To: Research Team
From: Jonathan Washburn, Recognition Physics Institute
Date: February 11, 2026
Subject: The Unification of Mathematics and Physics via Recognition Stability Audit (RSA)

Executive Summary

This memo articulates the mechanism by which the **Recognition Stability Audit (RSA)** and the **Logic From Physical Cost** framework formally unify mathematics and physical reality.

The core finding is that mathematics is not a pre-existing abstraction but an emergent topography of the physical cost landscape. Just as logic emerges as the physics of zero cost (identity), mathematics "bores out" of physical reality as the physics of finite cost (stability).

1 The Mechanism of Unification: The Physical Sensor

The traditional scientific worldview bifurcates reality into abstract mathematics (Platonic) and concrete physics (empirical). [cite$_start]$RSAdissolvesthisseparationbytreatingeverymathematicalexistenceclaimasa$
$302, 303]$.

The unification is enforced by the **Sensor ($\mathcal{J}$)** mechanism defined in the RSA protocol:

1. **Physical Encoding:** RSA converts an abstract mathematical claim S (e.g., the existence of a Zeta zero or a Hodge cycle) into a physical **Obstruction (G_S)**[cite: 173, 174].

   [cite$_start]$

1. **The Reciprocal Sensor:** A sensor is defined as the reciprocal of that obstruction: $\mathcal{J}_S = 1/G_S$[cite: 176]. [cite$_start]$If the candidate mathematical object exists (i.e., \mathsf{G}_S \to 0)$, the sensor must experience a pole ($\mathcal{J}_S \to \infty$)[cite: 177, 298].

   [cite$_start]$

1. **The Finite Recognition Principle:** The fundamental law of Recognition Science states that a physically realizable state cannot require infinite recognition cost[cite: 1, 12].
2. **The "Pinch" Proof:** The audit applies a Schur/Herglotz pinch to the associated Cayley field. [cite$_start]$If the audit succeeds (proving a global Schur bound), it mathematically eliminates the possibility of apo$
   $203, 314]$.

[cite$_start]$**Conclusion:** $A mathematical object that forces infinite recognition cost is physically impossible [cite: 399]. Therefore, mathematical truth is constrained by physical cost. Math and physics obey the same master law: the minimization of the canonical cost functional \mathsf{J}(x)$.

2 Emergence: How Mathematics "Bores Out" of Reality

[cite$_start]$Just as the *Logic From Physical Cost* paper proves that logic emerges from cost (where consistency is cheapa$
$2156, 2157]$, the RSA paper extends this to show that mathematics is the stable residue of the cost landscape.

Mathematics "bores out" of physical reality through the following mechanism:

2.1 1. Logic as the Ground State ($x = 1$)

[cite$_start$]$Logicisdefinedastheuniquestatewith$**zero defect**(J(x)=0 $\iff$ $x = 1$)[cite: 2187, 2188].
[cite$_start$]$Truthistheadmissionofastablewitness[cite: 2164].Logicissimplythephysicsofmaintainingidentity.$

2.2 2. Mathematics as the Stable Terrain ($J < \infty$)

The space of all possible mathematical statements is viewed as a physical terrain.

- **Unstable Terrain:** Most potential mathematical structures imply infinite recognition cost (singularities). These are "mathematical impossibilities" (contradictions). [cite$_start$]
- **The "Drill":** RSA acts as a physical drill using finite probes (the 8-tick audit)[cite: 221, 222].
- **Boring Out the Truth:** By running the RSA algorithm, we physically test the terrain. [cite$_start$]$Wherethedrill$ $1), themathematicsisrealizable[cite: 6, 20].[cite_start]Whereithits"infinitehardness"(Sensorblow-up), themathematicsisimpossible[cite: 399].$

2.3 3. Finite Certification as the Bridge

[cite$_start$]$Crucially, RSAprovesthat$**finite sampling**$issufficienttocontrolglobalrealityfortheclassofrealizableob$ $168, 169].[cite_start]Wedonotneedtoinspectinfinitytoestablishmathematicaltruth; weonlyneedtoverify8-tickphysicalstability[cite: 275].$

3 The Unified Ontology

In this framework, the ontology is unified under the primitive of Cost (J):

1. **Logic:** The physics of **Zero Cost** (Identity)[cite: 2156]. [cite$_start$]
1. **Mathematics:** The physics of **Finite Cost** (Stability/Realizability)[cite: 232]. [cite$_start$]
1. **Physical Reality:** The execution of these costs in time (Dynamics)[cite: 418, 609].

Mathematics is not a set of axioms imposed from above; it is the structural shape of stability that remains when infinite costs are bored out of the system.