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ON THE INTRODUCTION OF THE THEORY OF REAL NUMBERS AT THE STAGES OF THE EDUCATIONAL SYSTEM

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ANNOTATION

In this article, we want to express an opinion on the stages of the education system where the theory of real numbers is introduced, which of these methods is preferable to teach.

Keywords: rational number, irrational number, axiomatic method, constructive method, ordering, density, continuity, equivalence, fundamental sequence, infinite decimal periodic fractions, section.

As is known, the theory of real numbers is introduced mainly in two ways: constructive or axiomatic.

Constructive method: in the constructive theory of real numbers, it is usually assumed that the theory of rational numbers is known, and the concept of an irrational number is introduced and methods for calculating it are indicated.

Axiomatic method: The process of axiomatic construction of the theory of real numbers can be started with the axiomatic construction of the theory of natural numbers. Schematically, this process will look as follows.

Taking a non-empty set, the relations between the elements of this set are specified through a system of axioms to which actions are subject, laws to which actions are subject, the connection of this action and relations is specified through a system of axioms, and the set is declared a set of natural numbers, and its elements are natural numbers .

The set of natural numbers N after being taken as the "base" N and Z - before the set of integers, $r, r, \ldots, r, \ldots$ ni Q - up to the set of rational numbers, Q the set of all real numbers, while ni R expands to, the need for such extensions is justified. Each extension is represented by a certain system of axioms. The expansion is performed in such a way that in the set (for example, Q in) the actions to be performed are also performed in the set resulting from the expansion of this set (i.e., B), and the result will be equal to the result in the previous set, and also in the previous set (Q c), Generally speaking, “impossible” action (such as extracting the root) will be performed in the extended set.

Generally speaking, one can also enter a set of real numbers all at once without using such successive extensions. Something that is not empty for this, R a set is taken, the relations between the elements of this set, actions, patterns that these actions obey, connections between actions and relations are given through a system of axioms. the set is declared to be the set of real numbers, and its elements to be real numbers, and it is stated that the assigned mathematical object (for example, the number axis, which is a geometric representation of the set of real numbers) that satisfies this axiom system actually exists.

We now briefly present the methods known to us for constructing the theory of real numbers.

Cantor's theory of real numbers.

This theory is based on the concept of fundamental sequences whose members are rational numbers.

let will be . If $\forall \varepsilon > 0$ for a number so $n_0 = n_0(\varepsilon) \in N$ if there is a natural number, all $n > n_0$ va $\forall m \in N$ for $|x_{n+m} - x_n| < \varepsilon$ if, $\{x_n\}$ the sequence is called the fundamental sequence.

The set of all fundamental sequences whose members consist of rational numbers ϕ is denoted by. If $\{x_n\},\{y_n\} \in \phi$ the limit of the sequence is equal to 0, the sequences are called equally strong ($\{x_n\},\{y_n\}$ equivalent $\{x_n\} - \{y_n\}$) and $\{x_n\} \sim \{y_n\}$ are denoted as. We assume that all fundamental sequences that are mutually equivalent belong to the same class. For example, $\{a_n\} \in \phi$ va $\lim_{n\to\infty} a_n = r$ if the limit is equal, all $\{a_n\}$ fundamental sequences will be unit.

In particular, these classes include $r, r, \ldots, r, \ldots$ the sequence will also be actual, and $r, r, \ldots, r, \ldots$ we also call the class that defines a number the class of all functional sequences that are equivalent.

If $\{a_n\} \in \phi$ if the limit of a sequence is a rational number, such a sequence I type is called a sequence, and the entire I set of sequence types ϕ_1 is defined via.

If $\{a_n\} \in \phi$ such a sequence, if the limit of the sequence is not a rational number, II the type is called a sequence and is a set of such sequences. ϕ_2 called. Then $\phi = \phi_1 \cup \phi_2$ it will. The class of all mutually equivalent sequences of types is called an irrational number. In Cantor's theory, a real number is defined as follows: the class of mutually equivalent fundamental sequences of rational numbers is called a real number.

Next, the properties of the elements of the set are studied, and operations and relations over real numbers are derived through them.

Haqiqiy sonlarning aksiomatik nazariyasi

One R is given a set, let its elements satisfy the following axioms.

Axiom of Order . $\forall x, y \in R$ for this, $x = y, x < y, < x > y$ one and only one of the relations are relevant and $z \in R$ for $x < y$ and $y < z$ if, $x < z$ let it be.

Axiom operations addition . $\forall x, y, z \in R$ for

1. $x + y = z$

2. $x + y = y + x$

3. $x + (y + z) = (x + y) + z$

4. $\forall x \in R$ for $\exists 0 \in R$ there is whether $x + 0 = x$

5. $\forall x \in R$ for $\exists(-x) \in R$ there is whether $x + (-x) = 0$

6. $x < y$ bo'lsa $\forall z \in R$ for $x + z < y + z$.

1. **I. _** **Axioms of the Operation of Multiplication .** $\forall x, y, z \in R$ for $x \cdot y = z$

2. $x \cdot y = y \cdot x$

3. $(x \cdot y) \cdot z = x \cdot (y \cdot z)$

4. $\forall x \in R$ for $\exists 1 \in R$ there is whether $x \cdot 1 = x$

5. Differs from zero $\forall x \in R$ for $\exists \frac{1}{x} \in R$ there element $x \cdot \frac{1}{x} = 1$

6. $x < y$ va $z > 0$ bo'lsa $x \cdot z < y \cdot z$.

I.I. _ Distribution axiom of multiplication with respect to addition .

$\forall x, y, z \in R$ uchun $(x+y)\cdot z = x\cdot z + y\cdot z$

II. **Axiom of Archimedes.** $\forall x \in R$ so for $n \in Z$ is, $n > x$ let it be.

III. Axiom continuity . Any system of segments located inside $[a_1, b_1] \supset [a_2, b_2] \supset \ldots \supset [a_n, b_n] \supset \ldots$ **for all these segments there is at least one number.**

IV.The elements $I - IV$ of a set that satisfies the axioms is called the set of real numbers.

V.V. _ After that, the reciprocity between all points on the number axis and the set of real numbers $A \bigcup A' = Q$ is one-to-one correspondence.

Dedekind theory of real numbers.

First of all, Q in the set of rational numbers, the concept of a cross section is introduced:

A set of rational numbers Q so that A and A' if divided into sets, then

$A \neq \varnothing, A' \neq \varnothing$

1) $A \bigcup A' = Q$

2) $\forall a \in A$ va $\forall a' \in A'$ uchun $a < a'$

if the conditions are met A and A' the collection Q in the set is said to perform the cut and (A, A') is designated as.

A a subset of the multiple section class, A' on the other hand, the set is called the highest cross section class.

Q defined in the (A, A') slice collection there can be only 3 varieties:

1) 1) subclass the cross section A into the largest element (r_0 rational number) exists, the highest class of the section A' while the smallest element does not exist. In this r_0 rational number will be the closing element of the subclass. A subclass of a cross section A into the largest element does not exist, a higher class of a cross section A' into the smallest element (r_0' a rational number) exists. In this r_0' rational number will be the closing element of the highest class. A subclass of the cross section A in the largest element does not exist, a higher class of the cross section A' in the smallest element does not exist. This lower Class A in the upper class A' is missing closing elements. Q any closing element in the set r was (A, A') cut can be made and vice versa.

2) Thus, rational cuts performed in a set with elements of the set are a one-to-one correspondence between the elements of the set.
3) A set of rational numbers of the third kind, made into a cross-section-sections without a closing element, are called irrational sections. one says that an irrational cut performed at defines an irrational number and denotes a set of irrational numbers by a letter.
4) Also, rational and irrational numbers are called real numbers under the general name and are denoted by the letter of the set of all real numbers : $R = R \bigcup Q$.

$\left(A, A^{'}\right)$ with the help of cuts, R the properties of ordering and density of the set of real numbers are specified. Q how in a set R the concept of a section is introduced into the set, and for such sections the following statement is proved: (Dedekind's theorem) R one $\alpha \in R$ real number fulfills in any cut, i.e., any section $\alpha \in R$ will be a closing element. So, R any cut made in any single cut is a single real number, and vice versa.
It then shows the completion of the set of real numbers and performing operations on the real numbers

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