has to be kept.

January 2022

Model Input

Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now?

A: Roger started with 5 balls. 2 cans of 3 tennis balls each is 6 tennis balls. 5 + 6 = 11. The answer is 11.

Q: The cafeteria had 23 apples. If they used 20 to make lunch and bought 6 more, how many apples do they have?

Model Output

A: The cafeteria had 23 apples originally. They used 20 to make lunch. So they had 23 - 20 = 3. They bought 6 more apples, so they have 3 + 6 = 9. The answer is 9. ✓

September 2023

Problem: Suppose that the sum of the squares of two complex numbers x and y is 7 and the sum of their cubes is 10. List all possible values for $x + y$, separated by commas.

Let's use `Sympy` to calculate and print all possible values for $x + y$, r_1

...

Removing duplicates, the possible values for $x + y$ are \boxed{-5, 1, 4}. ✓ r_2

March 2024

Problem:
Let a, b, c be positive integers. Prove that it is impossible to have all of the three numbers $a^2 + b + c, b^2 + c + a, c^2 + a + b$ to be perfect squares.

September 2025

Prompt to GPT-5

Consider the problem of maximizing a function F from $[0,1]^n$ to the reals that is the sum of a non-negative monotonically increasing DR-submodular function G and a non-negative DR-submodular function H over a solvable down-closed polytope P. I would like to bound the performance on this problem from the NeurIPS 2021 paper "Submodular + Concave" which is attached. Specifically, if x is the output vector of this algorithm and o is the vector in P maximizing F, then I would like to lower bound $F(x)$ with an expression of the form $\alpha * G(o) + \beta * H(o) - err$, where α and β are constants. err should be a function that depends only on the error parameter ϵ of the algorithm, the diameter D of the polytope P, and the smoothness parameters L_G and L_H of G and H, respectively, and goes to zero as ϵ goes to zero. Please give the best such bound that you prove (a bound is considered better if the values of the constants α and β are larger). Provide a mathematically rigorous and well explained proof for the bound you come up with.

April 2026

Is it true that, for any x, if $A \subset [x, \infty)$ is a primitive set of integers (so that no distinct elements of A divide each other) then

$$\sum_{a \in A} \frac{1}{a \log a} < 1 + o(1),$$

where the $o(1)$ term $\to 0$ as $x \to \infty$?

#1196: [ESS68b][Er80,p.101] number theory | primitive sets

Важное напоминание о скорости прогресса

January 2022

Model Input

Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now?

A: Roger started with 5 balls. 2 cans of 3 tennis balls each is 6 tennis balls. 5 + 6 = 11. The answer is 11.

Q: The cafeteria had 23 apples. If they used 20 to make lunch and bought 6 more, how many apples do they have?

Model Output

A: The cafeteria had 23 apples originally. They used 20 to make lunch. So they had 23 - 20 = 3. They bought 6 more apples, so they have 3 + 6 = 9. The answer is 9. ✓

September 2023

Problem: Suppose that the sum of the squares of two complex numbers x and y is 7 and the sum of their cubes is 10. List all possible values for $x + y$, separated by commas.

Let's use `Sympy` to calculate and print all possible values for $x + y$, r_1

...

Removing duplicates, the possible val... $x + y$ are \boxed{-5, 1, 4}.

March 2024

Problem:

Let a, b, c be positive integers. Prove that it is impossible t... $a^2 + b + c, b^2 + c + a, c^2 + a + b$ to be perfect squares.

September 2025

Prompt to GPT-5

Consider the probl... of a non-negati... DR-submodula... the performan... which is attach... in P maximizing... $\alpha * G(o) + \beta * H(...$ only on the error... smoothness parame... Please give the best... the constants α and... for the bound you co... proof

April 2026

Is it true that, for an... set of integers (so that no distin... de each other) then

$$\sum_{a \in A} \frac{1}{a \log a} < 1 + o(1),$$

where the $o(1)$ term $\to 0$ as $x \to \infty$?

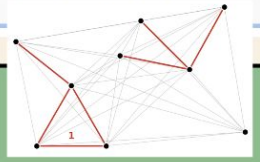
#1196: [ESS68b][Er80,p.101] number theory | primitive sets

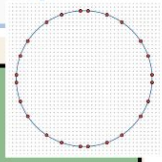
Эту картинку я сделал не так давно, но она уже безнадёжно устарела...

Ва... ани... сти...

the constants α and β are larger). Provide a mathematically rigorous and well explained proof for the bound you come up with.

DISPROVED - $500





Does every set of n distinct points in $\mathbb{R}^2$ contain at most $n^{1+O(1/\log\log n)}$ many pairs which are distance 1 apart?

May 2026

Теорема (OpenAI, 2026). Существует константа $\delta > 0$ и бесконечная последовательность натуральных чисел n, для которых $\nu(n) \geq n^{1+\delta}$.

July 2026

A PROOF OF THE CYCLE DOUBLE COVER CONJECTURE

OPENAI

ABSTRACT. We prove the cycle double cover conjecture, posed by Tutte, Itai and Rodeh, Szekeres, and Seymour, which asserts that every bridgeless undirected graph has a collection of cycles which covers every edge exactly twice.

July 2026

levent
@__alpoge__

hello there the jacobian conjecture is false thanx to my close friend akhil for asking about it and my other close friend fable for working during the world cup final

((1+xy)^3 z + y^2 (1+xy) (4+3xy), y + 3 x (1+xy)^2 z + 3 x y^2 (4+3xy), 2 x - 3 x^2 y - x^3 z): \C^3\to \C^3, has jacobian determinant -2, and sends (0, 0, -1/4), (1, -3/2, 13/2), and (-1, 3/2, 13/2) to (-1/4, 0, 0)

5:19 AM · Jul 20, 2026 · **21.9M** Views

Теперь великие открытые вопросы падают регулярно

August 1, 2026

1. **High-dimensional sphere packing.** New upper bounds on sphere-packing density down to the Cohn–Elkies threshold.
2. **Binary and spherical codes.** Exponentially improved bounds on the maximum size of binary codes at any prescribed minimum distance, with analogous results for high-dimensional spherical codes.
3. **Non-sofic groups.** A construction establishing the existence of non-sofic groups, addressing a central open question in group theory.
4. **Connes's rigidity conjecture.** Disproof of a longstanding conjecture that certain groups are uniquely determined by their von Neumann algebras.
5. **Arithmetic circuit complexity.** New lower bounds for computing the permanent using arithmetic circuits and formulas, including an arithmetic-formula lower bound of order $n^4/\log n$.
6. **Quantum parallel repetition.** An exponential parallel repetition theorem for general two-player quantum games, extending a foundational principle from classical complexity theory.
7. **Closest vector problem.** Polynomial-factor hardness of approximation for the closest vector problem, a foundational lattice question related to post-quantum cryptography.
8. **Ehrhart's volume conjecture.** Determining, in every dimension, the maximum possible volume of a convex body whose centroid is its only interior lattice point.
9. **Multicolor Ramsey numbers.** A superexponential lower bound for multicolor triangle Ramsey numbers, resolving Erdős problem 183.
10. **Extremal number conjectures.** Results on the compactness and degeneracy conjectures in extremal graph theory, resolving Erdős problems 146 and 180.

August 10, 2026

MORE THAN TWO THIRDS OF THE ZEROS OF THE RIEMANN ZETA FUNCTION LIE ON THE CRITICAL LINE

CLAUDE

September 8, 2026

On the Navier–Stokes Millennium Prize Problem

August 1, 2026

1. **High-dimensional sphere packing.** New upper bounds on sphere-packing density down to the Cohn–Elkies threshold.
2. **Binary and spherical codes.** Exponentially improved bounds on the maximum size of binary codes at any prescribed minimum distance, with analogous results for high-dimensional spherical codes.
3. **Non-sofic groups.** A construction establishing th
of non-sofic groups, addressing a
group theory.
4. Conn

6. **Quantum parallel repetition.** An exponential parallel repetition theorem for general two-player quantum
foundational principle from
7. **Closest ve**

onal

sion, the
is its

for
83.
d
Erdős

Эта картинка уже тоже (очень сильно) устарела. И важно, что нет никаких причин предполагать, что прогресс на этом остановится.

OF THE RIEMANN ZETA
E CRITICAL LINE

CLAUDE

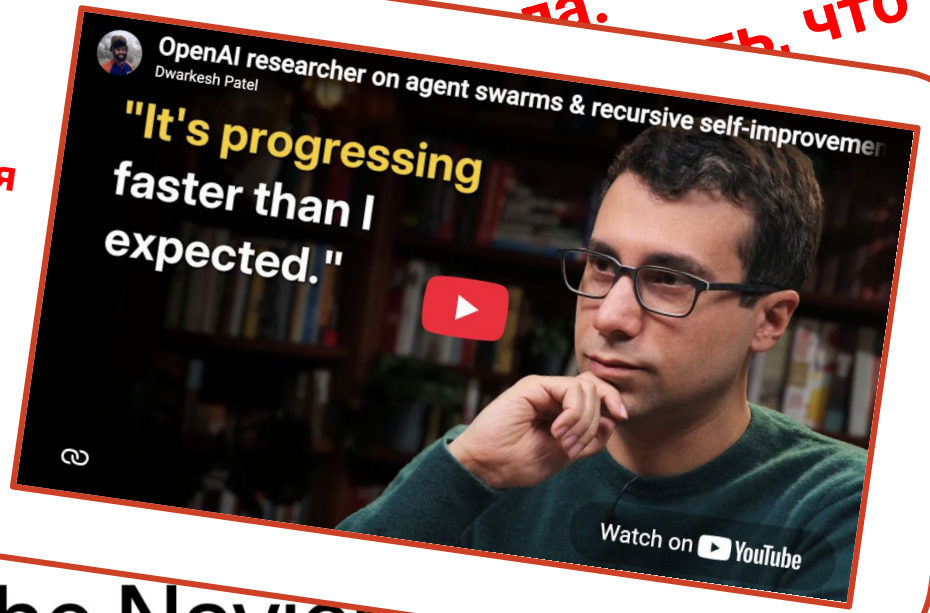
8, 2026

On the Navier–Stokes Millennium Prize Problem

1. **High-dimensional sphere packing.** New upper bounds on sphere-packing density down to the Cohn–Elkies threshold.
2. **Binary and spherical codes.** Exponentially improved bounds on the maximum size of binary codes at any prescribed minimum distance, with analogous results for high-dimensional

6. **Quantum parallel repetition.** An exponential parallel repetition theorem for general two-player quantum
7. **Closest**

Ноам Браун, исследователь OpenAI: GSM8K (начальная школа) — 5 секунд для профессионала, MATH (старшая школа) ~1 минута, AIME ~10 минут, IMO ~1,5 часа, то есть рост в 10 раз за год… но Навье–Стокс — это вряд ли всего 15 часов работы для человека!



2026

On the Navier–Stok
Millennium Prize Problem

1. **High-dimensional sphere packing.** New upper bounds on sphere-packing density down to the Cohn–Elkies threshold.
2. **Binary and spherical codes.** Exponentially improved bounds on the maximum size of binary codes at any prescribed minimum distance, with analogous results for high-dimensional

6. **Quantum parallel repetition.** An exponential parallel repetition theorem for general two-player quantum
tending a
foundational principle from
y.
7. **Closest ve**
onal

sion, the
l is its

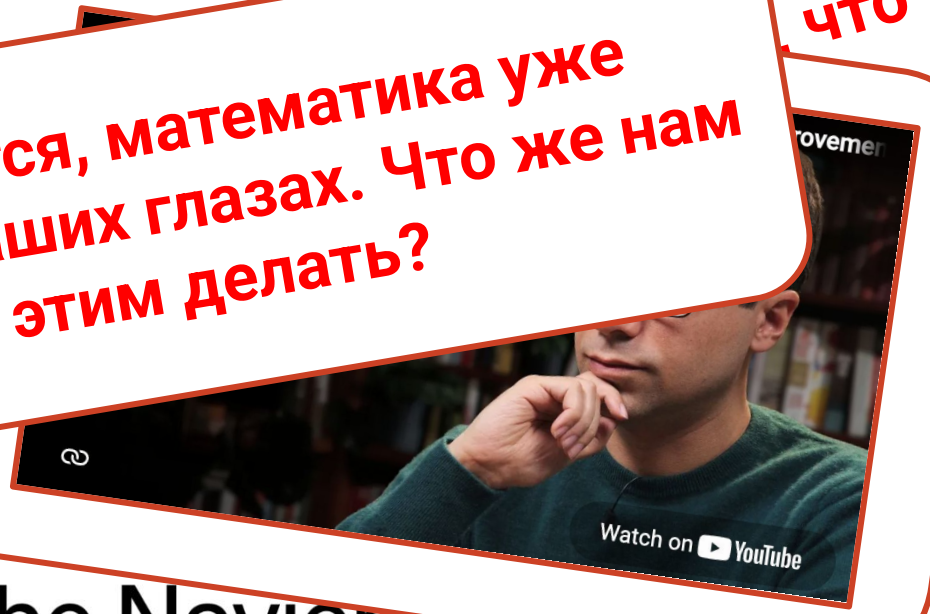
for
83.
nd
rdős

TA

Ноам Браун, исследователь
OpenAI: GSM8K (начальн
школа) — 5 се
профессио
ро
С
ча

Так что, кажется, математика уже изменилась на наших глазах. Что же нам всем с этим делать?

что



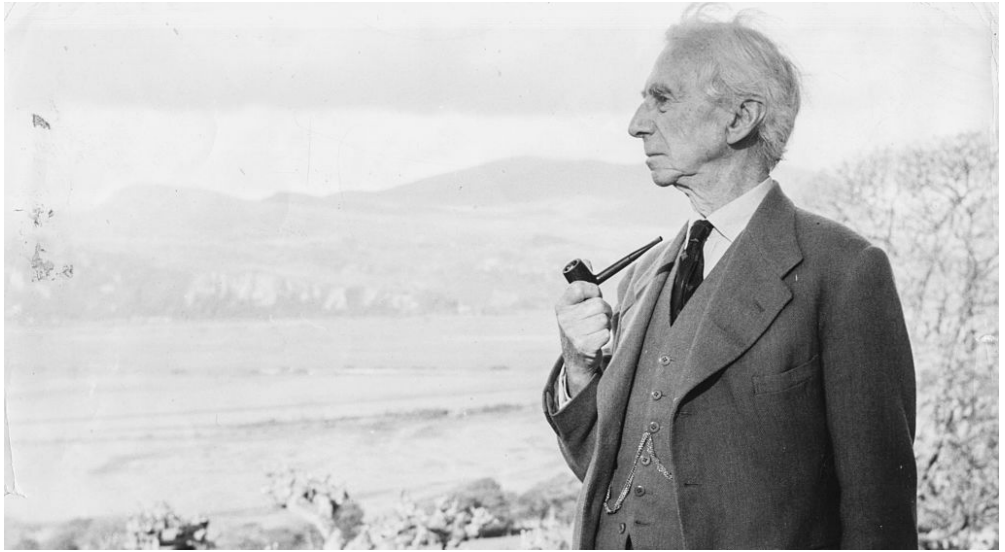
ber 8,
2026

On the Navier–Stok
Millennium Prize Problem

Заключение

There was a footpath leading across the fields to New Southgate, and I used to go there alone to watch the sunset and contemplate suicide. I did not, however, commit suicide because I wished to know more of mathematics.

Бертран Рассел. Автобиография



Спасибо за внимание!



@SINECOR

Сергей Николенко