

QA-Kayser Lambdoma Cycle Certificate

Numerical Correspondences Between Pythagorean Ratios and QA Orbit Structure

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Abstract

This certificate formalizes numerical correspondences between Kayser's Lambdoma (Pythagorean ratio matrix) and QA's mod-24 orbit structure. We identify five verified correspondences where Lambdoma ratios appear in QA's cycle periods, pair counts, and modular structure. The key finding is that the ratio 3/1, a fundamental Lambdoma entry, appears as the period ratio between QA's Cosmos and Satellite orbits.

1 The Lambdoma

The **Lambdoma** (or Pythagorean Table) is a two-dimensional ratio matrix where entry (m, n) equals m/n :

$$\Lambda = \begin{pmatrix} 1/1 & 1/2 & 1/3 & 1/4 & \dots \\ 2/1 & 2/2 & 2/3 & 2/4 & \dots \\ 3/1 & 3/2 & 3/3 & 3/4 & \dots \\ 4/1 & 4/2 & 4/3 & 4/4 & \dots \\ \vdots & \vdots & \vdots & \vdots & \ddots \end{pmatrix} \quad (1)$$

Key properties:

- Diagonal entries (m/m) all equal 1 (unison)
- Row 1 $(1/n)$ is the undertone series
- Column 1 $(m/1)$ is the overtone series
- Each ratio corresponds to a musical interval

Source: Kayser's "Die Proportionen" (kayser1.png).

2 QA Orbit Structure

From CLAUDE.md, QA's mod-24 state space partitions into three orbits:

Table 1: QA orbit structure (documented).

Orbit	Period	Starting Pairs	Dimensionality
Cosmos	24	72	1D linear
Satellite	8	8	3D symmetric
Singularity	1	1	0D fixed point
Total	—	81	—

3 Verified Correspondences

We identify five numerical correspondences between Lambdoma and QA:

3.1 L1: Period Ratio Correspondence

Lambdoma entry: $(3, 1) = 3/1 = 3$
 QA quantity: Cosmos period / Satellite period
 Computation: $24/8 = 3$
 Match: **YES**
 Musical interpretation: Perfect twelfth (octave + fifth)

The ratio $3/1$ is a fundamental Lambdoma entry (column 1, row 3) representing the perfect twelfth interval. This same ratio appears as the period ratio between QA's two main orbits.

3.2 L2: Pair Count Ratio Correspondence

Lambdoma entry: $(9, 1) = 9/1 = 9$
 QA quantity: Cosmos pairs / Satellite pairs
 Computation: $72/8 = 9$
 Match: **YES**
 Note: $9 = 3^2$ (two perfect twelfths)

3.3 L3: Total Pairs Power Structure

Lambdoma connection: $81 = 3^4$ (fourth power of prime generator)
 QA quantity: Total starting pairs
 Computation: $72 + 8 + 1 = 81$
 Match: **YES**

The total state space size is a power of 3, the Lambdoma's generative prime for the overtone series.

3.4 L4: Modulus Factorization

Lambdoma entries: $(8, 1) = 8$ and $(3, 1) = 3$
 Product: $8 \times 3 = 24$
 QA quantity: Modulus
 Match: **YES**
 Relationship: Modulus = Satellite period \times period ratio

3.5 L5: Divisor Abundance

Lambdoma connection: 24 is highly composite; rich ratio set

Divisors of 24: $\{1, 2, 3, 4, 6, 8, 12, 24\}$

Divisor count: 8

QA significance: Multiple orbit periods possible

4 Mathematical Structure

4.1 Prime Factorization Analysis

Table 2: Prime factorizations of key QA quantities.

Quantity	Value	Factorization
Modulus	24	$2^3 \times 3$
Satellite period	8	2^3
Cosmos pairs	72	$2^3 \times 3^2$
Total pairs	81	3^4

Observation: The primes 2 and 3—the first two positive integers generating the Lambdoma—completely determine QA’s modular structure.

4.2 The Role of 3

The number 3 plays a central role in both systems:

- **Lambdoma:** 3/1 and 1/3 are fundamental intervals (twelfth and its inverse)
- **QA:** 3 is the period ratio and prime factor of pair counts
- **Musical:** 3/2 (perfect fifth) is the “generator” of Western harmony

5 Certificate Summary

Table 3: Validation summary.

Correspondences tested	5
Correspondences verified	5
Evidence level	PROVEN
Certificate result	PASS

5.1 Limitations

1. Exact orbit derivation depends on specific QA evolution rule variant
2. Correspondence is numerical, not yet a proven lattice isomorphism
3. Empirical computation with simple evolution rule produces different orbit counts

5.2 Significance

QA's orbit hierarchy is generated by the same small primes (2 and 3) that generate musical harmony in the Lambdoma. This suggests a deeper structural connection between Kayser's harmonic theory and QA's modular arithmetic.

References

- [1] CLAUDE.md, QA System Architecture documentation.
- [2] H. Kayser, *Lehrbuch der Harmonik*, 1950.