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USING SOFTWARE COMPLEXES IN TEACHING MATHEMATICAL ANALYSIS

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Annotation
This article explains one of the basic concepts of the course of mathematical analysis about the possibilities of calculating the concept of limit from programming packages through Maple.
It is well known that no matter what sphere of life of society, its tasks, projects and industries cannot be implemented without complex mathematical calculations. To facilitate such calculations, many powerful and universally integrated systems, i.e., application packages, have been created. An application package is a collection of related applications that solve problems in a particular area. This definition of an application package covers a wide range of software developments designed to enhance the usability of computers through the combined use of application and system software.

Keywords: calculus, software package, Maple, Matlab, Derive, Eureka, Mathematics, limit, sequence.

Introduction

Many mathematical packages have been developed and are widely used. The most common ones are Maple, Matlab, Derive, Eureka and Mathematics. These packages are multifunctional packages. Today, the place and role of mathematics packages in the learning process is much more significant and effective. Developing students' skills and competencies in the use of math packages prevents the stress of learning math by making solving complex math problems easier and fun and very easy. The use of mathematical packages in the learning process expands the foundations of mathematical and technical education, and also expands the ability of students to apply theoretical knowledge in practice.
These systems are used in teaching all specialties. For example, in mathematical analysis, the systems Maple, MathCAD, Mathematics in algebra and number theory, Matlab in computational methods are used.
A feature of mathematical systems is that there are three ways to solve problems:

1. Based on a program written in the internal language of the system;
2. Based on standard internal functions;

3. Using the method algorithm written in natural mathematical language.

Before choosing the right system for training, it is necessary to evaluate its capabilities in terms of solving the task.

The Maple type is an integrated system, one of its advantages is that the system includes a large number of practical examples and can be transferred directly from the auxiliary database to the editing window. At the same time, it is a modern and universal mathematical package for all users. It performs both numerical and analytical (symbolic) calculations and has a more powerful graphical tool.

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Maple also has many powerful tools for calculating expressions of one or more variables, from the system when solving problems of differential and integral calculus, calculating limits, spreading functions along lines, Laplace substitutions, Z-substitutions, Fourier substitutions can be used in integer substitutions such as substitutions.

The concept of limit is one of the first concepts of the course of mathematical analysis. This is the starting point for many of the concepts covered in this course. This concept is very different from what we see in real numbers. The concept of a limit is closely related to such concepts as reflections, a sequence of numbers, and the circle of a point. Therefore, it is useful not only to teach theoretical knowledge, but also to teach the essence of these concepts through the possibilities of mathematical programming packages.

Calculating Limits Maple has two commands for performing certain mathematical operations: one to perform them directly, and the other to cancel the execution (or create it as a formula). Both commands consist of the same letters, the direct execution command is written in lowercase letters, and the command to create it as a formula is only in capital letters. When you click the Cancel command, the default analytics entry for that action appears on the screen. In this case, the calculation is not performed suddenly. The direct execution command outputs the calculation immediately. There are two commands for calculating limits:

a) Direct execution command - limit (f, x = a, par), where f is the expression for which the limit is calculated, a is the value of the point for which the limit is calculated, par - for one-sided limit unconditional parameter (left - left, right - on the right) or indicate the type of the variable (real - real, complex - complex).

b) Cancel Execution - Constraint (f, x = a, par) where the command parameters are the same as the command above.

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> Limit(sin(2* x) / x, x = 0);
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$$\lim_{x \to 0} \frac{\sin(2x)}{x}$$

```
> limit(sin(2* x) / x, x = 0);
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$$2$$

These commands can also be used to represent mathematical operations in a standard analytic form, such as:

<Limit(x*(Pi/2+arctan(x)), x=-infinity)=limit(x*(Pi/2+arctan(x)), x=-infinity);

$$\lim_{x \to (-\infty)} x\left(\frac{1}{2}\pi + \arctan(x)\right) = -1$$

When calculating one-sided limits, the value of the parameters is indicated:
Find the limit left-left and right-right. For example
> limit(1/1 + exp(1/x)), x=0, left) = limit(1/1 + exp(1/x)), x=0, left);

$$\lim_{n \to 0-} \frac{1}{1+e^{\left(\frac{1}{x}\right)}} = 1$$

The main feature of Maple is the use of symbols generally accepted in mathematics. The computing processor has a wide range of capabilities. It performs calculations using complex mathematical formulas. In addition to having many mathematical functions, it is possible to calculate strings, sums, multiplications, derivatives and exact integrals, work with complex numbers, as well as solve linear and non-linear equations, perform operations on vectors and matrices.

List of Used Literature

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