

Lesson 45: Log Rules

By the end of the lesson, we will be able to:

- ~ Understand Properties of Logarithms
 - * Change the base of log functions so we can evaluate them.
 - * Expand Logarithmic Expressions.
 - * Condense Logarithmic Expressions.

Lesson 45: Log Rules

There are 4 properties of logarithms that are used to evaluate and rewrite log expressions.

The first Property of Logs is:

Change of Base Property: $\log_b x = \frac{\log x}{\log b}$ or $\log_b x = \frac{\ln x}{\ln b}$

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Evaluate using a calculator and the change of base property:

$$\text{Change of Base Property: } \log_b x = \frac{\log x}{\log b} \text{ or } \log_b x = \frac{\ln x}{\ln b}$$

A. $\log_4 12$ (trick: b is for bottom.... it goes on bottom.)

B. $\log_{20} 26.3$

C. $\log_5 125$

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Two more important Properties of Logs

Product Property: $\log_b(mn) = \log_b m + \log_b n$

Quotient Property: $\log_b\left(\frac{m}{n}\right) = \log_b m - \log_b n$

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Expand each log expression

D. $\log_2(5xy)$

E. $\ln\left(\frac{a}{b+1}\right)$

F. $\log_3\left(\frac{pq}{6}\right)$

G. $\ln\left(\frac{w}{xy}\right)$

Numbers on top are added

Product Property: $\log_b(mn) = \log_b m + \log_b n$

Numbers on bottom are subtracted

Quotient Property: $\log_b\left(\frac{m}{n}\right) = \log_b m - \log_b n$

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Condense each log expression (- goes on bottom, + goes on top)

H. $\ln a + \ln b + \ln c$

I. $\log 5 - \log x - \log(y - 4)$

J. $\log_3 5 - \log_3 u + \log_3 6$

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The fourth Property of Logs is:

$$\text{Power Property: } \log_b(m^p) = p \cdot \log_b m$$

(Follow the previous rules and the power goes out front)

Expand each log expression using the Properties of Logs.

K. $\log_5 \left(\frac{x^3}{y^2} \right)$

L. $\ln(a^5 \sqrt{b})$

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$$\text{Power Property: } \log_b(m^p) = p \cdot \log_b m$$

Remember, fractions rewrite as roots ($x^{\frac{1}{2}} = \sqrt[2]{x}$)

Practice - Condense each log expression

M. $2 \ln x + \frac{1}{2} \ln(z + 2)$

N. $2 \log 5 + \frac{1}{3} \log u - 4 \log 3$

LOG RULES

CHANGE OF
BASE:

$$\log_b x = \frac{\log x}{\log b} \text{ or } \frac{\ln x}{\ln b}$$

$$\log_b (x)^n = n \cdot \log_b (x)$$

$$\log_b (xy) = \log_b x + \log_b y$$

$$\log_b \left(\frac{x}{y} \right) = \log_b x - \log_b y$$

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By the end of the lesson, we will be able to:

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 - * Change the base of log functions so we can evaluate them.
 - * Expand Logarithmic Expressions.
 - * Condense Logarithmic Expressions.

CAN YOU???

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Homework:

Assignment 45