FORMING STUDENTS' SKILLS IN USING ELEMENTS OF MATHEMATICAL ANALYSIS ON THE EXAMPLE OF NATIONAL CERTIFICATE EXAMS

Prenov Barlikbay Barakbaevich
Head of the Department of "Mathematics" of the Nukus State Pedagogical Institute named after Ajinyoz, Doctor of Physical and Mathematical Sciences (DSc), Professor
Oteniyazov Erkin Turganbaevich
Support doctoral student of the Karakalpak Scientific Research Institute of Natural Sciences of the Academy of Sciences of the Republic of Uzbekistan

In the current rapidly developing field of education, every teacher is required to work with a new approach to his subject and creativity. The teacher should not only give students knowledge, but also be able to show the most important issues of the subject and direct them to the algorithm for solving them. In order for students to achieve such results, the teacher is required to introduce a new approach to education, to develop the skills of creating and using advanced pedagogical technologies of teaching, modern educational and methodological complexes, and to have the competence to show various methods of solving individual issues in the subject.

Mathematics develops human intelligence, attention, cultivates determination and will to achieve the intended goal, provides algorithmic discipline and expands thinking.
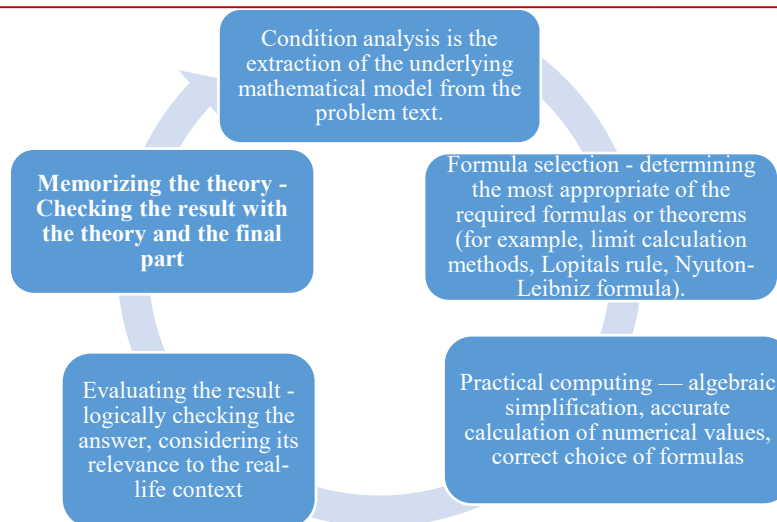
Studying mathematics involves the formation of the ability to make personal, family, professional and economic plans based on accurate calculations, to read various diagrams, drawings and models in everyday activities, to use scientific and technical innovations that facilitate human labor, increase labor productivity, and create favorable conditions. These competencies are formed in students through general education subjects. Also, based on the content of each general education subject, general science-related competencies are formed in students.

Improving the quality of education in the Republic of Uzbekistan, developing students' independent thinking and practical problem-solving skills are one of the priority areas of state policy, and a number of laws have been created to fully implement these processes. In particular, the development of the education sector is ensured on the basis of the Decree of the President of the Republic of Uzbekistan No. PF-5712 dated April 29, 2019 - "On improving the system of assessing the quality of education in the Republic of Uzbekistan", the Resolution of the President of the Republic of Uzbekistan No. PQ-4884 dated November 6, 2020 - "On measures to expand the participation of students in national and international assessment programs", the Law of the Republic of Uzbekistan "On Education" (new edition, September 23, 2020) and a number of other laws.

In recent years, the introduction of a national certification system in the general secondary and secondary specialized education system has made it possible to assess knowledge and skills in mathematics at the level of international requirements. The purpose of the national certificate questions is to determine the ability of students not only to memorize ready-made formulas, but also to apply their knowledge in practical situations. Part of the questions of these national certificate exams is made up of complex questions related to the disciplines of mathematical analysis, analytical geometry, algebra and number theory.

The course of mathematical analysis - such topics as limit, derivative, integral, finding a surface, properties and equations of functions, sequences - plays a key role in the formation of students' logical thinking not only in higher education, but also at the higher stages of the general secondary school mathematics course. As a result, questions based on these topics in the national certificate exams test students' deep analytical approach.

The following sequential methodological approach is recommended for solving mathematical analysis problems in the questions of the national certificate in mathematics:

Currently, in the national certificate exams in general education subjects, a total of 45 questions are asked, including closed-type test tasks, as well as open-type test tasks. In these exams, the most difficult questions are mainly functional equations and geometric problems that are solved by applying derivatives and integrals.

A functional equation is an equation for finding an unknown function, in which the function itself or the values of various arguments are involved. In a simple algebraic equation, there is an unknown number, while in a functional equation there is an unknown function. Let's consider the solution of some questions of this type.

Example 1. Given the following functional equation: Find the number of s $f(x) + 3f\left(\dfrac{1}{x}\right) = 4x$ that are equal to

x a) $f(2)$ and b) $f(x) = 0$.

Solution: To solve the example, we use the operations related to the concept of a function from the mathematical analysis course. We perform substitutions using the properties of functions $x \to \dfrac{1}{x}$, which results in the following system of functional equations.

$$\begin{cases} f(x) + 3f(x) = 4x \\ f\left(\dfrac{1}{x}\right) + 3f(x) = \dfrac{4}{x} \end{cases} \Rightarrow \begin{cases} 3f(x) + 9f(x) = \dfrac{12}{x} \\ f(x) + 3f\left(\dfrac{1}{x}\right) = 4x \end{cases}$$

$8f(x) = \dfrac{12}{x} - 4x, \Rightarrow f(x) = \dfrac{3}{2x} - \dfrac{x}{2}$, so we $f(2) = -\dfrac{1}{4}$ now $f(x) = 0$ find the values that will be:

$\dfrac{3}{2x} - \dfrac{x}{2} = 0, \Leftrightarrow x_{1,2} = \pm\sqrt{3}$, so it has 2 roots.

Example 2. $f(x) = ax^2 + bx + c$ A quadratic function is given. The parabola has a vertex $(1;4)$ at a point. The parabola Ox intersects $\dfrac{a+b+c}{k}$ the line at points $(-2;0)$ and. From the given example $(k;0)$, find the sum of the coordinates of the vertices of the parabola of the function $g(x)$ if a) , b) $g(x) = 3f\left(\dfrac{x}{5}\right) - 2$.

Solution: To solve the example, $f(x) = ax^2 + bx + c$ we write the quadratic function in form.

$f(x) = a(x - x_0)^2 + y_0$

$$f(x) = a(x-1)^2 + 4$$

$$f(-2) = 0$$

$$a(-2-1)^2 + 4 = 0, \iff a = -\frac{4}{9}$$

Then, and $f(x) = ax^2 + bx + c$

$$f(1) = a + b + c = 4$$

Hence, $f(x) = -\frac{4}{9}(x-1)^2 + 4$. Now condition a) of the problem find for k what we will find .

$$f(k) = 0, \implies -\frac{4}{9}(k-1)^2 + 4 = 0, \iff k = 4.$$

a) $\quad \dfrac{a+b+c}{k} = \dfrac{4}{4} = 1$

b) $\quad g(x) = 3f\left(\dfrac{x}{5}\right) - 2 = 3\left(-\dfrac{4}{9}\left(\dfrac{x}{5}-1\right)^2 + 4\right) - 2,$

$$\implies x_0 = 5 , \; y_0 = 10, \iff x_0 + y_0 = 15.$$

Example 3. Given a tin can consisting of a right circular cylinder with radius r and height h. The tin used in the container is as follows: $S_{asos+yon sirt+qopqoq} = \pi r^2 + 2\pi rh + \pi r^2 = 2\pi(r^2 + rh)$. The volume of the container $V = \pi r^2 h$. S Assuming that the base is known, V find the largest value of.

Solution: To solve the given problem, we use the knowledge we have gained from the mathematical analysis course on the topic of maximum and minimum points of a function as follows.

-        Initially, determine which parameter will allow the volume to reach its maximum value:
-        We can solve the problem using the basic formula and obtain the desired function:
-        Function maximum value find:

given issue condition according to $S = 2\pi r^2 + 2\pi rh$, in which case the condition of the issue is according to of the base face known so, h our height $h = \dfrac{S - 2\pi r^2}{2\pi r}$ equal Now the volume collection formula according to

$$V = \pi r^2 h = \frac{1}{2}(Sr - 2\pi r^3) = \frac{1}{2}r(S - 2\pi r^2)$$

Condition of the issue according to r of $V \geq 0$ to be values is interested, that is

$$0 \leq r \leq \sqrt{\frac{S}{2\pi}}$$

This is the cross section. So the point find must, V of this on point value the most big Let. Now the function maximum point to find Let's go. For this V joint from the function r to paint derivative we will get

$$V'(r) = \frac{1}{2}(S - 6\pi r^2), V''(r) = -6\pi r < 0$$

So, r the function has a maximum at the point. Now we find the stationary points of the function.

$$V'(r) = 0, \iff S - 6\pi r^2 = 0$$

$$2\pi r^2 + 2\pi rh - 6\pi r^2 = 0$$

from the equation h , $h = 2r$. So, if the diameter of the container is equal to its height, the volume of the container will be the largest.

Therefore, to successfully solve problems like the above, students are required to have not only theoretical knowledge, but also practical skills, logical thinking and the ability to independently analyze. The correct application of concepts such as limit, derivative, integral, and the ability to apply them to real-life situations increases students' mathematical literacy and creates the necessary foundation for studying in higher education institutions.

Also, in the process of solving problems in mathematical analysis, students acquire the skills of independent research, achieving precise results, effectively using formulas, and comparing different solutions. This develops their logical thinking and is of great importance in their future scientific and practical activities.

Therefore, deep mastery of mathematical analysis problems is an important condition for achieving high results in national certification exams, and also serves as a main tool for developing the general intellectual potential of students.

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