

# QA-Kayser Lambdoma Cycle Certificate

## Numerical Correspondences Between Pythagorean Ratios and QA Orbit Structure

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Will

Quantum Arithmetic Research Group

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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
<b>Total</b>	—	<b>81</b>	—

### 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

**Lambda 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 Lambda—completely determine QA’s modular structure.

### 4.2 The Role of 3

The number 3 plays a central role in both systems:

- **Lambda:**  $3/1$  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	<b>PASS</b>

### 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.