Can *Pi, i,* and *e* generate the Real Numbers

by Jim Rock

Abstract. We show that attempting to map the set of real numbers to the natural numbers by listing them as infinite decimal fractions is futile. The real numbers are represented as the limit of partial decimal sums. This allows them to be explicitly referenced and makes them into a countable set. We conjecture that the *Pi, i,* and *e* generate the Real Numbers.

The positive integers can be put in one to one correspondence with the terminating decimal fractions in the open interval (0, 1). $1 \to .1,\ 2 \to .2,\ \ldots,\ 10 \to .01,\ \ldots$ Each terminating decimal is the mirror image reflection through the decimal point of a positive integer. The mapping does not include any repeating decimal fractions. From this mapping the set of all rational numbers would appear to be uncountable. This shows that attempting to map the real numbers in the closed interval [0, 1] to the natural numbers, by listing them as infinite decimal fractions is futile. Cantor's diagonal proof that the real numbers are an uncountable set can never even get started.

The problem is in defining the real numbers as the set of all infinite decimal expansions. That's vague. Most non-algebraic real numbers cannot be explicitly referenced. We need a new definition.

Let p be an integer. Each real number S is:

the limit $m \to \infty \quad n = 1 \text{ to } m,\ 0 \leq a_n \leq 9 \ \sum p + a_n / 10^n = S$.

Being able to explicitly reference each real number makes the real numbers into a denumerable set.

$$e^{i\Pi} = -1$$

Using -1 and the six arithmetic processes (addition, subtraction, multiplication, division, root extraction, and exponentiation) all algebraic numbers can be generated.

Perhaps $\Pi^{ie} = t$

is a base for generating all transcendental numbers, and using t and $t / t = 1$ with the six arithmetic processes all Real Numbers can be generated.

Explore the detailed proofs and fascinating consequences of the Real Numbers as a denumerable set in https://arxiv.org/abs/1002.4433

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