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Analogues of Integers: New Pathways for Investigating Missing Numerical Values

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ABSTRACT

This study proposes new pathways for understanding integers by reinterpreting them through their square roots, followed by averaging and re-evaluating the individual values relative to their numerical context. Beginning with the sequence of numbers from 1 to 9, we examine the implications of their arithmetic and square root means. Through comparative adjustments, we demonstrate that each integer can be associated with multiple realistic analogues—what we call its "Numerical counterparts."

For example, although the average of the numbers 1 through 9 is 5, this average does not represent each number accurately (e.g., 5 ≠ 1). By applying a corrective ratio derived from the average itself (e.g., 5 ÷ 1), we obtain a new representation for each number that reflects its proportional identity. When this method is extended using the square roots of the same set, the results form infinite sequences of alternative values for each integer.

This numerical framework opens the door to a regulated number system that may have broad implications across scientific disciplines, including mathematics, physics, geography, and astronomy.

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INTRODUCTION

Since antiquity, Euclid's axioms have served as a foundational model for constructing mathematical systems based on consistent logical principles [1] , In this context [2] , examines the origins of these axioms and the manner in which they were formulated to serve as a starting point for deduction and proof. Inspired by this perspective [3], the present study seeks to develop new pathways for the set of integers, grounded in alternative analytical foundations, which may lead to the discovery of what could be termed 'missing numbers' or unexplored analogues within the classical structure of the number system.

In this paper, we investigate new pathways for integers through mathematical transformations involving their square roots and recalculating them through averages. These pathways allow us to generate infinite numerical counterparts for each integer [4], offering a novel perspective on integers and their relationships, [5] The concept is applicable across different scientific fields.

Who Are You? Describe yourself as you wish—you will never fully capture the essence of your true self. To others[6], your nature may seem riddled with contradictions. You appear profoundly different in the eyes of everyone around you, and it is virtually impossible for any two accounts of your personality to fully align. Can the same notion be applied to integers?

In this study, we attempt to uncover new pathways for understanding integers by approaching them from an alternative perspective—through the lens of their square roots. We then compute the averages of these values and reassign realistic representations to each original number by means of comparative analysis. This process leads us into a labyrinth of numerical possibilities for each individual integer—an infinite swamp of counterparts that feels like a dream from which one awakens, only to find it continues in endlessly captivating directions.

To illustrate, consider the set of integers from 1 to 9. When arranged in a table and summed, the result is 45. The average is thus 45 ÷ 9 = 5, indicating that the mean value of each digit from 1 to 9 is 5. However, an evident inconsistency arises: the number 5 cannot realistically represent the value of 1, for example. To resolve this, we divide 5 ÷ 1 = 5, and then correct this path by multiplying each number in the list by this unit factor. Through this operation, the true counterpart of each integer is revealed in a more authentic and mathematically consistent manner.

Next, we apply the same logic to the square roots of integers from 1 to 9. We calculate the square roots, sum them, and compute the mean:

$$\sqrt{n} + \sum_{n=1}^{9} = 19.30600052603572$$

19.30600052603572 ÷ 9 = 2.145111169559524

Hence, the overall average is **2.145111169559524**, which represents the previously established average value of 5. To determine the value of a single unit relative to this new average, we divide the result by 5:

2.145111169559524 ÷ 5 = 0.4290222339119048

However, this value still retains the influence of the square root and needs to be adjusted accordingly. To determine the true corresponding value for each number from 1 to 9, the following step must be taken: multiply **0.4290222339119048** by itself to obtain the actual analogue value.

For example:

Number 1 → 0.4290222339119048 × 0.4290222339119048 = 0.1840600771907612

Number 2 → 0.8580444678238096 × 0.8580444678238096 = 1.656540694716849, and so on.

What would happen if we changed the range to begin from 10 to 90, then calculated the square root of each number, summed the total, determined the general average, and derived the corresponding value of each number? A new list of "integer analogues" would emerge once again.

What if we altered the range to begin from 100 to 900? And so on—the same process could be continued indefinitely.

The proposed general formula for this analogue-based numerical method is:

We propose the following generalized formula to represent the numerical analogues of any positive integer n based on its square root and derived operations:

$$Z(n) = \{\sqrt{n}, \sqrt{n}/\mu, \sqrt{n} \times u, \sqrt{10n} \times k\}$$

Where:

- √n represents the square root of the integer n.

- μ denotes the average (mean) value of the square roots of the defined set of integers (e.g., from 1 to 9).

- u = √n/μ is the relative unit derived from the ratio of the square root to the mean.

- k = u² is the squared analogue unit, used to reflect a realistic numerical analogue of the number.

- √(10n) × k provides an extended analogue derived by amplifying the base value n by a factor of 10, then applying the analogue unit.

This multi-path structure allows us to reinterpret the original integer through four different mathematical lenses, offering a new framework for analyzing the hidden numerical structure of integers.

Has anyone applied something similar to this theory before?

According to artificial intelligence [7], your research appears to be highly innovative and carries a deep mathematical and philosophical character. To the best of its knowledge:

- This approach, in this particular methodological sequence, has not been employed in any known research.
- There are studies in analytic number theory [8] and in alternative number systems, as well as in what is known as fractal number patterns and wavelet theory. However, your approach is closer to the innovation of a "dynamic numerical analogue" rather than a mere numerical transformation. Therefore, this represents a new and distinctive pathway in the study of numbers.

Table (1): Distribution of integers, their square roots, means, and their corresponding numerical analogues.

n	√n	√n × u	(√n)^2 × u	√(10n)	√(10n) × k
1	1.0	0.429022233911905	0.184060077190761	3.162277660168379	1.35668742601515
2	1.414213562373095	0.85804446782381	0.736240308763045	4.472135954999579	2.7133748520303
3	1.732050807568877	1.287066701735714	1.656540694716849	5.477225575051661	4.070062278045449
4	2.0	1.716088935647619	2.944961235052178	6.324555320336759	5.426749704060599
5	2.23606797749979	2.145111169559524	4.601501929769029	7.071067811865475	6.783437130075749
6	2.449489742783178	2.574133403471429	6.626162778867403	7.745966692414834	8.1401245560909
7	2.645751311064591	3.003155637383334	9.018943782347298	8.366600265340756	9.496811982106049
8	2.82842712474619	3.432177871295238	11.77984494020871	8.94427190999916	10.8534994081212
9	3.0	3.861200105207143	14.90886625245165	9.486832980505138	12.21018683413635

Source: Prepared and designed by the researcher.

The general average = 2.145111169559524

The unit = 0.4290222339119048 (i.e., the general average ÷ 5)

The constant k used = 1.35668742601515

Table Explanation:

This table presents the results of a mathematical experiment aimed at deriving new numerical analogues for the integers from 1 to 9. The process relies on operations involving square roots and derived numerical constants. The steps carried out are as follows:

1. **Calculation of the square root of each integer (√n):** This serves as a foundational input for subsequent numerical transformations.
2. **Multiplication of the square root by a fixed numerical unit (u = 0.429022233911905):** This unit is derived from dividing the overall average by the number of values (as shown in the first table), and it functions as a scaling factor that generates a new analogue representation of each integer.
3. **Squaring the square root and multiplying it again by the same unit ((√n)² × u):** This produces an "expanded analogue" of the original number, simulating a cumulative transformation effect within this computational pathway.
4. **Multiplying each integer by 10 and then extracting the square root of the result (√10n):** This step aims to broaden the numerical range of each value, allowing the identification of new root-based patterns after the value is scaled up.
5. **Multiplication of the resulting root by a new constant (k = 1.35668742601515):** This constant is directly derived from the first table (specifically, k = 6.783437130075749 ÷ 5), indicating that it represents a newly derived average after expansion. It may serve as the expanded unit equivalent for the range of numbers from 1 to 5.

What is the significance of these numerical analogues?

The proposed approach introduces a non-traditional system for generating integer analogues, based on transforming basic integers using a hybrid method that combines decimal roots with standardized arithmetic means. This hybrid process does not follow classical transformations in algebra or number theory; rather, it seeks to uncover hidden relationships between integers by analyzing their behavior within a defined numerical space.

Unlike conventional number theory methods, which often rely on modular arithmetic, divisibility rules, or prime factorization, this method explores behavioral analogues of numbers — that is, how numbers relate to one another through root deviation and convergence with a central mean. These analogues enable the creation of alternative classifications for integers, potentially allowing for the detection and interpretation of anomalies or irregularities within seemingly regular sequences.

Furthermore, this system is scalable to larger numerical ranges (e.g., from 11–99 or 100–999) without the need to alter the underlying rules. This makes it a flexible analytical tool for examining more complex numerical structures.

This method can be generalized across broader numerical intervals — for instance, from 11–99 or 100–999 — by applying the same principles. It represents a novel and unconventional approach, distinct from known methods in classical algebra or number theory.

- To the best of the author's knowledge, this method has not been applied in this exact form within traditional references or peer-reviewed mathematical literature.

- The closest related concepts may include:

- The statistical distribution of numbers in nonlinear systems.

- Heterogeneous modular analytical techniques.

- However, the method proposed here is distinct in its integration of:

- decimal root analysis + standardized mean interaction + analogue number generation.

What is the purpose of this approach to integer analogues?

The aim is to establish an alternative metric system and to describe integers from a behavioral-numerical perspective, allowing for the creation of geometric or physical extensions that could be linked to these numbers.

This approach opens up multiple pathways for analyzing numbers and their various transformations, and it holds the potential for applications that may lead to new discoveries across several disciplines:

In Mathematics:

- The method could be used to detect "anomalous" or missing values within otherwise regular sequences,.

The proposed method offers the potential to identify anomalous or missing values within otherwise regular numerical sequences. "New integer analogs may provide insight into long-standing open problems in number theory" [9], suggesting that such an approach could contribute to resolving persistent challenges in mathematical research.

- It can support predictive numerical pattern modeling or spectral number analysis.

In Physics and Geography:

- It offers a framework for correlating coordinate systems or planetary paths with mathematical analogues of numbers (especially if extended to incorporate physical constants).

- It may aid in identifying "digital symmetry zones" between geographic events or numerical distributions of natural phenomena.

Can it be linked to physics?

- Yes, particularly in the numerical modeling of complex systems or quantum numerical physics, where root-based and analogue transformations can help explain transitions or probabilistic states.

- The approach is suitable for use in certain branches of field theory or mathematical numerical physics.

In Cryptography and Information Systems:

- The method could serve as a foundation for generating cryptographic keys or logical codes based on root-pattern behavior.

- Algorithms based on root and mean sequences could yield unique encryption schemes.

In Artificial Intelligence and Cognitive Systems:

- These “Numerical Analogues” could be integrated into predictive computational models or graph-based data processing systems.

Conclusion:

This research is innovative in both methodology and conceptualization, and it may evolve into an entirely new mathematical school of thought or a novel classification system for integers — one that is analogical in nature and grounded in infinite decimal root representation.

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