The max nature number

1. Introduce

As we know, nature number is infinite, why is there a max nature number? To clearly find it, let’s introduce the definition of limit and infinity.

In mathematics, a limit(symbol: $\lim_{x \to \infty} x$) is the value that a function or sequence "approaches" as the input or index approaches some value. Limits are essential to calculus (and mathematical analysis in general) and are used to define continuity, derivatives, and integrals.

Infinity (symbol: ∞) is an abstract concept describing something without any bound or larger than any number.

2. Limit is unreachable

Firstly let's look a simple sequence $\frac{1}{2^n}$, according to the definition of limit, $\lim_{n\to\infty}\frac{1}{2^n}=0$.

To any nature number n, $\frac{1}{2^n}>0$ => $\frac{1}{2^n}>\lim_{n\to\infty}\frac{1}{2^n}=\frac{1}{2^\infty}$.

We get 2 deductions:

The limit of sequence $\frac{1}{2^n}$ is unreachable.

The infinity ∞ is unreachable.

Actually, these 2 deductions seem redundant, they can be fetched from the definition directly.

3. Limit is reachable

Secondly let's look the old Zeno problem.

Suppose a man's speed is 2m/s, tortoise's speed is 1m/s, the distance from man to tortoise is 1m.

The man began to chase after tortoise, when

the man reaches the first position of tortoise, tortoise run $\frac{1}{2}$ m;

the man reaches the second position of tortoise, tortoise run $\frac{1}{2^2}$ m;

the man reaches the third position of tortoise, tortoise run $\frac{1}{2^3}$ m;

...

the man reaches the n-th position of tortoise, tortoise run $\frac{1}{2^n}$ m;

...

The distance from man to tortoise is $\frac{1}{2^n}$ m and $\lim_{n\to\infty}\frac{1}{2^n}$ =0.

Because the man is faster than the tortoise, he will catch up the tortoise after 1 second (1m/(2m/s-1m/s) = 1s). Even more the man will then exceed tortoise. It means the distance from man to tortoise becomes from 1m to 0m and to negative number. The distance of 0m is reachable.

(deduction 1): the limit of sequence $\frac{1}{2^n}$ is reachable.

Suppose the n-th position of tortoise is the reach point => $\frac{1}{2^n}=\lim_{n\to\infty}\frac{1}{2^n}$ =0

=> $\frac{1}{2^{n+1}}=\frac{1}{2^n}\cdot\frac{1}{2}$ =0 => n+1 = n =>n+2=n

=>...n+k=n (k is nature number)=>∞=n.

(deduction 2): the infinity ∞ is reachable.

Because the deductions are totally mathematical deduction, they are nothing to do with physics, then it’s credible.

4. The max nature number

Since the infinity is reachable, let's find out about the max nature number.

In quantum mechanics, the Planck length is the minimum space length.

$$\ell_P = \sqrt{\frac{\hbar G}{c^3}} \approx 1.616\,229(38) \times 10^{-35}\ \mathrm{m}$$

Since 2^n is also a nature number, we can simply define a new nature number N = 2^n (the n-th position of tortoise is the reach point).

The minimum distance from man to tortoise is $\frac{1}{2^n} = \lim_{n\to\infty}\frac{1}{2^n} = \frac{1}{2^\infty} = \frac{1}{N} = \ell_P$

=> ∞ = N = $\frac{1}{\ell_P} = \sqrt{\frac{c^3}{\hbar G}} \approx 618724203\times10^{26}$

(deduction 3): the max nature number is $\sqrt{\frac{c^3}{\hbar G}}$, which is also infinity (about 618724203×10^{26}) . Any nature number more than $\sqrt{\frac{c^3}{\hbar G}}$ is nonsense.

5. Conclusion

Thank ancient philosopher Zeno, who brought such an interesting and meaningful paradox. It imply that the limit is reachable. Then we can deduct the infinity is $\sqrt{\frac{c^3}{\hbar G}}$, about 618724203×10^{26} , Any nature number more than $\sqrt{\frac{c^3}{\hbar G}}$ is nonsense.