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# LOGARITHMIC FUNCTIONS, EQUATIONS AND INEQUALITIES

Abdullayev Nurbek Shuhrat o'g'li
Ro'ziqulov Sa'dulla Egamnazar o'g'li
Tursunov Zohidjon Tohirjon ògli

| A B S T R A C T | K E Y W O R D S |
|---|---|
| This article provides information on logarithmic functions, equations, and solutions to inequalities. | Logarithmic functions, equations, inequalities, graph, function, interval positive. |

## Introduction

**Logarithmic function.** let $a > 0$, $a \neq 1$. Given that the number N is a logarithm on the basis a, the number A is said to be the degree indicator that needs to be raised to form the number N, and is denoted by logaN.

By definition, ax = n (a > 0, a 1 1) is the X solution of the equation

X = logaN number. The action of finding the logarithm of an expression is called logarithm of the same expression, while finding the same expression itself according to a given logarithm is called potentiation.

when the expression x = logaN is potentiated, a recursive n = ax is formed. with $a > 0$, $a \neq 1$, and $N > 0$, the equations ax = N and logaN = X are of equal strength.

Thus we have a function y = logax ($a > 0$, $a \neq 1$) that is continuous and monotonic in its field of detection. This function:

a basis is called a logarithmic function. the Y = logax function is the inverse function to the Y = ax function. Its graph is generated by a symmetric substitution of the function graph y = ax with respect to the straight line y = X. Since the logarithmic function is an inverse function to the exponential function, its properties can be generated using the exponential function properties.

In particular, the defining domain of the function f (x) = ax was $D(f) = \{-\infty < x < +\infty\}$, and the domain of change was $E(f) = \{0 < y < +\infty\}$. Accordingly, for a logax function $f(x) = D(f) = \{0 < x < +\infty\}$, $E(f) = \{-\infty < y < +\infty\}$.

at $a > 1$, the logax function $(0; +\infty)$ is continuous in light, increasing, negative at $0 < x < 1$, positive at $x > 1$, increasing from $-\infty$ to$+\infty$. Similarly at $0 < a < 1$ the function is continuous at $(0;+\infty)$, decreasing from $+\infty$ to 0, taking positive values at $0 < x < 1$ range, and negative values at $x > 1$. The ordinate axis is a vertical asymptote for the logax function.

Let's consider the following examples:

1.To solve 2x=4, we write 2x=22 and find the solution x=2.

2.Let 2x = 5. it is difficult to describe 5 on the right side in the form of a degree with a base of 2. But it is known to us that there is a real root of this equation. To solve such equations, the concept of logarithm is introduced.

In general, the root of the equation ax=b (a>0, a≠1, b>0) is called the logarithm of the number b according to base A.

Description: the logarithm of a number B according to base A is said to be the degree indicator that a number will need to be raised to form a number B, and is defined as logab. ax=equation B (since x=logab

aloga B / B (1) < BR >

can be written in the form. (1) the formula is called the basic logarithmic axiom, where *a>0a≠1*vab*>0*

2) Examples: 1) log2162) find the value of log50,04.

3) Solution: 1) since 16=24, it is necessary to raise the two to the fourth level to form 16, which means log216 = 4.

4) 2)it is known that 0,04% of the volume is 5%. Therefore log50, 04=-2

5) Examples: 3. we find log4 x to satisfy the equations 4) log x 4 to satisfy.

6) Solution: using the basic logarithmic axiom:

7) $x = 4^{\frac{1}{2}} = 2$

8) $x^{\log x\, 4}$ □ 4, ya`ni $x^{\square\ 34}$ □ 4, $x$ □ $4^{\square 34}\sqrt{\ \square}\ ^{1}$ we find the S.

9) $\frac{3}{}256$

For any number a>0, b>0, a 1 1, b 1 1, x>0, y>0, and the real desired numbers n and m, the following equalities are satisfied:

1) $\log_a 1$ □ 0, 2) $\log_a a$□1,
3) $\log_a (xy)$ □ $\log_a x$□$\log_a y$, $x$
4) $\log_a \frac{}{y}$□ $\log_a x$□$\log_a y$,
5) $\log_a x^n$ □$n\log_a x$,
6) $\log_a m\, x$□ $\frac{1}{}m \log_a x$,
7) log *am xn* □ $\frac{}{}$*mn* log *a x*,
8) $\log_a x$□ $\frac{\log^b x\ ,}{\log_b a}$
9) $\log_a b$□ $\frac{1}{\log_b a}$,

These equalities arise from the properties of the exponential function. We will prove some of these.

Using logarithmic axiom: $x$ □ $a^{\log a\, x}$, $y$ □ $a^{\log a\, y}$ we find the.

Whether or not we multiply these equalities by terms

$xy$ □ $a\log_a x * a\log_a y$ □ $a\log_a x$□$\log_a y$, $x$ □ $a\log_a x$

$:a\log_a y$ □ $a\log_a x$□$\log_a y$, is formed.

$y$

From these equalities come the Equalities 3) and 4) according to the definition of the logarithm. X to Alo X if we increase both sides of the mirror to n-level, X to Alo x yields and from this we find loga X to NLO.

To prove that the formula for the transition from one-base logarithm to another-base logarithm is 8) in private 9), we proceed as follows: loga x gömək B gömək

From both sides of the resulting expression x=ab we find a logarithm according to base b:

$b$ $b\log_b$ $a$□$b$□ —— $\log^b x$

$\log_b x$□ $\log_b a$ □ $\log_b a$

Putting the value of b on the left side, we obtain the formula 8). If we say x=b from this formula, we get the formula 9).

**5- example.** If $\log_2 5$□$a$ va $\log_2 3$□$b$ bo`lsa, $\log_2 3000$ ni $a$ va $b$ express through?

**Solution:** $\log_2 3000$ □ $\log_2 (3$□$5^3$ □$2^3)$ □ $\log_2 3$□$3\log_2 5$□$3\log_2 2$ □ $b$ □$3a$ □3 **6-xample.** If $\log_3 x$ □ $\log_3 7$□$2\log_3 5$□$3\log_3 2$ bo`lsa, $x$ find.

$^2\log_3 2^3$ □ $\log_3$ —— —— $72$□$5_3{}^2$ □ $\log_3 175_8$,

**Solution:** $\log_3 x$ □ $\log_3 7$ □ $\log_3 5$ □

From this $x$ □ $\frac{175}{8}$ □ 21,875

**Decimal and natural logarithms. Definition 1.** The basis *a=10* the logarithms that are decimal logarithms are called and *lgx* is expressed through, i.e. $\log_{10}x=\lg x$

**7- example.** $\lg 100=\lg 10^2=2$

*8:* $\lg 0{,}01=\lg 10^{-2}=-2$

**2- description.** A Natural logarithm is said to be a logarithm whose basis is a number e, and *lnx* is defined by, i.e. $\log_e x=\ln x$, *e* the number is an irrational number, $e=2{,}7182818284\ldots$ a in practice $e\approx 2{,}7$ can be taken as. Between decimal and natural logarithms

$\lg x$ □ $\frac{1}{\ln 10}$ □$\ln x$ □ 0,434294$\ln x$ and

$\ln x$ □ $\frac{1}{\lg e}$ □$\lg x$ □ 2,302551$\lg x$ there is a link. A in practice $\lg x$□ 0,4$\ln x$ and $\ln x$□ 2,3$\lg x$ equalities can be used.

**9- example.** *ln100*, $lge^2$ calculate.

$\ln 100$ □ 2,3□$\lg 100$ □ 2,3□2 □ 4,6.

**Solution:**

$\lg e^2$ □ $2\lg e$ □ 2□0,4$\ln e$ □ 0,8.

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