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# The Sum of Odd Integers: Proof and Verification Examples

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**Abstract.** This manuscript demonstrates submission layout only. It proves an elementary identity, shows how to report the scope of a formal verification, and uses the classical $3n + 1$ problem to illustrate an explicitly unproved conjecture. Authors must replace all sample names, AI-use records, computations, and links with factual information.

**Keywords.** mathematical proof; formal verification; experimental conjecture; AI contribution disclosure

## 1 Introduction

A submission should distinguish proved theorems, precisely identified machine-checked statements, and unproved conjectures. Everything below is a formatting example, not a claim of new research. For broader discussion of mathematical proof, see [1].

## 2 A proved mathematical result

**Theorem 2.1.** *For every positive integer $n$,*

$$\sum_{k=1}^{n}(2k-1) = n^2. \tag{2.1}$$

*Proof.* For $n = 1$, both sides equal 1. Assuming the identity holds for $n$, we have

$$\sum_{k=1}^{n+1}(2k-1) = n^2 + (2n+1) = (n+1)^2.$$

The conclusion follows by induction. □

**Result status:** Theorem 2.1 has a complete human-checkable proof. No formal-verification claim is made here.

## 3 How to report formal proof artifacts

For an actual proof-assistant submission, state the system and version, library versions, target statements, verification command, axioms and trust boundary, and explain the correspondence between prose and formal statements. The following code is a syntax example; mark it verified only after an independent rerun in a pinned environment.

Listing 1: Lean-style illustrative code (not a formalization of the theorem above)

```
theorem add_comm_example (a b : Nat) : a + b = b + a := by
  exact Nat.add_comm a b
```

**Actual verification record:** [Insert proof-assistant version, project commit, command, output, target theorem and dependency audit; state "not verified" when appropriate.]

## 4 Experimental conjecture and computational evidence

**Conjecture 4.1** ($3n+1$ problem (example))**.** *Let $T(n) = n/2$ for even $n$ and $T(n) = 3n+1$ for odd $n$. The conjecture states that every positive integer eventually reaches 1 under iteration.*

**Result status:** Conjecture 4.1 is unproved. Finite computation is not a general proof; the sample table does not report new experimental results.

Table 1: Illustrative record format (values listed by hand)

| $n$ | Example trajectory | Steps to 1 |
|---|---|---|
| 2 | $2 \to 1$ | 1 |
| 3 | $3 \to 10 \to 5 \to 16 \to 8 \to 4 \to 2 \to 1$ | 7 |
| 4 | $4 \to 2 \to 1$ | 2 |

A real experimental submission must supply code, environment, search range, stopping rules, error checks, and counterexample-search records. Figure 1 is a replaceable placeholder.

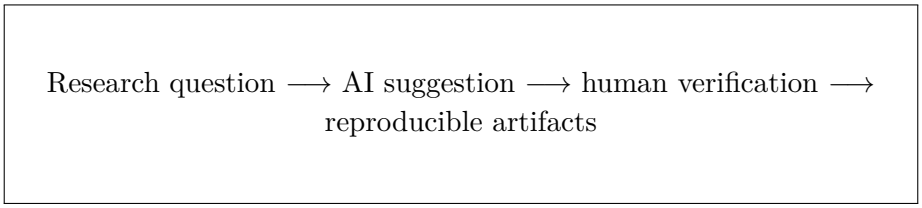



Figure 1: Example placement for a figure, workflow, or computation

## 5 AI contribution, author responsibility, and materials

**AI contribution statement.** [State provider, model and available version, dates, tasks, affected theorem or code, decisions to use or reject suggestions, important errors, and limita-

tions. This sample does not invent actual AI use.]

**Human verification and author contributions.**

[Identify the human authors who checked proofs, reran code, verified citations, and approved the final manuscript. Do not list an AI tool as an author.]

**Reproducibility materials.** [Provide code, data, formal proof files, pinned versions or access limitations; do not fabricate a repository link.]

**Competing interests and funding.** [Disclose accurately; state "none" if applicable.]

## Pre-submission checklist

1. Title, abstract, and keywords match the main claims.
2. Every theorem, conditional result, formal verification, and unproved conjecture is clearly labeled.
3. All named authors checked the essential proofs, computations, data, and citations.
4. Any AI use is mapped to tasks, available versions, dates, affected results, and human checks.
5. Formal proof files identify targets, axioms, dependencies, and rerun instructions.
6. Experimental work includes code, ranges, precision, negative results, and counterexample searches.
7. PDF, editable source, and necessary supplementary materials are ready.
8. Conflicts, funding, and access restrictions have been disclosed.

## References

[1] D. Ruelle, *The Mathematician's Brain: A Personal Tour Through the World of Mathematics*, Princeton University Press, 2007.