S = 1 - S
doesn't resolve to
-1/12

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1 Grandi's series

As everybody knows, the Grandi's series is demonstrated by subtracting 2 said identical series.

- S
- $1 - S$

Let's show why those 2 series are actually different.

2 S is a 1 dimension matrix

2.1 Transform a serie in a 1 dimension matrix

$$S = 1 - 1 + 1 - 1 + ... + 1$$

or

$$S = 1 - 1 + 1 - 1 + ... - 1$$

We can transform S into a 1 dimension matrix using this method :

- Using only addition in the series by replacing the substraction of the number n_i by $+(-n_i)$ where i is the position in the serie.
- Put each term of the serie of T terms in a 1 dimension matrix of size T

For the serie S, we then get :

$$S = (1, -1, ..., 1)$$

or

$$S = (1, -1, ..., -1)$$

2.2 0 as a 1 dimension matrix ?

0 depends on the the serie it is being added.

2.3 justification

In order to be able to add 2 matrices, the matrices needs to have the same size.

2.4 Example with S

$$S = (1, -1, \ldots , 1)$$

$$S = (0, 0, \ldots , 0)$$

or

$$S = (1, -1, \ldots , -1)$$

$$S = (0, 0, \ldots , 0)$$

3 Conclustion

We cannot substract S from 1 because 1 is a natural number and S is a matrix.

What is 1 as a matrix ? All 1's ? Only one 1 ? Multiple 1's ?

The 1 from natural number encoded as a matrix of size N is this matrix :

$$1 = (1, 1, \ldots , 1)$$

or this one :

$$1 = (1, 0, \ldots , 0)$$

or yet another one ?

What is sure, is that 1 - S won't be the same dependending on your definition of 1 represented as a matrix and this ambiguity is what leads to a mistake in the Grandi's series demonstration.