

Unit 2 Day 2: Properties of Logs and Solving using Properties

Natural logarithm: has a base of e (2.718), ($\log_e y$) but we write $\ln y$

All properties that apply to logarithms also apply to the natural log!

Properties of Logarithms (Expanding and Condensing)

- $\log_b mn = \log_b m + \log_b n$
- $\log_b \frac{m}{n} = \log_b m - \log_b n$
- $\log_b m^p = p \log_b m$

How to "undo"

\bullet	\leftrightarrow	$+$
\div	\leftrightarrow	$-$
$+$	\leftrightarrow	\bullet
$-$	\leftrightarrow	\div

Ex. Condense Each Logarithm

1. $7 \ln x^7 = \ln x^7$

2. $\log(x) + \log(x-2) = \log[x(x-2)] = \log(x^2 - 2x)$

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

4. $\ln(x+5) - \ln x = \ln \frac{x+5}{x}$

Solving Using Properties

Solve the following. You may have to use some condensing properties!

1. $\ln(3x-5) = 4$
 $e^4 = 3x-5$
 $e^4 + 5 = 3x$
 $x = \frac{e^4 + 5}{3} = 19.87$

2. $\log_6(4x+2) + \log_6 2 = 2$
 $\log_6[2(4x+2)] = 2$
 $6^2 = 2(4x+2)$
 $36 = 8x+4$
 $32 = 8x$
 $x = 4$

3. $\log_2(8x^3) - \log_2(2x) = 6$
 $\log_2\left(\frac{8x^3}{2x}\right) = 6$
 $\log_2(4x^2) = 6$
 $2^6 = 4x^2$
 $64 = 4x^2$
 $16 = x^2$
 $4 = x$

4. $\log_3(2x+1) + \log_3 3 = 4$
 $\log_3[3(2x+1)] = 4$
 $3^4 = 6x+3$
 $81 = 6x+3$
 $78 = 6x$
 $x = 13$

5. $\log_2(x+6) - \log_2 x = 2$
 $\log_2\left(\frac{x+6}{x}\right) = 2$
 $2^2 = \frac{x+6}{x}$
 $4 = \frac{x+6}{x}$
 $4x = x+6$
 $3x = 6$
 $x = 2$

6. $\ln(4x-1) = 3$
 $e^3 = 4x-1$
 $e^3 + 1 = 4x$
 $x = \frac{e^3 + 1}{4} = 5.27$