The ∞ Definition Method

Connection Method to Shinichi Mathematics, Vol. 1

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Abstract

This paper introduces the *Infinity Definition Method* a foundational redefinition of structure in mathematics. By adopting the symbolic identities

$$\frac{1}{\infty} = 0 \quad \text{and} \quad \frac{1}{0} = \infty$$

as axiomatic, the method reconceptualizes arithmetic, limits, and equality. We examine the latent role of $\frac{1}{\infty} = 0$ in convergent series and unveil the hidden symmetry in limit operations where $1 = 0$ is implied structurally.

1 Notation

- X: a positive integer
- N: a generalized variable capable of encoding arbitrary phenomena
- ∞: infinity
- $\infty := 10^N$: Infinity as a structural variable, defined as:

2 Foundational Definitions

$$\begin{aligned} \frac{1}{\infty} &= 0 \\ \frac{1}{0} &= \infty \\ 1 &= 0 \quad \text{(in the structure of limits)} \end{aligned}$$

These expressions, typically regarded as "undefined" or meaningful only within limits in conventional mathematics, are here adopted as structural definitions.

3 Relation to Infinite Series

Consider the geometric series:

$$1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \cdots = 2$$

Its convergence relies on the implicit limit:

$$\lim_{x \to \infty} \frac{1}{x} = 0 \quad \Rightarrow \quad \frac{1}{\infty} = 0$$

Thus, in the context of infinite series, $\frac{1}{\infty} = 0$ is implicitly accepted.

4 Division and Infinite Transformation

$$1 \div \infty = 0 \quad \text{(via limit process)}$$
$$1 \div 0 = \infty \quad \text{(by inverse operation)}$$

We begin with the following relation:

$$1 \div \infty = 0 \quad \Rightarrow \quad \frac{1}{\infty} = 0$$

Multiplying both sides by ∞, we obtain:

$$\frac{1}{\infty} \cdot \infty = 0 \cdot \infty \quad \Rightarrow \quad 1 = 0 \cdot \infty$$

In conventional mathematics, the term $0 \cdot \infty$ is considered undefined (or contradictory), leading to the interpretation:

$$1 = 0 \quad \text{(contradiction)}$$

However, in this theory, we restore structural consistency through definition-based transformation by multiplying both sides again by $\frac{1}{0}$:

$$1 \cdot \frac{1}{0} = (0 \cdot \infty) \cdot \frac{1}{0}$$

Left-hand side:

$$1 \cdot \frac{1}{0} = \frac{1}{0}$$

Right-hand side:

$$(0 \cdot \infty) \cdot \frac{1}{0} = \infty$$

Now, if we define:

$$\frac{1}{0} = \infty$$

Then the following structural identity is derived:

$$1 = 0 \cdot \infty \quad \text{and} \quad \frac{1}{0} = \infty$$

Therefore, in this theoretical framework, the equation $1 = 0$ is not a contradiction, but rather a generative expression arising from structural transformation.

5 Definition-Based Formulation of ∞

In this paper, infinity ∞ is not treated merely as a symbol of a mathematical limit, but rather as a definable variable that can be handled structurally and computationally. Specifically, we define it as follows:

$$\infty = 10^N$$

Here, N is considered a variable capable of encapsulating all forms of mathematical phenomena, including algebraic operations, computational procedures, and logical structures. Thus, ∞ is not a fixed value, but a quantifiable and structurally scalable variable, whose form and magnitude can be adjusted according to the selection of N.

6 The Role of Definition in Mathematics

- Infinity is not merely a result of calculation, but a definable variable.
- All operations can be restructured through definitional selection.
- The consistency of propositions and answers is born from how definitions are chosen.

7 Conclusion

If $\frac{1}{\infty} = 0$ and $\frac{1}{0} = \infty$ are accepted as mathematical equations, then mathematics can be structurally redefined beyond the traditional scope of divergence and limits.

The expression $1 \div 0$ has long been deemed undefined, not because it is meaningless, but because no computation method had been established. By defining it inversely—analogous to the concept of series—it becomes solvable.

Within series convergence, the phenomenon $1 = 0$ subtly appears, representing a latent structure of infinity.

Infinity (∞) is a structural concept that emerges as the result of a defined computational process, and depending on that definition, it can serve as a valid answer. However, when infinity is treated as a numerical object and used in expressions such as $1 + \infty$, logical inconsistencies or contradictions can easily arise.

Nevertheless, mathematics contains cases—such as infinite series—where the handling of ∞ becomes unavoidable. In such cases, it becomes necessary to redefine what state ∞ represents, in order to preserve structural and logical clarity.

This is precisely where the **Infinity Definition Method** comes into play. The following structural definitions typically serve as its foundation:

$$\frac{1}{\infty} = 0 \qquad \text{(limit-based expression)}$$
$$1 = 0 \qquad \text{(structural equivalence)}$$
$$\frac{1}{0} = \infty \qquad \text{(inverse relationship)}$$

An alternative approach involves structurally defining infinity in advance. For example:

$$\infty = 10^N$$

Here, N is a structural variable capable of encapsulating operations, logic, and growth. Thus, ∞ becomes a scalable and definable mathematical construct.

This suggests that infinity depends on the observer's definition — what is infinite to one (e.g., 100) may be finite to another (e.g., 10,000).

The **Infinity Definition Method** refers to this twofold system:

- Infinity derived from structural relationships
- Infinity predefined as a functional constant

This framework offers a unified approach for treating infinity not as an abstract divergence, but as a definable, manipulable element within mathematics.

This approach thus becomes a foundational definitional theory, applicable not only to division but also to higher-level mathematical theories such as the structure of primes .

"The answer in mathematics depends on the choice of definition."

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