MATHEMATICS · GRADES 10-12

Evaluating logarithms

Difficulty level: Advanced

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Overview of the concept

This is how you work out how many times you have to multiply a number by itself to reach another number. Figuring out how many years it takes your savings to double is a logarithm, and so is working out how many doublings it takes for a population to reach a certain size. It turns a growth question into a simple count. Once you can count the steps, you can plan for how long something will take.



Rule

Logarithm: $\log_b(a)$ is the power you raise b to in order to get a.

So $\log_{10}(1000) = 3$ because $10^3 = 1000$.

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Worked examples

EXAMPLE 1

Q Evaluate $\log_{10}(1000)$

SOLUTION

10^___ = 1000

Work out the powers: $10^1 = 10$, $10^2 = 100$, $10^3 = 1000$

So $\log_{10}(1000) = 3$

EXAMPLE 2

Q Evaluate $\log_2(64)$

SOLUTION

2^___ = 64

Work out the powers: $2^5 = 32$ and $2^6 = 64$

So $\log_2(64) = 6$

Practice questions

1 Evaluate $\log_2(8)$.

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2 What power of 2 gives 32?

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3 Evaluate $\log_{10}(10)$.

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4 Evaluate $\log_5(1)$.

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5 Your savings double every year. How many years will it take for $100 to grow to $800?

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6 Evaluate $\log_2(\frac{1}{8})$.

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7 One of these logarithms equals 2. Which one?

A $\log_2(4)$

B $\log_3(27)$

C $\log_{10}(1000)$

D $\log_2(8)$

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8

$\log_5(1)$ is 0. Why?

A. Any base raised to the power 0 is 1, so log 5 (1) is 0

B. Any base raised to the power 1 is 1, so log 5 (1) is 1

C. 5 raised to the power 0 is 0, so log 5 (1) is 0

D. Logarithms of 1 are always 1

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$\log_2(64) = 6$. What is $\log_2(128)$?

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10 **Three of these logarithms equal 2 and one does not. Which one does not equal 2?**

A $\log_2(8)$

B $\log_3(9)$

C $\log_4(16)$

D $\log_5(25)$

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ANSWER KEY

1. 3

2. 5

3. 1

4. 0

5. 3

6. -3

7. $\log_2(4)$

8. Any base raised to the power 0 is 1, so $\log_5(1)$ is 0

9. 7

10. $\log_2(8)$

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