Section 8.5

Properties of Logarithms

Properties of Logarithms

bases must be equal!

Product Property	$\log_b m + \log_b n = \log_b (m \cdot n)$
Quotient Property	$\log_b m - \log_b n = \log_b \frac{m}{n}$
Power Property	$\log_b m^n = n \cdot \log_b m$

$+ \rightarrow *$

$- \rightarrow \div$

→ write as a single logarithm

① Coefficients ⇒ exponents

Condense the Expressions

- $\log 6 + 2\log 2 - \log 3$

$\log 6 + \log 2^2 - \log 3$

$\log(6 \cdot 2^2) - \log 3$

$\log 24 - \log 3 = \log \frac{24}{3} = \boxed{\log 8}$

- $\frac{1}{5}[\log_3 x + \log_3(x-2)] - \log_3 x$

$\frac{1}{5}\left[\log_3(x^2-2x)\right] - \log_3 x$

$\log_3 (x^2-2x)^{1/5} - \log_3 x = \log_3\left[\frac{(x^2-2x)^{1/5}}{x}\right]$

- $\frac{1}{3}\ln x + 5\ln(x-3)$

$= \ln x^{1/3} + \ln(x-3)^5$

$= \ln\left[x^{1/3}(x-3)^5\right]$ ⇐ Both Good!

$= \ln\left[\sqrt[3]{x}\cdot(x-3)^5\right]$

Expand the Expressions

- $\log_4 5x^3y$

$5 \cdot x^3 \cdot y$

$\log_4 5 + \log_4 x^3 + \log_4 y$

$\log_4 5 + 3\log_4 x + \log_4 y$

- $\log \dfrac{x^2-1}{x^3} = \log \dfrac{(x+1)(x-1)}{x^3}$

$= \log(x+1) + \log(x-1) - \log x^3$

$= \log(x+1) + \log(x-1) - 3\log x$

- $\ln \dfrac{\sqrt{3x-5}}{7} = \ln \left(\dfrac{3x-5}{7}\right)^{1/2}$

$\frac{1}{2}\ln(3x-5) - \ln 7$

- $\log_2 \dfrac{\sqrt{x}y^4}{z^4} =$

$\sqrt{x} = x^{1/2}$

$-\log_2 z^4$

$\frac{1}{2}\log_2 x + 4\log_2 y - 4\log_2 z$

Change of Base Formula

Rewriting with common logarithms: $\log_b a = \frac{\log a}{\log b}$ → base 10

Rewriting with natural logarithms: $\log_b a = \frac{\ln a}{\ln b}$ → base "e"

Evaluate the expressions using common and natural logarithms

a.) $\log_3 7$ $= \frac{\log 7}{\log 3}$ or $\frac{\ln 7}{\ln 3}$

b.) $\log_4 29$ $\frac{\log 29}{\log 4}$ $\frac{\ln 29}{\ln 4}$

Practice Problems

Textbook page 496 – 497

- #30 – 45 (expand) 38 - 44 evens
- #46 – 57 (condense) 51, 53, 57
- #58 – 73 (change of base formula) 58-64 evens
- #77 – 79 (apps) ~~*~~