MATHAUDIT / DETAILED REPORT

Correctness, proof completeness, and novelty audit

Transcendence of continued fractions over function fields and a quantitative version of Uchiyama's theorem

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Paper	arXiv:2608.15119v1
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Prompt	Standardized prompt
Novelty cutoff	August 15, 2026
Paper license	CC BY-SA 4.0
Scope	Statements, proofs, and novelty only

Important limitation. AI-generated analysis. This report is not a correctness certificate or a substitute for expert scrutiny. A Correct status may coexist with yellow typos or minor formal corrections that do not affect substantive soundness. It means that this audit found no unresolved substantive error under the stated criteria; it is not formal verification and should remain open to expert challenge and correction.

SUMMARY

01	Statements	Correct
02	Proofs	Correct
03	Novelty	No non-novelty findings

01 / STATEMENTS

Statements

Correct

The quantitative function-field Roth bound, the Davenport–Roth denominator-growth estimate, both quasi-periodic transcendence criteria, and the palindrome criterion are correct over characteristic-zero coefficient fields.

Theorem 6: Exceptionally good rational approximations have the claimed quantitative bound

Pages 3–4 and 7–10 · Theorems 6 and 16, Proposition 17 · arXiv:2608.15119v1

Correct

Solutions are counted modulo simultaneous multiplication by $K^\times$, as specified in Remark 7. For an integral algebraic Laurent series of degree d, the explicit choice $m = \lfloor 100d^2\varepsilon^{-2} \rfloor + 1$ and the displayed δ satisfy Uchiyama's separation hypotheses. Ordering reduced solutions by denominator norm and spacing their indices produces m forbidden approximants if more than $k + (m-1)\ell$ occur; the estimates for k and ℓ give $\exp(Cd^2\varepsilon^{-2})$. Multiplying a general algebraic series by its leading coefficient makes it integral, and the finite split by $\gcd(a, q)$ preserves the same exponential order.

Theorem 18: Algebraic denominator growth satisfies the Davenport–Roth bound

Pages 10–12 · Theorem 18 · arXiv:2608.15119v1

Correct

Writing $\gamma_j = \deg q_{j+1}/\deg q_j$, Liouville's inequality gives a uniform upper bound for γ_j. Indices with $\gamma_j > 1 + \varepsilon$ yield distinct solutions of Theorem 6, so there are fewer than $\exp(c\varepsilon^{-2})$ of them; all other indices contribute at most $i\varepsilon$ to $\log \deg q_i$. Choosing ε proportional to $1/\sqrt{\log i}$ gives

$$\log \log |q_i| < \frac{Ci}{\sqrt{\log i}},$$

with finitely many small indices absorbed into C.

Theorem 4: Both quasi-periodic criteria force quadraticity or transcendence

Pages 3 and 12–17 · Theorem 4 and Section 4.1 · arXiv:2608.15119v1

Correct

In part (a), the periodic quadratic approximants share $n_i + \lambda_i r_i$ initial partial quotients with α. The resulting upper approximation bound, the quadratic Liouville lower bound, and Theorem 18 contradict the limsup hypothesis if an algebraic α has degree greater than two. In part (b), Lemma 19 bounds the height of the quadratic approximants. The two applications of the function-field Subspace Theorem either force a repeated quadratic approximant or a rational linear dependence whose limiting ratio gives an approximation violating Liouville's inequality. Both alternatives exclude algebraic degree at least three.

Theorem 5: Arbitrarily long palindromic prefixes imply quadraticity or transcendence

Pages 3 and 17–18 · Theorem 5 and its proof · arXiv:2608.15119v1

Correct

For every palindromic prefix, symmetry of the convergent matrix gives $p_n = q_{n-1}$. The three displayed linear forms at (p_{n-1}, q_n, q_{n-1}) have product smaller than a negative power of the vector height, so Ratliff's Subspace Theorem puts infinitely many such vectors in one proper rational subspace. Passing to the limit in that fixed relation yields

$$u\alpha^2 + v\alpha + w = 0.$$

Thus an algebraic α is quadratic; otherwise it is transcendental.

02 / PROOFS

Proofs

Correct

The quantitative parameter check, reduction from general to integral algebraic series, denominator-growth decomposition, quadratic-approximant arguments, and two Subspace-Theorem applications are correct and complete. The material Uchiyama and Ratliff inputs match the primary sources.

Theorem 16 and Theorem 6: The quantitative Uchiyama argument and the integrality reduction close all cases

Pages 7–10 · Theorem 16, Proposition 17, and proof of Theorem 6 · arXiv:2608.15119v1

Correct and complete

The chosen parameters meet each of Uchiyama's conditions (3)–(5), including positivity of the relevant denominator in the nontrivial case. Consecutive reduced fractions of equal denominator norm cannot both satisfy the approximation inequality, so the ordered list has strictly increasing norms. The k and ℓ selections then force the exact forbidden configuration from Uchiyama's Section 7 and have the required exponential bound. For nonintegral α, each monic divisor b of the leading coefficient gives a coprime integral approximation after removing b; Theorem 16 handles large denominators and Proposition 17 bounds the finitely many smaller norms. Summing over the finitely many b completes the proof.

Verifiable source: Uchiyama, Rational approximations to algebraic functions

Theorem 18: The large-jump and small-jump denominator estimates are compatible

Pages 10–12 · proof of Theorem 18 · arXiv:2608.15119v1

Correct and complete

Every large ratio $\gamma_j > 1 + \varepsilon$ turns the jth convergent into a solution with exponent $2 + \varepsilon$, and distinct convergents remain distinct modulo $K^\times$. Theorem 6 therefore bounds their count. Liouville's estimate bounds the size of each large contribution, while the remaining logarithms are at most ε. The final choice of ε keeps the exponentially bounded exceptional term below the desired order, and all constants depend only on α.

Theorem 4(a): Periodic quadratic approximants and denominator growth give the required contradiction

Pages 12–14 · proof of Theorem 4(a) · arXiv:2608.15119v1

Correct and complete

The purely periodic block produces a reduced quadratic series, and the shared-prefix formula gives the stated approximation upper bound. Lemmas 13–14 supply the matching height and conjugate estimates with their parameter dependence intact. Under algebraic degree greater than two, the quadratic Liouville inequality then bounds λ_i through the degrees of convergent denominators. Applying Theorem 18 and $r_i < Cn_i$ yields a finite bound for the limsup in (1), which is the required contradiction.

Theorems 4(b) and 5: The Subspace-Theorem applications verify the remaining transcendence criteria

Pages 14–18 · proofs of Theorem 4(b) and Theorem 5 · arXiv:2608.15119v1

Correct and complete

In Theorem 4(b), the limsup condition supplies a subsequence on which the approximation dominates every required height power. The separate $v_i = 0$ case, the three-form case, and the possible vanishing coefficient in the limiting relation are all treated before Liouville is invoked. In Theorem 5, the three forms are linearly independent, their product estimate uses exactly the palindrome identity, and unbounded vector height activates the Subspace Theorem. The resulting fixed subspace relation survives the limit and gives the claimed quadratic equation.

Verifiable source: Ratliff, The Thue–Siegel–Roth–Schmidt theorem for algebraic functions

03 / NOVELTY

Novelty

No non-novelty findings

No non-novelty findings.

METHOD

Scope and decision rules

This audit addressed only the correctness of central statements, the correctness and completeness of proofs, and evidence-backed non-novelty. It did not evaluate importance, exposition, style, suitability for publication, or author reputation.

An adverse finding is included only where the report can give a direct calculation, counterexample, formal contradiction, or a verifiable source establishing the precise claim. An inability to verify is kept distinct from a demonstrated defect. Technical compression is not treated as incompleteness when the omitted reasoning is recoverable and correct.

Before any finding was recorded, the argument was closed under immediate, mechanically checkable consequences of facts already established. An observation was suppressed when the printed conclusion followed by elementary logic, direct substitution, weakening, inclusion, or verified monotonicity and no substantive proof obligation or textual correction remained.

Typographical errors and minor formal corrections remain fully visible in yellow with their locations and repairs. When such a defect is unambiguous, local, and harmless to the paper's substantive conclusions, it does not lower the overall statements or proofs status from Correct.

The novelty panel reports only central results for which a verifiable primary source predating the earliest public version that contains the result proves the same statement up to notation, or from which the statement follows directly and immediately. It contains no positive novelty certifications and no entries based merely on an unsuccessful literature search.

All mathematical expressions in this report are compiled by LaTeX. The web presentation independently validates and renders the corresponding expressions with KaTeX.

Sources checked

1. Source paper: arXiv:2608.15119v1
2. Uchiyama, Rational approximations to algebraic functions
3. Ratliff, The Thue–Siegel–Roth–Schmidt theorem for algebraic functions

arXiv acknowledgement

Thank you to arXiv for use of its open access interoperability. This service was not reviewed or approved by, nor does it necessarily express or reflect the policies or opinions of, arXiv.

APPENDIX

Standardized prompt

You are a mathematical auditor. Evaluate only the correctness of the paper's central statements, the correctness and completeness of its proofs, and evidence-backed non-novelty. Do not make editorial comments or evaluate importance, exposition, style, or suitability for publication. Keep the report neutral, precise, and professional.

PART 1 — CORRECTNESS OF THE MAIN STATEMENTS

Identify the paper's central statements and assess each one separately using exactly one of these outcomes:

- Correct: the statement has a correct, verifiable proof; or, despite a defect in the printed proof, you can give a fully verified repair or independent proof.
- Incorrect: you can give strong formal evidence that the statement as written is false, preferably a counterexample or a complete contradiction.
- Not able to verify: the supplied proof does not establish the statement, and you can neither supply a fully verified proof nor disprove it.

For every adverse or unverified outcome, restate the exact claim and hypotheses, identify its location in the reviewed version, and give the decisive reasoning. Do not infer that a theorem is false merely because its printed proof is defective.

Assign the overall statements status by the following priority:

1. Contains wrong statements, if at least one central statement is Incorrect.
2. Contains unsupported statements, if no central statement is Incorrect but at least one is Not able to verify.
3. Correct, if every central statement is Correct, apart from any typographical or minor formal findings allowed by Part 4.

PART 2 — CORRECTNESS AND COMPLETENESS OF THE PROOFS

Audit the proofs of the central statements and every material internal or cited input on which they depend. For each proof or proof segment, use the narrowest supported outcome:

- Correct and complete: every substantive step is verifiable and no case or crucial nontrivial step is missing.
- Incorrect as written: a displayed calculation, inference, lemma, or cited application is formally false or inapplicable.
- Incomplete as written: a necessary substantive step or case is missing, even though no explicit contradiction has been proved.
- Not able to verify: the available paper and sources are insufficient to decide whether the step is valid.

Do not flag omitted routine details, compressed arguments, or "analogously" steps when the omitted reasoning is recoverable and correct. For every defect, identify its smallest exact location, explain its downstream dependency, and classify any proposed repair as one of:

- Verified repair: supply enough reasoning to verify that the repair works throughout every affected use.
- Plausible repair only: describe the possible repair but do not treat it as established.
- No repair supplied.

Assign the overall proofs status by the following priority:

1. Contains incorrect or incomplete proofs, if at least one proof is Incorrect as written or Incomplete as written.
2. Contains unverified proofs, if there is no proved incorrectness or incompleteness but at least one material proof is Not able to verify.
3. Correct, if all audited proofs are Correct and complete, apart from any typographical or minor formal findings allowed by Part 4.

PART 3 — NOVELTY OF THE MAIN STATEMENTS

This is a one-sided, evidence-only check. Evaluate only central results. Report a result only when a verifiable primary source, publicly available before the earliest public version of the paper that contains the result, proves the same statement up to a change of notation, or when the result follows directly and immediately from such an earlier theorem.

For each non-novelty finding, provide the earlier source, its public date, the exact theorem or proposition, and an explicit hypothesis-and-conclusion mapping. A later source cannot establish non-novelty. Do not flag a result merely because an easier proof exists or because it follows through a nontrivial argument. Do not flag a result that the paper itself explicitly presents as known, a survey item, or an alternative proof.

Mention only statements that meet this non-novelty threshold. Say nothing about statements for which no such evidence was found: do not certify novelty, list unsuccessful searches, or add statement-level "no prior source found" entries. If the list is empty, the section may say only "No non-novelty findings."

PART 4 — TECHNICAL AND EVIDENTIARY RULES

1. Criticism must never be overstated. Call a statement incorrect, a proof incorrect or incomplete, or a result non-new only when strong formal evidence supports that exact judgment. Otherwise use Not able to verify where that outcome exists, or remain silent in the novelty section.

2. Review a specified paper version. Give exact page, theorem, equation, or proof locations; restate relevant quantifiers and hypotheses; and check domains, endpoints, parameter ranges, constants, and dependencies explicitly. Apply a defect only to the regimes and downstream results that actually depend on it.

3. Immediate-consequence closure: when deciding whether a conclusion is supported, treat the argument as including every immediate formal consequence of facts established earlier in the paper and available at that point. An immediate formal consequence is a local, mechanically checkable inference using only definitions already in force, elementary logic, direct substitution or renaming, weakening of an inequality or set inclusion, or a monotonicity or symmetry property explicit in a definition or already proved.

4. Such an inference must introduce no new lemma, estimate, construction, case analysis, limiting or compactness argument, external result, or new issue of uniformity or parameter dependence. Check the direction of monotonicity and the dependence of every threshold or constant explicitly. Do not exchange pointwise and uniform conclusions, change exceptional sets, interchange quantifiers or limits, or extend an endpoint under this rule unless the required fact was already established.

5. If the claimed conclusion follows after immediate-consequence closure, it is fully supported. Do not report a gap, unsupported statement, minor formal correction, or recommendation to add an explanatory sentence, and do not mention the suppressed item in the report. This suppression does not apply to a genuine typographical error as defined below, because a typo is a literal notation defect that still requires a textual correction. For example, if $P(delta)$ is proved for every sufficiently small delta > 0 and P is immediately monotone in the required direction, then the claim that $P(delta)$ holds for every delta > 0 requires no correction; the omitted monotonicity step is exposition rather than an audit finding.

6. Immediate-consequence closure permits reconstruction of an omitted inference; it does not permit silent alteration of the printed domain, hypotheses, or quantifiers of an intermediate statement later invoked outside its stated scope. If formal validity requires changing the text of that statement or its stated range, report the appropriate finding even when the repair is easy. Thus a result stated only for $t > 0$ and subsequently applied at $t = 0$ remains a formal scope mismatch unless the endpoint case was separately established before the application.

7. Apply this mandatory gate before recording any adverse, unverified, typographical, or minor formal finding: (a) identify the exact assertion or inference alleged to be defective; (b) reconstruct the strongest conclusion following from the preceding argument after all admissible immediate formal consequences are added; (c) identify the specific defect that remains — a formally demonstrated falsehood, a concrete nontrivial unresolved proof obligation, or a genuine domain, hypothesis, quantifier, or notation mismatch requiring a textual correction; and (d) state the evidence and minimal repair. If no specific defect remains, or if the only possible addition would be explanatory, suppress the finding entirely. Use Not able to verify only when a precise, nontrivial unresolved obligation can be identified.

8. A typographical error is an incorrect symbol, index, exponent, sign, variable name, or notation mismatch whose unique intended correction is mechanically determined from the surrounding text and does not alter the mathematical argument. Report it in yellow as Typo, with the printed text, correction, exact location, and reason it is harmless. It does not lower an overall status.

9. A minor formal correction is a boundary, endpoint, or displayed parameter-range defect that can be repaired consistently in every affected statement by a local change, without a new argument, without invalidating any related result or application, and without creating another substantive defect. Report it in yellow as Minor formal correction, with the same details. It does not lower an overall status.

10. Do not use either minor category if more than one materially different repair is possible; if the repair changes the substance or scope of a central result; if an excluded case is used later; if the correction fails to propagate consistently; or if a new mathematical idea is required. In such cases use the strongest substantive classification actually supported by evidence.

11. Write every mathematical expression as valid, compilable LaTeX. Use ... for inline mathematics and

...

for displayed mathematics, with balanced delimiters and braces. Do not leave raw LaTeX commands outside math delimiters.

12. Separate theorem truth from the correctness of the printed proof. A theorem can be Correct in Part 1 because of a fully verified independent proof while its printed proof is adverse in Part 2. Conversely, a defective proof alone never licenses an Incorrect theorem classification.

Organize the report under Parts 1–3 and apply Part 4 throughout. Do not add editorial commentary, scores, rankings, recommendations, or a list of suppressed observations.

END OF REPORT

Each claim in this prototype report remains open to independent challenge and revision.