

# Collatz Conjecture Proof (Work in Progress)

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preface:

$$0 \in \mathbb{N}$$

$$a \bmod_k b \equiv a - b \left\lfloor \frac{a}{b} \right\rfloor + k$$

$$a \bmod b \equiv a \bmod_0 b$$

pf:

$$\text{let } n, m, k, p \in \mathbb{N}, \quad f(x) = \begin{cases} 3x + 1, & x \bmod 2 \equiv 1 \\ \frac{x}{2}, & x \bmod 2 \equiv 0 \\ \text{undef,} & \text{otherwise } (x \notin \mathbb{Z}) \end{cases}$$

$$3^p \neq 2^k \neq 2^m$$

therefore multiplying by 3 has no effect on the ability to reach  $2^n$ .  
neither does dividing by 2.

$3n + 1 \stackrel{?}{=} 2^k \therefore$  adding does have an effect.

$\log_2 x \in \mathbb{N} \iff 1$  is reached after  $\log_2 x$  iterations.

$|\mathbb{N}| = \infty \iff |2^{\mathbb{N}}| = \infty$  (there are infinite  $2^n$ s.)

one of the  $2^n$ s will always be reached because iterating through  $f$   
will add 1 every time it is odd.

■?

footnotes:

will only prove for  $x \in \mathbb{N}$ .

the formulas for  $f$  or mod have to change for  $x \in \mathbb{I}, \mathbb{C}$

ie:  $3i \bmod 2 = i \notin \{1, 0\}$ .

the conjecture does not hold  $\forall x \in -\mathbb{N}$  because  $x = -5$  loops.