Postulates on the operations of Zero, Infinity and Indeterminate

Swapnil Thapaliya

EVEREST COLLEGE, NEPAL

ABSTRACT: Operations on all undefined terms is thought to be meaningless and not possible. It's not the case anymore, in this paper I am presenting the answers to many queries related to 0 and ∞ and also how operations can be done on Indeterminate or undefined numbers. I have also provided a set of postulates/axiom on the operation of Indeterminate, Infinity and Zero.

Zero, Infinity and Indeterminate are not numbers they are something very different than numbers.

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REPRESENTING THE TERMS/NOTATIONS/BASIC RULES

In this whole paper the terms are represented as followed

Zero	:	0
Pure infinity	:	∞
Indeterminate	:	$\perp$ (Swap's Symbol)

$0/0$, ∞/∞, $\infty-\infty$, $0/\infty$ are some Indeterminate terms. These terms can be simplified into a single term which is given in the upcoming pages.

The value of $\frac{n}{0}$

$\frac{n}{0}$ is an undefined term; (where n is any real)

i.) In, $\frac{0.0000000000000\ldots1}{1}$ the numerator is a number very close to 0. In this case the answer is a number very small.

ii.) In, $\frac{1}{0.0000000000000\ldots1}$ the denominator is a number very close to 0. In this case the answer is a number very big.

In, i.) If we replace the numerator with 0, we get the smallest number 0. So, if we were to replace the denominator with 0 in ii.) according to the pattern we get the largest number which is ∞.

If we were to divide 1 by 0 using long division we would,

0)1(9999999999…

-0

1

....

Here, Dividend: 1, Divisor: 0, Quotient: Infinitely long number ∞
Remainder: Using 10-adic numbers the remainder is found to be 0
And hence, $\frac{n}{0}$ = ∞; (where n is any real any number expect o, if n = o, then it would be indeterminate (⊥).)

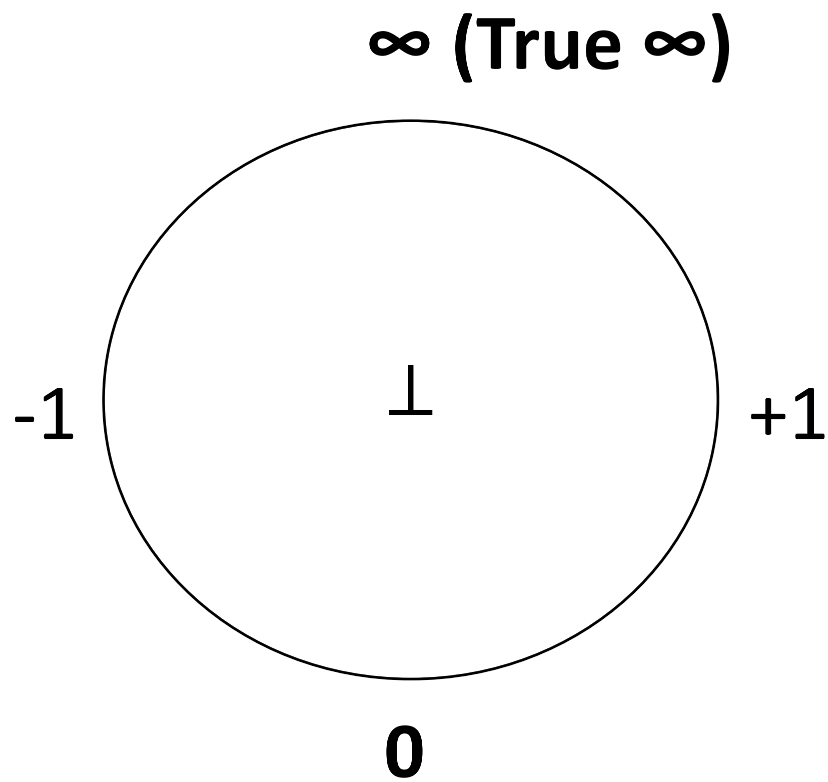
Theoretical way of defining

$\frac{0}{1}$: If you have 0 mango and you need to give each person 1 mango equally, how many people can you give it to. Ans: 0 because you do not have a mango

$\frac{1}{0}$: If you have 1 mango and you give each person 0 mango equally, how many people can you give it to. Ans: Infinite people before it completes.

Here, ∞ is neither positive nor negative. It is the true infinity. Just like 0 is neither positive nor negative just in the same way ∞ is neither positive nor negative.

The Infinite wheel Theory *(This represents the complete number line.)*



Here,

∞ is true infinity and ⊥ doesn't lie on any point it is all the point itself.

Reaching ∞ from -1 is -∞, Reaching ∞ from +1 is +∞.

The true number sequence is: 0,1,2 ..., ∞, ... -2, -1,0,1 and so on

Where ... between 2 and ∞ represents +∞ and the ... between ∞ and -2 represents -∞.

(This is extra part of another paper I am working on which may be useful for understanding this paper clearly.)

<u>Definition of Indeterminate ($\perp$)</u>

Any Indeterminate term in an equation can be substituted with any number in its place where the indeterminate term is a single term, then the $\perp$ term should be substituted into a number and operation can be conducted within the newly substituted term. In an equation all the $\perp$ present should be substituted with the same term. The equation will not differ and the equation will still be correct if it was firstly correct.

The value of $\frac{0}{0}$

From the definition we know all the indeterminant forms (⊥) can be represented as any number.

Dividing 0 by 0 using long division, Let the quotient be Q,

0)0(Q

<u>-0</u>

0

....

No matter what value you put on Q, you get 0 and it makes no change.

<u>Theoretical way of defining</u>

$\frac{0}{0}$: If you have 0 mango and you give each person 0 mango equally, how many people can you give it to. Ans: As many as you want i.e., any number. Since, you need to distribute 0 mango equally and complete the mango you have, you can distribute as many mangoes as you want and since your mangoes are already completed from the beginning you can end it any time. Even though the mangoes are completed you can still distribute them because you are not distributing any. Conclusion: It can be represented as any number. (For correct uses follow the postulates given.)

Representation of all Indeterminant terms in form of $\frac{0}{0}$.

Here, we know, $\frac{n}{0} = \infty$ and $\frac{0}{0} = \perp$

I. $\frac{\infty}{\infty}$

$= \frac{\frac{n}{0}}{\frac{n}{0}}$

$= \frac{n}{0} \times \frac{0}{n}$

$= \frac{0}{0}$

II. $\infty - \infty$

$= \frac{n}{0} - \frac{n}{0}$

$= \frac{n-n}{0}$

$= \frac{0}{0}$

III. $\frac{\mathbf{0}}{\infty}$

$= \frac{0}{\frac{n}{0}}$

$= \frac{0}{1} \times \frac{n}{0}$

$= \frac{0 \times n}{1 \times 0}$

$= \frac{0}{0}$

Every Indeterminate number can be written in the form of $\perp$ (Including the indices).

Since, Every Indeterminate number $= \frac{0}{0} = \perp$. We know,

Postulates on operations of Zero, Infinity and ⊥

1) **Indeterminate terms are a whole single term;**

   As in sin (30) you cannot perform operations only on sin, operation should be performed on the whole sin (30) term i.e., 1/2. In the same way in 0/0 you cannot perform operation only on the single numerator 0, operations should be performed on the whole 0/0 term i.e., ⊥

2) **All indeterminate terms (⊥) can be represented as any number;**

   *When you get x * $\perp = 0$*
   We can, Let $\perp = 1$
   *X * 1 = 0*
   X = 0
   Else Let $\perp = 1234509876$
   We still get, x = 0
   Which is the correct answer.

3) **⊥ follows all the rules any normal variable on mathematics does;**

   ⊥+ ⊥=2 ⊥
   i.e., $\frac{0}{0}+\frac{0}{0}$ = $2 \times \frac{0}{0}$ *where* $\frac{0}{0}$ *is a single term*
   *when we let ⊥ = 3 we get, 2 ⊥ = 2*3=6*

Axioms for operations on 0, ∞ and ⊥

Here, $n \in \mathbb{R}, n \neq 0, n \neq \infty$

∞ = true infinity (It is neither positive nor negative)

$\perp = \text{Indeterminate}$

****Following the postulates is fundamental for performing operations accurately. ****

1) Zero
   a) Addition and subtraction
      i) 0+0=0
      ii) 0-0 =0
      iii) 0+n=n
      iv) 0-n =-n
      v) n-0 =n
   b) Multiplication and Division
      i) 0 * 0=0
      ii) n * 0=0
      iii) 0/n =0
      iv) n/0 =∞

2) Infinity
   a) Addition and subtraction
      i) ∞+n=∞
      ii) ∞+∞=∞
      iii) ∞-n=∞
      iv) ∞-∞=⊥
   b) Multiplication and Division
      i) ∞*n=∞
      ii) ∞*(-n) =∞
      iii) ∞*0==⊥
      iv) ∞*∞=∞
      v) ∞/n=∞
      vi) n/∞=0

3) Indeterminate (⊥)

For operating on ⊥, follow the same rules of any variable term.

[NOTE: Operation on Indices is not Included]

Uses/Application of Indeterminate ($\perp$)

- $\perp$ is used to represent a value of the variable, which can be any number while still ensuring the equation remains valid.

In an equation,

*Find the value of X such that multiplying X with 0 you get 0.

= Here,

$X \times 0 = 0$

$X = \frac{0}{0}$ [we are not dividing both side by 0 to send to the other side]

$X = \perp$

IF you put any number in the place of x, we still get the correct answer. Hence, X is an $\perp$.

Conclusion/References

This manuscript was written to provide a set of answers for unsolved or debated topics including rules for performing mathematical operations on 0, ∞ and $\perp$.

"Universe was nothing yet it became everything; They say Zero is nothing; yet 0 became everything" -Swapnil

This paper was written by Swapnil Thapaliya from Nepal at the age of 15.

References

https://en.wikipedia.org/wiki/Wheel_theory

https://ijrar.org/papers/IJRAR2001568.pdf