Didactic Tools That Activate Students' Cognitive Activity Through The "Integration Of Complex Functions And Its Applications" Module

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ABSTRACT

The organizational aspects, practical importance and theoretical foundations of the implementation of the pedagogical education cluster are highlighted. The author tried to justify his views with the opinions of Western scientists. The scientific researches of Western scientists regarding the educational cluster are analyzed and the author's attitude to them is expressed

Keywords: "Case-study" technology (from the English "case"-suitcase, method, "study"-problematic situation, pedagogical educational cluster, mimetic method, cluster strategies, purpose, tasks, principles of pedagogical educational cluster and directions

One of the main issues is the introduction of modern knowledge, pedagogic and computer technologies into the teaching process. It is especially important to focus on the teaching of mathematics in higher education (including the theory of complex variable functions) with new knowledge, practical applications, on the basis of modern pedagogical and computer technologies. The theory of functions with complex variables is widely used to represent real physical processes. Therefore, conducting research on the methodology of teaching technologies, including the theory of complex variable functions, the integration of complex functions and its applications module, and the development of new didactic tools that activate the cognitive activity of students are considered urgent issues.

In order to activate students' cognitive activity, non-standard tests together with standard tests play an important role. Non-standard tests include open and closed tests, compatibility tests, creative tests, etc. Here are some examples of tests of this type.

1. Write the omitted words (formulas):

If f(z) is a function in a domain G with one connection_____ is, then the integral obtained from the function f(z) along any closed contour C lying in G _____ will be: _____.

J: analitik\ equal to zero \ $\oint_C f(z)dz = 0$.

2. Write one formula that expresses the following 3 properties of the integral obtained from the function f(z) of the complex variable

1) The constant multiplier can be taken out of the integral sign.

2) If the direction of the integration contour is changed to the opposite, the sign in front of the integral symbol also changes.

3) The integral obtained from the sum of a finite number of functions is equal to the sum of the integrals obtained from each of its terms.

J:

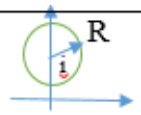
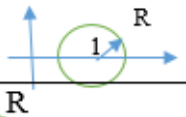
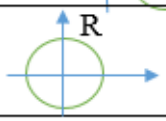
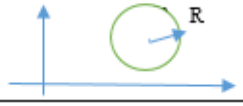
$$\int_{C^+}[a_1 f_1(z)+a_2 f_2(z)+\ldots+a_n f_n(z)]dz=-a_1\int_{C^-} f_1(z)dz-a_2\int_{C^-} f_2(z)dz-\ldots-a_n\int_{C^-} f_n(z)dz$$

3. Install compatibility:

I= a $\int_{\Gamma}\frac{dz}{z^2+4}$**, here** $\Gamma\ |z+2i|=2$ **circle. A) a=1/π, B) a=2, C) a=0,5**

1) I=-π, 2) I=-π/4, 3) I=-1/2
J: A-3, B-1, C-2

4. Install compatibility:

A	$\int_{\lvert z\rvert=R} f(z)dz$	1	
B	$\int_{\lvert z-z_0\rvert=R} f(z)dz$	2	
C	$\int_{\lvert z-1\rvert=R} f(z)dz$	3	
D	$\int_{\lvert z-i\rvert=R} f(z)dz$	4	

J.: A-3; B-4; C-2; D-1.

5. $f(z)=\frac{1}{2\pi i}\oint_{\Gamma}\frac{f(\xi)d\xi}{\xi-z}$ Write the omitted sentence in the following sentence that expresses the essence of Cauchy's formula.

The essence of the Cauchy formula is that it calculates the value of the function f(z) at the inner point z of the sphere E _____ f(ξ) is represented by the value.

J: G is in outline.

Recently, the "Case-study" method has been successfully used in the practice of education in foreign countries, and today it is becoming more and more popular in the education of our republic.

"Case-study" technology (from English "case" - suitcase, method, "study" - problematic situation, analysis of problematic situations) is a technology that serves to form students' skills to find the most optimal options by analyzing a specific, real problem situation.

In fact, the case study teaches students to study and analyze situations of any kind.

"Case-study" technology was first used in the educational process in 1870 at the law school of Harvard University, USA.

There are also ready-made versions of educational cases that can be purchased. However, the most effective way is to achieve independent creation of cases for each subject.

Harvard University alone develops 700 cases per year. They cost $10. But some cases cost from 500 to 1000 dollars.

Below we present examples of cases designed to fit the theme of integration of complex functions.

Case 1. Let us take a smooth line C in the plane. This line may not be closed. Let's assume $f(\varsigma)$ let the one-valued function be continuous on this line C. If we take any point z that does not lie on the line C, then $\frac{f(\varsigma)}{\varsigma-z}$ fraction C is continuous at all points of the line because ς since the point is an arbitrary point lying on C $\varsigma\neq z$. For this reason $\frac{1}{2\pi i}\int_C\frac{f(\varsigma)}{\varsigma-z}d\varsigma$ has a definite value for every point z (not lying in C) in the integral plane. So, that integral is a function of z, i.e $F(z)=\frac{1}{2\pi i}\int_C\frac{f(\varsigma)}{\varsigma-z}d\varsigma$.

Case assignment. Check the special cases of this integral, determine which formula or theorem it corresponds to in the module. 1) The line C is closed, and the function f(z) is analytic in the field G bounded by it:

a) point z is outside G;

b) point z is inside G;

c) point z is on the boundary of G.

Instructions to students. 1) Understand the essence of the case sufficiently.

2) Pay attention to the conditions of the theorems and formulas presented in the lecture. 3) Try to fully solve the case assignment based on the given sources.

Recommended resources.

1) Sirojiddinov S.Kh., Maqsudov Sh., Salahiddinov M. Theory of functions of a complex variable. Tashkent:, "Teacher", 368 p.

Case 2. If *f(z)* the boundary of the function is closed, bounded by a smooth or piecewise smooth closed line $\overline{E}$ is single-valued and analytic in the field, then the following formula is appropriate:

$$f(z_0)=\frac{1}{2\pi i}\oint_{\Gamma}\frac{f(z)dz}{z-z_0}$$

In this case, when the integral moves in the positive direction, that is, along , the area E always remains on the left. This formula is called Cauchy's formula.

Case assignment. $$\int_{|z-d|=r}\frac{1}{az^2+bz+c}dz$$

analyze the value of the integral depending on parameters a, b, c, d, r using the Cauchy formula.

1) choose the parameters a, b, c, d, r so that the contour of integration I(II, III, IV in the quarter az^2+bz+c Let one of the roots of the square triangle be inside the contour, and the other outside the contour, and find the value of the integral.

1) choose the parameters a, b, c, d, r in such a way that the integration contour passes through the I, II, III, IV quarters, az^2+bz+c Let one of the roots of the square triangle be inside the contour, and the other outside the contour, and find the value of the integral.

Instructions to students. 1) Understand the essence of the case sufficiently. 2) Pay attention to the theoretical information in the lecture on the module.

3) az^2+bz+c the roots of the square triangle depending on the parameters a, b, c and their roots $|z-d|=r$ pay attention to their position relative to the circle. 4) Support your analysis with examples. 5) Try to fully solve the case assignment based on the given recommendations and sources.

Recommended resources.

1) Sirojiddinov S.Kh., Maqsudov Sh., Salahiddinov M. Theory of functions of a complex variable. Tashkent:, "Teacher", 368 p.

Case 3. If the boundary of the function f(z) is closed, bounded by a smooth or piecewise smooth closed line $\overline{E}$ is single-valued and analytic in the field, then the following formula is appropriate:

$$f(z_0)=\frac{1}{2\pi i}\oint_{\Gamma}\frac{f(z)dz}{z-z_0}$$

In this case, when the integral moves in the positive direction, that is, along , the area E always remains on the left.

This formula means that in order to calculate the value of an analytic function in an area E at an arbitrary interior point of this area, it is sufficient to know its values at the boundary of the area E.

Case assignment. Write your thoughts about the possibility of solving practical problems (metalworking, medicine, emergency situations) using the formula, giving importance to the formula given in the case and the highlighted consideration.

Instructions to students. 1) Understand the essence of the case sufficiently. 2) Pay attention to the theoretical information in the lecture on the module. 3) State the practical problem and state how the formula is used to solve the problem. 4) Try to connect the boundary problems for the Laplace equation with the problems of solving.

Recommended resources.

1) Sirojiddinov S.Kh., Maqsudov Sh., Salahiddinov M. Theory of functions of a complex variable. Tashkent:, "Teacher", 368 p.

2) Salokhiddinov M. "Mathematical physics equations" T.: Uzbekistan 2002 y-448 p.

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