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| Research (What is it about?) | **Relative cardinality of numerical sets** |
| UNN authors | *Sergeyev Ya.* |
| We find (The result) | It is established that the measuring procedure for numerical sets (cardinality of a set) depends on the ***numeral system*** which plays the role of a measuring tool. The consequences of this statement for some mathematical problems are considered including the two Hilbert problems. |
| Abstract | When you see a dot in the clear sky and then a flying bird when you look through binoculars just there you have no doubts that the dot and the bird are the single object which is described with different accuracy. Physicists are sure that the experimental result is not an intrinsic property of the object but its appearance when we use a measuring tool. However mathematicians deal with infinite sets in such a manner as if the measuring tool (numeral system) doesn't influence the result. As the consequences, there exist undetermined operations ∞-∞, ∞/∞, etc. or expressions of $\sum_1^\infty$ type which have no numerical sense. The reason of difficulties is not the nature of infinite sets but the result of the "poor" numeral system which is used for its description. The introduction of new number named ***grossone*** (a symbol in the circle below) which is equal to the ***number of naturals*** in the conventional numeral system, when the natural series has the following form<br>$$\mathbb{N} = \{1, 2, 3, \ldots, ① - 1, ①\}$$<br>allows one to eliminate the symbolic uncertainties, to ***compare the sizes of infinite sets*** in conformity with Euclid's Common Notion no. 5 "The whole is greater than the part" and to improve the accuracy of description of many mathematical objects.<br>We first show that this new way gives one a new approach to the classical Hypotheses of Continuum by Cantor (the first Hilbert problem), allows one to specify the Riemann hypothesis in the prime number theory (the eighth Hilbert problem) and to avoid the occurrence of nonempty sets of measure zero in probability computations. |

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| Representative articles 2017-2018, quartiles | 1. *Sergeyev Ya. D.* Numerical infinities and infinitesimals: Methodology, applications, and repercussions on two Hilbert problems. EMS Surveys in mathematical sciences. **4**(2). 219-320 (2017). | – |
| | Q-index (Qi) for the result | **0** |
| | | ***grey*** |

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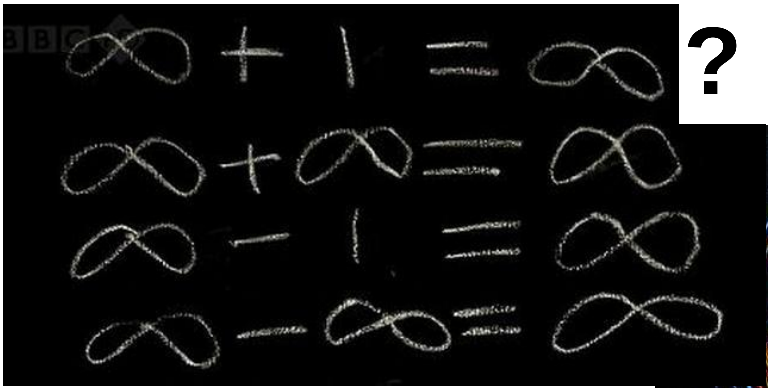
| In collaboration | University of Calabria, Rende 87036, Italy |

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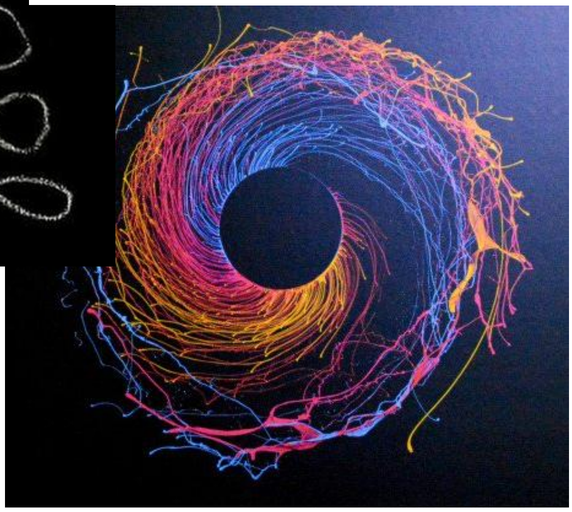


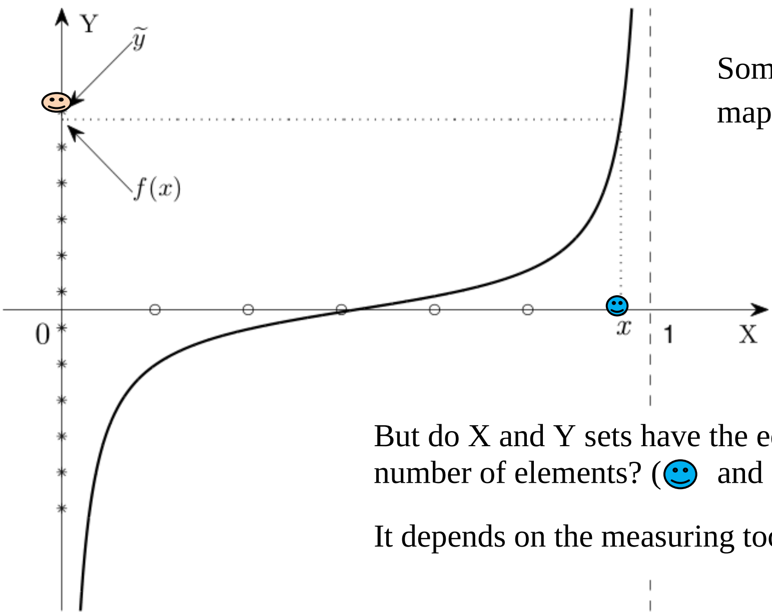
$$\int_0^{\infty} x^2\,dx \;\textbf{?}$$

$$\int_0^{①} x^2\,dx = \frac{1}{3}①^3, \qquad \int_0^{①^2} x^2\,dx = \frac{1}{3}①^6.$$

The infinity sets are everywhere but there are different results.

**2,000000…** and **1,999999…** Are they different numbers**?**

$$2.\underbrace{000\ldots00}_{①\text{ digits}} - 1.\underbrace{999\ldots9}_{①\text{ digits}} = 0.\underbrace{000\ldots01}_{①\text{ digits}}.$$




Some function is a ***one-to-one*** **(?)** map of two sets – is it true?

But do X and Y sets have the equal number of elements? ( and )

It depends on the measuring tool.