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LOGARITHMIC FUNCTIONS

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Annotation: "Logarithms" is a traditional course in algebra and the beginning of high school analysis, but at the same time it is very difficult for students to perceive because of the complexity of the material, the concentration of the presentation. According to the current programs in secondary school mathematics, the study of logarithms, logarithmic equations and inequalities is planned for the end of the algebra course and the beginning of the analysis so very little time is devoted to the study of this material. That is why students' knowledge of this material is much lower than the knowledge of other topics they have been studying for several years.

Keywords: logarithmic function, methods, natural logarithm.

Consequently, students' knowledge of the logarithmic function is formal, it manifests itself when solving the corresponding equations, inequalities, systems of equations. Due to the insufficiency of solving tasks in practice, there is a problem of incomplete assimilation of the material.

In mathematics and other sciences, functions containing a logarithm are quite common. A function of the form where a is a given number, a > 0, a ≠ 1 is called a logarithmic function.

Properties of the logarithmic function:

1. The domain of definition is the set of all positive numbers. $(0; +\infty)$. This follows from the definition of the logarithm (because the logarithm exists only of a positive number!)
2. The set of values of a logarithmic function is the set of all real numbers.
3. Unlimited function. (Follows directly from 2 properties.)
4. Increasing if a > 1, and decreasing if . $0 < a < 1$

We prove the increase by definition of the increasing function if , then $x_1 < x_2$, то $f(x_1) < f(x_2)$.

Let. $a > 1, 0 < x_1 < x_2$

By the basic logarithmic identity $x_1 = a^{x_1}, x_2 = a^{x_2}$,, therefore $a^{x_1} < a^{x_2}$. By the property of degrees with the same base, greater than 1 $x_1 < x_2$, we have: . I.e., a larger value of the argument corresponds to a larger value of the function, therefore, the function is increasing. Similarly , the decrease of the function at the base is proved $0 < a < 1$.

5. Zeros of the function: x = 1

6. The intervals of the sign of constancy and .

If a > 0, then the function takes positive values at x > 1, negative values at 0 < x < 1.

If 0 < a < 1, the function takes positive values at 0 < x < 1, negative values at x > 1.

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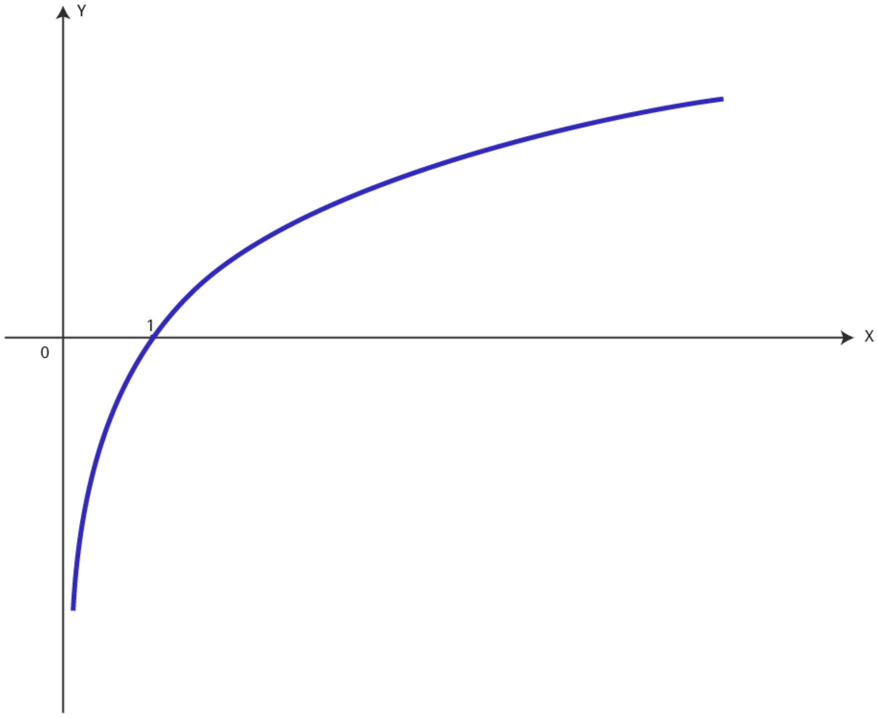
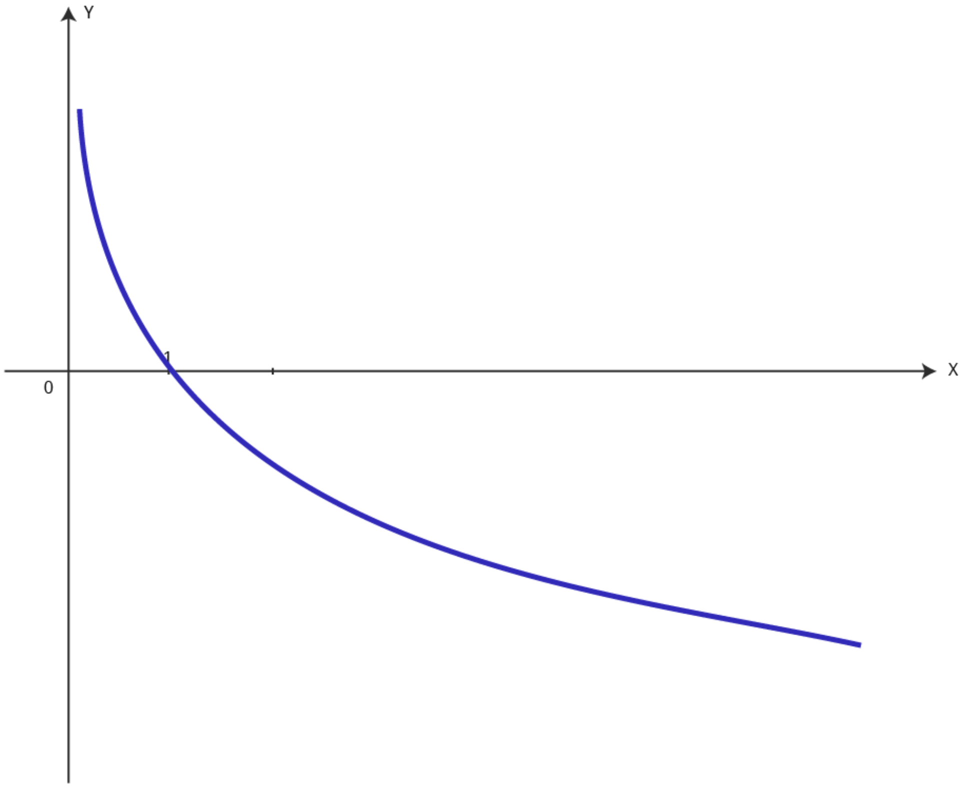
From the considered properties of the logarithmic function, it follows that its graph is located to the right of the Ou axis, necessarily passes through the point (1; 0) and has the form: if the base is greater than 1 (graph No. 1) and if the base is greater than zero, but less than 1 (graph No. 2).





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Suppose that $x_1 \neq x_2$, for example, $x_1 < x_2$. Then if the base $a > 1$, by virtue of the increasing function $x_1 < x_2$. Contradiction with the problem condition. If $0 < a < 1$, then the function is decreasing and $x_1 > x_2$. There is also a contradiction with the condition of the problem that $x_1 = x_2$. Hence, $x_1 = x_2$.

This property is applied when solving equations.

The logarithm of the quotient (fraction) is equal to the difference between the logarithms of the divisible and the divisor.

loga x\y = logax - logay, (a > 0, a ≠ 1 и x > 0, y > 0)

The difference of logarithms is equal to the logarithm of the quotient of the sublogarithmic expressions.

logax - logay = loga xy, (a > 0, a ≠ 1 и x > 0, y > 0)

The solution of logarithmic equations is based on the definition of the logarithm, the properties of the logarithmic function and the properties of the logarithm

Basic methods for solving logarithmic equations:

log a f(x) = b <=> f(x) = ab a > 0, a ≠ 1.

2. log f(x) g(x) = b <=> (f(x))b = g(x), f(x) > 0, f(x) ≠ 1, g(x) > 0

log a f(x) = log a g(x) <=> f(x) = g(x), f(x) > 0

log f(x) g(x) = logf(x) h(x) <=> g(x) = h(x), f(x) > 0, f(x) ≠ 1, g(x) > 0

The logarithm of the number b on the base a, where a > 0, a ≠ 1, b > 0, is the exponent of the degree to which the base a must be raised to get the number b.

In other words, the natural logarithm of the number b is the solution of the equation ex = b.

The natural logarithm is denoted by ln x.

Graph of the function y = ln x

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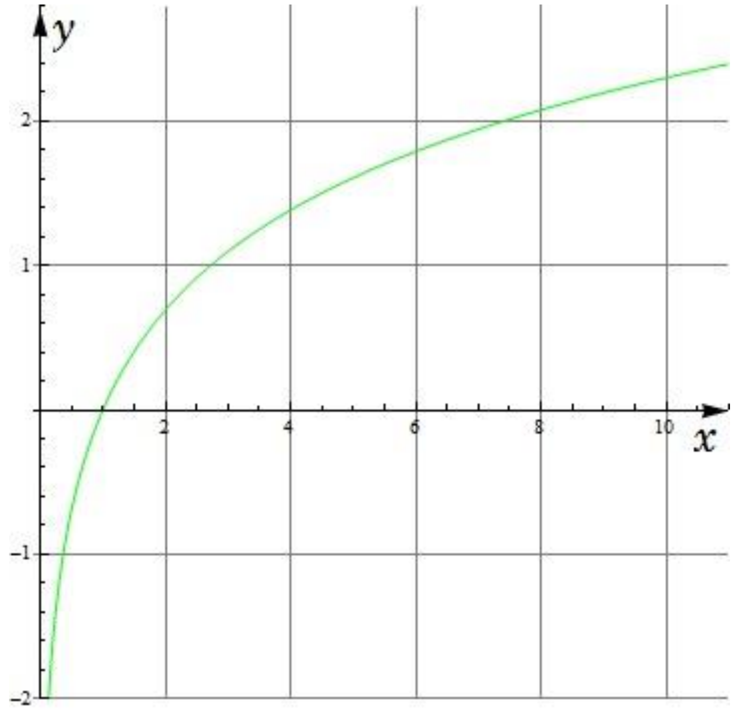

D(y): x ϵ (0; +∞).

The sub-logarithmic expression is positive. The graph does not intersect the Oy axis.

ri x = 1 the logarithmic function y = loga x acquires a value equal to 0.

The graph intersects the Ox axis at the point (1; 0).

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