An Unsolved Mystery: The Collatz Conjecture

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The Collatz Conjecture is a famous unsolved mathematical problem.

It is also called the 3x + 1 problem or the Hailstone sequence.

It was proposed by Lothar Collatz in 1937.

The Collatz Rule

Take any positive number (n) and follow these steps:

i. If n is even, divide it by 2 → (n ÷ 2).

ii. If n is odd, multiply it by 3 and add 1 → (3n + 1).

iii. Repeat the process until you reach 1.

Example of Collatz Sequence

Let's start with n = 6

- **6 is even, so:** 6 ÷ 2 = 3
- **3 is odd, so:** (3 × 3) + 1 = 10
- **10 is even, so:** 10 ÷ 2 = 5
- **5 is odd, so:** (5 × 3) + 1 = 16
- **16 is even, so:** 16 ÷ 2 = 8
- **8 is even, so:** 8 ÷ 2 = 4
- **4 is even, so:** 4 ÷ 2 = 2
- **2 is even, so:** 2 ÷ 2 = 1

Final sequence: 6 → 3 → 10 → 5 → 16 → 8 → 4 → 2 → 1

No matter which number you start with, you always reach 1! (So far, no exception has been found).

Properties of the Collatz Conjecture

i. **Applies to all positive numbers:** Start with any number, and the process continues.

ii. **Numbers fluctuate before reaching 1:** Some numbers increase a lot before decreasing.

iii. **Still Unsolved!:** Mathematicians have tested it for billions of numbers but haven't proven it for all numbers.