Infinite number

moon kyom
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Added the infinite sign and the infinitesimal sign and defined an operation.
The infinite calculation of number became possible.
The benefits gained by infinite number is as follows.

•The exact limit representation becomes possible.
•Divergence of the integral representation becomes possible.
•Divergence of the infinite sequence representation becomes possible.
•Calculations are extended to the Infinite.

Infinite number is mathematics will lead to a new area.

1 Infinity

1.1 Odd, even and 0.999…

The number of odd and the number of integer are the same.
If the above proposition is true, Set of integer minus the set of odd must be the empty set.
This is a contradiction.

$$\begin{aligned} &\textit{number of integer} = \textit{infinity.} \\ &\textit{number of integer} = \textit{number of odd} + \textit{number of even.} \\ &\textit{number of odd} = \textit{number of even.} \end{aligned}$$

number of odd is half of number of integer

A moves at a speed of 1, B moves at a speed of 2, if they move infinitely then they are not able to meet.
The ratio of distance is always 2.

We are easy to see "1 = 0.999…" is strange.
But there are numerous ways to prove about "1 = 0.999…".
This article contains answers about "1 = 0.999…".

1.2 Point, length, area, volume

1m length consists of the infinitely many points.
points of 2m length is twice as many as points of 1m length.
$1\mathrm{m}^2$ area was composed of 1m horizontal and 1m vertical.
$1\mathrm{m}^1 \times 1\mathrm{m}^1 = 1\mathrm{m}^2$
$1\mathrm{m}^3$ Volume was composed of $1\mathrm{m}^2$ area and 1m height.
$1\mathrm{m}^2 \times 1\mathrm{m}^1 = 1\mathrm{m}^3$

This is an example of the infinite number.

2 Infinite operation

$$\begin{tikzcd}
\cdots & \square^2 \arrow[r, bend right, "\times\infty"'] & \square^1 \arrow[l, bend right, "\times\square"'] \arrow[r, bend right, "\times\infty"'] & 1 \arrow[l, bend right, "\times\square"'] \arrow[r, bend right, "\times\infty"'] & \infty^1 \arrow[l, bend right, "\times\square"'] \arrow[r, bend right, "\times\infty"'] & \infty^2 \arrow[l, bend right, "\times\square"'] & \cdots
\end{tikzcd}$$

1 = *Unit.*
∞ = *Infinity.*
$\square$ = *Infinitesimal.*
$\infty \times \square = 1$
$\infty \times \infty = \infty^2$
$\square \times \square = \square^2$

2.1 The decimal and the positive integer

The number of positive decimal and the number of positive integer are the same.

0.00, 0.10, 0.20, 0.30, ... , 0.80, 0.90,
0.01, 0.11, 0.21, 0.31, ... , 0.81, 0.91,
0.02, 0.12, 0.22, 0.32, ... , 0.82, 0.92,
...
0.031, 0.131, 0.231, 0.331, ... , 0.831, 0.931,
...

0.01 corresponds to the 10, 0.21 corresponds to the 12
0.931 corresponds to the 139

2.2 The Sum of infinite sequence

If the number of positive integer is unit ∞, then the sequence of nature number may be calculated by the formula of arithmetic sequence sum.

$$\sum(\text{nature number}) = \frac{\infty \times (2 \times 1 + (\infty - 1) \times 1)}{2} = \frac{\infty^2 + \infty}{2}$$

First method of the decimal sequence sum.

Sum of first decimal is $4.5 \times \infty / 10$
Sum of second decimal is $0.45 \times \infty / 10$

$$\begin{aligned}
& \ 4.5 \quad \times \infty / 10 \\
& + 0.45 \quad \times \infty / 10 \\
& + 0.045 \quad \times \infty / 10 \\
& + \ldots \\
& = 4.999 \ldots 5 \quad \times \infty / 10
\end{aligned}$$

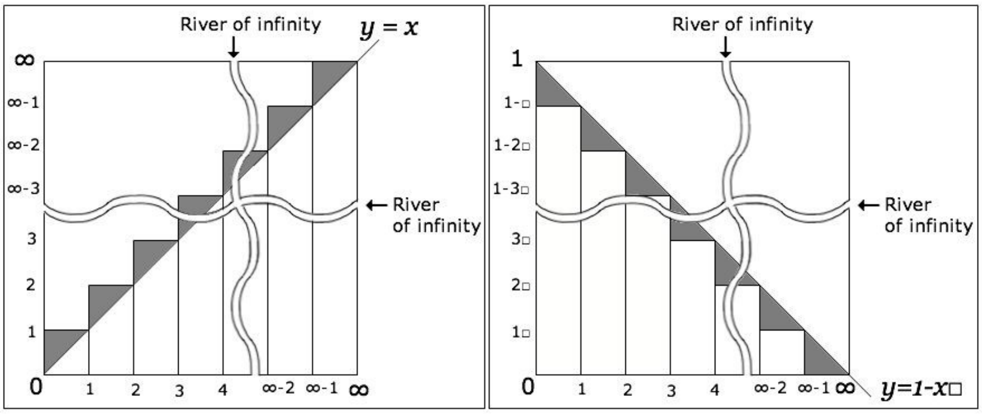
last decimal number is 5.

$$\sum(\text{decimal}) = \frac{5\times\infty-5}{10} = \frac{\infty-1}{2}$$

Second method of the decimal sequence sum.
If the formula of arithmetic sequence sum is using.

$$\sum(\text{decimal}) = \frac{\infty\times(2\times\square+(\infty-1)\times\square)}{2} = \frac{\infty+1}{2}$$

Two results have difference as 1.
This difference between both parts of the picture is gray.



The first method did not include one.
If first method include 1, sum is $\frac{\infty+1}{2}$.

$$\sum(\textit{nature number}) = \sum(\textit{decimal})\times\infty$$

2.3 The Calculus

If the number of positive integer is unit ∞, then number of real number is $2\times\infty^2$
Usually used as a base to real number than nature number.
If the number of real number is unit ∞, then number of nature number is 1/2

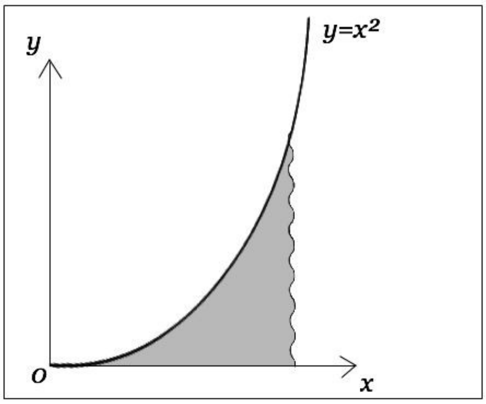
The table below shows Calculate the value of a few infinite number.
Unit is the positive real number.

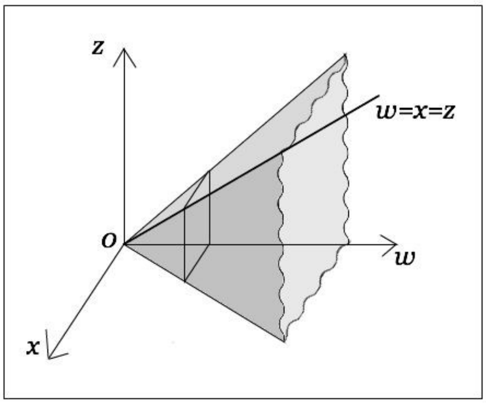
Number of positive real number	∞
Number of nature number	1
$\sum(\textit{nature number})$	$\frac{\infty+1}{2}$
$\sum(\textit{nature number}^2)$	$\frac{2\infty^2+3\infty+1}{6}$
$\int(\textit{positive real number})$	$\frac{\infty^2}{2}$
$\int(\textit{positive real number}^2)$	$\frac{\infty^3}{3}$
$\lim \frac{1}{x}$	□
$\lim \frac{1}{x^2}$	$□^2$

Divergence of the integral representation becomes possible.
Divergence of the infinite sequence representation becomes possible.
The exact limit representation becomes possible.

∞ is the ratio difference between □ and $□^2$.
This is like the ratio difference between 1 and ∞.

Infinite number represented number of relative about unit.





Integral of x^2 is $\frac{\infty^3}{3}$.

Three-dimensional coordinates function(w = x = z) is shape of quadrangular pyramid.

This infinite pyramid is the size of $\frac{\infty^3}{3}$.

This is calculated with next two kind.

Size of three-dimensional is ∞^3 and size of quadrangular pyramid is $\frac{1}{3}$.

x×z increase to w-axial direction.

If x=z, then $x \times z = x^2$.
Calculus leads to the infinite number.

2.4 Exponential infinite number

Infinite number may be classified as a infinite degree.
if real number is unit,
then infinite degree of real number is 0. Is denoted by $\text{real number} \times \infty^0$.
If Infinite number Is denoted by $\text{real number} \times \infty^1$, infinite degree is 1.
Number of real number is the case.
If Infinite number Is denoted by $\text{real number} \times \infty^2$, infinite degree is 2.
sum of real number sequence is the case.
$\text{real number} \times \infty^1$ are bigger than $\text{real number} \times \infty^{0.5}$.
$\text{real number} \times \infty^0$ are smaller than $\text{real number} \times \infty^{0.5}$.

Multiplication of real number A and B is $(A \times \infty^0) \times (B \times \infty^0) = A \times B \times \infty^0$
Multiplication of infinite number A and B is $(A \times \infty^1) \times (B \times \infty^2) = A \times B \times \infty^3$
The ∞^0 were omitted from the multiplication of real number.

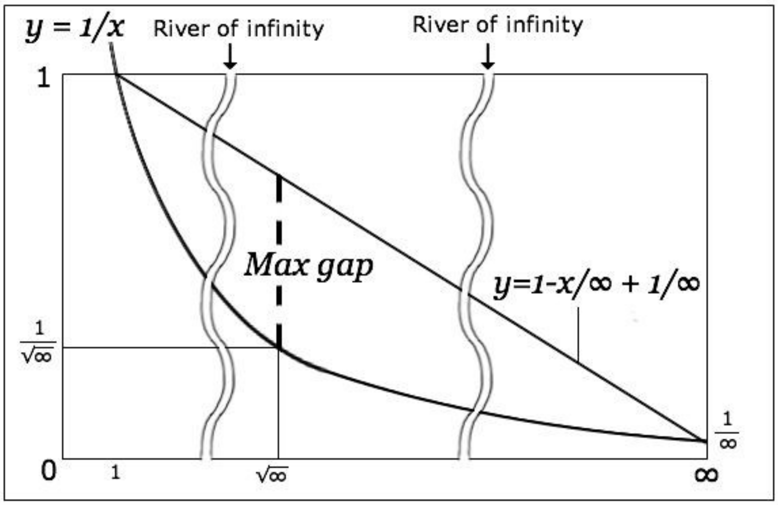
2.5 Z1

The ∞ of sequence as $\frac{1}{\infty}$ is smaller the positive real number.
If want change infinite degree requires the operation of infinite number.
The sequence is represented as y=1/x. called Z1.
Infinite degree of ∑Z1 are smaller than 1.

The sum of the 99th of Z1 sequence is about 5.17.
From 100th element until ∞th element draws the straight line and the area of the territory is

$$\left(\frac{1}{100} - \square\right) \times \frac{\infty - 100}{2} + \square \times (\infty - 100) + 5.17... \quad = \quad \frac{\infty}{200} - 50 \times \square + 5.17...$$

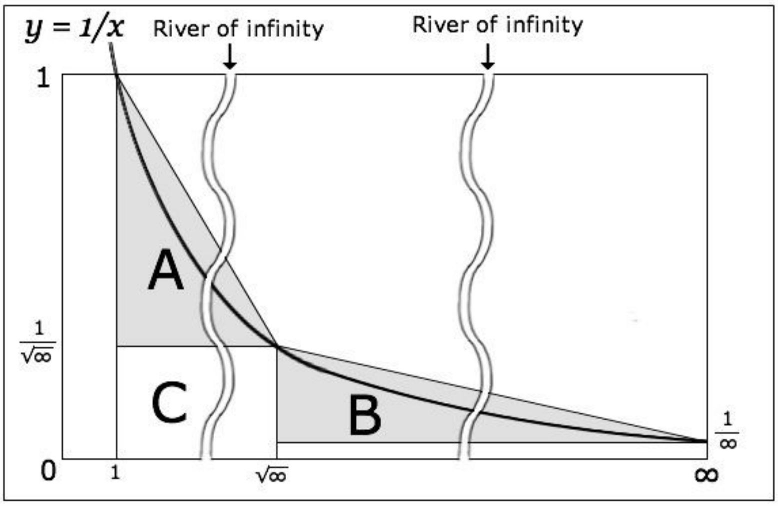
∑Z1 are smaller than ∞/200.
the calculation result of 10000th the element is about ∞/20000 and ∑Z1 is smaller then this.
If calculates that what kind of natural possibility element, ∑Z1 is smaller that.
Infinite degree of ∑Z1 are smaller than 1.



Linear function passing through 1 and 1/∞ is fa(x) = $1-\frac{x}{\infty}+\frac{1}{\infty}$.

fb(x) = $\frac{1}{x}$.

fa(x) and fb(x) is the biggest gap is x = $\sqrt{\infty}$.



A area is $(\sqrt{\infty}-2+1/\sqrt{\infty})/2$.
B area is $(\sqrt{\infty}-2+1/\sqrt{\infty})/2$.
C area is 1.
The area of under B is $1-1/\sqrt{\infty}$.
Sum is $\sqrt{\infty}$, ∑Z1 is smaller that.
Infinite degree of ∑Z1 are smaller than 0.5, or same

2.6 Real number, rational number, irrational number

The real number will be able to define with two kind.
The first one is represented by natural numbers + decimal number.

It was the small conceptual real number.
The second one is defined as including the rational number and the irrational number.
It was the great conceptual real number.

The nature number that express the rational number and the small real number are the same.
The problem is between 0-1.
The number of the decimal number is ∞, The number of the rational number which is the possibility of showing with 1/x is ∞.
When includes 2/x, 3/x,…, the number of the rational number is bigger number of the decimal number.
The rational number uses x/y two number. the number of the rational number is maximum ∞^2.
But less then ∞^2, because the rational number is duplicated.

1/3 is expressed number with '/' operation.
Technically, the Calculation is not completed.
The small real number can not contain 1/3
0.3333… not be able to express without (…).

Also, do not say …33333 is the real number.

The real number used in the current definition of mathematics, including the the rational number and the irrational number.
This definition is broad and unclear boundaries.

Function f(x) = 1/x, if x is ∞then the value is □.

$$\frac{1}{\infty-1}=\square+\square^2+\square^3+\ldots$$

This value is expressed with all infinite degree which is smaller 0.

∞and □ is the relative numbers.
The infinite number Expresses a proportion about infinite unit.
∞ of the decimal system grows 5 times the binary system.
1/3 is not the recurring decimal from the ternary numeral system.

2.7 Error of differential

Differential x^2 is $\frac{dy}{dx}=2x+dx$.
This dx is □.
Appears a similar small value in the sum of an infinite sequence.
The reason where this value occurs is standardized at minimum unit.
This Differential standardize at □ unit.
The sum of infinite sequence standardize at integer unit.
The shape of error is like a staircase.

This value can not abandon. it is a very large value in calculation of infinity
But, $\square^2$ in dx using, can reduce the error value.

$\square^3$ and $\square^\infty$ and $\square^{\infty^{\infty^{\cdots}}}$ are also available.

Integral also get the same conclusion.

2.8 Example of the infinite number.

2.8.1 ζ

$$\begin{aligned}
\sum\zeta &= \zeta(1)+\zeta(2)+\zeta(3)+\zeta(4)+\ldots\\
\infty &= \frac{1}{1^1}+\frac{1}{1^2}+\frac{1}{1^3}+\frac{1}{1^4}+\ldots\\
1 &= \frac{1}{2^1}+\frac{1}{2^2}+\frac{1}{2^3}+\frac{1}{2^4}+\ldots\\
\frac{1}{2} &= \frac{1}{3^1}+\frac{1}{3^2}+\frac{1}{3^3}+\frac{1}{3^4}+\ldots\\
\frac{1}{3} &= \frac{1}{4^1}+\frac{1}{4^2}+\frac{1}{4^3}+\frac{1}{4^4}+\ldots\\
\ldots &= \ldots
\end{aligned}$$

$$\sum\zeta(x)-\zeta(1)=\infty-\square$$

2.8.2 1/x

$$
\begin{aligned}
1 &= (\infty-0)^0 \times \square^1 + (\infty-1)^0 \times \square^1 + (\infty-2)^0 \times \square^1 + \ldots \\
\frac{1}{2} &= (\infty-0)^1 \times \square^2 + (\infty-1)^1 \times \square^2 + (\infty-2)^1 \times \square^2 + \ldots \\
\frac{1}{3} &= (\infty-0)^2 \times \square^3 + (\infty-1)^2 \times \square^3 + (\infty-2)^2 \times \square^3 + \ldots \\
\frac{1}{4} &= (\infty-0)^3 \times \square^4 + (\infty-1)^3 \times \square^4 + (\infty-2)^3 \times \square^4 + \ldots \\
\ldots &= \quad \ldots
\end{aligned}
$$

2.8.3 e

$$
\begin{aligned}
(1+\square)^1 &= 1+\ 1\square \\
(1+\square)^2 &= 1+\ 2\square+\ 1\square^2 \\
(1+\square)^3 &= 1+\ 3\square+\ 3\square^2+\ 1\square^3 \\
(1+\square)^4 &= 1+\ 4\square+\ 6\square^2+\ 4\square^3+\ 1\square^4 \\
(1+\square)^5 &= 1+\ 5\square+10\square^2+10\square^3+\ 5\square^4+\ 1\square^5 \\
(1+\square)^6 &= 1+\ 6\square+15\square^2+20\square^3+15\square^4+\ 6\square^5+\ 1\square^6 \\
\ldots &= \ldots
\end{aligned}
$$

The multiplication of 1+□ on a regular basis, have increased the go.
Be able to calculate the value of the same infinite degree.

$$
\begin{aligned}
(1+\square)^\infty &= 1 + \frac{\infty \times \square}{1} + \frac{(\infty-1)\times\infty\times\square^2}{1\times 2} + \frac{(\infty-2)\times(\infty-1)\times\infty\times\square^3}{1\times 2\times 3} \\
&\quad + \frac{(\infty-3)\times(\infty-2)\times(\infty-1)\times\infty\times\square^4}{1\times 2\times 3\times 4} + \frac{\ldots}{\ldots} \\
(1+\square)^\infty &= 1 + (1) + (0.5 + \frac{-\square}{2}) + (0.1666\ldots + \frac{-3\square+2\square^2}{6}) \\
&\quad + (0.041666\ldots + \frac{-6\square+11\square^2+5\square^3}{24}) + \ldots
\end{aligned}
$$

3. 0 and infinite expontial infinity

The multiplication of 0 can make Everything disappear.

0 is similar to . $\square^{\infty^{\infty^{\cdots}}}$

but not 0.

The inverse of $\square^{\infty^{\infty^{\cdots}}}$ is $\infty^{\infty^{\infty^{\cdots}}}$.

$$\square^{\infty^{\infty^{\cdots}}} \times \infty^{\infty^{\infty^{\cdots}}} = 1$$

If inverse of 0 define @, then $0 \times @ = 1$.
@ to remove the paradox which occurs with multiplication operation of 0.

$1 \times 0 = 0$, $\frac{1}{0} = @$

All the inverse operation becomes possible.

But now, $\frac{@}{0} = @^2$ and $0 \times 0 = 0^2$ was made.

If define $@^2 = @$, then It becomes the notion of ∞ currently uses from mathematics.
0 and @ is difficult because remove data.
Any more will not be able to accomplish an operation.
In order to be an operation continuously the 0^2 is necessary.
But I do not know what is 0^2 , is necessary?
If some number have the power of God, it will be @.

Conclusion

Infinite number possibility to reduce the paradox of infinity.
Infinite number should give a new interpretation about the Continuum hypothesis.
Our vision is to send it over the river of infinity.

Also, the infinite number gives the answer of "1 = 0.999…".

seoul, korea
E-mail : nossaacc@naver.com