



THE USE OF INTERACTIVE METHODS DURING TEACHING THE TOPIC “PROPERTIES AND GRAPH OF AN EXPONENTIAL FUNCTION”.

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Annotation. This article discusses the widespread use of interactive pedagogical technologies in the classroom in order to increase student activity and develop critical thinking skills in schools. In particular, the use of such methods as “Word Game”, “Mathematical Market” and “Mathematical Dominoes” when teaching the topic “Properties and graph of an exponential function” is shown.

Key words: Interactive methods, exponential function, “Word game”, “Mathematical market”, “Mathematical dominoes”.

ИСПОЛЬЗОВАНИЕ ИНТЕРАКТИВНЫХ МЕТОДОВ ПРИ ПРЕПОДАВАНИИ ТЕМЫ «СВОЙСТВА И ГРАФИК ПОКАЗАТЕЛЬНОЙ ФУНКЦИИ».

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Аннотация: В данной статье рассматривается широкое использование интерактивных педагогических технологий на уроке с целью повышения активности учащихся и развития навыков критического мышления в школах. В частности, показано использование таких методов, как «Игра слов», «Математический рынок» и «Математическое домино» при преподавании темы «Свойства и график показательной функции».

Ключевые слова: Интерактивные методы, показательная функция, “Игра слов”, “Математический рынок”, “Математическое домино”.

One of the important requirements for the organization of modern education is to achieve high results in a short time, without spending too much mental and physical effort. The teacher’s responsibilities include conveying to students certain theoretical knowledge in a short time, developing their skills and competencies for certain activities, as well as monitoring students’ activities, assessing the level of knowledge, skills and abilities. and the competencies they acquire require high pedagogical skills and a new approach to the educational process.

The main goal of pedagogical technologies in education is to place the student at the center of the educational process in the educational system, to



develop independent and creative activity, to turn students into active participants in the lesson, removing them from simple memorization and automatic repetition of educational materials [1-8]. Only then will students have their own opinions about important life achievements and problems, the practical application of the topics covered, and they will be able to justify their point of view [9-15].

Pedagogical technology is inherently subjective. Regardless of the form, method and means of organization, technology: increases the effectiveness of teaching activities; make decisions about mutual cooperation between teachers; ensure that students receive in-depth knowledge of academic subjects; developing students' independent, free and creative thinking skills; creating the necessary conditions for students to realize their potential; it is necessary to guarantee the priority of democratic and humanitarian ideas in the pedagogical process [16-24].

Currently, when it comes to introducing new methods or innovations into the educational process, it is understood that interactive methods are used in the educational process. Interactivity is the activity of two people, that is, the educational and cognitive process takes place in the form of dialogue (computer communication) or based on the interaction of a student and a teacher [25-32]. Interactivity is mutual activity, movement, affectivity that arises in the dialogue between a student and a teacher. The main goal of the interactive method is to create an environment for active, free thinking of the student by creating the most favorable situation for the learning process. He demonstrates his intellectual potential, capabilities, improves the quality and effectiveness of education. The lesson is organized on the basis of interactivity in such a way that no student is left behind, that is, they have the opportunity to openly express what they see, know and think.

Every opinion expressed by students, whether right or wrong, is not criticized. Students will have the opportunity to make their personal contribution to the study and mastery of the content of the subject, working in collaboration and co-creation. There is a process of mutual exchange of knowledge, ideas and thoughts. Such situations ensure mutual sincerity and increase the desire to acquire and master new knowledge. During the lesson, mutual support, sincere and friendly relationships are formed. The creation of such an environment has great educational significance. In dialogue processes, the student learns to think critically, find solutions to complex issues based on analysis, search for information, freely express some alternative opinions in mutual negotiations, and such skills are formed. When organizing interactive classes in the educational



process, you can use individual, pair, group work, research projects, role-playing games, working with documents, working with sources of information, creative work.

This article provides guidelines for teaching the topic “Properties and graphs of exponential functions”, known from a high school mathematics course.

As we all know, from the Mathematics course to the subject of Exponential Functions, students were required to master concepts such as functions, complex functions, inverse functions, periodic functions, and rational equations and inequalities.

To increase students' interest in the lesson, you can use the word game method.

In the word game method, a word associated with a new topic is written in English, and students find English words and use capital letters to form a word associated with the new topic.

This method can be used to determine what students know about a topic at the beginning of the learning process, and at the end of the process, what news students have learned. This method is also widely used in the classroom as visual evidence of the integration process.

Advantages: This method helps students to see their personal development, and the teacher to evaluate the quality of the education they provide.

Difficulties: you must strictly adhere to the time allotted for completing the exercise. Lengthening the process can change the essence of the exercise.



As a result, a function word is formed.

To study the exponential function, you need to know the following properties.

- 1) $a^0 = 1$
- 2) $a^1 = a$
- 3) $a^{n+m} = a^n * a^m$
- 4) $a^{n-m} = \frac{a^n}{a^m}$
- 5) $(a^n)^m = a^{mn}$
- 6) $(ab)^n = a^n * b^n$
- 7) $(\frac{a}{b})^n = \frac{a^n}{b^n}$
- 8) $a^{\frac{m}{n}} = \sqrt[n]{a^m}$

It is known that powers can be considered in the form $a^{\frac{m}{n}}$ with a fractional exponent or a^p with a real exponent. Moreover, in some values of the indicator the degree a^p may not matter, for example; The expression $-3^{\frac{1}{2}} = \sqrt{3}$ does not make sense in the set of real numbers. To prevent such situations, it is necessary to satisfy the inequality $a > 0$ for the degree a^p with a real exponent p . Since $1^p = 1$ for any real number p , studying powers with base 1 does not provide any new information.



Conclusion: In order for the degree a^p for an arbitrary real exponent p to take a certain value, the conditions base $a > 0$ and $a \neq 1$ must be met.

Consider a real number a satisfying the conditions $a > 0$ and $a \neq 1$. A function of this type $y = a^x$ is called an exponential function.

The exponential function $y = a^x$ has the following properties.

- ▶ The range of definition of the exponential function $y = a^x$ consists of the set of all real numbers: $D(y) = (-\infty; +\infty)$;
- ▶ The range of values of the exponential function $y = a^x$ consists of the set of all positive real numbers: $E(y) = (0; +\infty)$;
- ▶ The exponential function $y = a^x$ does not intersect with the Ox axis.
- ▶ The exponential function $y = a^x$ intersects the Oy axis at the point $(0; 1)$.
- ▶ The exponential function is not periodic, neither even nor odd.
- ▶ The function $y = a^x$ decreases in those values of a that satisfy the inequalities $0 < a < 1$. Decreasing area $(-\infty; +\infty)$.
- ▶ The function $y = a^x$ increases for values of $a > 1$ that satisfy the inequalities: the increasing interval consists of $(-\infty; +\infty)$.

Meanwhile, as a lyrical digression, an interesting fact can be cited. For example, the dependence of the amount of dust y on height x is expressed by the function $y = p * e^{-qx}$. Here the numbers p, q are parameters, and e is an irrational number called the Euler number. Its approximate value is 2.71.

An example of solving examples on the topic of exponential function:

$$\begin{aligned} & \frac{(a^{2\sqrt{3}}-1)(a^{2\sqrt{3}}+a^{\sqrt{3}}+a^{3\sqrt{3}})}{a^{4\sqrt{3}}-a^{\sqrt{3}}} = \frac{(a^{2\sqrt{3}}-1)(a^{2\sqrt{3}}+a^{\sqrt{3}}+1)a^{\sqrt{3}}}{a^{\sqrt{3}}(a^{3\sqrt{3}}-1)} = \frac{(a^{2\sqrt{3}}-1)(a^{2\sqrt{3}}+a^{\sqrt{3}}+1)}{(a^{3\sqrt{3}}-1)} = \\ & \frac{a^{3\sqrt{3}}+a^{2\sqrt{3}}+a^{4\sqrt{3}}-a^{\sqrt{3}}-1-a^{2\sqrt{3}}}{(a^{3\sqrt{3}}-1)} = \frac{(a^{2\sqrt{3}}-1)(a^{2\sqrt{3}}+a^{\sqrt{3}}+1)}{(a^{3\sqrt{3}}-1)} = \\ & \frac{a^{3\sqrt{3}}*(1+a^{\sqrt{3}})-(1+a^{\sqrt{3}})}{(a^{3\sqrt{3}}-1)} = \frac{(a^{2\sqrt{3}}-1)(a^{2\sqrt{3}}+a^{\sqrt{3}}+1)}{(a^{3\sqrt{3}}-1)} = \frac{(a^{3\sqrt{3}}-1)(a^{\sqrt{3}}+1)}{(a^{3\sqrt{3}}-1)} = 1+a^{\sqrt{3}} \end{aligned}$$

Mathematical Markets - This activity can usually be done as a review lesson at the end of a large section or chapter. After completing a chapter, the teacher prepares examples on cards that relate to the material covered in the chapter. Each card contains 2-3 examples of varying complexity, and each example is assigned a "price" depending on the level of difficulty (for example, 5 \$, 10 \$, 20 \$,...). The number of cards depends on the number of students in the class. And students buy their favorite fruits and work on hidden examples.



Scope of Use: This method can be used to determine what students know about a topic at the beginning of the learning process and what news students have learned at the end of the process.

Advantages: This method helps students to see their personal development, and the teacher to evaluate the quality of the education they provide.

Difficulties: you must strictly adhere to the time allotted for completing the exercise. Lengthening the process can change the essence of the exercise.

Examples of “5 \$” (find the range of values of the function):

- $y = -3^x$
- $y = 4^x + 1$
- $y = \left(\frac{1}{2}\right)^x - 1$
- $y = \left(-\frac{1}{3}\right)^x$

Examples of “10 \$”:

$$\frac{(a^{2\sqrt{3}}-1)(a^{2\sqrt{3}}+a^{\sqrt{3}}+a^{3\sqrt{3}})}{a^{4\sqrt{3}}-a^{\sqrt{3}}}$$

$$\frac{a^{\sqrt{5}}-b^{\sqrt{7}}}{a^{\frac{2\sqrt{5}}{3}}+a^{\frac{\sqrt{5}}{3}}*b^{\frac{\sqrt{7}}{3}}+b^{\frac{2\sqrt{7}}{3}}}$$

$$\frac{a^{2\sqrt{2}}-b^{2\sqrt{3}}}{(a^{\sqrt{2}}-b^{\sqrt{3}})^2}+1$$

$$\sqrt{(x^\pi + y^\pi)^2 - x^\pi y^\pi}$$

Mathematical Dominoes. The game is played according to the rules of the game of dominoes. Cards (sheets) with mathematical examples are used as domino stones. Mathematical dominoes vary depending on the subject.

For example: the domino “stone” dedicated to the end of the chapter “Exponential Function” might look like this

start	$(\sqrt{3}^{\sqrt{3}})^{\sqrt{3}}$
-------	------------------------------------

3	$64^{\sqrt{2}} : 64^{3\sqrt{2}}$
---	----------------------------------

4	$5^{\sqrt[3]{16}} \sqrt[3]{4}$
---	--------------------------------

625	$3^{1-2\sqrt{3}} * 9^{1+\sqrt{3}}$
-----	------------------------------------

1	finish
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The answer to the previous example in the first part of the stone is the example in the second part. As a result, two stones end up next to each other on the board.



You can also glue the “stone” to the left of the first “stone”. As a result, three “stones” are located side by side on the board.

The game continues in the same spirit.

Areas of Use: This method can be used to determine what students know about a topic at the beginning of the learning process, and at the end of the process, what news students have learned.

Advantages: This method helps students to see their personal development, and the teacher to evaluate the quality of the education provided to them.

Difficulties: you must strictly adhere to the time allotted for completing the exercise. Lengthening the process can change the essence of the exercise.

In conclusion, we note that the use of interactive teaching methods helps to create a comfortable environment for students in the classroom, in which every student feels successful. If schoolchildren and students take an active part in this process, their interest and passion for the subject they study will increase. This positive learning experience increases their overall satisfaction and promotes long-term knowledge retention. Thanks to this, the quality of education can be improved.

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