OpenAI's Reasoning Model Disproves a 1946 Erdős Conjecture in Geometry

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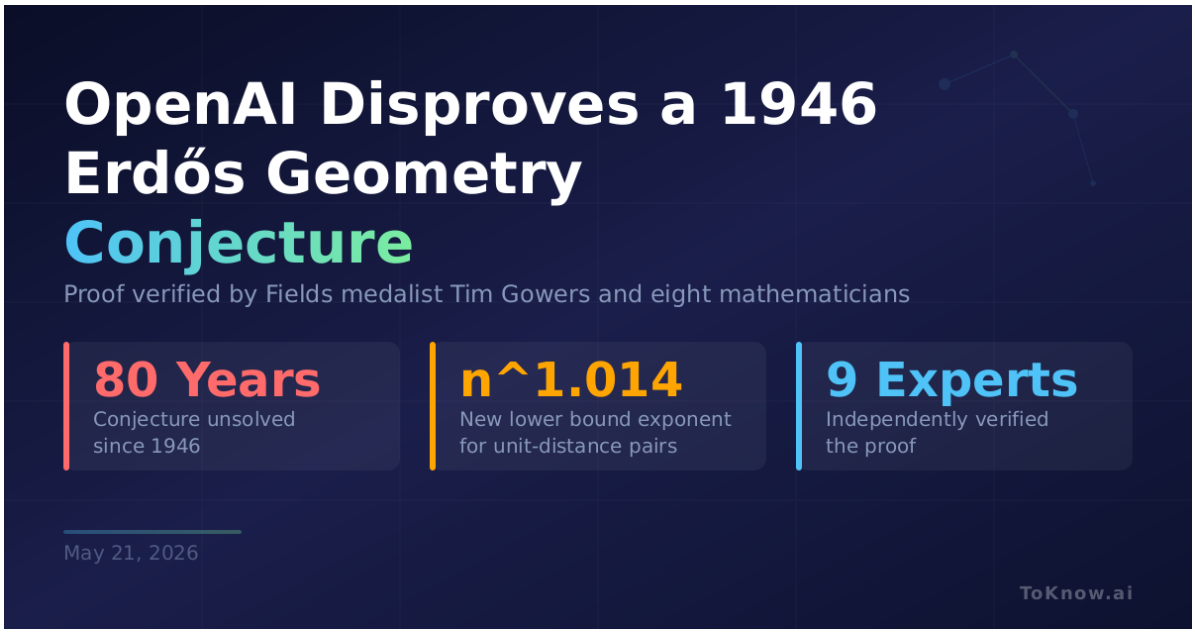

An internal OpenAI reasoning model has disproved a conjecture Paul Erdős posed in 1946: given n points in a plane, how many pairs can sit exactly one unit apart? For decades, mathematicians believed square-grid-based arrangements were essentially the best possible. The AI model found a new family of constructions that does meaningfully better. Princeton's

Will Sawin quickly sharpened the result: the new constructions yield at least n^1.014 unit-distance pairs, where all previous lower bounds had exponents that shrink toward 1 as n grows. The proof uses algebraic number theory, specifically a technique for constructing number fields with many symmetries, that nobody had connected to this geometry problem before. The model was a general-purpose reasoning system, not trained for mathematics or pointed at this conjecture.

Fields medalist Tim Gowers said he would recommend the proof for the Annals of Mathematics "without any hesitation." Nine leading mathematicians co-authored a companion paper verifying the argument. A general AI system, with no math-specific training or targeted prompts, produced a result professionals couldn't reach in 80 years. This follows a retracted 2025 claim that GPT-5 had solved Erdős problems when it had only found existing solutions.

Previous AI math milestones, like AlphaGeometry on olympiad problems or GPT-5.5's Ramsey number proof, worked within well-studied domains or used specialized pipelines. Here, a general-purpose model bridged algebraic number theory and combinatorial geometry to solve a prominent open problem. The bottleneck for mathematical discovery may be shifting from human intuition to compute time.

Sources:

- OpenAI Disproves Erdős Conjecture (OpenAI Blog)
- OpenAI Solved an 80-Year-Old Math Problem (TechCrunch)
- Companion Remarks on the Disproof (Gowers et al., arXiv)
- An Explicit Lower Bound for the Unit Distance Problem (Sawin, arXiv)
