INTRODUCTION TO

logarithms

Bur Oak Math Club • October 23rd 2024

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01

What is a Logarithm?

What is a Logarithm?

A logarithm is the **power** to which **a number must be raised** , in order to get another number.

Logarithmic Form and Exponential Form

$$log_b m = x \longleftrightarrow b^x = m$$

Useful Logarithm formulas

Logarithmic laws			
Products:	$\log_b mn$	$=$	$\log_b m + \log_b n$
Ratios:	$\log_b \frac{m}{n}$	$=$	$\log_b m - \log_b n$
Powers:	$\log_b n^p$	$=$	$p \log_b n$
Roots:	$\log_b \sqrt[q]{n}$	$=$	$\frac{1}{q} \log_b n$
Change of bases:	$\log_b n$	$=$	$\log_a n \log_b a$

let's try some examples!

02

Past CSMC Problems

Past CSMC Questions

2015 Part A

4. Determine all values of x for which

$$\left(2 \cdot 4^{x^2-3x}\right)^2 = 2^{x-1}.$$

Past CSMC Questions

2021 Part A

5. What are all real numbers $x > 0$ for which

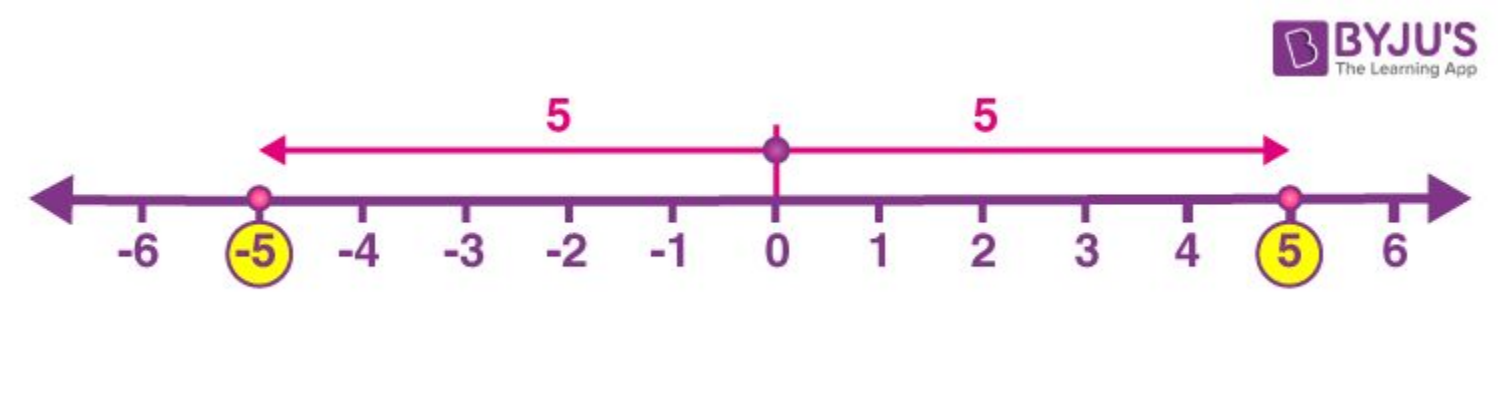
$$\log_2(x^2) + 2\log_x 8 = 392 / (\log_2(x^3) + 20\log_x(32))?$$

04

What are absolute values?

What is an absolute value?

The absolute value of a number is the magnitude of the number. It can be represented as the distance from zero on the number line, regardless of the direction.



Let's try an example

Solve $|-3x+5| = 4.$

03

Other Practice Problems

Solutions can be found on the CEMC Website

Other Practice Problems

Euclid 2024 Question 8

Determine all triples (x, y, z) of real numbers that are solutions to the following system of equations:

$$\begin{aligned} \log_9 x + \log_9 y + \log_3 z &= 2 \\ \log_{16} x + \log_4 y + \log_{16} z &= 1 \\ \log_5 x + \log_{25} y + \log_{25} z &= 0 \end{aligned}$$

Other Practice Problems

Euclid 2023 Question 8

Determine all real values of x for which

$$\sqrt{\log_2 x \cdot \log_2(4x) + 1} + \sqrt{\log_2 x \cdot \log_2\left(\frac{x}{64}\right) + 9} = 4$$

Other Practice Problems

Euclid 2017 Question 8

Determine all pairs (a, b) of real numbers that satisfy the following system of equations:

$$\sqrt{a} + \sqrt{b} = 8$$
$$\log_{10} a + \log_{10} b = 2$$

Other Practice Problems

Euclid 2016 Question 9

Determine all real numbers $x > 0$ for which

$$\log_4 x - \log_x 16 = \frac{7}{6} - \log_x 8$$

Other Practice Problems

Euclid 2015 Question 9

Consider the following system of equations in which all logarithms have base 10:

$$(\log x)(\log y) - 3\log 5y - \log 8x = a$$
$$(\log y)(\log z) - 4\log 5y - \log 16z = b$$
$$(\log z)(\log x) - 4\log 8x - 3\log 625z = c$$