TEACHING THE CONCEPT OF LIMIT WITH THE HELP OF PEDAGOGICAL RESEARCH, INTERDEPENDENCE OF DISCIPLINES AND METHODS OF PEDAGOGICAL PRACTICE

Solayeva Mehribon Norimonovna
Teacher of Mathematics Department of Chirchik State Pedagogical Institute
Email: mehribon.solayeva@bk.ru

Abstract: This article discusses some theorems about function limits and applications of these theorems. The ease of explaining these theorems to school students is analyzed.

Keywords: Concept of limit, pedagogical research, continuity of disciplines, pedagogical practice.

INTRODUCTION, LKITERATURE REVIEW AND DISCUSSION

At present, according to the national program of Personnel Training of the president, in order to conduct entrance examinations in each course and higher educational institutions at a high level, very high requirements are imposed on students and teachers of mathematics and other sciences. One of the simple examples of what we are saying is that in the current school mathematics, the subject of limits and limits for entrance examinations in higher education institutions and almost everyone knows that some examples of higher mathematics come across questions and tests. Therefore, we need to develop new methods of teaching mathematics to students very simply and quickly. In this article, we will consider how to give the concept of limits i.e. function limits to schoolchildren in a simple way. Before this, of course, we need to introduce the concept of sequence limits, since knowing the function limit without knowing what the sequence is and what the sequence limit is, is certainly one of the complex issues.

Definition: arbitrary $\varepsilon > 0$ for a sufficiently small number such that n_0 is found, $n > n_0$ $|x_n - a| < \varepsilon$ if the inequality is fulfilled, then the number a is called the limit of the sequence and is defined as $\lim\limits_{n\to\infty} x_n = a$ [1].

Before explaining the meaning of this definition to readers, we will dwell on the sequence. We explain what the sequence itself is. Sequence, this is a sequence of numbers in which each natural number corresponds to a real number,is called a sequence of numbers and is called $a_n, b_n, \ldots x_n$we usually mark the sequence as x_n. Another simple example of sequences can be drawn from the fact that the arithmetic and geometrical progressions that we learn in the 9th grade of the school mathematics course can be cited in the example definition.

Progressions are considered one of the limited parts of the series section, that is, progressions are subject to a certain law, depending on the extent to which each has received a hadi. As for the sequences, it is said that each natural number corresponds to one number according to a certain rule.

For example: $a_n = 2n + 1$ this is an arithmetic progression. $x_n = \frac{1}{n}$this is an example of a sequence. In the first sequence, each of his hadi pushes through the addition of a number to the previous Hadi. In the second example, the sequence number is not subject to a rule. For this reason, the progression is part of the sequence.

Now, if we are talking about the limit of the series: then the limit of the series itself, when this number of series limits seeks to Infinity, what number does the series itself strive for? The question is answered by the series limit.

In the above examples, we will consider how the formula for the sum of all the Hades of an infinitely decreasing geometric progression, in which there is an infinitely decreasing geometric progression, depends on the limit of the sequence from which it originated.

$b_1, b_2 \ldots b_n$-whether an infinitely decreasing geometric progression is given, we find the sum of the bounds of this progression. $S_n = \frac{b_1(q^n-1)}{q-1}$where S_n is the sum of the progression, b_1 is the first line of the progression, $q -$ is the salary of the progression. In case the progression is infinitely decreasing the progression mahraji suddenly becomes smaller. To find the sum of all the Hades of the progression, we pass the sum formula to the limit INT of the number of Hades striving to Infinity. And from this

it turns out that $\lim_{n\to\infty} \frac{b_1(q^n-1)}{q-1} = \frac{b_1\cdot(-1)}{q-1} = \frac{b_1}{1-q}$. For this reason, we are taught that in the 9th grade of the school course of mathematics, the sum of the infinitely decreasing geometrical progression is $S = \frac{b_1}{1-q}$, which is due to the limit of the sequence. In itself, it is known that after such examples, the reader will have an idea of the sequence and its limit. After that, a bottleneck is possible with regard to the function and its limit.

Definition :for an arbitrary ε $\forall\varepsilon > 0$ number, such a $\delta(\varepsilon)$number is found, if argument x satisfies $|x - a| < \delta(\varepsilon)$ inequality in all values different from a $f(x)$function $|f(x) - A| < \varepsilon$ inequality, then when x tends to argument A, the function $f(x)$ is called having a limit equal to A [1].

In fact, the function limit is described as two-homogeneous. That is, the definition by the perimeter and the definition by the language of the series. The definition in the language of the environment from these two definitions is quite understandable to the schoolboy and is considered easy to assimilate, so we have cited the definition in the language of the environment as the definition of the limit. It is worthwhile to explain the meaning of this definition to the reader in such a way.

For all values of a function argument different from that of point A, the function $f(x)$ moves to a single point A, where the argument is x, when f (x) seeks A, and the $\lim_{x\to a} f(x) = A$

- Examples:

1. $\lim_{x\to 3}(x^3 + x - 5) = 25$ prove that limit definition using$\forall\varepsilon > 0 \exists\delta(\varepsilon)$ for the number 0 is found, $|x - 3| < \delta$ when the inequality is fulfilled, $|x^3 + x - 30| < \varepsilon$ inequality must be fulfilled. $|x^3 - 27 + x - 3| = |(x-3)(x^2 + 3x + 9) + (x - 3)| = |(x-3)(x^2 + 3x + 10)| = |(x-3)(x^2 - 6x + 9 + 9x + 1)| = |(x-3)((x-3)^2 + 9(x-3) + 28)| < |\delta^3 + 9\delta^2 + 28\delta| < |\delta^3 + 9\delta^2 + 27\delta + 27| = |(\delta+3)^3| = \varepsilon \Rightarrow \ \delta + 3 = \sqrt[3]{\varepsilon} \Rightarrow \delta = \sqrt[3]{\varepsilon} - 3$ this proves that equality is right

about limits Theorem

Theorems 1: if $f(x)$ and $g(x)$functions in argument $x \to a$ have a limit, then the sum and subtraction of these functions also have a limit, and this limit will be equal to the sum and subtraction of the limits of functions $f(x)$ and $g(x)$[2]

$$\lim_{x\to a}\big(f(x) \pm g(x)\big) = \lim_{x\to a} f(x) \pm \lim_{x\to a} g(x).$$

Theorem 2: if $f(x)$ and $g(x)$ functions in argument $x \to a$ have a limit, then the multiplication of these functions also has a limit, which will be equal to the multiplication of the limits of functions $f(x)$ and $g(x)$ [2].

$$\lim_{x\to a} f(x)\cdot g(x) = \lim_{x\to a} f(x)\cdot \lim_{x\to a} g(x)$$

Theorem 3: if in argument $x \to a$ $f(x)$ and $g(x)$ functions have a limit, then $g(x)$ function limit is different from zero $\frac{f(x)}{g(x)}$ there is also a limit of proportion, its limit is equal to the ratio of the limits of functions $f(x)$ and g(x) [2]

$$\lim_{x\to a} \frac{f(x)}{g(x)} = \frac{\lim_{x\to a} f(x)}{\lim_{x\to a} g(x)}.$$

Results from theorems: The invariable multiplier can be output before the limit Mark [2]. education record $\lim_{x\to a} k\cdot f(x) = k\cdot \lim_{x\to a} f(x)$

If n is a natural number, then $\lim_{x\to a} x^n = a^n$, $\lim_{x\to a} \sqrt[n]{x} = \sqrt[n]{a}$ will be. [2]

This $P(x) = a_0x^n + a_1x^{n-1} + a_2x^{n-2} + \cdots + a_n$ the limit of the polynomial in $x \to a$ is equal to the value of this polynomial in $x = a$, that is, $\lim_{x\to a} P(x) = P(a)$ [2].

This $R(x) = \frac{P(x)}{Q(x)} = \frac{a_0x^n+a_1x^{n-1}+\cdots a_n}{b_0x^m+b_1x^{m-1}+\cdots b_m}$ fraction the limit of the rational function in $x \to a$, if a belongs to the area of determination of this function, then this function is equal to the value in $x = a$ that is, $\lim_{x\to a} R(x) = R(a)$ equal [2].

The purpose of bringing the above theorem and results is to prevent the idea that in the mind of schoolchildren, the argument tends to a number, the limit is actually equal to the value of the function at this point. It is known that now we know that schoolchildren think that the limit of function is actually equal to the value of the function at this point. This leads to some misunderstanding.

For example: $\lim_{x\to 6} \frac{x-6}{\sqrt{x+3}-3}$ It seems that if we put 6 instead of argument in this limit, we will come to the appearance of $\frac{0}{0}$ [2]. This is actually considered to be non-certainty, but some students make up the answer that the limit is equal to 0. Such a misconception in similar examples is caused by the reader's idea that the limit, as we have already noted above, is equal to the value of the function at that point in the argument. Therefore, all the above theorems and results must be known by the students, and it is emphasized that the end result in fractional rational functions belongs to the area of function determination of the number sought. $\lim_{x\to 6} \frac{x-6}{\sqrt{x+3}-3}$ in this example, the number that Arg int seeks does not belong to the field of function determination. What can be done in such cases? In the example above, we save the function salary from irrationality

$$\lim_{x\to 6} \frac{x-6}{\sqrt{x+3}-3} =$$

$$= \lim_{x\to 6} \frac{(x-6)(\sqrt{x+3}+3)}{(\sqrt{x+3}-3)(\sqrt{x+3}+3)}$$

$$= \lim_{x\to 6} \frac{(x-6)(\sqrt{x+3}+3)}{x+3-9} = \lim_{x\to 6} \frac{(x-6)(\sqrt{x+3}+3)}{x-6} = \lim_{x\to 6} (\sqrt{x+3}+3)$$

$$= 6$$

As for the next examples $\frac{0}{0}, \frac{\infty}{\infty}, \infty - \infty, \infty + \infty$let's look at the inaccuracies in appearance.

Example: $\lim_{x\to\infty} x(\sqrt{4x^2-1} - 2x)$ calculate limit[3].

Solution: if we put infinity instead of argument using the above theorem, then the uncertainty in the form of $\infty - \infty$ is formed. In order to solve this uncertainty, we will do the work to get rid of the irrationality passed in the 10 class of the school mathematics course, that is, multiply by the addition of the expression. $\lim_{x\to\infty} x(\sqrt{4x^2-1}-2x) = \lim_{x\to\infty} \frac{x(\sqrt{4x^2-1}-2x)(\sqrt{4x^2-1}+2x)}{(\sqrt{4x^2-1}+2x)} = \lim_{x\to\infty} \frac{x(4x^2-1-4x^2)}{(\sqrt{4x^2-1}+2x)} = \lim_{x\to\infty} \frac{-x}{(\sqrt{4x^2-1}+2x)}$ see that the last argument is equal from cheksizga intiltirib limit when $\frac{\infty}{\infty}$ aniqmas done in the form of is formed. To get rid of this inaccuracy, we do as follows. education record $\lim_{x\to\infty} \frac{-x}{(\sqrt{4x^2-1}+2x)} = -\lim_{x\to\infty} \frac{x}{x(\sqrt{4-\frac{1}{x^2}}+2)} = -\lim_{x\to\infty} \frac{1}{\sqrt{4-\frac{1}{x^2}}+2} = -\frac{1}{4}$.

In the event that the function limit is Aniq$\infty - \infty$ indeterminate, many students always come to the idea that zero is equal to zero and choose a zero solution. And from this solution it is possible to see that from the uncertainty in the form of$\infty - \infty$, a limited number of outputs is also possible.

Example: $\lim_{x\to\infty}(\sqrt{x^2-4}-x)$ calculate the limit[3].

Solution: even when calculating this limit, the uncertainty in the form of $\infty - \infty$ is generated. To reveal this indeterminacy, too, we will do the work of getting rid of irrationality, as above. $\lim_{x\to\infty}(\sqrt{x^2-4}-x) = \lim_{x\to\infty} \frac{(\sqrt{x^2-4}-x)(\sqrt{x^2-4}+x)}{(\sqrt{x^2-4}+x)} = \lim_{x\to\infty} \frac{x^2-4-x^2}{(\sqrt{x^2-4}+x)} = \lim_{x\to\infty} \frac{-4}{(\sqrt{x^2-4}+x)}$ is calculated by putting the Infinity from the decimal point to the decimal point of the Decimal Fraction of $\frac{-4}{\infty} = 0$, and the limit would be equal to zero.

Now we stop at opening the inaccuracies in the form of $\frac{\infty}{\infty}$.

Example: $\lim_{x\to\infty} \frac{3x^5-2x^2}{x^3+3x-x^5}$ calculate the limit[3].

Solution: based on the above theorem, if we consider putting Infinity into the image and the Mahraj of the fractional rational polynomial, then Aniq $\frac{\infty}{\infty}$ is formed from the apparent uncertainty. When working such examples are guided as follows, that is, we subtract the largest degree of the argument from the numerator and denominator of the fraction. education record $\lim_{x\to\infty} \frac{3x^5-2x^2}{x^3+3x-x^5} = \lim_{x\to\infty} \frac{x^5(3-\frac{2}{x^3})}{x^5(-1+\frac{1}{x^2}+\frac{3}{x^4})} = \lim_{x\to\infty} \frac{(3-\frac{2}{x^3})}{(-1+\frac{1}{x^2}+\frac{3}{x^4})} = \frac{3}{-1} = -3$ is equal to.

CONCLUSION

In conclusion, we can say that the theory of limits is used in finding the sequence of numbers and the yield of the function. Therefore, finding the limit of sequence and function must of course be taught to the students in part. Therefore, we consider that the teaching of the concept of limits in mathematics by the methods of pedagogical research, inextricability of Sciences and pedagogical practice gives high results in schools of general secondary education.

REFERENCES

[1] Fixtengolts G.M. Fundamentals of Mathematical Analysis. Teacher's Publishing House, Tashkent, 1970. 243 p.

[2] Sh.R.Khurramov Higher mathematics. Volume I Cholpon Publishing House Tashkent - 2018

[3] Sh.A.Alimov, O.R.Kholmuhammaedov, M.A.Mirzaahmedov. Algebra Textbook for 9th grade of secondary schools. Publishing House "Teacher" Publishing House Eoshkent-2014.

[4] M.A.Mirzaahmedov, Sh.N.Ismailov, A.Q.Amanov. "Mathematics" textbook for 11th grade. Toshent- 2018