

AI4Math WS

Workshop on Artificial Intelligence for Mathematics

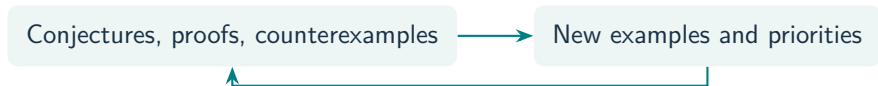
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The classical computational discovery cycle: Colton's HR

1. **Form concepts:** build definitions from existing concepts.
2. **Compute examples:** calculate properties and populate data tables.
3. **Make conjectures:** infer candidate relationships from the data.
4. **Prove or refute:** seek proofs or counterexamples.
5. **Assess and steer:** evaluate interestingness; choose what to explore next.



Five-activity synthesis of Colton, *Automated Theory Formation in Pure Mathematics* (2001), §§4.1.1, 4.5; chs. 6–10. Activities overlap; these are not five separately named sequential stages in the thesis.

Recent AI successes: from solutions to understanding

A Severe Misalignment of AI in Mathematics | 11 September 2026

- **Changed context:** the declaration points to LLM successes on major outstanding problems; the workshop brings agent-based tools into this setting.
- **The gap:** producing a solution does not automatically make its key ideas, methods and connections clear to mathematicians.
- **The concern:** rushed, benchmark-driven output can outpace careful explanation, attribution and community assimilation.
- **The opportunity:** AI can deepen mathematical study when development and use serve understanding, including the training of students.

From computational output to shared mathematics

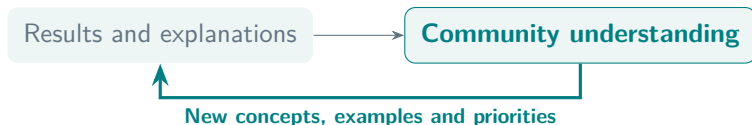
The community's work of understanding and incorporating results needs an explicit place in our account of discovery.

Declaration and its stated concerns: mathandai.org; doi:10.5281/zenodo.22737750. The transition to an extended cycle is our interpretation.

Extending the cycle: community assimilation of results

Retain HR's five activities; make community assimilation explicit.

1. **Form concepts:** build definitions from existing concepts.
2. **Compute examples:** calculate properties and populate data tables.
3. **Make conjectures:** infer candidate relationships from the data.
4. **Prove or refute:** seek proofs or counterexamples.
5. **Assess and steer:** evaluate interestingness; choose what to explore next.
6. **Build community understanding and reuse:** explain, connect, teach and incorporate results into shared mathematics.



1–5: synthesis of Colton, *Automated Theory Formation in Pure Mathematics* (2001), §§4.1.1, 4.5; chs. 6–10.

6: our workshop extension, motivated by submission 01 and the Math and AI declaration; not a phase implemented in HR.

The five papers in the extended discovery cycle

Paper	Phases addressed
Müller	6. Community understanding and reuse ; supported by 4. Prove or refute (formal checking).
Ford	2. Compute examples ; representation infrastructure for 1. Form concepts .
Kappelmann	4. Prove or refute : infrastructure for proof development.
Bajpai et al.	5. Assess and steer (expert-selected targets); 4. Prove or refute (checked solutions).
Pastorek	2. Compute examples , 3. Make conjectures , 4. Prove or refute , 5. Assess and steer .

Our mapping of submissions 01–05. Phases 1–5 summarise HR; phase 6 is our workshop extension.