

Date: April 8th, 2009

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Title: *The $3x + 1$ problem*

Abstract: *The $3x + 1$ problem* is also known as the *Collatz problem*, the *Syracuse problem*, *Kakutani's problem*, *Hasse's algorithm*, and *Ulam's problem*. The Collatz function can be defined as

$$C(n) = \begin{cases} 3x + 1 & \text{if } x \equiv 1 \pmod{2}, \\ \frac{x}{2} & \text{if } x \equiv 0 \pmod{2}. \end{cases}$$

It has been claimed that for any positive integer, x , after a finite number of iterations we reach 1. This has been shown for $x \leq 240$ but it has not been proven that this function converges to 1. Many have tried to prove this claim and have extensively studied it, including Lothar Collatz and Jeffery Lagarias. It was first discovered by Collatz while studying group theory and number theory. Different methods have been used to try to prove the claim such as polynomial analogues, parity sequences, mapping it to the iteration of the function, reversing the function, etc. We will discuss some of these methods, particularly polynomial analogues.