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Narrowing the condition for the existance of Collatz Cycles

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Abstract Insert your abstract here. Include keywords, PACS and mathematical subject classification numbers as needed.

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1 Introduction

The Collatz conjecture is one of the unsolved "Million Buck Problems" [1]. When Lothar Collatz began his professorship in Hamburg in 1952, he mentioned this problem to his colleague Helmut Hasse. From 1976 to 1980, Collatz wrote several letters but missed referencing that he first proposed the problem in 1937. He introduced a function $g : \mathbb{N} \to \mathbb{N}$ as follows:

$$g(x) = \begin{cases} 3x + 1 & 2 \nmid x \\ x/2 & \text{otherwise} \end{cases} \tag{1}$$

This function is surjective, but it is not injective (for example $g(3) = g(20)$) and thus is not reversible. The Collatz conjecture states that for each start number $x_1 > 0$ the sequence $x_1, x_2 = g(x_1), x_3 = g(x_2), \ldots$ will at some point enter the so called trivial cycle $1, 4, 2$. One example is the sequence $17, 52, 26, 13, 40, 20, 10, 5, 16, 8, 4, 2, 1$ starting at $x_1 = 17$. The assumption has not yet been proven. If the conjecture were wrong, then for a starting number x_1 the sequence either would diverge indefinitely or enter a cycle different

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Table 1 Please write your table caption here

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from the trivial one (a so called non-trivial cycle). Subject of our investigation are the non-trivial cycles and the question if these cycles are possible, under which condition they might occur and which cycles can be considered to be impossible. For this we define a more convenient function opting out all even integers from Collatz sequences:

$$f(x) = (3x + 1) \cdot 2^{-\alpha(x)} \tag{2}$$

Note that $\alpha(x)$ is the highest exponent for which $2^{\alpha(x)}$ exactly divides $3x + 1$.

2 Related Research

Hercher [2] dealed with conditions for a cycle and showed that a .

3 Defining the conditions for cycles

Text with citations [3] and [**?**].

3.1 Subsection title

as required. Don't forget to give each section and subsection a unique label (see Sect. 3).

Paragraph headings Use paragraph headings as needed.

$$a^2 + b^2 = c^2 \tag{3}$$

References

1. S. W. Williams, Million Buck Problems, National Association of Mathematicians Newsletter, 31(2), 1-3 (2000)
2. C. Hercher, Über die Länge nicht-trivialer Collatz-Zyklen, Die Wurzel, 6-7, 1-13 (2018)
3. Author, Book title, page numbers. Publisher, place (year)

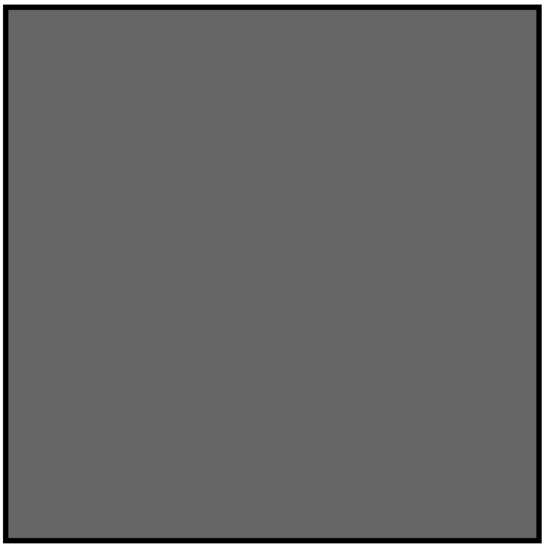

Fig. 1 Please write your figure caption here

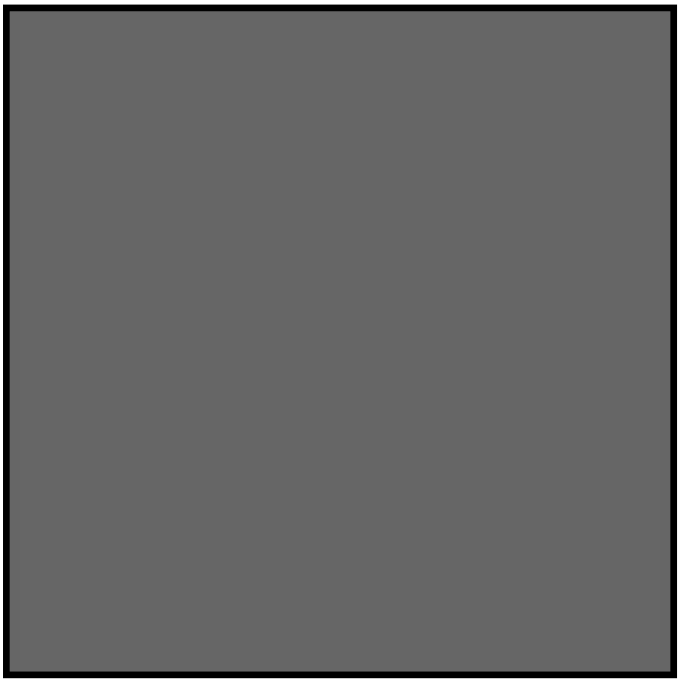

Fig. 2 Please write your figure caption here