LEAN POOL: AN AI-MAINTAINED ARCHIVE OF FORMALIZED MATHEMATICS

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Paper under double-blind review

ABSTRACT

As AI systems increasingly contribute to mathematical research, formal proofs make it possible to check arguments before they have been fully examined by mathematicians. Reusing these proofs requires more than preserving their source: formalizations must remain compatible with evolving libraries, and their results must be easy to find and understand. We present Lean Pool, a living archive of mathematical formalizations maintained together as Lean and Mathlib evolve. It combines AI agents, automated checks, and human oversight to maintain independently developed projects while preserving their attribution. We analyze the archive's contribution and maintenance history, accepted optimizations, mathematical reviews, and evidence of reuse. The operational record shows that agent-assisted maintenance can restore compatibility across dependency upgrades and support library-wide proof shortening and compilation improvements. It also records follow-up repairs after initial automation, the resource demands of large reviews, and tradeoffs between reusable interfaces and compilation cost. Archived mathematics is reused in subsequent research-level formalization. We release the archive, its maintenance workflows, exposition site, and supporting analysis artifacts, aiming to provide a maintained formal counterpart to arXiv.

1 INTRODUCTION

AI systems can produce mathematical arguments faster than mathematicians can read and absorb them. Formalization makes the correctness of these arguments mechanically checkable while their ideas are still being understood. OpenAI's *Ten Advances in Mathematics and Theoretical Computer Science* and *Finite Time Blowup for Navier–Stokes* illustrate this role: both released long AI-generated arguments alongside Lean formalizations (OpenAI, 2026f;b). The releases describe how formalization accompanied these discoveries (OpenAI, 2026d;c).

These formalizations can also become foundations for later research. A reader needs to find the relevant theorem, inspect its assumptions, and use it in a new development. That requires more than preserving the original source: as Lean and Mathlib evolve, the formalization must remain compatible with the libraries on which new work depends.

Lean Pool is a living archive for this purpose. It gives completed formalizations a persistent, searchable home while maintaining them together in a common Lean/Mathlib environment. Its contributors include people submitting their own mathematics, people using AI agents, and agents discovering and importing existing projects. The archive preserves attribution and project organization while applying shared checks to contributions and subsequent maintenance.

Admission rules. Completed projects must contain no `sorry` or `admit` and introduce no axioms beyond `Classical.choice`, `propext`, and `Quot.sound`. They must avoid `set_option`, unchecked declarations, and mechanisms that bypass the repository's resource limits or linters. Every project requires a card identifying its authors, upstream source, proof provenance, and main results with their informal statements. Accepted source must carry an `Apache-2.0` or `MIT` license. The mechanical checks appear in Appendix B. Open challenges are kept separately from completed formalizations.

Reviewers: please read the Reviewer Guidelines (iclr.cc/Conferences/2027/ReviewerGuidelines) and the AI Policy for Reviewers (iclr.cc/Conferences/2027/AIPolicyForReviewers). If you used AI to expand, edit, or polish your review, please provide the input text to the LLM. Better still, consider skipping the LLM and submitting your original text: we, and the authors, are much more interested in your unedited thoughts than in what an LLM has to say. AI-assisted or not, you are putting your name and reputation behind your review: LLM-generated falsehoods, hallucinations or misrepresentations are subject to disciplinary action, which may include desk-rejecting all papers you have authored.

A formal counterpart to the mathematical literature. Figure 1 illustrates our proposal for connecting mathematical papers to a growing collection of maintained formalizations.

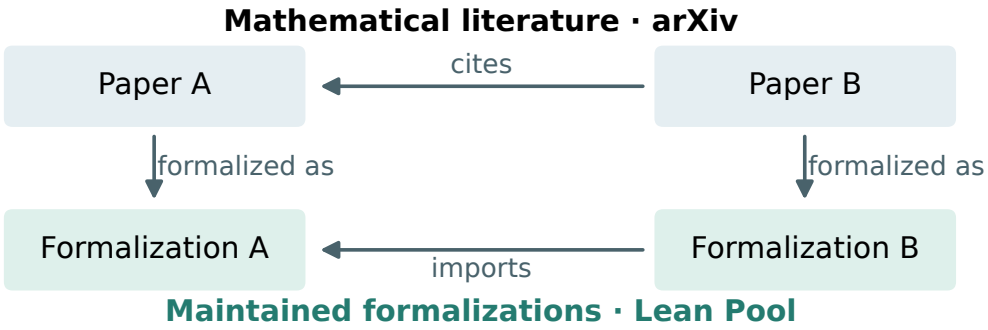

Figure 1: The proposed relationship between arXiv and Lean Pool. New mathematics has both a paper and a maintained formalization. An author places the paper on arXiv and contributes its formalization to Lean Pool. Subsequent work cites the paper and imports the formalization, so formal dependencies can mirror the dependency graph of the mathematical literature. As formalization becomes easier and cheaper, we anticipate that most new mathematics papers will have accompanying formalizations. Lean Pool provides a home for these developments and maintains their connections as Lean and Mathlib evolve.

This paper analyzes the archive and the operations already used to maintain it: community contributions, dependency upgrades, accepted optimization changes, deployed LLM reviews, and the tools through which readers find and inspect mathematics. Historical builds show that agent-assisted upgrades restore compatibility. Accepted changes demonstrate library-wide proof shortening and faster compilation. A separate LeanEval audit documents reuse of archived mathematics in research-level formalization (Anonymous authors, 2026). We provide the archive, its maintained workflows, and the analysis and source records supporting these findings.

2 Contributing to and maintaining the archive

Community contributions. Work enters Lean Pool through direct contributions and through attributed imports of upstream projects. A contributor can propose a repository or submit a prepared project. The PR history includes contributions of new formalizations, improvements to archived proofs, and infrastructure for discovering and checking projects. Appendix C.1 attributes these contributions.

A submitter and a formalization's authors need not be the same people. Project cards retain upstream authorship even when a maintainer or an agent performs the import. Their provenance labels distinguish human-written, AI-written, and mixed proofs. GitHub accounts identify who submitted a change; they do not measure the division of labor between that person and their agents.

Recurring work. Daily jobs search for recent and older formalizations, inspect open PRs, address maintainer issues, optimize existing projects, and announce accepted contributions. A separate dependency-update workflow detects new Lean/Mathlib releases, builds the archive, assigns failing projects to repair agents, and assembles their patches for review. These job definitions evolve alongside the archive. Appendix C describes their responsibilities and outputs.

Continuous integration. CI combines a full-library build, warning checks, Mathlib's declaration and source-style linters, and archive-specific quality gates. The latter check project cards, attribution, allowed axioms, proof and file sizes, and attempts to bypass the checks. A compiled-environment audit complements source scanning. Profiling reports the compilation cost of new files and compares modified files with their earlier versions; it is advisory in the observed workflow.

These checks share Mathlib's build-and-lint foundation. Lean Pool adds admission rules for independently attributed projects and LLM review of their mathematical claims. Tau Ceti also uses Mathlib linters and an axiom audit, and its performance workflow makes resource regression checks a merge condition. Appendix B compares the mechanical checks and profiling methods directly.

Evidence and scope. We analyze dated observations of a continuously changing archive, together with its source history and retained public PR records. Compatibility evidence combines historical replays with the latest production upgrade logs. Optimization results describe accepted changes, and review statistics describe retained service reports. The historical build-resource comparison uses clean library builds on the same machine. Appendix A specifies the observation periods and measurement scopes.

3 The archive and evidence of reuse

The collection spans logic, number theory, algebra, analysis, geometry, probability, and computer science, with scale and participation summarized in Table 1.

Table 1: Scale and participation at successive observations. Physical source lines include comments and blank lines. Declaration commands are counted lexically in source, excluding examples; generated auxiliary declarations are excluded. Project-card provenance describes proof authorship. Contributor counts use GitHub user accounts with merged PRs and exclude bots. Community PRs exclude the maintainer account. Open challenges are outside the source census.

Archive property	September 11	September 18
Completed projects	180	202
Lean source files	4,621	6,719
Physical source lines	1,572,694	2,892,826
Source declaration commands	87,789	170,433
Registered main results	700	795
Human / AI / mixed projects	70 / 80 / 30	70 / 94 / 38
Contributors with merged PRs	16	16
Community PRs merged	58	62

Its contents range from classical structural theorems to recently proved results. The classification of compact surfaces development builds from triangulations to normal forms for surfaces with boundary. The incompleteness development formalizes Gödel's theorems for arithmetic, together with arithmetization and provability logic. The polynomial Freiman–Ruzsa development uses entropy to establish bounds in additive combinatorics and reuses the archive's existing entropy library. Recent imports include the Navier–Stokes and Euler blowup developments, non-sofic groups, and results on quantum parallel repetition (OpenAI, 2026b;a;f). The archive also contains a characterization of language generation in the limit, connecting formalized mathematics to learning theory (Li et al., 2026). Appendix I links the imported projects to their publications; the Lean Pool Zulip channel announces newly added results with attribution.

Figure 2 follows the archive's growth and maintenance over time.

Reuse in research-level mathematics. Lean Pool is the most reused external repository in the LeanEval structural audit (Anonymous authors, 2026); Figure 6 in the appendix reports the comparison and its definition of reuse.

Build resources. Appendix A.2 compares historical clean library builds on the same Azure host, retaining the measured revisions separately from the current census.

4 Maintaining compatibility as dependencies evolve

A common environment remains useful only if archived projects can move with Lean and Mathlib. The dependency-update workflow tests unchanged source under new dependencies, assigns failures

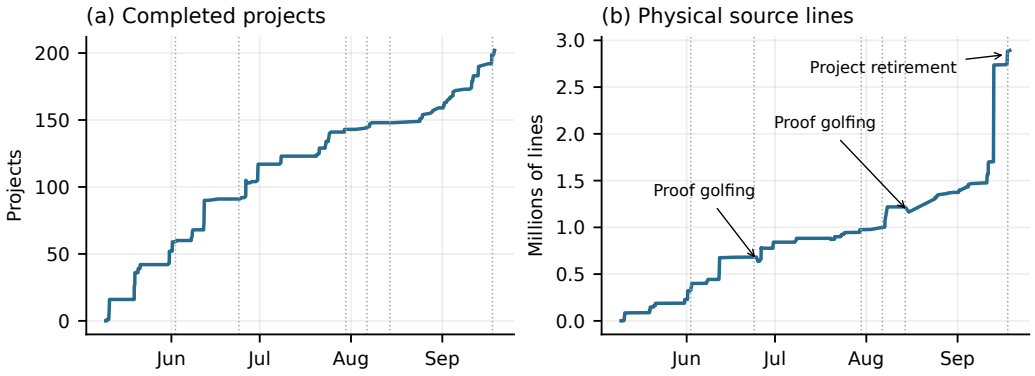

Figure 2: Growth of the living archive. The curves show registered projects and physical Lean source lines, including comments and blank lines. Dotted markers indicate dependency upgrades. The project count continues to grow through periods of proof golfing; the annotated dips in source size mark library-wide compression and compilation optimizations. A separate project removal is labeled explicitly.

to agents, and checks the repaired projects together. Table 2 records the projects affected by historical upgrades.

Table 2: Projects encountering compiler failures under dependency upgrades. Earlier rows replay the original pre-upgrade source with the new environment. The final row uses the retained production probe before repairs. It measures the archive at that probe; subsequent imports and a separately accepted curation change altered membership before merge. The stable migration ultimately passed the combined archive build and repository checks. Warning-only cleanup is excluded from the failure count.

From Lean	To Lean	Projects at probe	Compiler failures
4.30.0-rc2	4.31.0-rc1	59	44
4.31.0-rc1	4.32.0-rc1	91	58
4.32.0-rc1	4.33.0-rc1	143	100
4.33.0-rc1	4.33.0-rc2	145	19
4.33.0-rc2	4.34.0-rc1	148	3
4.34.0-rc1	4.34.0	191	97

The original upstream environments, including earlier Lean releases, are listed for every imported project in Appendix H. The latest migration to stable Lean required follow-up integration after the initial repair jobs, including updates to supporting APIs; Appendix D records the production stages and source changes as a proxy for maintenance effort.

5 Proof shortening and compilation speed

A shared archive also permits improvements across independently developed projects. Accepted changes include library-wide proof compression, contributor-supplied golfing, replacement of expensive proof searches, and simplification of computation-heavy certificates. Table 3 measures their effect on the source size, complete-library build time, and peak memory at their historical revisions.

Table 4 adds recent import cleanup, proof simplification, and reusable-API work, using the project-level measurements recorded with those changes.

An ongoing module-and-proof optimization proposal and its historical benchmark are reported separately in Appendix E.

Table 3: Clean builds of the complete Lean Pool library before and after accepted PRs. Dependencies and build settings are fixed within each pair on the same Azure VM. Time is elapsed build time; RAM is sampled peak combined memory of the build workers. Parentheses give time saved, computed from unrounded measurements; negative values mean longer builds. Source savings include refactoring and declaration removal. Proof shortening does not uniformly reduce build time: contributor golfing uses less memory but takes longer in this run. Each row reports one clean before/after pair; Appendix E gives the protocol.

Accepted change	Lines removed	Build min ↓ before → after	RAM GiB ↓ before → after
117 Proof-search simplification	511	5.30 → 5.25 (+1.1%)	15.6 → 15.6
187 Library-wide compression	45,217	16.11 → 15.59 (+3.3%)	26.1 → 26.9
246 Contributor proof golfing	12,515	21.83 → 23.01 (-5.4%)	25.9 → 24.6
338 Certificate simplification	513	30.22 → 29.13 (+3.6%)	21.0 → 20.9
339 Elaboration-cost reduction	54,965	28.46 → 26.82 (+5.8%)	19.8 → 19.6

Table 4: More recent accepted changes, using measurements already recorded in their PRs. The restricted-sum comparison is the median of repeated clean project builds with warm dependencies. The Navier–Stokes comparison uses interleaved clean project builds on Azure and reports their means; the refactor adds reusable APIs at a small elapsed-time cost. The import cleanup has unmatched cache states, so no speedup is reported. These are project-level observations and do not estimate whole-library improvements.

Accepted change	Lines removed ↑	Project seconds ↓
Tactic-import cleanup	735	—
Restricted-sum proofs	65	20.01 → 18.45
Navier–Stokes reusable APIs	—	879.68 → 887.79

6 Mathematical review in operation

A proof checker validates a formal statement, while admission also requires that the statement corresponds to the contribution being advertised. The mathematical review service has examined faithfulness, novelty, significance, sources, and code quality. Maintainers and contributors can revise the submission or resolve questions raised by its report. Figure 3 summarizes the service's recorded verdicts and subsequent PR outcomes.

Table 5 summarizes recorded price estimates; repeated-review agreement and the service's subsequent redesign and pause are reported in Appendix F.

Table 5: Recorded review price estimates, separated by billing regime. Historical comments report API-based estimates. The newer Azure service consumes Codex account quota and reports a Standard-API-equivalent price using uncached-input rates. The equivalent prices are not cash payments. Totals cover retained reports with recorded estimates and exclude missing or overwritten executions.

Price basis	Reports	Total	Median
Historical API estimates	285	$308.52	$0.20
Codex API-equivalent estimates	6	$752.38	$89.03

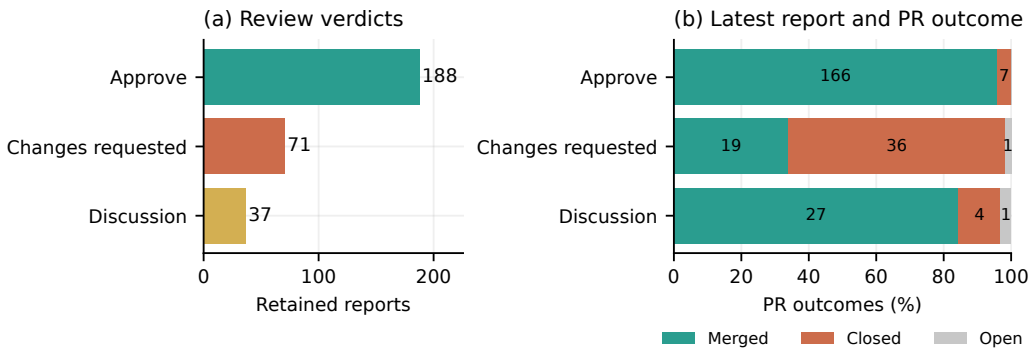

Figure 3: Retained mathematical review-service reports. Left: all retained structured reports. Right: PR outcomes at the observation date, grouped by each PR's latest retained verdict; labels give counts and bar lengths give proportions. Most reports approve their submissions. Requests for changes precede both closures and subsequent merges, while discussion verdicts include unresolved submissions. Findings concern statement mismatches, attribution, incomplete results, duplicate definitions, and unnecessary code. Greptile's advisory reviews and free-form daily-agent comments are outside this census. The recorded outcomes are merge and closure decisions; review accuracy was not independently labeled.

7 Exposition and the Structure of the Library

The exposition site presents the archive at the level of projects, mathematical results, and supporting declarations. Each project's card supplies an informal account, attribution, source references, and links to its headline results. Selecting a result connects this account to its Lean statement and the surrounding development. This combines the contributor's explanation of what was formalized with structure extracted from the checked code. The site builds on the Lean Machine Learning exposition tools (LeanMachineLearning contributors, 2026).

Table 6 summarizes the coverage of this common interface across independently developed projects.

Table 6: Coverage of the deployed Exposition export. Nodes are source-visible declarations and edges are intra-project dependencies, with generated auxiliaries followed internally. The scaffold is excluded. The export reflects the accepted stable-version migration; later imports in the current source census had not yet appeared in this deployment.

Exposition coverage	Count
Documented projects	198
Source declarations	173,090
Theorems and lemmas	124,058
Dependency links	1,391,354
Declarations used by multiple others	87,297

The dependency graph exposes the supporting definitions and lemmas behind a result. Readers can follow its prerequisites or inspect the declarations that use it, while highlighted headline results provide entry points into a larger development. The declaration viewer also exposes direct and transitive dependency counts, allowing readers to locate results with substantial supporting developments and intermediate declarations shared by later proofs. These are dependencies within the formalized project; the connections between papers and between imported projects are a separate level of organization.

Table 7 illustrates the range of project structures already available through this interface.

Figure 4 shows the Incompleteness project; a selected theorem's statement panel appears in Appendix G.

Table 7: Examples of the mathematical structures exposed by Exposition. Counts are recomputed from the retained project graphs. Large developments expose reusable intermediate results as well as their headline theorems; graph size measures formal dependency structure, not mathematical importance.

Project	Declarations	Dependencies
Gödel's incompleteness theorems	7,849	141,353
Classification of compact surfaces	7,831	79,034
Navier–Stokes and Euler	48,626	530,547
Language generation in the limit	419	1,823

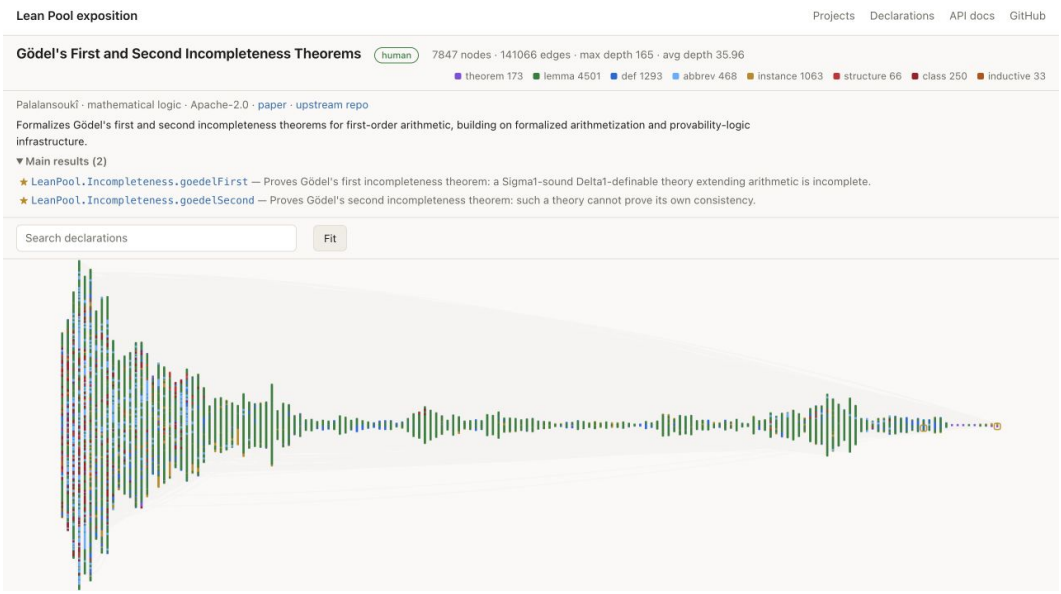

Figure 4: The Incompleteness project in Exposition. The project card identifies its formalization author and upstream source and lists the headline results. The graph places declarations within the supporting development, making its structure visible alongside the informal account. The headline results include Gödel's incompleteness theorems, while the surrounding graph exposes the formal infrastructure on which they depend. Selecting a declaration links its position in the graph to its statement, source, and API documentation. This makes the project accessible both from its main mathematical claims and from the lemmas used to establish them. The screenshot illustrates the interface captured before the latest upgrade; the coverage table uses the newer export listed in Appendix A.

The graph and statement panels complement the source and API documentation: the graph identifies relevant declarations, and the linked documentation provides their full formal context. In particular, a reader can move from a project's informal claim to the assumptions and definitions used in its formal statement before building on the result. Section 8 places this inspection step within the archive's discovery and reuse workflow.

Keeping this view current is part of maintaining the library. The documentation pipeline checks the correspondence between exported results and project cards. Recent changes reuse unchanged project graphs and successful CI build outputs when publishing documentation, avoiding repeated extraction and compilation while keeping verification of the published data. Appendix G describes the conditions under which those outputs can be reused.

8 FINDING AND BUILDING ON ARCHIVED RESULTS

The preferred discovery tools are Octo semantic search, the exposition site, and project cards, connected by the workflow in Table 8.

Table 8: Finding a result and following it into a development. A mathematical query, subject, or known paper provides an entry point. The reader can then inspect the candidate's assumptions and definitions before importing it alongside other archived work in the shared environment.

Starting point	Preferred tool	What the reader obtains
A mathematical question	Octo semantic search	Candidate declarations across the archive
A subject or project	Exposition	Project descriptions, statements, and dependency graphs
A known paper or result	Project card	Attribution, source references, and formal headline results
A candidate to reuse	Source and API documentation	Full assumptions, supporting definitions, and import paths

9 RELATED WORK

Archives and shared libraries. AFP combines contributed formalizations with review and continuing maintenance (Archive of Formal Proofs, 2026a;b; MacKenzie et al., 2021). Mathlib develops an integrated mathematical library (The mathlib Community, 2020; Baanen et al., 2026). Reservoir indexes Lean packages, the Rocq Platform distributes compatible packages, and Software Heritage preserves source histories (Lean FRO, 2026; Rocq Platform contributors, 2026; Abramatic et al., 2018). Table 9 compares Lean Pool with Tau Ceti, Palomar Registry, and Mathlib along their contribution, maintenance, acceptance, and documentation policies.

Discovery, formalization, and reuse. TheoremSearch retrieves statements from mathematical literature, while TheoremGraph connects statements and their dependencies across informal and formal sources (Alexander et al., 2026; Kurgan et al., 2026). LeanDojo and LeanAgent study retrieval and learning for proof construction (Yang et al., 2023; Kumarappan et al., 2025). Project-level benchmarks evaluate reasoning in existing libraries and software contexts (Hu et al., 2025; Xin et al., 2026; Ye et al., 2026b; Klingner et al., 2026). Semi-autonomous formalization connects informal arguments to checked developments (Ilin, 2026). The LeanEval structural audit studies the resulting code and documents cross-project reuse (Anonymous authors, 2026).

Repair and mathematical review. Compatibility studies, proof transport, and APRIL's compiler-feedback repair address the maintenance of formal proofs (Luan et al., 2025; Ringer et al., 2021; Wang et al., 2026). Statement-evaluation methods examine correspondence between informal claims and formal expressions (Poiroux et al., 2025; Liu et al., 2025b; Lu et al., 2025; Zhang et al., 2026a; Ye et al., 2026a). Expert assessments of generated mathematics identify obligations beyond filling proof gaps, including appropriate definitions, faithful statements, and usable library design (Ilin & Nugent, 2026; Meek et al., 2026).

10 CONCLUSION

Lean Pool brings completed formalizations into a common environment maintained through agent-assisted upgrades, optimization, review, and community contribution. Its operational history documents repeated maintenance, while the LeanEval audit shows reuse in subsequent research. As more mathematical papers acquire formal proofs, the archive provides a place to preserve their attribution and keep their dependencies usable for later work.

Table 9: Contribution and maintenance models in the Lean ecosystem, as documented by the projects (Lean Pool contributors, 2026; Tau Ceti Project, 2026; Palomar Registry, 2026; Lean Mathematical Library Community, 2026; The mathlib Community, 2020). Lean Pool maintains independent developments together. Tau Ceti and Mathlib integrate contributions into a shared mathematical API, with different roles for human and AI contributors. Palomar registers checked versions of separate repositories; updated versions require resubmission, verification, and review.

Project	Contributions	Maintenance	Acceptance criteria	Documentation
Lean Pool	Human, AI, and mixed projects; direct submissions and attributed imports	Agents propose upgrades and optimizations; maintainers oversee merges	Completed proofs; permitted axioms; attributed cards; permissive license; CI and mathematical review	Project cards, informal results, dependency graphs, source-linked API
Tau Ceti	AI-authored mathematics following human roadmaps	AI contributors update Mathlib pins and repair the integrated library	CI and adversarial AI review; roadmap fit, reuse, API coherence, and compatibility with Mathlib	Human roadmaps, module documentation, declaration docstrings
Palomar Registry	Human, AI, or mixed formalizations submitted by an author or authorized maintainer	Verified versions persist; authors resubmit updates	Lean and NanoDa proof checks; automated review of statement faithfulness, disclosure, and research interest	Recorded statements, provenance, dependencies, and public verification and review reports
Mathlib	Human contributors; disclosed AI use with contributor understanding and justification	Community maintenance across Lean releases	Human review, generality, integration, maintainability, style, and CI	Module and declaration documentation, API reference, library overviews

AI USE STATEMENT

Generative AI assisted the collection and organization of public-source evidence, analysis design and implementation, interpretation of operational records, literature discovery, figure generation, and drafting and revision of this paper. The archive's agents and review models are themselves objects of the study and are described separately in the paper. Reported numerical results are computed from retained source and execution records; they are not synthetic measurements. Validation checks source hashes, recomputes reported aggregates, and reconstructs the tables and figures. The author takes responsibility for the final manuscript and its supporting artifacts.

REPRODUCIBILITY STATEMENT

Appendix A defines the observation periods and measurement populations. The anonymous supplementary archive contains retained records, revision identifiers, analysis programs, and a reconstruction command for the reported displays. Historical build logs and corrected measurement protocols are included. Public PR reports are identified separately from measurements executed for the paper; reconstructing the analysis requires no model calls.

REFERENCES

Mohammed Abouzaid, Andrew J. Blumberg, Martin Hairer, Joe Kileel, Tamara G. Kolda, Paul D. Nelson, Daniel Spielman, Nikhil Srivastava, Rachel Ward, Shmuel Weinberger, and Lauren Williams. First Proof, 2026. URL https://arxiv.org/abs/2602.05192. arXiv:2602.05192.

Uri Abraham and Menachem Magidor. Cardinal Arithmetic. Handbook of Set Theory, 2009. URL https://doi.org/10.1007/978-1-4020-5764-9_15.

Jean-François Abramatic, Roberto Di Cosmo, and Stefano Zacchiroli. Building the universal archive of source code. *Communications of the ACM*, 61(10):29–31, 2018. doi: 10.1145/3183558. URL https://doi.org/10.1145/3183558.

Tom Adamczewski, Bernhard Böhmler, and Rene Marczinzik. A counterexample to Köthe's conjecture and a question of Rowen, 2026. URL https://arxiv.org/abs/2609.07996. arXiv:2609.07996.

Ron Aharoni and Vladimir Korman. Greene-Kleitman's theorem for infinite posets. *Order*, 9(3):245–253, 1992. doi: 10.1007/BF00383948. URL https://doi.org/10.1007/BF00383948.

Martin Aigner and Günter M. Ziegler. *Proofs from THE BOOK*. Springer Berlin Heidelberg, 2018. doi: 10.1007/978-3-662-57265-8. URL https://doi.org/10.1007/978-3-662-57265-8.

Luke Alexander, Eric Leonen, Sophie Szeto, Artemii Remizov, Ignacio Tejeda, Jarod Alper, Giovanni Inchiostro, and Vasily Ilin. Semantic Search over 9 Million Mathematical Theorems, 2026. URL https://arxiv.org/abs/2602.05216. arXiv:2602.05216.

Boris Alexeev, Kevin Barreto, Yanyang Li, Jared Duker Lichtman, Liam Price, Jibran Iqbal Shah, Quanyu Tang, and Terence Tao. Primitive sets and von Mangoldt chains: Erdős Problem #1196 and beyond, 2026. URL https://arxiv.org/abs/2605.00301. arXiv:2605.00301.

Noga Alon, Melvyn B. Nathanson, and Imre Ruzsa. The Polynomial Method and Restricted Sums of Congruence Classes. *Journal of Number Theory*, 56(2):404–417, 1996. doi: 10.1006/jnth.1996.0029. URL https://doi.org/10.1006/jnth.1996.0029.

Daniel D. Anderson. Quasi-complete Semilocal Rings and Modules. Commutative Algebra, 2014. URL https://doi.org/10.1007/978-1-4939-0925-4_2.

David Kurniadi Angdinata, Evan Chen, Chris Cummins, Ben Eltschig, Dejan Grubisic, Leopold Haller, Letong Hong, Andranik Kurghinyan, Kenny Lau, Hugh Leather, Seewoo Lee, Simon Mahns, Aram H. Markosyan, Rithikesh Muddana, Ken Ono, Manooshree Patel, Gaurang Pendharkar, Vedant Rathi, Alex Schneidman, Volker Seeker, Shubho Sengupta, Ishan Sinha, Jimmy Xin, and Jujian Zhang. ABC implies that Ramanujan's tau function misses almost all primes, 2026a. URL https://arxiv.org/abs/2603.29970. arXiv:2603.29970.

David Kurniadi Angdinata, Evan Chen, Ken Ono, Jesse Thorner, Jiaxin Zhang, and Jujian Zhang. On the paucity of lattice triangles, 2026b. URL https://arxiv.org/abs/2603.23928. arXiv:2603.23928.

N. C. Ankeny. Sums of three squares. *Proceedings of the American Mathematical Society*, 8(2):316–319, 1957. doi: 10.1090/S0002-9939-1957-0085275-8. URL https://doi.org/10.1090/S0002-9939-1957-0085275-8.

Anonymous authors. It Compiles. Now What? Assessing Research-Level Autoformalization Beyond Correctness, 2026. Manuscript. Supporting reuse data accompany this paper's supplementary material.

Archive of Formal Proofs. About the Archive of Formal Proofs, 2026a. URL https://isa-afp.org/about/. Accessed September 11, 2026.

Archive of Formal Proofs. Entry submission and updating entries, 2026b. URL https://isa-afp.org/submission/. Accessed September 11, 2026.

JEREMY AVIGAD, EDWARD DEAN, and JOHN MUMMA. A FORMAL SYSTEM FOR EUCLID'SELEMENTS. *The Review of Symbolic Logic*, 2(4):700–768, 2009. doi: 10.1017/S1755020309990098. URL https://doi.org/10.1017/S1755020309990098.

Anne Baanen, Matthew Robert Ballard, Johan Commelin, Bryan Gin-ge Chen, Michael Rothgang, and Damiano Testa. Growing Mathlib: Maintenance of a large scale mathematical library. In *Intelligent Computer Mathematics (CICM 2025)*, volume 16136 of *Lecture Notes in Computer Science*, pp. 51–70. Springer, 2026. doi: 10.1007/978-3-032-07021-0_4. URL https://doi.org/10.1007/978-3-032-07021-0_4.

Jineon Baek. On the Erdős–Tuza–Valtr conjecture. *European Journal of Combinatorics*, 124:104085, 2025. doi: 10.1016/j.ejc.2024.104085. URL https://doi.org/10.1016/j.ejc.2024.104085.

Jineon Baek and Seewoo Lee. Formalizing Mason-Stothers Theorem and its Corollaries in Lean 4, 2024. URL https://arxiv.org/abs/2408.15180. arXiv:2408.15180.

Michel L. Balinski and H. Peyton Young. *Fair Representation: Meeting the Ideal of One Man, One Vote*. Brookings Institution, n.d. URL https://archive.org/details/fairrepresentati00bali. Edition not specified by the project source link.

Barinder S. Banwait. A formal proof of the Ramanujan–Nagell theorem in Lean 4, 2026. URL https://arxiv.org/abs/2604.09808. arXiv:2604.09808.

Stefan Barańczuk. Reducing the number of equations defining a subset of the n-space over a finite field. *Annales de la Faculté des sciences de Toulouse : Mathématiques*, 33(1):177–182, 2024. doi: 10.5802/afst.1766. URL https://doi.org/10.5802/afst.1766.

Ben Barber, Daniela Kühn, Allan Lo, and Deryk Osthus. Edge-decompositions of graphs with high minimum degree, 2014. URL https://arxiv.org/abs/1410.5750. arXiv:1410.5750.

Henning Basold, Peter Bruin, and Dominique Lawson. The directed Van Kampen theorem in Lean. In *Interactive Theorem Proving (ITP 2024)*, 2024. doi: 10.4230/LIPIcs.ITP.2024.8. URL https://doi.org/10.4230/LIPIcs.ITP.2024.8.

Christian Bernert, Tim Browning, Jared Duker Lichtman, and Joni Teräväinen. Bounds on the exceptional set in the *abc* conjecture, 2024. URL https://arxiv.org/abs/2410.12234. arXiv:2410.12234.

I N Bernstein, I M Gel'fand, and S I Gel'fand. SCHUBERT CELLS AND COHOMOLOGY OF THE SPACESG/P. *Russian Mathematical Surveys*, 28(3):1–26, 1973. doi: 10.1070/RM1973v028n03ABEH001557. URL https://doi.org/10.1070/RM1973v028n03ABEH001557.

Alex Best, Christopher Birkbeck, Riccardo Brasca, Eric Rodriguez Boidi, Ruben van De Velde, and Andrew Yang. A complete formalization of Fermat's Last Theorem for regular primes in Lean, 2024. URL https://arxiv.org/abs/2410.01466. arXiv:2410.01466.

F. Beukers. A Note on the Irrationality of $\zeta(2)$ and $\zeta(3)$. *Bulletin of the London Mathematical Society*, 11(3):268–272, 1979. doi: 10.1112/blms/11.3.268. URL https://doi.org/10.1112/blms/11.3.268.

Rekha Biswal, Ken Ono, and Jujian Zhang. Chebyshev quotients, Demazure multiplicities, and Dyck-path models, 2026. URL https://arxiv.org/abs/2604.25246. arXiv:2604.25246.

Tom Bohman. A sum packing problem of Erdös and the Conway-Guy sequence. *Proceedings of the American Mathematical Society*, 124(12):3627–3636, 1996. doi: 10.1090/S0002-9939-96-03653-2. URL https://doi.org/10.1090/S0002-9939-96-03653-2.

Vico Bonfioli. Sharp five-distance and sup-norm gap theorems for Kronecker sequences (Lean 4 / Mathlib), 2026. URL https://doi.org/10.5281/zenodo.20532459. Software.

Manfred Borzechowski, Malvin Gattinger, Helle Hvid Hansen, Revantha Ramanayake, Francisco Trucco Dalmas, and Yde Venema. Propositional Dynamic Logic has Craig Interpolation: a tableau-based proof, 2025. URL https://arxiv.org/abs/2503.13276. arXiv:2503.13276.

Matej Brešar. The Wedderburn-Artin Theorem, 2024. URL https://arxiv.org/abs/2405.04588. arXiv:2405.04588.

Will Brian and Paul B. Larson. Choosing between incompatible ideals. *European Journal of Combinatorics*, 96:103349, 2021. doi: 10.1016/j.ejc.2021.103349. URL https://doi.org/10.1016/j.ejc.2021.103349.

D. L. Burkholder. Boundary Value Problems and Sharp Inequalities for Martingale Transforms. *The Annals of Probability*, 12(3), 1984. doi: 10.1214/aop/1176993220. URL https://doi.org/10.1214/aop/1176993220.

Mario Carneiro. Formalizing computability theory via partial recursive functions, 2018. URL https://arxiv.org/abs/1810.08380. arXiv:1810.08380.

Ben Cassie. Kuramoto-lean: Lean 4 Library for Finite-N Kuramoto Synchronisation Dynamics, 2026. URL https://doi.org/10.5281/zenodo.20468618.

Fan Chang, Hong Liu, and Miao Liu. A proof of Chvátal's conjecture via a sharp correlation inequality, 2026. URL https://arxiv.org/abs/2609.19123v1. arXiv:2609.19123v1.

Chapter II. Compact Self-Adjoint Operators. Chapter II. Compact Self-Adjoint Operators. Advanced Real Analysis, 2017. URL https://doi.org/10.3792/euclid/9781429799911-2.

Jon Cheah and Antoine de Saint Germain. On Upper Bounds of Frieze Patterns. *The Fibonacci Quarterly*, 63(1):98–106, 2025. doi: 10.1080/00150517.2024.2430958. URL https://doi.org/10.1080/00150517.2024.2430958.

Evan Chen and Ken Ono. Thakur's hypotheses on power sums of $\mathbb{F}_q[t]$, 2026. URL https://arxiv.org/abs/2606.16239. arXiv:2606.16239.

Evan Chen, Chris Cummins, Ben Eltschig, Dejan Grubisic, Leopold Haller, Letong Hong, Andranik Kurghinyan, Kenny Lau, Hugh Leather, Seewoo Lee, Aram Markosyan, Ken Ono, Manooshree Patel, Gaurang Pendharkar, Vedant Rathi, Alex Schneidman, Volker Seeker, Shubho Sengupta, Ishan Sinha, Jimmy Xin, and Jujian Zhang. Dead ends in square-free digit walks, 2026a. URL https://arxiv.org/abs/2602.05095. arXiv:2602.05095.

Evan Chen, Chris Cummins, Ben Eltschig, Dejan Grubisic, Leopold Haller, Letong Hong, Andranik Kurghinyan, Kenny Lau, Hugh Leather, Seewoo Lee, Aram Markosyan, Ken Ono, Manooshree Patel, Gaurang Pendharkar, Vedant Rathi, Alex Schneidman, Volker Seeker, Shubho Sengupta, Ishan Sinha, Jimmy Xin, and Jujian Zhang. Almost all primes are partially regular, 2026b. URL https://arxiv.org/abs/2602.05090. arXiv:2602.05090.

Evan Chen, Chris Cummins, GSM, Dejan Grubisic, Leopold Haller, Letong Hong, Andranik Kurghinyan, Kenny Lau, Hugh Leather, Seewoo Lee, Aram Markosyan, Ken Ono, Manooshree Patel, Gaurang Pendharkar, Vedant Rathi, Alex Schneidman, Volker Seeker, Shubho Sengupta, Ishan Sinha, Jimmy Xin, and Jujian Zhang. Fel's Conjecture on Syzygies of Numerical Semigroups, 2026c. URL https://arxiv.org/abs/2602.03716. arXiv:2602.03716.

Ruize Chen, Ben Eltschig, Scott Duke Kominers, Ken Ono, and Jujian Zhang. We Can't Agree to Disagree, Formally: Aumann's Theorem and Assumption Accounting in Lean, 2026d. URL https://doi.org/10.2139/ssrn.6837298.

Xiaohong Chen and Grigore Rosu. Completeness and incompleteness of basic matching logic, 2026. URL https://arxiv.org/abs/2608.13306. arXiv:2608.13306.

N. N. Chentsov. *Statistical Decision Rules and Optimal Inference*. American Mathematical Society, 1982. URL https://bookstore.ams.org/mmono-53. Translations of Mathematical Monographs, American Mathematical Society.

Ian Connell. Elliptic Curve Handbook, n.d. URL https://www.math.rug.nl/~top/ian.pdf. Documentation.

Stephen Cook and Phuong Nguyen. *Logical Foundations of Proof Complexity*. Cambridge University Press, 2010. doi: 10.1017/CBO9780511676277. URL https://doi.org/10.1017/CBO9780511676277.

Gabriel Coutinho, Yinchen Liu, Thomás Jung Spier, Quanyu Tang, and Shengtong Zhang. The Bollobás–Nikiforov inequality for nonnegative edge weights, 2026. URL https://github.com/ShengtongZhang-alt/BN/blob/edb5259dfd055ea31b4c46ac9ea4d33a758c2b99/docs/sol.tex.

Thomas M. Cover and Joy A. Thomas. *Elements of Information Theory*. Wiley, 2005. doi: 10.1002/047174882X. URL https://doi.org/10.1002/047174882X.

H. Cramér and H. Wold. Some Theorems on Distribution Functions. *Journal of the London Mathematical Society*, s1-11(4):290–294, 1936. doi: 10.1112/jlms/s1-11.4.290. URL https://doi.org/10.1112/jlms/s1-11.4.290.

C. G. T. de A. Moreira. Hausdorff measures and the Morse-Sard theorem. *Publicacions Matemàtiques*, 45:149–162, 2001. doi: 10.5565/PUBLMAT_45101_06. URL https://doi.org/10.5565/PUBLMAT_45101_06.

DomainTheory. Scott's 3 Successively Less Topological, Simpler, and More Constructive Presentations of Domain Theory and Their Equivalence, n.d. URL https://github.com/catskillsresearch/domain_theory/blob/main/arxiv.md. Repository manuscript; no author or date stated in the inspected document.

Antoine du Fresne von Hohenesche. Formalisation of the Bannai-Bannai-Stanton Theorem in Lean 4, 2026. URL https://github.com/AntoineduFresne/Bannai-Bannai-Stanton_Theorem/blob/main/Formalisation_Bannai_Bannai_Stanton_Theorem_Report_tex.pdf. Report.

Ákos Dúcz. A note on geometric colorings of the Moser lattice, 2026. URL https://arxiv.org/abs/2606.12325. arXiv:2606.12325.

Martin Dvorak and Vladimir Kolmogorov. Duality theory in linear optimization and its extensions – formally verified. *Annals of Formalized Mathematics*, Volume 2, 2026. doi: 10.46298/afm.14253. URL https://doi.org/10.46298/afm.14253.

EGRS75. A Machine-Checked Proof of the Erdős–Graham–Ruzsa–Straus Two-Prime Theorem, 2026. URL https://github.com/lyfar/egrs75-lean. Companion draft identified in repository README; no separate manuscript URL or author supplied.

P. Erdös. On Sets of Distances of n Points. *The American Mathematical Monthly*, 53(5):248–250, 1946. doi: 10.1080/00029890.1946.11991674. URL https://doi.org/10.1080/00029890.1946.11991674.

P. Erdős, R. L. Graham, I. Z. Ruzsa, and E. G. Straus. On the prime factors of $\binom{2n}{n}$. *Mathematics of Computation*, 29(129):83–92, 1975. doi: 10.1090/S0025-5718-1975-0369288-3. URL https://doi.org/10.1090/S0025-5718-1975-0369288-3.

P. Erdős, L. Lovász, and K. Vesztergombi. On the graph of large distances. *Discrete & Computational Geometry*, 4(6):541–549, 1989. doi: 10.1007/BF02187746. URL https://doi.org/10.1007/BF02187746.

Claude-Alain Faure and Alfred Frölicher. *Modern Projective Geometry*. Springer Netherlands, 2000. doi: 10.1007/978-94-015-9590-2. URL https://doi.org/10.1007/978-94-015-9590-2.

Zixu Feng and Hao Yuan. Optimal local linear convergence of Nesterov's accelerated gradient method for C^2 functions under the Polyak–Łojasiewicz inequality, 2026. URL https://arxiv.org/abs/2603.21516. arXiv:2603.21516.

Maxime Flin, Alesya Raevskaya, Ronja Stimpert, Jukka Suomela, and Qingxin Yang. 2-Coloring Cycles in One Round, 2026. URL https://arxiv.org/abs/2603.04235. arXiv:2603.04235.

José A. R. Fonollosa. Minimum modulus for the unique multiset-sum problem, 2026. URL https://arxiv.org/abs/2607.08366. arXiv:2607.08366.

Juliane Trianon Fraga and Vinicius de Oliveira Rodrigues. The Wallace problem and countably compact torsion-free Abelian groups in ZFC, 2026. URL https://arxiv.org/abs/2608.17317. arXiv:2608.17317.

Sophie Frisch and Leonid Vaserstein. Parametrization of Pythagorean triples by a single triple of polynomials. *Journal of Pure and Applied Algebra*, 212(1):271–274, 2008. doi: 10.1016/j.jpaa.2007.05.019. URL https://doi.org/10.1016/j.jpaa.2007.05.019.

Weibo Fu, Yanjun Han, Guanyang Wang, Jun Yan, Peng Zhang, and Zhengqing Zhou. Sharp small-deviation inequalities for sums of independent nonnegative random variables, 2026. URL https://arxiv.org/abs/2607.23980.

Giles Gardam. A counterexample to the unit conjecture for group rings. *Annals of Mathematics*, 194 (3), 2021. doi: 10.4007/annals.2021.194.3.9. URL https://doi.org/10.4007/annals.2021.194.3.9.

C. Geiger. Singular Moduli and the Ideal Class Group, 2020. URL https://github.com/ElodinLaarz/lean-thesis. MSc thesis, University of Washington; bibliographic description retained in the formalization repository.

Dan R. Ghica, George Kaye, and David Sprunger. A Complete Theory of Sequential Digital Circuits: Denotational, Operational and Algebraic Semantics, 2022. URL https://arxiv.org/abs/2201.10456. arXiv:2201.10456.

Juan Pablo Traverso Gianini. Affine Profile Reduction for Fractional Triangle Packings in Split Graphs, 2026a. URL https://github.com/jtraverso/erdos-81-chordal-clique-partitions/blob/main/preprints/PAPER_I/01_manuscript/PAPER_I_preprint_v1.3_en.pdf. Preprint v1.3; Erdős Problem #81 series, Paper I.

Juan Pablo Traverso Gianini. Complete-Split Extremizers for a Fractional Triangle-Cover Functional on Chordal Graphs, 2026b. URL https://github.com/jtraverso/erdos-81-chordal-clique-partitions/blob/main/preprints/PAPER_II/01_manuscript/PAPER_II_preprint_v1.2_en.pdf. Preprint v1.2; Erdős Problem #81 series, Paper II.

Juan Pablo Traverso Gianini. Linear-Error Clique Partitions of Split Graphs via Structured Triangle Packing, 2026c. URL https://github.com/jtraverso/erdos-81-chordal-clique-partitions/blob/main/preprints/PAPER_III/01_manuscript/PAPER_III_preprint_v1.5_en.pdf. Preprint v1.5; Erdős Problem #81 series, Paper III.

Madeleine Gignoux. Proofs as Coalgebras, 2026. URL https://eprints.illc.uva.nl/id/eprint/2423/. Master's thesis, ILLC MoL-2026-07.

Philippe Gille and Tamás Szamuely. *Central Simple Algebras and Galois Cohomology*. Cambridge University Press, 2017. doi: 10.1017/9781316661277. URL https://doi.org/10.1017/9781316661277.

Kurt Gödel. Über formal unentscheidbare Sätze der Principia Mathematica und verwandter Systeme I. *Monatshefte für Mathematik und Physik*, 38-38(1):173–198, 1931. doi: 10.1007/BF01700692. URL https://doi.org/10.1007/BF01700692.

W. T. Gowers, Ben Green, Freddie Manners, and Terence Tao. On a conjecture of Marton, 2023. URL https://arxiv.org/abs/2311.05762. arXiv:2311.05762.

W. T. Gowers, Ben Green, Freddie Manners, and Terence Tao. Marton's Conjecture in abelian groups with bounded torsion, 2024. URL https://arxiv.org/abs/2404.02244. arXiv:2404.02244.

GPT-5.4 Pro. A constant-factor lower bound for $H(n)$, 2026. URL https://github.com/math-inc/FrontierMathOpen-Hypergraphs/blob/main/paper/input.tex. Manuscript; author attribution reproduced from the title page.

GPT-6 Pro. Pattern complexity and Nivat's conjecture, 2026. URL https://github.com/boonsuan/nivat/blob/84fe839635bdebb7d5e80c209b4f578a0c767fcf/paper/nivat.pdf.

Ronald L. Graham, Donald E. Knuth, and Oren Patashnik. *Concrete Mathematics: A Foundation for Computer Science*. Addison-Wesley, 1994. URL https://cs.stanford.edu/~knuth/gkp.html. Second edition, Addison-Wesley.

Dhruv Gupta. *A Textbook of Formal Learning Theory*. Repository textbook, 2026. URL https://github.com/Zetetic-Dhruv/formal-learning-theory-book. Repository textbook.

W. H. Gustafson. What is the Probability that Two Group Elements Commute? *The American Mathematical Monthly*, 80(9):1031–1034, 1973. doi: 10.1080/00029890.1973.11993437. URL https://doi.org/10.1080/00029890.1973.11993437.

Richard K. Guy. Sets of Integers Whose Subsets Have Distinct Sums. North-Holland Mathematics Studies, 1982. URL https://doi.org/10.1016/S0304-0208(08)73500-X.

L.H. Harper. Optimal numberings and isoperimetric problems on graphs. *Journal of Combinatorial Theory*, 1(3):385–393, 1966. doi: 10.1016/S0021-9800(66)80059-5. URL https://doi.org/10.1016/S0021-9800(66)80059-5.

Scott Harper and Peiran Wu. Classifying the groups of order pq in Lean, 2025. URL https://arxiv.org/abs/2501.09769. arXiv:2501.09769.

Robin Hartshorne. *Algebraic Geometry*. Springer New York, 1977. doi: 10.1007/978-1-4757-3849-0. URL https://doi.org/10.1007/978-1-4757-3849-0.

Allen Hatcher. *Algebraic Topology*. Cambridge University Press, 2002. URL https://pi.math.cornell.edu/~hatcher/AT/AT.pdf. Cambridge University Press; imported source concerns graphs and free groups.

Alan Haynes and Juan J. Ramirez. Higher dimensional gap theorems for the maximum metric, 2020. URL https://arxiv.org/abs/2010.08842. arXiv:2010.08842.

D. R. Heath-Brown. Lectures on sieves, 2002. URL https://arxiv.org/abs/math/0209360. arXiv:math/0209360.

Chris Heunen, Ohad Kammar, Sam Staton, and Hongseok Yang. A convenient category for higher-order probability theory. 2017 32nd Annual ACM/IEEE Symposium on Logic in Computer Science (LICS), 2017. URL https://doi.org/10.1109/LICS.2017.8005137.

Boon Suan Ho. A 4AP-free permutation of the positive integers, 2026. URL https://arxiv.org/abs/2609.12780. arXiv:2609.12780.

Boon Suan Ho and Tomasz Kania. Halving the original Kalton–Roberts upper bound for nearly additive set functions, 2026. URL https://arxiv.org/abs/2606.06807. arXiv:2606.06807.

Lawrence Hollom. The Aharoni–Korman conjecture is false, 2024. URL https://arxiv.org/abs/2411.16844. arXiv:2411.16844.

RUPERT HÖLZL, SÖREN KLEINE, and FRANK STEPHAN. IMPROVED LOWER BOUNDS FOR STRONG n-CONJECTURES. *Journal of the Australian Mathematical Society*, 119(1):61–81, 2025. doi: 10.1017/S1446788725000084. URL https://doi.org/10.1017/S1446788725000084.

Jiewen Hu, Thomas Zhu, and Sean Welleck. miniCTX: Neural theorem proving with (long-)contexts. In *International Conference on Learning Representations*, 2025. URL https://proceedings.iclr.cc/paper_files/paper/2025/hash/1b5ef7bcc702a0232b4f1aea2523d0d2-Abstract-Conference.html.

Hao Huang. Induced subgraphs of hypercubes and a proof of the Sensitivity Conjecture. *Annals of Mathematics*, 190(3), 2019. doi: 10.4007/annals.2019.190.3.6. URL https://doi.org/10.4007/annals.2019.190.3.6.

S. D. Hughes. Powerful parts of consecutive integers and Davenport–Zannier polynomials, n.d. URL https://github.com/scottdhughes/erdos367. Companion paper identified in repository README; no separate publication record supplied.

James E. Humphreys. *Introduction to Lie Algebras and Representation Theory*. Springer New York, 1972. doi: 10.1007/978-1-4612-6398-2. URL https://doi.org/10.1007/978-1-4612-6398-2.

Norbert Hungerbühler and Micha Wasem. Non-Integer Valued Winding Numbers and a Generalized Residue Theorem. *Journal of Mathematics*, 2019:1–9, 2019. doi: 10.1155/2019/6130464. URL https://doi.org/10.1155/2019/6130464.

Adolf Hurwitz. Über die Composition der quadratischen Formen von beliebig vielen Variablen, n.d. URL https://eudml.org/doc/58420. Documentation.

IEEE Standard for Floating-Point Arithmetic. IEEE Standard for Floating-Point Arithmetic, 2019. URL https://doi.org/10.1109/IEEESTD.2019.8766229. Standard.

Vasily Ilin. Semi-Autonomous Formalization of the Vlasov-Maxwell-Landau Equilibrium, 2026. URL https://arxiv.org/abs/2603.15929. arXiv:2603.15929.

Vasily Ilin and Brian Nugent. Sorries Are Not the Hard Part: An Expert-Review Case Study of a Semi-Autonomous Formalization, 2026. URL https://arxiv.org/abs/2606.13925. arXiv:2606.13925.

Michael Behzat Ali Inal. The Exact Minimum Order for Unique Multiset Sums in Finite Abelian Groups, 2026. URL https://doi.org/10.17605/OSF.IO/C58Q9.

Thomas Jech. *Set Theory*. Springer Berlin Heidelberg, 2003. doi: 10.1007/3-540-44761-X. URL https://doi.org/10.1007/3-540-44761-X.

Mingrui Jing, Lei Zhang, Yusheng Zhao, Hongshun Yao, and Xin Wang. An Agentic Formalization for Certified Quantum Neural Network Design, 2026. URL https://arxiv.org/abs/2607.12981. arXiv:2607.12981.

William B. Johnson and Joram Lindenstrauss. Extensions of Lipschitz mappings into a Hilbert space. Contemporary Mathematics, 1984. URL https://doi.org/10.1090/conm/026/737400.

Victor G. Kac. *Infinite-Dimensional Lie Algebras*. Cambridge University Press, 1990. doi: 10.1017/CBO9780511626234. URL https://doi.org/10.1017/CBO9780511626234.

Todd Kemp. Math 247A: Introduction to Random Matrix Theory, n.d. URL https://www.math.ucsd.edu/~tkemp/247A.Notes.pdf. Lecture notes.

keston. no-way-labs/lean-critical-portraits: lean-critical-portraits, 2026. URL https://doi.org/10.5281/zenodo.20737896. Software.

Tyson Klingner, Drew Bladek, Escher Crawford, Bohao Chen, Ariel Fu, Kaira Nair, Jarod Alper, Giovanni Inchiostro, and Vasily Ilin. Evaluation of LLMs for Mathematical Formalization in Lean, 2026. URL https://arxiv.org/abs/2606.05632. arXiv:2606.05632.

Adarsh Kumarappan, Mo Tiwari, Peiyang Song, Robert Joseph George, Chaowei Xiao, and Anima Anandkumar. LeanAgent: Lifelong learning for formal theorem proving. In *International Conference on Learning Representations*, 2025. URL https://openreview.net/forum?id=Uo4EHT4ZZ8.

Ernst Eduard Kummer. Über die Ergänzungssätze zu den allgemeinen Reciprocitätsgesetzen. *Journal für die reine und angewandte Mathematik (Crelles Journal)*, 1852(44):93–146, 1852. doi: 10.1515/crll.1852.44.93. URL https://doi.org/10.1515/crll.1852.44.93.

Kenneth Kunen. Elementary embeddings and infinitary combinatorics. *Journal of Symbolic Logic*, 36 (3):407–413, 1971. doi: 10.2307/2269948. URL https://doi.org/10.2307/2269948.

Dirk Kunert. Period Length Formulas for Rational Cut-and-Project Strip Projections: Multiset and Set Cases, 2026a. URL https://github.com/dkunert/cut-and-project/blob/main/LaTeX/rational_cut_and_project_gap_periods.tex. Manuscript.

Dirk Kunert. A Lean 4 Formalization of the Three-Gap (Steinhaus) Theorem, Uniform in the Rotation Number, 2026b. URL https://github.com/dkunert/three-gap-theorem-lean/blob/main/paper/three_gap_theorem_lean.tex. Manuscript.

Simon Kurgan, Evan Wang, Eric Leonen, Sophie Szeto, Luke Alexander, Artemii Remizov, Jarod Alper, Giovanni Inchiostro, and Vasily Ilin. TheoremGraph: Bridging Formal and Informal Mathematics, 2026. URL https://arxiv.org/abs/2606.25363. arXiv:2606.25363.

T. Y. Lam. *A First Course in Noncommutative Rings*. Springer New York, 2001. doi: 10.1007/978-1-4419-8616-0. URL https://doi.org/10.1007/978-1-4419-8616-0.

Youness Lamzouri. A new proof that more than $2/3$ of the zeros of the Riemann zeta function are simple and on the critical line, 2026. URL https://arxiv.org/abs/2609.02882. arXiv:2609.02882.

Lean FRO. Reservoir: Package repository for Lean and Lake, 2026. URL https://github.com/leanprover/reservoir/blob/a5774ea3b51fef4a496f35c791cfa660c914454f/README.md. Repository revision a5774ea; accessed September 11, 2026.

Lean Mathematical Library Community. Contributing to Mathlib, 2026. URL https://leanprover-community.github.io/contribute/index.html. Accessed September 12, 2026.

Lean Pool contributors. Lean Pool continuous integration and quality rules, 2026. URL https://github.com/Vilin97/lean-pool/tree/9e51418621fcd2050d89dd5cfe593abc9a3976d4/.github.

LeanMachineLearning contributors. Exposition / referee: Tools to explain the content of a Lean library, 2026. URL https://github.com/LeanMachineLearning/exposition/tree/4f43fed3fa5a6f55ef6daf848f5a1b9dd348b0cf. Repository revision 4f43fed; accessed September 11, 2026.

Hua-Chieh Li. Arboreal Galois representation for a certain type of quadratic polynomials. *Archiv der Mathematik*, 114(3):265–269, 2019. doi: 10.1007/s00013-019-01390-x. URL https://doi.org/10.1007/s00013-019-01390-x.

Hua-Chieh Li. On Stoll's criterion for the maximality of quadratic arboreal Galois representations. *Archiv der Mathematik*, 117(2):133–140, 2021. doi: 10.1007/s00013-021-01609-w. URL https://doi.org/10.1007/s00013-021-01609-w.

Xiaoyu Li, Andi Han, Jiaojiao Jiang, and Junbin Gao. Characterizing Language Generation in the Limit: Finite Witnesses and a Separation-Width Hierarchy, 2026. URL https://arxiv.org/abs/2609.10525. arXiv:2609.10525.

Jyun-Jie Liao. Improved Exponent for Marton's Conjecture in $\mathbb{F}_2^n$, 2024. URL https://arxiv.org/abs/2404.09639. arXiv:2404.09639.

Haowei Lin and Shanda Li. Settling the Optimal Exponent Relating Sumsets and Difference Sets, 2026. URL https://arxiv.org/abs/2607.27199. arXiv:2607.27199.

Joram Lindenstrauss and Lior Tzafriri. *Classical Banach Spaces I and II*. Springer Berlin Heidelberg, 1996. doi: 10.1007/978-3-662-53294-2. URL https://doi.org/10.1007/978-3-662-53294-2.

Junqi Liu, Jujian Zhang, and Lihong Zhi. A Formal Proof of the Irrationality of $\zeta(3)$ in Lean 4, 2025a. URL https://arxiv.org/abs/2503.07625. arXiv:2503.07625.

Qi Liu, Xinhao Zheng, Xudong Lu, Qinxiang Cao, and Junchi Yan. Rethinking and improving autoformalization: Towards a faithful metric and a dependency retrieval-based approach. In *International Conference on Learning Representations*, 2025b. URL https://proceedings.iclr.cc/paper_files/paper/2025/hash/d630537fc4402cfa3ebbc7450a0cac91-Abstract-Conference.html.

Jianqiao Lu, Yingjia Wan, Yinya Huang, Jing Xiong, Zhengying Liu, and Zhijiang Guo. FormalAlign: Automated alignment evaluation for autoformalization. In *International Conference on Learning Representations*, 2025. URL https://proceedings.iclr.cc/paper_files/paper/2025/hash/fceedf8c9c0ff51f41b9fe0294ef0070-Abstract-Conference.html.

Xiaokun Luan, David Sanan, Zhe Hou, Qiyuan Xu, Chengwei Liu, Yufan Cai, Yang Liu, and Meng Sun. Why the proof fails in different versions of theorem provers: An empirical study of compatibility issues in Isabelle. *Proceedings of the ACM on Software Engineering*, 2(FSE): 1499–1521, 2025. doi: 10.1145/3715787. URL https://doi.org/10.1145/3715787.

Judith Ludwig and Christian Merten. Formalising the Bruhat-Tits Tree. *Annals of Formalized Mathematics*, Volume 2, 2026. doi: 10.46298/afm.15738. URL https://doi.org/10.46298/afm.15738.

Didrik Lundberg, Roberto Guanciale, Andreas Lindner, and Mads Dam. Hoare-Style Logic for Unstructured Programs. Lecture Notes in Computer Science, 2020. URL https://doi.org/10.1007/978-3-030-58768-0_11.

Carlin MacKenzie, Jacques Fleuriot, and James Vaughan. An evaluation of the archive of formal proofs, 2021. URL https://arxiv.org/abs/2104.01052.

Sven Manthe. A formalization of Borel determinacy in Lean. *Annals of Formalized Mathematics*, 2, 2026. doi: 10.46298/afm.15202. URL https://doi.org/10.46298/afm.15202.

David Marker. *Lectures on Infinitary Model Theory*. Cambridge University Press, 2016. doi: 10.1017/CBO9781316855560. URL https://doi.org/10.1017/CBO9781316855560.

Mathlib contributors. Mathlib continuous integration and build benchmarks, 2026. URL https://github.com/leanprover-community/mathlib4/tree/de5ce8a9a66a4aa68a9bdbb35b63a06d34d9ca11/.github/workflows.

Theodore Meek, Siyuan Ge, Di Qiu Xiang, Simon Chess, and Vasily Ilin. Formalizing Numerical Analysis: An Agent Pipeline and Quality Audit Beyond Kernel Acceptance, 2026. URL https://arxiv.org/abs/2606.14000. arXiv:2606.14000.

Lorenz Milla. A detailed proof of the Chudnovsky formula with means of basic complex analysis – Ein ausführlicher Beweis der Chudnovsky-Formel mit elementarer Funktionentheorie, 2018. URL https://arxiv.org/abs/1809.00533. arXiv:1809.00533.

Joseph K. Miller. A Formalization of the Mean-Field Derivation of the Vlasov Equation, 2026. URL https://arxiv.org/abs/2607.08986. arXiv:2607.08986.

Alexey Milovanov. Robust Harper Stability at the Exponential Scale, 2026. URL https://github.com/AlexeyMilovanov/BooleanIsoperimetry/blob/main/docs/robust-harper-stability-at-the-exponential-scale.pdf. Manuscript.

Paul Monsky. On Dividing A Square Into Triangles. *The American Mathematical Monthly*, 77(2): 161–164, 1970. doi: 10.2307/2317329. URL https://doi.org/10.2307/2317329.

Carles Marín Muñoz. What Order a Method Knows: certified Runge–Kutta order conditions over rooted trees, machine-checked in Lean 4, 2026a. URL https://doi.org/10.5281/zenodo.20787666.

Carles Marín Muñoz. How a Tree Remembers Its Cuts: the Connes–Kreimer–Foissy Hopf Algebra of Rooted Trees, Machine-Checked in Lean 4, 2026b. URL https://doi.org/10.5281/zenodo.20762280.

Carles Marín Muñoz. How a Tree Forgets Its Order: the Eulerian idempotent and the Adams spectrum on the commutative Connes–Kreimer–Butcher Hopf algebra of rooted trees, machine-checked in Lean 4, 2026c. URL https://doi.org/10.5281/zenodo.20774821.

Gábor P. Nagy and Attila Vajda. On a conjecture on the Kasami APN function: reductions, structure theorems, a proof for $k \bmod n \in \{1, 2, n-2, n-1\}$, and exhaustive verification for $n \leq 13$, 2026. URL https://arxiv.org/abs/2608.18584. arXiv:2608.18584.

John F. Nash. Equilibrium points in n -person games. *Proceedings of the National Academy of Sciences*, 36(1):48–49, 1950. doi: 10.1073/pnas.36.1.48. URL https://doi.org/10.1073/pnas.36.1.48.

Jürgen Neukirch. *Algebraic Number Theory*. Springer Berlin Heidelberg, 1999. doi: 10.1007/978-3-662-03983-0. URL https://doi.org/10.1007/978-3-662-03983-0.

Ivan Niven. The Transcendence of π. *The American Mathematical Monthly*, 46(8):469–471, 1939. doi: 10.1080/00029890.1939.11998903. URL https://doi.org/10.1080/00029890.1939.11998903.

Russell O'Connor. Certified Exact Transcendental Real Number Computation in Coq. Lecture Notes in Computer Science, 2008. URL https://doi.org/10.1007/978-3-540-71067-7_21.

Ryan O'Donnell. *Analysis of Boolean Functions*. Cambridge University Press, 2014. doi: 10.1017/CBO9781139814782. URL https://doi.org/10.1017/CBO9781139814782.

Monica Abu Omar. On quantum graph theory: non-commutative graph theory, 2026. URL https://theses.gla.ac.uk/85721/. MPhil(R) thesis, University of Glasgow.

OpenAI. Finite Time Blowup for the Euler Equation, 2026a. URL https://cdn.openai.com/pdf/315b36cd-ec98-4023-8342-93345194ece1/euler.pdf.

OpenAI. Finite Time Blowup for Navier–Stokes, 2026b. URL https://cdn.openai.com/pdf/32d9f210-8b73-45e0-91bc-82a30aef8a9a/navier-stokes.pdf. Research manuscript.

OpenAI. On the Navier–Stokes millennium prize problem, 2026c. URL https://openai.com/index/navier-stokes-solution/. September 8, 2026. Companion Lean formalization and verification report.

OpenAI. Ten advances in mathematics and theoretical computer science: Research release, 2026d. URL https://openai.com/index/ten-advances-in-mathematics/. August 1, 2026. Companion Lean formalizations and account of their production.

OpenAI. Improved Long Gaps Between Primes, 2026e. URL https://cdn.openai.com/pdf/51126fac-1b68-4128-9666-c908bcc16033/long_gaps.pdf. Manuscript.

OpenAI. Ten Advances in Mathematics and Theoretical Computer Science, 2026f. URL https://cdn.openai.com/pdf/ten-proofs-oai.pdf. Manuscript.

Lior Pachter. Optimal pebbling of the hypercube, 2026. URL https://arxiv.org/abs/2606.01685. arXiv:2606.01685.

Palomar Registry. About Palomar: Registration, verification, and versioning policy, 2026. URL https://palomar-registry.org/about.html. Accessed September 12, 2026.

Partial Combinatory Algebras. Partial Combinatory Algebras. Studies in Logic and the Foundations of Mathematics, 2008. URL https://doi.org/10.1016/S0049-237X(08)80003-1.

Jaan Parts. The chromatic number of the plane is at least 5 – a human-verifiable proof, 2020. URL https://arxiv.org/abs/2010.12661. arXiv:2010.12661.

Yann Pequignot. Towards better: A motivated introduction to better-quasi-orders. *EMS Surveys in Mathematical Sciences*, 4(2):185–218, 2017. doi: 10.4171/EMSS/4-2-2. URL https://doi.org/10.4171/EMSS/4-2-2.

Karl E. Petersen. *Ergodic Theory*. Cambridge University Press, 1983. doi: 10.1017/CBO9780511608728. URL https://doi.org/10.1017/CBO9780511608728.

Nathan Pflueger. An extended Demazure product on integer permutations via min-plus matrix multiplication, 2022. URL https://arxiv.org/abs/2206.14227. arXiv:2206.14227.

Auguste Poiroux, Gail Weiss, Viktor Kunčak, and Antoine Bosselut. Reliable evaluation and benchmarks for statement autoformalization. In *Proceedings of the 2025 Conference on Empirical Methods in Natural Language Processing*, pp. 17947–17969, 2025. doi: 10.18653/v1/2025.emnlp-main.907. URL https://aclanthology.org/2025.emnlp-main.907/.

Georges Poitou. Sur les petits discriminants, n.d. URL https://www.numdam.org/item/SDPP_1976-1977__18_1_A6_0/. Documentation.

Fernando Portela. Variational Optimisation of Spectral Sieve Quotients for Primes in Bounded Symmetric Intervals, 2026. URL https://doi.org/10.5281/zenodo.19763833.

Emily Riehl. *Category Theory in Context*. Dover Publications, 2016. URL https://emilyriehl.github.io/files/context.pdf. Dover Publications.

Talia Ringer, RanDair Porter, Nathaniel Yazdani, John Leo, and Dan Grossman. Proof repair across type equivalences. In *Proceedings of the 42nd ACM SIGPLAN International Conference on Programming Language Design and Implementation*, pp. 112–127. ACM, 2021. doi: 10.1145/3453483.3454033. URL https://dependenttyp.es/pdf/repair.pdf.

Aluna Rizzoli and Adam R. Thomas. Common neighbour conjectures for Saxl graphs fail at every base size, 2026a. URL https://arxiv.org/abs/2609.01367. arXiv:2609.01367.

Aluna Rizzoli and Adam R. Thomas. Computational source code and Lean formalization for Common neighbour conjectures for Saxl graphs fail at every base size, 2026b. URL https://doi.org/10.5281/zenodo.22231393. Software.

Rocq Platform contributors. The Rocq Platform: Guiding principles, 2026. URL https://rocq-prover.org/platform/platform-principles. Accessed September 11, 2026.

S M Nazmuz Sakib. Carry-Run Theorem and Sakib Index for the Exact Distribution of $\nu_p\binom{2n}{n}$ over n mod p^k, 2026. URL https://doi.org/10.33774/coe-2026-1w9zm. Cambridge Open Engage working paper.

Óscar Álvarez Sánchez. Demazure operators and Lean, 2024. URL https://bolito2.github.io/DemazureOperatorsLean/master_thesis.pdf. Master's thesis, University of Bonn.

I. J. Schoenberg. Remarks to Maurice Frechet's Article "Sur La Definition Axiomatique D'Une Classe D'Espace Distances Vectoriellement Applicable Sur L'Espace De Hilbert. *The Annals of Mathematics*, 36(3):724, 1935. doi: 10.2307/1968654. URL https://doi.org/10.2307/1968654.

Dana S. Scott. Domains for denotational semantics. Lecture Notes in Computer Science, 1982. URL https://doi.org/10.1007/BFb0012801.

Jean-Pierre Serre. Une formule de masse pour les extensions totalement ramifiées de degré donné d'un corps local. *Comptes Rendus de l'Académie des Sciences, Série A*, 286:1031–1036, 1978. URL https://gallica.bnf.fr/ark:/12148/bpt6k6234149b/f323.item.

Jean-Pierre Serre. *Trees*. Springer Berlin Heidelberg, 1980. doi: 10.1007/978-3-642-61856-7. URL https://doi.org/10.1007/978-3-642-61856-7.

Daniyar S. Shamkanov. Interpolation properties for provability logics GL and GLP. *Proceedings of the Steklov Institute of Mathematics*, 274(1):303–316, 2011. doi: 10.1134/S0081543811060198. URL https://doi.org/10.1134/S0081543811060198.

C. E. Shannon. A Mathematical Theory of Communication. *Bell System Technical Journal*, 27 (3):379–423, 1948. doi: 10.1002/j.1538-7305.1948.tb01338.x. URL https://doi.org/10.1002/j.1538-7305.1948.tb01338.x.

Zhaiming Shen and Lasse Rempe-Gillen. The exponential map is chaotic: An invitation to transcendental dynamics, 2014. URL https://arxiv.org/abs/1408.1129. arXiv:1408.1129.

Leon Simon. *Theorems on Regularity and Singularity of Energy Minimizing Maps*. Birkhäuser Basel, 1996. doi: 10.1007/978-3-0348-9193-6. URL https://doi.org/10.1007/978-3-0348-9193-6.

Libor Šnobl and Pavel Winternitz. *Classification and Identification of Lie Algebras*. American Mathematical Society, 2014. doi: 10.1090/crmm/033. URL https://doi.org/10.1090/crmm/033.

Michael Stoll. Galois groups over $\mathbb{Q}$ of some iterated polynomials. *Archiv der Mathematik*, 59(3):239–244, 1992. doi: 10.1007/BF01197321. URL https://doi.org/10.1007/BF01197321.

Jenő Szigeti and Leon vanWyk. A Constructive Elementary Proof of the Skolem-Noether Theorem for Matrix Algebras. *The American Mathematical Monthly*, 124(10):966, 2017. doi: 10.4169/amer.math.monthly.124.10.966. URL https://doi.org/10.4169/amer.math.monthly.124.10.966.

Ferenc Szöllősi and Patric R.J. Östergård. Constructions of Maximum Few-Distance Sets in Euclidean Spaces. *The Electronic Journal of Combinatorics*, 27(1), 2020. doi: 10.37236/8565. URL https://doi.org/10.37236/8565.

Tau Ceti contributors. Tau Ceti build and performance workflows, 2026. URL https://github.com/TauCetiProject/TauCeti/tree/d3e20db1f65d3e99bc186ccb7ea2978baab9024b/.github/workflows.

Tau Ceti Project. Tau Ceti: A Lean library downstream of Mathlib, 2026. URL https://github.com/TauCetiProject/TauCeti/blob/68c7e99191f2ebfe5a0b7ef6949eb6025ff9f3c1/README.md. Repository revision 68c7e99; accessed September 11, 2026.

The mathlib Community. The Lean mathematical library. In *Proceedings of the 9th ACM SIGPLAN International Conference on Certified Programs and Proofs*, pp. 367–381. ACM, 2020. doi: 10.1145/3372885.3373824. URL https://leanprover-community.github.io/papers/mathlib-paper.pdf.

William P. Thurston, Hyungryul Baik, Yan Gao, John H. Hubbard, Tan Lei, Kathryn A. Lindsey, and Dylan P. Thurston. Degree-d-invariant laminations, 2019. URL https://arxiv.org/abs/1906.05324. arXiv:1906.05324.

Phuc Tran and Van Vu. A Short Proof of Kahn-Kalai Conjecture. *The Electronic Journal of Combinatorics*, 31(3), 2024. doi: 10.37236/12266. URL https://doi.org/10.37236/12266.

Nikolay Ulyanov. Graph Puzzles III.1: A proof of Sabidussi's compatibility conjecture, n.d. URL https://github.com/gexahedron/sabidussi-lean/blob/032e640df0cc41d4d3d217f7c68628ab19cb3767/sabidussi_proof.pdf. Manuscript.

Matthijs Vákár, Ohad Kammar, and Sam Staton. A Domain Theory for Statistical Probabilistic Programming, 2018. URL https://arxiv.org/abs/1811.04196. arXiv:1811.04196.

Wouter Cames van Batenburg and Samuel Korsky. Asymptotically attaining the Moore bound, 2026. URL https://arxiv.org/abs/2608.03965. arXiv:2608.03965.

Tony van Ravenstein. The Three Gap Theorem (Steinhaus Conjecture). *Journal of the Australian Mathematical Society. Series A. Pure Mathematics and Statistics*, 45(3):360–370, 1988. doi: 10.1017/S1446788700031062. URL https://doi.org/10.1017/S1446788700031062.

Moshe Y. Vardi. An automata-theoretic approach to linear temporal logic. Lecture Notes in Computer Science, 1996. URL https://doi.org/10.1007/3-540-60915-6_6.

Roman Vershynin. *High-Dimensional Probability*. Cambridge University Press, 2026. doi: 10.1017/9781009490672. URL https://doi.org/10.1017/9781009490672.

Evan Wang, Simon Chess, Daniel Lee, Siyuan Ge, Ajit Mallavarapu, Jarod Alper, and Vasily Ilin. Learning to repair Lean proofs from compiler feedback, 2026. URL https://arxiv.org/abs/2602.02990. arXiv preprint.

Glynn Winskel. Event structures. Lecture Notes in Computer Science, 1987. URL https://doi.org/10.1007/3-540-17906-2_31.

Yutong Xin, Qiaochu Chen, Greg Durrett, and Işil Dillig. VeriSoftBench: Repository-scale formal verification benchmarks for Lean, 2026. URL https://arxiv.org/abs/2602.18307.

Kazuyuki Yagasaki. A new proof of Poincaré's result on the restricted three-body problem. *Journal of Mathematical Physics*, 66(5), 2025. doi: 10.1063/5.0266087. URL https://doi.org/10.1063/5.0266087.

Kaiyu Yang, Aidan Swope, Alex Gu, Rahul Chalamala, Peiyang Song, Shixing Yu, Saad Godil, Ryan J. Prenger, and Animashree Anandkumar. LeanDojo: Theorem proving with retrieval-augmented language models. In *Advances in Neural Information Processing Systems*, volume 36, 2023. URL https://proceedings.neurips.cc/paper_files/paper/2023/hash/4441469427094f8873d0fecb0c4e1cee-Abstract-Datasets_and_Benchmarks.html.

Li yao Xia, Yannick Zakowski, Paul He, Chung-Kil Hur, Gregory Malecha, Benjamin C. Pierce, and Steve Zdancewic. Interaction trees: representing recursive and impure programs in Coq. *Proceedings of the ACM on Programming Languages*, 4(POPL):1–32, 2019. doi: 10.1145/3371119. URL https://doi.org/10.1145/3371119.

Jiaying Ye, Samarth Rao, Leo Carlin, Kedar Chintalapati, Saharsh Bhargava, Rachit Jaiswal, Michael Zhou, Jared Darlington, Jiahe Lu, Jarod Alper, Vasily Ilin, and Henry Kvinge. Does My Embedding Reflect That $A = B$? Evaluating Mathematical Equivalence in Embedding Models, 2026a. URL https://arxiv.org/abs/2606.23959. arXiv:2606.23959.

Yinyu Ye, Michael J. Todd, and Shinji Mizuno. An O($\sqrt{}$nL)-Iteration Homogeneous and Self-Dual Linear Programming Algorithm. *Mathematics of Operations Research*, 19(1):53–67, 1994. doi: 10.1287/moor.19.1.53. URL https://doi.org/10.1287/moor.19.1.53.

Zhe Ye, Hantao Lou, Yuechun Sun, Peiyang Song, Zhengxu Yan, Timothe Kasriel, Qingyang Zhang, Kaiyu Yang, Soonho Kong, Jingxuan He, and Dawn Song. Vero: Can AI agents build formally verified software repositories?, 2026b. URL https://arxiv.org/abs/2608.13522.

Amir Zandieh, Majid Daliri, and Insu Han. QJL: 1-Bit Quantized JL Transform for KV Cache Quantization with Zero Overhead, 2024. URL https://arxiv.org/abs/2406.03482. arXiv:2406.03482.

Ke Zhang, Patricio Gallardo Candela, Sudhir Murthy, Yi Xie, Zhi Wang, and Maziar Raissi. Beyond compilation: Evaluating faithful natural-language-to-Lean statement formalization, 2026a. URL https://arxiv.org/abs/2606.31002v2. arXiv preprint, version 2, September 3, 2026.

Lei Zhang, Yusheng Zhao, Hongshun Yao, and Xin Wang. Building Shor's Algorithm in Lean: An Agentic Formalization of Quantum Attacks on RSA-2048 and P-256, 2026b. URL https://arxiv.org/abs/2607.14082. arXiv:2607.14082.

Shangtong Zhang. Towards Formalizing Reinforcement Learning Theory: A Robbins-Siegmund Approach, 2025. URL https://arxiv.org/abs/2511.03618. arXiv:2511.03618.

Zhen Zhang and R.W. Yeung. On characterization of entropy function via information inequalities. *IEEE Transactions on Information Theory*, 44(4):1440–1452, 1998. doi: 10.1109/18.681320. URL https://doi.org/10.1109/18.681320.

Shuoxing Zhou. ICC property (T) groups without W*-superrigidity, 2026. URL https://arxiv.org/abs/2608.02327. arXiv:2608.02327.

A Observation scope and measurement methods

The archive and its automation repository continue to change. Table 10 identifies the observations analyzed in this paper. Source revisions, original PR URLs, raw measurements, and analysis inputs are retained with the artifact. The full project/publication concordance follows in Appendix I.

Table 10: Observation periods and populations. The archive, its automation repository, and the exposition site continue to change; these dates specify the source observations and measurements used here.

Evidence	Observation
Archive source census	September 18, 2026, 17:44 UTC
Public PR records	Retrieved September 18, 2026
Structured review-service reports	Last retained report: September 13, 2026
Exposition export	September 18, 2026, 05:32 UTC
LeanEval reuse analysis	Analysis retrieved September 12, 2026
Automation job definitions	Repository revision retrieved September 12, 2026
Build resources	Clean builds measured September 13, 2026 (UTC)
Optimization comparison	Historical revisions rebuilt September 13–14, 2026 (UTC)
Exposition screenshots	Live interface captured September 12, 2026 (Pacific time)

The source census counts physical lines in the completed library, including comments, blank lines, and its scaffold. Contributor counts use PR author accounts classified by GitHub as users and count only merged contributions. They exclude bot accounts. First imports are identified from merge commits against their first parents, avoiding duplicate counts from stacked PRs.

The declaration-command census counts source syntax and excludes examples and compiler-generated auxiliaries. The exposition census counts declarations with source locations and follows auxiliaries when resolving dependencies; it uses a coherent deployed export that precedes the latest source additions. These populations are reported separately. The accepted stable-version migration passed the native combined-library CI build and repository checks. The earlier observation also has a retained independent kernel replay; that replay is not a new check of the current source revision.

Research artifacts. The supplementary archive provides the analysis programs and retained inputs for the reported tables and graphs. It includes build logs and memory samples, review reports, project and publication records, and the historical observations used in the figures. Its reconstruction procedure checks file hashes and regenerates the displays without compiler or model calls.

The research uses model assistance for collection, analysis code, mathematical inspection, and writing. Review-service outputs are identified as model-generated reports. Public-source attribution and the full project bibliography are retained independently of those assessments.

A.1 Changes in the collection

Table 11 identifies the additions since the earlier observation.

The archive also retired the forward-Euler and special-numbers projects through a separate curation PR. Its final record cites the archive's project-size threshold and the textbook scope of the material, respectively. This change is separate from the compiler repairs and is labeled as project retirement in the growth figure.

A.2 Build-resource comparison

Tables 12, 13, and 14 report the retained library comparison and its configuration. These measurements precede the latest imports and do not measure the current archive.

Table 11: Projects added after the earlier source census, ordered by current source size. Provenance is the project-card label. Counts describe the current imported source, including integration changes. The fluid-equation formalization is the largest individual addition. The complete publication concordance supplies attribution and companion papers.

Added project	Provenance	Lean lines
Finite-time breakdown for Navier–Stokes and Euler	AI	641,073
Polynomial-factor hardness of the closest vector problem	mix	135,818
Improved asymptotic bounds for binary and spherical codes	mix	111,290
Jordan–Schönflies theorem	AI	77,482
Quantum parallel repetition	mix	71,855
Ehrhart's sharp volume inequality	mix	56,357
Sharp asymptotic upper bounds for sphere packing	mix	55,712
Infinite counterexamples to Connes's rigidity conjecture	mix	40,198
Existence of a finitely presented non-sofic group	mix	34,900
Craig interpolation and Beth definability for propositional dynamic logic	mix	33,681
The Bollobás–Nikiforov conjecture	AI	15,227
Asymptotically attaining the Moore bound	mix	12,125
Serre's mass formula for totally ramified local-field extensions	AI	8,488
Nivat's conjecture	AI	6,838
Finite witnesses and the width hierarchy for language generation	AI	4,581
Chvátal's conjecture and sharp Boolean correlation	AI	3,811
Chaos and the Julia set of the complex exponential	AI	3,605
BKLO simultaneous perfect matchings and spread matchings	AI	1,845
The optimal exponent relating sumsets and difference sets	AI	1,575
A 4AP-free permutation of the positive integers	human	1,549
The Erdős–Sós conjecture (Erdős Problem 548)	AI	1,333
Bennett–Bernstein, Freedman, and Hoeffding concentration inequalities	AI	1,053
Even graphs are edge-disjoint unions of cycles	AI	768
Finite max-flow / min-cut	AI	714

Table 12: Historical clean library builds on the same Azure host, measured before the latest archive growth. Each library uses its supported dependency versions; this compares the observed revisions without isolating compiler-version effects. Dependencies are prebuilt, and each row recompiles the named library. CPU time sums user and system time across the build. RAM is sampled peak combined proportional resident memory of the build workers, accounting for shared pages. Lean Pool uses less CPU time than Mathlib and more than Tau Ceti, while its peak RAM use exceeds both. Lower arrows denote lower resource use. Configuration and elapsed time appear in Appendix A.2.

Library	Source MLOC	CPU hours ↓	RAM GiB ↓
Lean Pool	1.57	8.82	19.33
Mathlib	2.29	9.50	6.34
Tau Ceti	1.13	5.27	8.19

Table 13: Shared measurement host and repository-supported toolchains. Root-library artifact restoration is disabled, and the measurement checks that every source module is compiled. RAM samples combine the build process group; the observer pauses between scans, so the recorded peak is a sampled peak.

Setting	Value
Host	Azure Linux VM; AMD EPYC 9V45 96-Core Processor
CPU affinity / Lean threads	16 / 16
Physical RAM	125.8 GiB
Pool / Mathlib toolchain	Lean 4.34.0-rc1
Tau Ceti toolchain	Lean 4.34.0-rc2
Dependency preparation	Prebuilt; outside timing
Root library outputs	Absent before each build
Time instrumentation	GNU time; elapsed and aggregate user + system CPU
Memory instrumentation	Summed proportional resident memory of build workers

Table 14: Complete-library build measurements. Runs are sequential, with each library built from absent root outputs and external dependencies prepared outside timing. Compilation inputs are preloaded before the command. Downloading, documentation generation, and linting are excluded. Each row is a single clean build, and the same memory sampling protocol is used for the historical optimization comparisons.

Library	Wall min ↓	CPU hours ↓	RAM GiB ↓
Lean Pool	34.91	8.82	19.33
Mathlib	37.97	9.50	6.34
Tau Ceti	22.85	5.27	8.19

B CI AND PROFILING

Lean Pool builds the combined library, rejects unexpected warnings, checks generated project indexes, runs Mathlib's environment and text-style linters, and applies its repository-specific quality checker. Cold CI builds can be split across project shards; the assembled outputs are followed by a combined-library build and common checks. Python tooling has formatting, linting, and unit-test checks, while workflow checks validate the CI definitions.

The environment linters check simplifier normal forms, unused arguments, declaration types, and structures whose fields are all propositions. Source linters check naming, headers, whitespace, and layout conventions. Tau Ceti records existing exceptions in a baseline and rejects new violations; Pool rejects linter waivers in project content.

Archive-specific rules. Cards must identify authors, a primary source, proof provenance, subject tags, and formal main results paired with informal statements. The source license must be `Apache-2.0` or `MIT`. Registered results must resolve in Lean, and generated cards must agree with the registry. Completed projects cannot contain unfinished proofs, new axioms, unchecked declarations, linter waivers, diagnostic commands, or broad imports of all Mathlib. The environment audit also checks generated declarations for forbidden assumptions and programmatic attempts to change restricted options.

The separate challenge board permits explicit open statements. Their eventual solutions are checked against the registered statements with an independent kernel comparison. This exception does not apply to completed projects.

Profiling. For new files, the Pool profiler reports absolute source size, declaration counts, heartbeats, and elapsed elaboration measurements. For modified files it reports a before/after comparison and a statement-change summary. Heartbeats measure Lean's internal allocation-based computation counter. They complement elapsed time but do not replace a whole-build measurement. The displayed comment can summarize the largest file changes; raw measurements are retained as workflow artifacts.

Table 15: Mechanical checks and performance tooling in the observed repositories, supported by the retained workflow definitions and benchmark documentation (Lean Pool contributors, 2026; Mathlib contributors, 2026; Tau Ceti contributors, 2026). All use library compilation and Mathlib linters. Lean Pool adds project-level admission checks, while Tau Ceti requires a performance comparison for merging; Pool profiling is advisory. Mathlib maintains whole-build benchmark and telemetry infrastructure.

Responsibility	Lean Pool	Mathlib	Tau Ceti
Compilation	Combined archive build; warning rejection	Library build, tests, warning checks	Complete source-tree build; warning and output checks
Declaration lint	Mathlib environment linters	Mathlib lint driver	Mathlib environment linters with a recorded baseline
Source style	Mathlib style checks; no waivers	Source and bibliography style checks	Style and header checks; bounded files
Logical assumptions	Allowed-axiom check and compiled-environment audit	Standard trusted Lean foundations; library review and linting	Allowed-axiom audit of compiled sources
Project governance	Attributed cards, completed results, permissive license, separated content PRs	Review of shared mathematical API	AI-contributed mathematics under trusted governance checks
Resource policy	No content option overrides; source and proof size limits	Library-configured options and reviewed exceptions	No content option overrides; per-process watchdog
Performance	Advisory per-file profiling	Build benchmark and telemetry tooling	Required comparison using hardware instructions or CPU time; advisory heartbeats

Mathlib's build benchmark records whole-build instructions, CPU and elapsed time, peak memory, per-module measurements, and critical build paths. Tau Ceti's performance workflow compares immutable base and head revisions using retired instructions when available and CPU time otherwise. Its trusted measurement harness keeps candidate code separate from the recorded counters. Pool profiling is advisory in the observed configuration, whereas Tau Ceti publishes a required performance status. Table 15 compares the responsibilities of these workflows.

C Daily jobs and contributor participation

The separate Lean Pool automation repository contains maintained prompts and a host runner. The runner refreshes its checkout before execution and prevents duplicate instances of the same job. A configured fallback backend can continue a job after an execution failure. The supplement includes job specifications with account identifiers and local execution paths replaced by configuration placeholders. Job definitions specify responsibilities; they do not establish which model performed each historical contribution.

Dependency bumping is a separate scheduled repository workflow. It detects a release, prepares the updated environment, probes projects, assigns failures to repair agents, and assembles their patches. It then builds the combined archive and creates a draft PR reporting the outcome. Optimization and repair proposals remain subject to the repository checks and maintainer decisions.

C.1 What other contributors have added

Table 17 attributes further contributions to the archive.

Table 16: Daily responsibilities in the maintained automation repository. Discovery jobs prepare attributed imports; review and issue jobs act on existing submissions; optimization jobs improve archived code; announcements connect accepted results to the community. These are job responsibilities, not a census of completed executions. Dependency bumping runs in a separate scheduled repository workflow.

Job	Work performed
Recent discovery	Find recently completed formalizations; check attribution, license, fit, dependencies, and cost; prepare an import PR.
Older discovery	Search the preceding literature and repositories for completed projects missed by recent discovery; apply the same admission checks.
Open-PR review	Inspect current submissions, mathematical references, CI, reviews, and profiling; repair eligible branches or record unresolved issues.
Project optimization	Profile an existing project, shorten proofs or reduce compilation cost, validate the change, and open a PR.
Maintainer issues	Inspect submissions awaiting a maintainer decision; resolve eligible source or metadata problems and retain unresolved decisions.
Announcements	Identify newly accepted projects, check their advertised results, and announce them with attribution while suppressing duplicate posts.

Table 17: Contributions from community submitters through the current observation. Counts cover merged PRs; descriptions summarize the mathematics and tooling in their accepted changes. Project cards separately preserve upstream formalization authorship.

Contributor	Merged PRs	Contributions
lyfar	13	Combinatorics, geometry, and project corrections
jtraverso	7	Convex duality, graph decompositions, matching, flows, and concentration
Lemmy00	2	Pythagorean parametrization; Cramer–Wold
ldct	2	Commuting probability; Chudnovsky formula
AlexeyMilovanov	1	Harper's isoperimetric theorem
ElNando888	1	Krafft sieve
Hydrodynamical	1	Vlasov mean-field limit
dillon-11	1	Lehmer polynomial and Coxeter element
gersh	1	Three-body nonintegrability
jarfo	1	Unique multiset sums
mccorvie	1	Classification of surfaces
rkirov	1	Jacobian of a Riemann surface
vaguiarl	1	Odlyzko bound solution

D STABLE-VERSION MIGRATION

Table 18 follows the latest migration from the original production probe to the accepted integration.

The failed initial repair jobs concerned the graph fundamental-group and incompleteness developments. Subsequent integration repaired the combined source, resolved warnings, and adapted supporting APIs to changed Mathlib interfaces. The PR records strengthened auxiliary hypotheses concerning measurability, sigma-finiteness, and maximality, alongside import and namespace repairs. Its successful build establishes compatibility of the accepted statements; it does not establish equivalence of every declaration type before and after the upgrade. The migration record and successful CI run are retained with the supplement.

Table 19 reports the changes that landed in each upgrade.

Table 18: Production record of the stable-version migration. The initial agent jobs produced repair patches; additional agent-assisted integration addressed remaining build errors, warning changes, and API compatibility. Accepted membership reflects intervening imports and the separately approved project retirements. Source churn compares the merge with its first parent and therefore excludes those unrelated changes. Job success is the workflow status, not a guarantee that its patch completes the combined migration.

Recorded stage	Count
Probe projects	191
Compiler failures	97
Warning only projects	32
Repair jobs	97
Repair jobs succeeded	95
Repair jobs failed	2
Accepted projects	198
Changed files	639
Line churn	5,951

Table 19: Source changes in the accepted dependency upgrades. Churn is added plus removed physical Lean lines. It includes cleanup in projects that already compiled and therefore describes the work that landed rather than the minimum repair. These records provide an observable proxy for maintenance effort; historical monetary charges and human labor were not logged.

Target Lean	Files edited	Lines changed
4.31.0-rc1	825	25,583
4.32.0-rc1	402	5,653
4.33.0-rc1	576	11,690
4.33.0-rc2	585	5,221
4.34.0-rc1	448	4,676
4.34.0	639	5,951

E ACCEPTED OPTIMIZATION CHANGES

The historical optimizations in Table 3 were evaluated against their parent revisions by rebuilding the whole Lean Pool library on the same Azure VM. External dependencies are prepared before timing. The library's own build outputs are removed before each run, and dependency and toolchain inputs are read into memory outside the timed command. The dependency manifest and build configuration are identical within each comparison. Runs are sequential with the same CPU affinity and Lean thread settings.

Table 20 gives the complete build measurements.

Table 20: Complete-library builds underlying the optimization comparison. Each row reports one clean run, with the parent before the accepted change. Pairs whose initial preparation left an external module unbuilt were repeated on both sides after prebuilding it; only corrected pairs are reported. The VM uses the same CPU affinity and Lean thread setting as the library comparison. Dependencies are prebuilt and their compilation inputs preloaded outside timing. CPU hours sum user and system time across the build; RAM is combined proportional resident memory sampled throughout the run. These paired measurements use the historical toolchain for each change, so comparisons are within PRs rather than between different historical archive sizes.

PR	Revision	Lean	Wall min ↓	CPU hours ↓	RAM GiB ↓
117	Before	4.30.0-rc2	5.30	0.96	15.60
	After	4.30.0-rc2	5.25	0.94	15.57
187	Before	4.32.0-rc1	16.11	4.04	26.12
	After	4.32.0-rc1	15.59	3.90	26.85
246	Before	4.32.0-rc1	21.83	5.51	25.95
	After	4.32.0-rc1	23.01	5.81	24.58
338	Before	4.33.0-rc2	30.22	7.66	21.02
	After	4.33.0-rc2	29.13	7.38	20.89
339	Before	4.34.0-rc1	28.46	7.20	19.81
	After	4.34.0-rc1	26.82	6.78	19.55

The measurement script checks that every source module was compiled and that its compiled output exists. It samples the proportional resident memory of the build's process group, counting shared pages proportionally across workers. The same concurrent-memory measure is used for the comparison with Mathlib and Tau Ceti. Source changes include refactoring and deletion of existing declarations as well as shortening proof bodies.

The newer project comparisons in Table 4 retain their original measurement scopes. Restricted-sum proofs use repeated clean project builds with warm dependencies. The fluid-equation refactor uses an interleaved before/after ordering on Azure and adds APIs for downstream reuse. Its measured whole-project compilation time does not decrease, although the retained downstream client comparison uses fewer instructions and less memory. Tactic-import cleanup has differing cache preparation between runs; its source reduction is reported without a timing comparison. These observations are not pooled with the controlled whole-library measurements.

Work under review. Table 21 records the existing benchmark in the open module-and-proof optimization PR, which had not entered the source census.

F PRODUCTION REVIEWS AND AGREEMENT

Table 22 describes agreement within the retained histories of repeatedly reviewed PRs.

Table 23 separates the report types and explicit coverage limitations.

Service evolution and state. The original service used API calls with bounded review input. Its newer Azure configuration uses Codex account quota and partitions large changes into source portions before integrating their findings. The integration stage tracks open questions and requests original

Table 21: An open module-and-proof optimization proposal, separate from the accepted changes. The PR reports a matched historical workload with pinned dependencies and cold project caches on a shared WSL host. These are single runs of the original archive workload; the measured candidate predates later imports and follow-up edits. Retired instructions decrease, while the memory columns distinguish an individual process from sampled concurrent anonymous memory. The latter excludes file-backed mappings and is not the proportional-memory measure used in the Azure comparisons.

Historical workload	Instructions T ↓	Process GiB ↓	Anonymous GiB ↓
Original source	124.499	12.605	13.222
Measured proposal	103.172	2.891	5.594

Table 22: Agreement between retained reports of the same review type. Same-PR comparisons can span changed code and review models. Same-revision comparisons require an explicit matching reviewed commit. Report pairs are dependent when a PR has repeated reviews; agreement describes verdict consistency rather than mathematical correctness.

Comparison	Pairs	Same verdict
Same PR	69	37
Same reviewed revision	0	0

Table 23: Composition of the retained review-service reports. Project, challenge, solution, and refactor reviews follow distinct rubrics. Explicit partial-coverage notices are counted separately and may occur in any category.

Report category	Reports
Project	278
Challenge	7
Solution	2
Refactor	9
Explicitly partial reports	14

source excerpts when needed. A coverage manifest records which source ranges were presented. This describes coverage of the input, not an independent assessment of the model's mathematical accuracy. The workflow was manually disabled before the current observation. Its retained reports therefore describe past executions; they do not establish ongoing coverage of the most recent imports. Free-form daily-agent review comments remain outside the structured report census.

Price accounting. Historical comments expose API-based price estimates. The Azure comments expose nominal Standard-API-equivalent estimates while execution consumes account quota. The latter value input at uncached rates and omit VM costs. They are not invoices. The census retains changed versions of a review when available and deduplicates identical report revisions. Overwritten or unrecorded executions are not recoverable from the retained comments, so totals are prices attached to retained reports rather than the complete expenditure of operating the archive.

G EXPOSITION, DISCOVERY, AND REUSE

Figure 5 follows a main result from the project overview into its formal statement and supporting declarations.

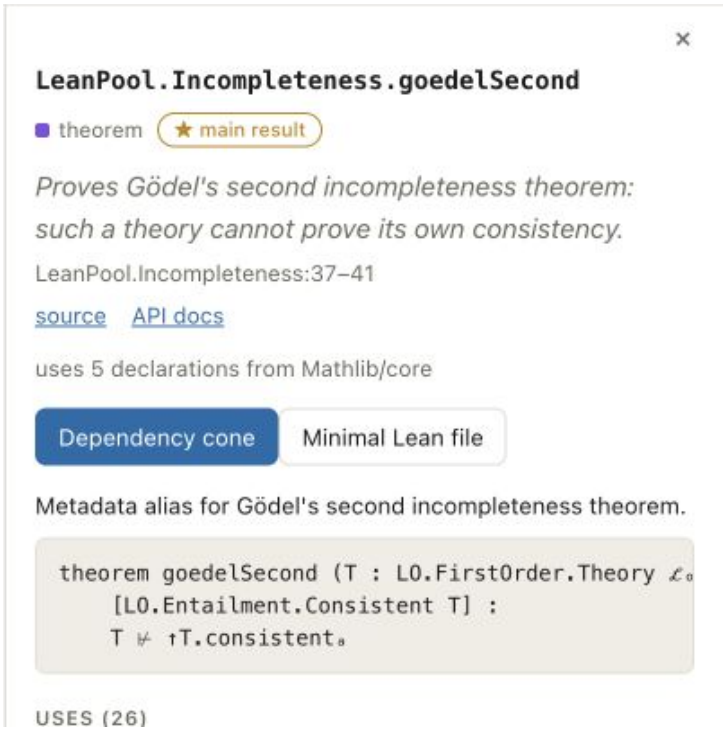

Figure 5: The theorem panel for Gödel's second incompleteness theorem in Exposition. Selecting a headline result opens its informal description, Lean statement, and links to source and API documentation. This close-up shows how the site connects a result in the overview graph to its formal account. Capture dates appear in Table 10.

Maintaining the publication pipeline. The latest documentation changes cache project graph exports by their source, transitive import dependencies, toolchain configuration, and extractor version. A changed dependency invalidates the affected export. Documentation can reuse successful native-CI Lean artifacts only after matching the source revision and verified source tree; otherwise it takes the ordinary build path. Data validation still runs when a cached graph is reused. The retained change includes a focused cache demonstration, but no matched full-pipeline elapsed-time comparison, so the paper makes no aggregate documentation-speedup claim.

G.1 Recorded reuse

Table 24 lists source-level reuse documented in the retained histories.

Table 24: Recorded reuse beyond the archive. The entries distinguish attributed source copying, an explicit package dependency, and use within later projects controlled by the maintainer. These source histories complement the LeanEval declaration-matching analysis.

Consumer	Recorded reuse
Feige development	Copies attributed Pool isoperimetry; applies its theorem
Poincaré development	Pins Pool and reexports its nonintegrability theorem
Maintainer homotopy development	Contains attributed homotopy modules imported through Pool
Maintainer Mazur development	Uses the archived Grothendieck-vanishing result

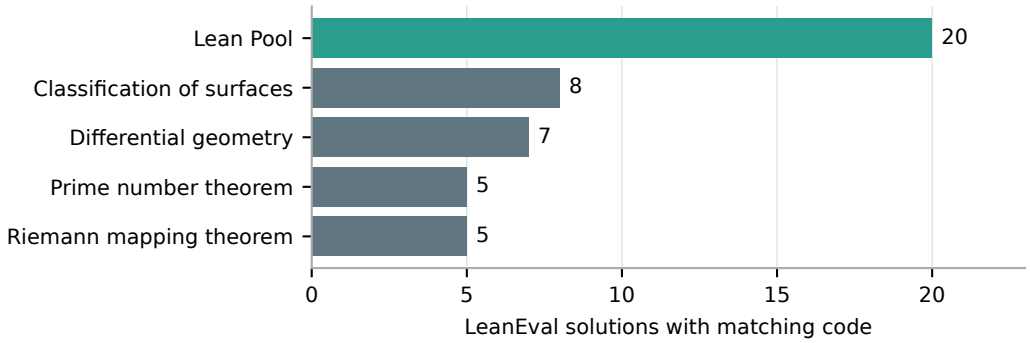

Figure 6: Reuse of public repositories in the LeanEval audit (Anonymous authors, 2026). Lean Pool has matching declarations in more solutions than any other repository in the comparison. Counts are solutions with matching normalized source declarations, including copied code; ordinary package imports such as Mathlib dependencies are excluded. A solution can match both an archived project and its upstream repository. The audit's agent traces document how archived mathematics entered subsequent research-level formalizations. Further source-level reuse appears in Appendix G.1.

H Original upstream Lean versions

Table 25 records the upstream environment for each imported project.

Table 25: Original upstream Lean environments for every current project, ordered as in the publication concordance. Unmarked entries use an import pin or explicit original import report. A dagger marks the latest upstream default-branch revision before registration, used when the import pin is unavailable. A dash denotes an unavailable toolchain. Version links lead to the retained source evidence.

No.	Project	Upstream Lean
1	2-Coloring Cycles in One Round	4.28.0†
2	A 4AP-free permutation of the positive integers	4.33.1
3	A Conditional Fourteen-Point Case of Erdős Problem 132	4.32.0-rc1†
4	A Conditional Sieve Criterion for Twin Primes via Krafft Geometry	4.32.0-rc1†
5	A Detailed Proof of the Chudnovsky Formula	4.32.0-rc1†
6	A formalization of Borel determinacy in Lean	4.28.0-rc1†
7	A sharp 5/8 bound for Erdős Problem 865	4.28.0

No.	Project	Upstream Lean
8	ABC implies that Ramanujan's tau function misses almost all primes	4.26.0†
9	Accelerated Nesterov convergence under local Polyak-Lojasiewicz conditions	4.28.0†
10	Almost all primes are partially regular	4.26.0†
11	Analysis of Boolean functions in Lean	4.16.0-rc2†
12	Apportionmentlib	4.30.0†
13	Archon-FirstProof-Results	4.28.0†
14	Artin-Wedderburn Theorem	4.14.0-rc2†
15	Asymptotically attaining the Moore bound	4.32.2
16	Aumann's Agreement Theorem	4.28.0†
17	Axiomatic projective geometry (Faure–Frölicher)	—
18	Bennett–Bernstein, Freedman, and Hoeffding concentration inequalities	4.28.0
19	BKLO simultaneous perfect matchings and spread matchings	4.28.0
20	Boolean Isoperimetry and Conway–Guy Coherent Gaps	4.28.0†
21	Brauer Group Core	4.26.0-rc2†
22	Burkholder Martingale Transform Inequality	4.30.0-rc2
23	Carlet's Kasami cyclic-additive conjecture	4.33.0
24	Certified Runge-Kutta Order Conditions	4.30.0-rc2
25	Chaos and the Julia set of the complex exponential	4.34.0
26	Chebyshev Quotients and Demazure Multiplicities	4.28.0
27	Chordal graphs: minimal separators and simplicial vertices	4.34.0-rc1†
28	Chvátal's conjecture and sharp Boolean correlation	4.33.1
29	Circuit Complexity in Lean 4	4.29.0-rc4†
30	circuitlib: a circuit verification library for Lean 4	4.30.0-rc1
31	Classification of Compact Surfaces	4.32.2†
32	Classification of groups of order p * q	4.15.0†
33	Classification of low-dimensional solvable Lie algebras	4.19.0†
34	Clawristotle: Vlasov-Maxwell-Landau steady-state classification	4.24.0
35	Coinductive Interaction Trees using QPFs	4.29.0†
36	Common-neighbour counterexamples for Saxl graphs	4.34.0-rc2
37	Conditional formalization of Zhou's Connes-rigidity counterexample	4.34.0-rc2
38	Connes-Kreimer Hopf algebra of rooted trees	4.30.0-rc2†
39	Convex Three-Distance Degree-Six Theorem and Exceptional-Word Closures	4.34.0-rc1†
40	Counterexamples to graph compactness and two-degenerate extremal bounds	4.32.0
41	Counting Critical Portraits	4.31.0†
42	Craig interpolation and Beth definability for propositional dynamic logic	4.33.1
43	Craig Interpolation for Gödel-Löb logic via coalgebraic proofs	4.28.0†
44	Dead Ends in Square-Free Digit Walks	4.26.0
45	Demazure Operators and Lean	4.14.0-rc3†

No.	Project	Upstream Lean
46	Density-One GKP Divisibility and Its Carry-Language Characterization	4.32.0-rc1†
47	Directed Topology in Lean 4	4.6.0-rc1
48	Disproof of the Aharoni-Korman Conjecture	4.16.0-rc2†
49	Disproof of the Köthe conjecture (Krempa's matrix form)	4.28.0
50	DomainTheory	4.30.0
51	Duality theory in linear optimization and its extensions	4.18.0†
52	Ehrhart's sharp volume inequality	4.32.0
53	Erdős Problem #137: powerful products of consecutive integers	4.28.0
54	Erdős Problem #367	4.28.0
55	Erdős Problem 346: Ratio Limit Forces the Golden Ratio	4.31.0†
56	Euclidean Distance Geometry	4.32.0-rc1†
57	Euler's pentagonal number theorem	4.26.0-rc2
58	Even graphs are edge-disjoint unions of cycles	4.28.0
59	Event Structures and Causal-Consistent Reversibility	4.28.1†
60	Exact odd-prime distributions of central-binomial valuations	4.32.0-rc1†
61	Exceptional Set in the abc Conjecture	4.21.0-rc3†
62	Existence of a finitely presented non-sofic group	4.32.0
63	Existence of Nash equilibria via Brouwer's fixed-point theorem	4.30.0†
64	Explicit type A_n and BC_n root pairings	4.30.0-rc2†
65	Extended Demazure Product on ASP Permutations	4.31.0-rc2
66	Factorization Systems	4.14.0-rc2†
67	Feige's sharp unit-slack inequality	4.31.0
68	Fel's Conjecture on Syzygies of Numerical Semigroups	4.26.0
69	Fermat's Last Theorem for regular primes	4.34.0-rc2
70	FinEqs - reducing equations defining a subset of n-space over a finite field	4.24.0†
71	Finite max-flow / min-cut	4.28.0
72	Finite witnesses and the width hierarchy for language generation	4.24.0
73	Finite Čencov-Petz Uniqueness	4.29.1
74	Finite-N Kuramoto Synchronization	4.31.0-rc1†
75	Finite-time breakdown for Navier–Stokes and Euler	4.34.0-rc2
76	Finitely generated cones and finite LP duality	4.28.0†
77	First Order Language of ZF Set Theory	4.22.0-rc3†
78	Flean: Floating-Point Numbers in Lean	4.27.0-rc1†
79	Formal Learning Theory Kernel	4.29.0-rc6†
80	Formalisation of the Bruhat-Tits Tree	4.19.0†
81	Formalizations of theorems related to model checking	4.30.0†
82	Formalized Complex Analysis in Lean	4.28.0-rc1†
83	Foundational local complex-analytic geometry	4.32.0
84	FrontierMath Ramsey Hypergraphs	4.28.0
85	Fundamental groups of finite connected graphs	4.32.0

No.	Project	Upstream Lean
86	Galois groups of quadratic polynomial iterates	4.33.1
87	Genus-Zero Pairings and Catalan Numbers	4.29.0-rc6†
88	Geometric Four-Colorings of the Moser Lattice and Ring	4.32.0-rc1†
89	Global completeness of one-sorted definedness-free matching logic	4.33.0
90	Grothendieck's Vanishing Theorem	4.28.0
91	Gödel's First and Second Incompleteness Theorems	4.16.0-rc2
92	Halving the Kalton-Roberts upper bound	4.28.0†
93	Homogeneous self-dual interior-point method for linear programming	4.31.0-rc1†
94	Hurwitz's Classification of Euclidean Composition Algebras	4.33.0
95	Improved asymptotic bounds for binary and spherical codes	4.32.0
96	Improved long gaps between consecutive primes	4.33.0
97	Improved Lower Bounds for Strong n-Conjectures	4.30.0-rc2†
98	Infinitary logic and countable model theory	4.34.0-rc1
99	Infinite counterexamples to Connes's rigidity conjecture	4.32.0
100	Irrationality of $\zeta(3)$	4.18.0†
101	Jordan–Schönflies theorem	4.32.2
102	Kahn–Kalai expectation-threshold theorem	4.32.0
103	Known Bounds for the Hadwiger-Nelson Problem	4.32.0-rc1†
104	Lean-QuantumAlg	4.30.0
105	Lehmer's Polynomial and the E10 Coxeter Element	4.32.0-rc1†
106	Lentil: Temporal Logic of Actions in Lean 4	4.28.0†
107	Leo Moser's finite distinct-subset-sums inequality	4.32.0-rc1†
108	Maxima of Coxeter frieze patterns are Fibonacci numbers	4.10.0-rc2†
109	Mean-field derivation and well-posedness of the Vlasov equation	4.33.0-rc1
110	Minimum modulus for the unique multiset-sum problem	4.32.0†
111	Misere combinatorial games	4.29.0-rc1
112	Modular forms and the generalized residue theorem	4.29.0-rc8
113	Monlib4 Operator-Algebra and Quantum-Set Core	4.21.0-rc3†
114	Monotonicity Formula for Stationary Harmonic Maps	4.30.0-rc2
115	Monsky's Theorem	4.16.0-rc2†
116	Moreira's version of Sard's theorem	4.27.0-rc1
117	MRiscX	4.29.0†
118	Nash-Williams fronts and 2-better-quasi-orders	4.28.0
119	Near-perfect triangle packings from sum-zero triples	4.28.0†
120	Neukirch's Algebraic Number Theory: Hilbert ramification theory	4.5.0-rc1†
121	Nivat's conjecture	4.33.1
122	On the paucity of lattice triangles	4.26.0†
123	Optimal Pebbling Number of the Hypercube	4.30.0-rc2†
124	Oracle Computability and Turing Degrees	4.24.0†
125	Osterwalder-Schrader Axioms for the Gaussian Free Field	4.29.0†

No.	Project	Upstream Lean
126	Partial Combinatory Algebras	4.15.0-rc1†
127	PCF Theory	4.18.0-rc1†
128	Period Lengths of Rational Cut-and-Project Gap Sequences	4.29.1
129	Planar Point Sets Whose Non-Diameter Distances Form a Geometric 3-Chain	4.31.0-rc1†
130	Poincaré's Nonintegrability Theorem for the Restricted Three-Body Problem	4.33.0-rc1†
131	Pointwise Birkhoff Ergodic Theorem	4.20.0-rc5†
132	Poitou's Explicit Odlyzko Bound for Root Discriminants	4.33.0-rc1†
133	Polylean Unit Conjecture Counterexample	4.19.0-rc3†
134	Polynomial ABC (Mason–Stothers) and its corollaries	4.9.0-rc2
135	Polynomial parametrizations of Pythagorean triples	4.30.0-rc2†
136	Polynomial-factor hardness of the closest vector problem	4.32.0
137	Prekopa-Leindler, Brunn-Minkowski, and the isoperimetric inequality	4.26.0-rc2†
138	Primitive Sets Above x (Erdos Problem 1196)	4.30.0-rc1†
139	Pumping Lemma for Context-Free Grammars	4.15.0-rc1†
140	Pólya's enumeration theorem	4.14.0-rc2
141	Quadratic-order prime classification	4.28.0†
142	Quantum parallel repetition	4.32.0
143	Quartic-over-logarithmic lower bound for rational permanent formulas	4.32.0
144	Quasi-Borel Spaces	4.28.0-rc1†
145	Radó's theorem for Riemann surfaces	4.33.0
146	Rellich–Kondrachov compact embedding theorem	4.29.1†
147	Riemann Mapping Theorem	4.26.0
148	Riemann–Roch for algebraic function fields	4.31.0
149	RL Theory in Lean	4.28.0-rc1†
150	Sabidussi's compatibility conjecture for Eulerian multigraphs	4.31.0
151	Selberg Sieve	4.7.0-rc2†
152	Sensitivity Conjecture: sqrt(deg) <= sensitivity	4.28.0†
153	Serre's mass formula for totally ramified local-field extensions	4.32.2
154	Shannon Entropy Characterization	4.28.0†
155	Sharp asymptotic upper bounds for sphere packing	4.32.0
156	Sharp Five-Distance and Sup-Norm Gap Theorems	4.30.0†
157	Simple zeros of the Riemann zeta function	4.34.0-rc2
158	Spectral positivity	4.30.0
159	Spectral theorem for compact self-adjoint operators	4.29.1
160	Stable phase retrieval for Hermite-Fock expansions	4.29.0-rc6†
161	Strengthened V0 Bounded Arithmetic Interfaces	4.22.0†
162	Sums of Distinct Factorials That Are Powers of Two (Erdos Problem 403)	4.31.0†
163	Sums of Three Squares	4.29.1†

No.	Project	Upstream Lean
164	Sundog certificates	4.30.0
165	Superexponential lower bounds for multicolor triangle Ramsey numbers	4.32.0
166	Synthetic Euclidean geometry: Euclid's Elements Book I	—
167	Thakur's hypotheses on power sums of F_q[t]	4.28.0†
168	The 5/8 theorem	4.28.0†
169	The Anderson Conjecture: A Weakly Quasi-Complete Ring Need Not Be Quasi-Complete	4.29.0-rc8†
170	The Bannai-Bannai-Stanton Bound on Distance Sets	4.31.0†
171	The Bollobás–Nikiforov conjecture	4.33.0-rc1
172	The Convex-Octagon Case of Erdős Problem 97	4.32.0-rc1†
173	The Cramer-Wold theorem	4.32.0-rc1†
174	The Erdős–Graham–Ruzsa–Straus two-prime theorem	4.29.1†
175	The Erdős–Sós conjecture (Erdős Problem 548)	4.28.0
176	The Erdős–Tuza–Valtr conjecture	4.13.0-rc3
177	The Fundamental Inequality of Valued Fields	4.30.0†
178	The Hanson-Wright inequality for sub-Gaussian quadratic forms	4.33.0
179	The Jacobian of a Compact Riemann Surface	4.33.0-rc2
180	The Johnson–Lindenstrauss Lemma and Quantized JL	4.31.0†
181	The Kunen inconsistency theorem	4.29.0-rc4†
182	The main theorem of polytopes	4.7.0-rc2
183	The optimal exponent relating sumsets and difference sets	4.32.1
184	The polynomial Freiman–Ruzsa conjecture	4.34.0-rc2
185	The polynomial method and restricted sums of congruence classes	4.27.0-rc1
186	The Ramanujan-Nagell theorem	4.26.0-rc2
187	The Rupert Problem for convex polyhedra	4.28.0
188	The Three-Gap (Steinhaus) Theorem	4.29.1
189	The transcendence of π	4.30.0-rc2†
190	The Wallace problem in ZFC	4.30.0
191	The Zhang-Yeung non-Shannon information inequality	4.28.0-rc1
192	Turán's theorem (the "Book" weighting proof)	4.24.0-rc1†
193	Ulm's theorem for countable reduced abelian p-groups	4.30.0-rc1
194	Unconditional Schauder Bases	4.30.0-rc2
195	Uniqueness of Shannon Capacity-Achieving Priors	4.29.1†
196	Verified canonical labelling of finite graphs	4.33.1
197	Verified interval-Cauchy real arithmetic	4.17.0-rc1†
198	Virasoro Project	4.27.0-rc1†
199	Weierstrass models and singular points for Tate's algorithm	nightly 2023-08-19†
200	Whitehead's theorem for CW-complexes	4.21.0-rc3
201	Wigner Semicircle Distribution	4.24.0†
202	ZFLean	4.27.0†

I IMPORTED PROJECTS AND THEIR PUBLICATIONS

Table 26: Complete concordance of the current archive and its publications. Each registered project has a row and a link to its upstream repository. Companion papers and manuscripts describe the formalized results or development; mathematical sources provide underlying results. Source records distinguish papers, books, manuscripts, and repository documentation. Projects removed before the observation are excluded.

No.	Imported project / upstream	Publications and mathematical sources
1	2-Coloring Cycles in One Round	Companion paper: 2-Coloring Cycles in One Round (Flin et al., 2026).
2	A 4AP-free permutation of the positive integers	Companion paper: A 4AP-free permutation of the positive integers (Ho, 2026).
3	A Conditional Fourteen-Point Case of Erdős Problem 132	Mathematical source: Constructions of Maximum Few-Distance Sets in Euclidean Spaces (Szöllősi & Östergård, 2020).
4	A Conditional Sieve Criterion for Twin Primes via Krafft Geometry	Companion preprint: Variational Optimisation of Spectral Sieve Quotients for Primes in Bounded Symmetric Intervals (Portela, 2026).
5	A Detailed Proof of the Chudnovsky Formula	Mathematical source: A detailed proof of the Chudnovsky formula with means of basic complex analysis – Ein ausführlicher Beweis der Chudnovsky-Formel mit elementarer Funktionentheorie (Milla, 2018).
6	A formalization of Borel determinacy in Lean	Companion paper: A formalization of Borel determinacy in Lean (Manthe, 2026).
7	A sharp 5/8 bound for Erdős Problem 865	No publication identified; see upstream documentation.
8	ABC implies that Ramanujan's tau function misses almost all primes	Companion paper: ABC implies that Ramanujan's tau function misses almost all primes (Angdinata et al., 2026a).
9	Accelerated Nesterov convergence under local Polyak-Lojasiewicz conditions	Companion paper: Optimal local linear convergence of Nesterov's accelerated gradient method for C^2 functions under the Polyak–Łojasiewicz inequality (Feng & Yuan, 2026).
10	Almost all primes are partially regular	Companion paper: Almost all primes are partially regular (Chen et al., 2026b).
11	Analysis of Boolean functions in Lean	Mathematical source (book): Analysis of Boolean Functions (O'Donnell, 2014).
12	Apportionmentlib	Mathematical source (book): Fair Representation: Meeting the Ideal of One Man, One Vote (Balinski & Young, n.d.).
13	Archon-FirstProof-Results	Source challenge paper: First Proof (Abouzaid et al., 2026).
14	Artin-Wedderburn Theorem	Mathematical source: The Wedderburn-Artin Theorem (Brešar, 2024). Mathematical source (book): A First Course in Noncommutative Rings (Lam, 2001).
15	Asymptotically attaining the Moore bound	Companion paper: Asymptotically attaining the Moore bound (van Batenburg & Korsky, 2026).
16	Aumann's Agreement Theorem	Companion paper: We Can't Agree to Disagree, Formally: Aumann's Theorem and Assumption Accounting in Lean (Chen et al., 2026d).
17	Axiomatic projective geometry (Faure–Frölicher)	Mathematical source (book): Modern Projective Geometry (Faure & Frölicher, 2000).
18	Bennett–Bernstein, Freedman, and Hoeffding concentration inequalities	Companion manuscript for reusable components: Linear-Error Clique Partitions of Split Graphs via Structured Triangle Packing (Gianini, 2026c).

No.	Imported project / upstream	Publications and mathematical sources
19	BKLO simultaneous perfect matchings and spread matchings	Companion manuscript for reusable components: Linear-Error Clique Partitions of Split Graphs via Structured Triangle Packing (Gianini, 2026c). Mathematical source: Edge-decompositions of graphs with high minimum degree (Barber et al., 2014).
20	Boolean Isoperimetry and Conway–Guy Coherent Gaps	Mathematical source: A sum packing problem of Erdös and the Conway-Guy sequence (Bohman, 1996). Companion manuscript: Robust Harper Stability at the Exponential Scale (Milovanov, 2026). Mathematical source: Optimal numberings and isoperimetric problems on graphs (Harper, 1966).
21	Brauer Group Core	Mathematical source (book): Central Simple Algebras and Galois Cohomology (Gille & Szamuely, 2017).
22	Burkholder Martingale Transform Inequality	Mathematical source: Boundary Value Problems and Sharp Inequalities for Martingale Transforms (Burkholder, 1984).
23	Carlet's Kasami cyclic-additive conjecture	Companion paper: On a conjecture on the Kasami APN function: reductions, structure theorems, a proof for $k \bmod n \in \{1, 2, n-2, n-1\}$, and exhaustive verification for $n \leq 13$ (Nagy & Vajda, 2026).
24	Certified Runge-Kutta Order Conditions	Companion preprint: What Order a Method Knows: certified Runge–Kutta order conditions over rooted trees, machine-checked in Lean 4 (Muñoz, 2026a).
25	Chaos and the Julia set of the complex exponential	Mathematical source: The exponential map is chaotic: An invitation to transcendental dynamics (Shen & Rempe-Gillen, 2014).
26	Chebyshev Quotients and Demazure Multiplicities	Companion paper: Chebyshev quotients, Demazure multiplicities, and Dyck-path models (Biswal et al., 2026).
27	Chordal graphs: minimal separators and simplicial vertices	Companion preprint: Complete-Split Extremizers for a Fractional Triangle-Cover Functional on Chordal Graphs (Gianini, 2026b).
28	Chvátal's conjecture and sharp Boolean correlation	Companion paper: A proof of Chvátal's conjecture via a sharp correlation inequality (Chang et al., 2026).
29	Circuit Complexity in Lean 4	No publication identified; see upstream documentation.
30	circuitlib: a circuit verification library for Lean 4	Mathematical source: A Complete Theory of Sequential Digital Circuits: Denotational, Operational and Algebraic Semantics (Ghica et al., 2022).
31	Classification of Compact Surfaces	No publication identified; see upstream documentation.
32	Classification of groups of order p * q	Companion paper: Classifying the groups of order pq in Lean (Harper & Wu, 2025).
33	Classification of low-dimensional solvable Lie algebras	Mathematical source (book): Classification and Identification of Lie Algebras (Šnobl & Winternitz, 2014).
34	Clawristotle: Vlasov-Maxwell-Landau steady-state classification	Companion paper: Semi-Autonomous Formalization of the Vlasov-Maxwell-Landau Equilibrium (Ilin, 2026).
35	Coinductive Interaction Trees using QPFs	Prior Coq formalization paper: Interaction trees: representing recursive and impure programs in Coq (yao Xia et al., 2019).

No.	Imported project / upstream	Publications and mathematical sources
36	Common-neighbour counterexamples for Saxl graphs	Companion paper: Common neighbour conjectures for Saxl graphs fail at every base size (Rizzoli & Thomas, 2026a). Software release: Computational source code and Lean formalization for Common neighbour conjectures for Saxl graphs fail at every base size (Rizzoli & Thomas, 2026b). The registered Zenodo DOI identifies the accompanying software.
37	Conditional formalization of Zhou's Connes-rigidity counterexample	Companion paper: ICC property (T) groups without W^*-superrigidity (Zhou, 2026).
38	Connes-Kreimer Hopf algebra of rooted trees	Companion preprint: How a Tree Forgets Its Order: the Eulerian idempotent and the Adams spectrum on the commutative Connes–Kreimer–Butcher Hopf algebra of rooted trees, machine-checked in Lean 4 (Muñoz, 2026c). Companion preprint: How a Tree Remembers Its Cuts: the Connes–Kreimer–Foissy Hopf Algebra of Rooted Trees, Machine-Checked in Lean 4 (Muñoz, 2026b).
39	Convex Three-Distance Degree-Six Theorem and Exceptional-Word Closures	Mathematical source: On the graph of large distances (Erdős et al., 1989).
40	Counterexamples to graph compactness and two-degenerate extremal bounds	Companion paper: Ten Advances in Mathematics and Theoretical Computer Science (OpenAI, 2026f).
41	Counting Critical Portraits	Mathematical source: Degree-d-invariant laminations (Thurston et al., 2019). Software release: no-way-labs/lean-critical-portraits: lean-critical-portraits (keston, 2026). The registered Zenodo DOI identifies software.
42	Craig interpolation and Beth definability for propositional dynamic logic	Companion paper: Propositional Dynamic Logic has Craig Interpolation: a tableau-based proof (Borzechowski et al., 2025).
43	Craig Interpolation for Gödel-Löb logic via coalgebraic proofs	Companion thesis: Proofs as Coalgebras (Gignoux, 2026). Mathematical source: Interpolation properties for provability logics GL and GLP (Shamkanov, 2011).
44	Dead Ends in Square-Free Digit Walks	Companion paper: Dead ends in square-free digit walks (Chen et al., 2026a).
45	Demazure Operators and Lean	Companion thesis: Demazure operators and Lean (Sánchez, 2024). Mathematical source: SCHUBERT CELLS AND COHOMOLOGY OF THE SPACESG/P (Bernstein et al., 1973).
46	Density-One GKP Divisibility and Its Carry-Language Characterization	Mathematical source (book): Concrete Mathematics: A Foundation for Computer Science (Graham et al., 1994).
47	Directed Topology in Lean 4	Companion paper: The Directed Van Kampen Theorem in Lean (Basold et al., 2024).
48	Disproof of the Aharoni-Korman Conjecture	Companion paper: The Aharoni–Korman conjecture is false (Hollom, 2024). Mathematical source: Greene-Kleitman's theorem for infinite posets (Aharoni & Korman, 1992).
49	Disproof of the Köthe conjecture (Krempa's matrix form)	Companion paper: A counterexample to Köthe's conjecture and a question of Rowen (Adamczewski et al., 2026).

No.	Imported project / upstream	Publications and mathematical sources
50	DomainTheory	Companion manuscript: Scott's 3 Successively Less Topological, Simpler, and More Constructive Presentations of Domain Theory and Their Equivalence (DomainTheory). Mathematical source: Domains for denotational semantics (Scott, 1982).
51	Duality theory in linear optimization and its extensions	Companion paper: Duality theory in linear optimization and its extensions – formally verified (Dvorak & Kolmogorov, 2026).
52	Ehrhart's sharp volume inequality	Companion paper: Ten Advances in Mathematics and Theoretical Computer Science (OpenAI, 2026f).
53	Erdős Problem #137: powerful products of consecutive integers	No publication identified; see upstream documentation.
54	Erdős Problem #367	Companion manuscript: Powerful parts of consecutive integers and Davenport–Zannier polynomials (Hughes, n.d.).
55	Erdős Problem 346: Ratio Limit Forces the Golden Ratio	No publication identified; see upstream documentation.
56	Euclidean Distance Geometry	Mathematical source: Remarks to Maurice Frechet's Article "Sur La Definition Axiomatique D'Une Classe D'Espace Distances Vectoriellement Applicable Sur L'Espace De Hilbert (Schoenberg, 1935).
57	Euler's pentagonal number theorem	No publication identified; see upstream documentation.
58	Even graphs are edge-disjoint unions of cycles	Companion manuscript for reusable components: Linear-Error Clique Partitions of Split Graphs via Structured Triangle Packing (Gianini, 2026c).
59	Event Structures and Causal-Consistent Reversibility	Mathematical source: Event structures (Winskel, 1987).
60	Exact odd-prime distributions of central-binomial valuations	Mathematical source (working paper): Carry-Run Theorem and Sakib Index for the Exact Distribution of $\nu_p\binom{2n}{n}$ over n mod p^k (Sakib, 2026). Mathematical source: Über die Ergänzungssätze zu den allgemeinen Reciprocitätsgesetzen. (Kummer, 1852).
61	Exceptional Set in the abc Conjecture	Companion paper: Bounds on the exceptional set in the abc conjecture (Bernert et al., 2024).
62	Existence of a finitely presented non-sofic group	Companion paper: Ten Advances in Mathematics and Theoretical Computer Science (OpenAI, 2026f).
63	Existence of Nash equilibria via Brouwer's fixed-point theorem	Mathematical source: Equilibrium points in n -person games (Nash, 1950).
64	Explicit type A_n and BC_n root pairings	Mathematical source (book): Introduction to Lie Algebras and Representation Theory (Humphreys, 1972).
65	Extended Demazure Product on ASP Permutations	Companion paper: An extended Demazure product on integer permutations via min-plus matrix multiplication (Pflueger, 2022).
66	Factorization Systems	Mathematical source (book): Category Theory in Context (Riehl, 2016).
67	Feige's sharp unit-slack inequality	Companion paper: Sharp small-deviation inequalities for sums of independent nonnegative random variables (Fu et al., 2026).
68	Fel's Conjecture on Syzygies of Numerical Semigroups	Companion paper: Fel's Conjecture on Syzygies of Numerical Semigroups (Chen et al., 2026c).

No.	Imported project / upstream	Publications and mathematical sources
69	Fermat's Last Theorem for regular primes	Companion paper: A complete formalization of Fermat's Last Theorem for regular primes in Lean (Best et al., 2024).
70	FinEqs - reducing equations defining a subset of n-space over a finite field	Companion paper: Reducing the number of equations defining a subset of the n-space over a finite field (Barańczuk, 2024).
71	Finite max-flow / min-cut	Companion manuscript for reusable components: Linear-Error Clique Partitions of Split Graphs via Structured Triangle Packing (Gianini, 2026c).
72	Finite witnesses and the width hierarchy for language generation	Companion paper: Characterizing Language Generation in the Limit: Finite Witnesses and a Separation-Width Hierarchy (Li et al., 2026).
73	Finite Čencov-Petz Uniqueness	Mathematical source (book): Statistical Decision Rules and Optimal Inference (Chentsov, 1982).
74	Finite-N Kuramoto Synchronization	Companion preprint: Kuramoto-lean: Lean 4 Library for Finite-N Kuramoto Synchronisation Dynamics (Cassie, 2026).
75	Finite-time breakdown for Navier–Stokes and Euler	Companion paper: Finite Time Blowup for Navier–Stokes (OpenAI, 2026b). Companion paper: Finite Time Blowup for the Euler Equation (OpenAI, 2026a).
76	Finitely generated cones and finite LP duality	Companion preprint: Affine Profile Reduction for Fractional Triangle Packings in Split Graphs (Gianini, 2026a).
77	First Order Language of ZF Set Theory	Mathematical source (book): Set Theory (Jech, 2003).
78	Flean: Floating-Point Numbers in Lean	Technical standard: IEEE Standard for Floating-Point Arithmetic (IEEE Standard for Floating-Point Arithmetic).
79	Formal Learning Theory Kernel	Companion textbook: A Textbook of Formal Learning Theory (Gupta, 2026).
80	Formalisation of the Bruhat-Tits Tree	Companion paper: Formalising the Bruhat-Tits Tree (Ludwig & Merten, 2026). Mathematical source (book): Trees (Serre, 1980).
81	Formalizations of theorems related to model checking	Mathematical source: An automata-theoretic approach to linear temporal logic (Vardi, 1996).
82	Formalized Complex Analysis in Lean	No publication identified; see upstream documentation.
83	Foundational local complex-analytic geometry	No publication identified; see upstream documentation.
84	FrontierMath Ramsey Hypergraphs	Companion manuscript: A constant-factor lower bound for $H(n)$ (GPT-5.4 Pro, 2026). Mathematical source: Choosing between incompatible ideals (Brian & Larson, 2021).
85	Fundamental groups of finite connected graphs	Mathematical source (book): Algebraic Topology (Hatcher, 2002).
86	Galois groups of quadratic polynomial iterates	Mathematical source: On Stoll's criterion for the maximality of quadratic arboreal Galois representations (Li, 2021). Mathematical source: Arboreal Galois representation for a certain type of quadratic polynomials (Li, 2019). Mathematical source: Galois groups over $\mathbb{Q}$ of some iterated polynomials (Stoll, 1992).
87	Genus-Zero Pairings and Catalan Numbers	No publication identified; see upstream documentation.

No.	Imported project / upstream	Publications and mathematical sources
88	Geometric Four-Colorings of the Moser Lattice and Ring	Companion paper: A note on geometric colorings of the Moser lattice (Dúcz, 2026).
89	Global completeness of one-sorted definedness-free matching logic	Companion paper: Completeness and incompleteness of basic matching logic (Chen & Rosu, 2026).
90	Grothendieck's Vanishing Theorem	Companion expert-review paper: Sorries Are Not the Hard Part: An Expert-Review Case Study of a Semi-Autonomous Formalization (Ilin & Nugent, 2026). Mathematical source (book): Algebraic Geometry (Hartshorne, 1977).
91	Gödel's First and Second Incompleteness Theorems	Mathematical source: Über formal unentscheidbare Sätze der Principia Mathematica und verwandter Systeme I (Gödel, 1931).
92	Halving the Kalton-Roberts upper bound	Companion paper: Halving the original Kalton–Roberts upper bound for nearly additive set functions (Ho & Kania, 2026).
93	Homogeneous self-dual interior-point method for linear programming	Mathematical source: An O($\sqrt{}$nL)-Iteration Homogeneous and Self-Dual Linear Programming Algorithm (Ye et al., 1994).
94	Hurwitz's Classification of Euclidean Composition Algebras	Mathematical source (document): Über die Composition der quadratischen Formen von beliebig vielen Variablen (Hurwitz, n.d.).
95	Improved asymptotic bounds for binary and spherical codes	Companion paper: Ten Advances in Mathematics and Theoretical Computer Science (OpenAI, 2026f).
96	Improved long gaps between consecutive primes	Companion paper: Improved Long Gaps Between Primes (OpenAI, 2026e).
97	Improved Lower Bounds for Strong n-Conjectures	Companion paper: IMPROVED LOWER BOUNDS FOR STRONG n-CONJECTURES (HÖLZL et al., 2025).
98	Infinitary logic and countable model theory	Mathematical source (book): Lectures on Infinitary Model Theory (Marker, 2016).
99	Infinite counterexamples to Connes's rigidity conjecture	Companion paper: Ten Advances in Mathematics and Theoretical Computer Science (OpenAI, 2026f).
100	Irrationality of $\zeta(3)$	Companion paper: A Formal Proof of the Irrationality of $\zeta(3)$ in Lean 4 (Liu et al., 2025a). Mathematical source: A Note on the Irrationality of $\zeta(2)$ and $\zeta(3)$ (Beukers, 1979).
101	Jordan–Schönflies theorem	No companion paper is listed in the retained upstream documentation; the repository documents the theorem and its proof structure.
102	Kahn–Kalai expectation-threshold theorem	Mathematical source: A Short Proof of Kahn-Kalai Conjecture (Tran & Vu, 2024).
103	Known Bounds for the Hadwiger-Nelson Problem	Mathematical source: The chromatic number of the plane is at least 5 – a human-verifiable proof (Parts, 2020).
104	Lean-QuantumAlg	Companion paper: Building Shor's Algorithm in Lean: An Agentic Formalization of Quantum Attacks on RSA-2048 and P-256 (Zhang et al., 2026b). Companion paper: An Agentic Formalization for Certified Quantum Neural Network Design (Jing et al., 2026).
105	Lehmer's Polynomial and the E10 Coxeter Element	No publication identified; see upstream documentation.
106	Lentil: Temporal Logic of Actions in Lean 4	No publication identified; see upstream documentation.

No.	Imported project / upstream	Publications and mathematical sources
107	Leo Moser's finite distinct-subset-sums inequality	Mathematical source: Sets of Integers Whose Subsets Have Distinct Sums (Guy, 1982).
108	Maxima of Coxeter frieze patterns are Fibonacci numbers	Companion paper: On Upper Bounds of Frieze Patterns (Cheah & de Saint Germain, 2025).
109	Mean-field derivation and well-posedness of the Vlasov equation	Companion paper: A Formalization of the Mean-Field Derivation of the Vlasov Equation (Miller, 2026).
110	Minimum modulus for the unique multiset-sum problem	Mathematical source (preprint): The Exact Minimum Order for Unique Multiset Sums in Finite Abelian Groups (Inal, 2026). Companion paper: Minimum modulus for the unique multiset-sum problem (Fonollosa, 2026).
111	Misere combinatorial games	No publication identified; see upstream documentation.
112	Modular forms and the generalized residue theorem	Mathematical source: Non-Integer Valued Winding Numbers and a Generalized Residue Theorem (Hungerbühler & Wasem, 2019).
113	Monlib4 Operator-Algebra and Quantum-Set Core	Companion thesis: On quantum graph theory: non-commutative graph theory (Omar, 2026). Mathematical source: A Constructive Elementary Proof of the Skolem-Noether Theorem for Matrix Algebras (Szigeti & vanWyk, 2017).
114	Monotonicity Formula for Stationary Harmonic Maps	Mathematical source (book): Theorems on Regularity and Singularity of Energy Minimizing Maps (Simon, 1996).
115	Monsky's Theorem	Mathematical source: On Dividing A Square Into Triangles (Monsky, 1970).
116	Moreira's version of Sard's theorem	Mathematical source: Hausdorff measures and the Morse-Sard theorem (de A. Moreira, 2001).
117	MRiscX	Mathematical source: Hoare-Style Logic for Unstructured Programs (Lundberg et al., 2020).
118	Nash-Williams fronts and 2-better-quasi-orders	Mathematical source: Towards better: A motivated introduction to better-quasi-orders (Pequignot, 2017).
119	Near-perfect triangle packings from sum-zero triples	Companion preprint: Linear-Error Clique Partitions of Split Graphs via Structured Triangle Packing (Gianini, 2026c).
120	Neukirch's Algebraic Number Theory: Hilbert ramification theory	Mathematical source (book): Algebraic Number Theory (Neukirch, 1999).
121	Nivat's conjecture	Companion AI-generated manuscript: Pattern complexity and Nivat's conjecture (GPT-6 Pro, 2026).
122	On the paucity of lattice triangles	Companion paper: On the paucity of lattice triangles (Angdinata et al., 2026b).
123	Optimal Pebbling Number of the Hypercube	Companion paper: Optimal pebbling of the hypercube (Pachter, 2026).
124	Oracle Computability and Turing Degrees	Prior formalization paper: Formalizing computability theory via partial recursive functions (Carneiro, 2018).
125	Osterwalder-Schrader Axioms for the Gaussian Free Field	No publication identified; see upstream documentation.
126	Partial Combinatory Algebras	Mathematical source: Partial Combinatory Algebras (Partial Combinatory Algebras).

No.	Imported project / upstream	Publications and mathematical sources
127	PCF Theory	Mathematical source: Cardinal Arithmetic (Abraham & Magidor, 2009).
128	Period Lengths of Rational Cut-and-Project Gap Sequences	Companion manuscript: Period Length Formulas for Rational Cut-and-Project Strip Projections: Multiset and Set Cases (Kunert, 2026a).
129	Planar Point Sets Whose Non-Diameter Distances Form a Geometric 3-Chain	No publication identified; see upstream documentation.
130	Poincaré's Nonintegrability Theorem for the Restricted Three-Body Problem	Mathematical source: A new proof of Poincaré's result on the restricted three-body problem (Yagasaki, 2025).
131	Pointwise Birkhoff Ergodic Theorem	Mathematical source (book): Ergodic Theory (Petersen, 1983).
132	Poitou's Explicit Odlyzko Bound for Root Discriminants	Mathematical source (document): Sur les petits discriminants (Poitou, n.d.).
133	Polylean Unit Conjecture Counterexample	Mathematical source: A counterexample to the unit conjecture for group rings (Gardam, 2021).
134	Polynomial ABC (Mason–Stothers) and its corollaries	Companion paper: Formalizing Mason-Stothers Theorem and its Corollaries in Lean 4 (Baek & Lee, 2024).
135	Polynomial parametrizations of Pythagorean triples	Mathematical source: Parametrization of Pythagorean triples by a single triple of polynomials (Frisch & Vaserstein, 2008).
136	Polynomial-factor hardness of the closest vector problem	Companion paper: Ten Advances in Mathematics and Theoretical Computer Science (OpenAI, 2026f).
137	Prekopa-Leindler, Brunn-Minkowski, and the isoperimetric inequality	No publication identified; see upstream documentation.
138	Primitive Sets Above x (Erdos Problem 1196)	Companion paper: Primitive sets and von Mangoldt chains: Erdős Problem #1196 and beyond (Alexeev et al., 2026).
139	Pumping Lemma for Context-Free Grammars	No publication identified; see upstream documentation.
140	Pólya's enumeration theorem	No publication identified; see upstream documentation.
141	Quadratic-order prime classification	Mathematical source (thesis): Singular Moduli and the Ideal Class Group (Geiger, 2020).
142	Quantum parallel repetition	Companion paper: Ten Advances in Mathematics and Theoretical Computer Science (OpenAI, 2026f).
143	Quartic-over-logarithmic lower bound for rational permanent formulas	Companion paper: Ten Advances in Mathematics and Theoretical Computer Science (OpenAI, 2026f).
144	Quasi-Borel Spaces	Mathematical source: A Domain Theory for Statistical Probabilistic Programming (Vákár et al., 2018). Mathematical source: A convenient category for higher-order probability theory (Heunen et al., 2017).
145	Radó's theorem for Riemann surfaces	No publication identified; see upstream documentation.
146	Rellich–Kondrachov compact embedding theorem	No publication identified; see upstream documentation.

No.	Imported project / upstream	Publications and mathematical sources
147	Riemann Mapping Theorem	No publication identified; see upstream documentation.
148	Riemann–Roch for algebraic function fields	No publication identified; see upstream documentation.
149	RL Theory in Lean	Companion paper: Towards Formalizing Reinforcement Learning Theory: A Robbins-Siegmund Approach (Zhang, 2025).
150	Sabidussi's compatibility conjecture for Eulerian multigraphs	Companion manuscript: Graph Puzzles III.1: A proof of Sabidussi's compatibility conjecture (Ulyanov, n.d.).
151	Selberg Sieve	Mathematical source: Lectures on sieves (Heath-Brown, 2002).
152	Sensitivity Conjecture: sqrt(deg) <= sensitivity	Mathematical source: Induced subgraphs of hypercubes and a proof of the Sensitivity Conjecture (Huang, 2019).
153	Serre's mass formula for totally ramified local-field extensions	Mathematical source: Une formule de masse pour les extensions totalement ramifiées de degré donné d'un corps local (Serre, 1978).
154	Shannon Entropy Characterization	Mathematical source: A Mathematical Theory of Communication (Shannon, 1948).
155	Sharp asymptotic upper bounds for sphere packing	Companion paper: Ten Advances in Mathematics and Theoretical Computer Science (OpenAI, 2026f).
156	Sharp Five-Distance and Sup-Norm Gap Theorems	Software release: Sharp five-distance and sup-norm gap theorems for Kronecker sequences (Lean 4 / Mathlib) (Bonfioli, 2026). Mathematical source: Higher dimensional gap theorems for the maximum metric (Haynes & Ramirez, 2020).
157	Simple zeros of the Riemann zeta function	Companion paper: A new proof that more than $2/3$ of the zeros of the Riemann zeta function are simple and on the critical line (Lamzouri, 2026).
158	Spectral positivity	No publication identified; see upstream documentation.
159	Spectral theorem for compact self-adjoint operators	Mathematical source: Chapter II. Compact Self-Adjoint Operators (Chapter II. Compact Self-Adjoint Operators).
160	Stable phase retrieval for Hermite-Fock expansions	No publication identified; see upstream documentation.
161	Strengthened V0 Bounded Arithmetic Interfaces	Mathematical source (book): Logical Foundations of Proof Complexity (Cook & Nguyen, 2010).
162	Sums of Distinct Factorials That Are Powers of Two (Erdos Problem 403)	No publication identified; see upstream documentation.
163	Sums of Three Squares	Mathematical source: Sums of three squares (Ankeny, 1957).
164	Sundog certificates	No publication identified; see upstream documentation.
165	Superexponential lower bounds for multicolor triangle Ramsey numbers	Companion paper: Ten Advances in Mathematics and Theoretical Computer Science (OpenAI, 2026f).
166	Synthetic Euclidean geometry: Euclid's Elements Book I	Mathematical source: A FORMAL SYSTEM FOR EUCLID'SELEMENTS (AVIGAD et al., 2009).
167	Thakur's hypotheses on power sums of F_q[t]	Companion paper: Thakur's hypotheses on power sums of $\mathbb{F}_q[t]$ (Chen & Ono, 2026).
168	The 5/8 theorem	Mathematical source: What is the Probability that Two Group Elements Commute? (Gustafson, 1973). The registry DOI resolves to an unrelated article; this row cites the Gustafson paper named by the registry.

No.	Imported project / upstream	Publications and mathematical sources
169	The Anderson Conjecture: A Weakly Quasi-Complete Ring Need Not Be Quasi-Complete	Mathematical source: Quasi-complete Semilocal Rings and Modules (Anderson, 2014).
170	The Bannai-Bannai-Stanton Bound on Distance Sets	Companion report: Formalisation of the Bannai-Bannai-Stanton Theorem in Lean 4 (du Fresne von Hohenesche, 2026).
171	The Bollobás–Nikiforov conjecture	Companion manuscript: The Bollobás–Nikiforov inequality for nonnegative edge weights (Coutinho et al., 2026).
172	The Convex-Octagon Case of Erdős Problem 97	Mathematical source: On Sets of Distances of n Points (Erdös, 1946).
173	The Cramer-Wold theorem	Mathematical source: Some Theorems on Distribution Functions (Cramér & Wold, 1936).
174	The Erdős–Graham–Ruzsa–Straus two-prime theorem	Companion draft: A Machine-Checked Proof of the Erdős–Graham–Ruzsa–Straus Two-Prime Theorem (EGRS75). Mathematical source: On the prime factors of $\binom{2n}{n}$ (Erdős et al., 1975).
175	The Erdős–Sós conjecture (Erdős Problem 548)	The retained upstream documentation states that a paper is in preparation; it links the Erdős Problems statement and its Lean formalization.
176	The Erdős–Tuza–Valtr conjecture	Companion paper: On the Erdős–Tuza–Valtr conjecture (Baek, 2025).
177	The Fundamental Inequality of Valued Fields	No publication identified; see upstream documentation.
178	The Hanson-Wright inequality for sub-Gaussian quadratic forms	Mathematical source (book): High-Dimensional Probability (Vershynin, 2026).
179	The Jacobian of a Compact Riemann Surface	No publication identified; see upstream documentation.
180	The Johnson–Lindenstrauss Lemma and Quantized JL	Mathematical source (QJL): QJL: 1-Bit Quantized JL Transform for KV Cache Quantization with Zero Overhead (Zandieh et al., 2024). Mathematical source: Extensions of Lipschitz mappings into a Hilbert space (Johnson & Lindenstrauss, 1984).
181	The Kunen inconsistency theorem	Mathematical source: Elementary embeddings and infinitary combinatorics (Kunen, 1971).
182	The main theorem of polytopes	No publication identified; see upstream documentation.
183	The optimal exponent relating sumsets and difference sets	Companion paper: Settling the Optimal Exponent Relating Sumsets and Difference Sets (Lin & Li, 2026).
184	The polynomial Freiman–Ruzsa conjecture	Mathematical source: Marton's Conjecture in abelian groups with bounded torsion (Gowers et al., 2024). Mathematical source: Improved Exponent for Marton's Conjecture in $\mathbb{F}_2^n$ (Liao, 2024). Mathematical source: On a conjecture of Marton (Gowers et al., 2023).
185	The polynomial method and restricted sums of congruence classes	Mathematical source: The Polynomial Method and Restricted Sums of Congruence Classes (Alon et al., 1996).
186	The Ramanujan-Nagell theorem	Companion paper: A formal proof of the Ramanujan–Nagell theorem in Lean 4 (Banwait, 2026).
187	The Rupert Problem for convex polyhedra	No publication identified; see upstream documentation.

No.	Imported project / upstream	Publications and mathematical sources
188	The Three-Gap (Steinhaus) Theorem	Companion manuscript: A Lean 4 Formalization of the Three-Gap (Steinhaus) Theorem, Uniform in the Rotation Number (Kunert, 2026b). Mathematical source: The Three Gap Theorem (Steinhaus Conjecture) (van Ravenstein, 1988).
189	The transcendence of π	Mathematical source: The Transcendence of π (Niven, 1939).
190	The Wallace problem in ZFC	Companion paper: The Wallace problem and countably compact torsion-free Abelian groups in ZFC (Fraga & Rodrigues, 2026).
191	The Zhang-Yeung non-Shannon information inequality	Mathematical source: On characterization of entropy function via information inequalities (Zhang & Yeung, 1998).
192	Turán's theorem (the "Book" weighting proof)	Mathematical source (book): Proofs from THE BOOK (Aigner & Ziegler, 2018).
193	Ulm's theorem for countable reduced abelian p-groups	No publication identified; see upstream documentation.
194	Unconditional Schauder Bases	Mathematical source (book): Classical Banach Spaces I and II (Lindenstrauss & Tzafriri, 1996).
195	Uniqueness of Shannon Capacity-Achieving Priors	Mathematical source (book): Elements of Information Theory (Cover & Thomas, 2005).
196	Verified canonical labelling of finite graphs	No publication identified; see upstream documentation.
197	Verified interval-Cauchy real arithmetic	Prior Coq formalization paper: Certified Exact Transcendental Real Number Computation in Coq (O'Connor, 2008).
198	Virasoro Project	Mathematical source (book): Infinite-Dimensional Lie Algebras (Kac, 1990).
199	Weierstrass models and singular points for Tate's algorithm	Mathematical source (document): Elliptic Curve Handbook (Connell, n.d.).
200	Whitehead's theorem for CW-complexes	No publication identified; see upstream documentation.
201	Wigner Semicircle Distribution	Mathematical source (lecture notes): Math 247A: Introduction to Random Matrix Theory (Kemp, n.d.).
202	ZFLean	Mathematical source (book): Set Theory (Jech, 2003).