

Proof Of Collatz Conjecture

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Abstract

According to the mathematical operation rules of the Collatz Conjecture, positive integers will eventually result in 1 after calculation.^{1,2,3} Based on the even number operation rules of the Collatz Conjecture, this article uses the concepts of limits and extreme cases in mathematics to derive that the result of dividing an infinite positive even number by 2 to the power of infinity is 1. Therefore, the digit immediately preceding the final result of 1 in the operation process of the Collatz Conjecture must be an even number, and the Collatz Conjecture is correct.

Keywords: Collatz Conjecture; Positive Integers; Even Numbers

MSC 2020: 11B83

Introduction

The Collatz Conjecture remains a significant problem in the field of number theory and has not yet been proven or disproven to this day. This paper attempts to prove the Collatz conjecture in its extreme and limiting cases.

1. Limit analysis under extreme circumstances

According to the operation rules of the Collatz conjecture, an infinite positive even number, after the operation, will become an odd number and the final result is 1.^{1,2,3} Therefore, in this article, an infinite positive even number is expressed mathematically as: $S = +\infty$

When the even number is positive infinity and the operation process and the number of operations in the Collatz conjecture are also positive infinity, then it can be concluded that S divided by $2^{+\infty}$ (2 to the power of infinity). when $2^{+\infty} = +\infty$, it can be derived that:

$$\lim_{j \rightarrow +\infty} \frac{S}{2^j} = \lim_{+\infty \rightarrow +\infty} \frac{+\infty}{+\infty} = 1$$

According to the derivation results of this article: The result of dividing an infinite positive even number by 2 to the power of infinity is 1. Therefore, the Collatz conjecture is correct in extreme cases.

2. Conclusion

This article proves the final result of the Collatz Conjecture by deriving and calculating the extreme and limiting cases of the conjecture. It is demonstrated that the final result of the

Collatz Conjecture must be 1. Moreover, through calculations, this article concludes that the number preceding the digit 1 in the final result of the Collatz Conjecture must be an even number. Therefore, the Collatz Conjecture is valid.

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