Juniors

AP Statistics

Business Calc

AP Computer Science

Expanding math

Unit 4

Learning Target

I can use the properties of logs to expand and condense logarithms with the same base.

Product Property

$$\log_a(uv) = \log_a u + \log_a v$$

$\log_2(3xy) = \log_2 3 + \log_2 x + \log_2 y$

Quotient Property

$$\log_a\left(\frac{u}{v}\right) = \log_a u - \log_a v$$

$\log_4\left(\frac{3x}{2y}\right)$

$\log_4 3 + \log_4 x - \log_4 2 - \log_4 y$

..

(Power)

Exponent Property

$$\log_a u^n = n \log_a u$$

$$\log_7 x^3 = 3 \log_7 x$$

Summary of Logarithmic Properties (for all formulas, x, y, and b, are all > 0, a and $b \neq 1$)		
Product Rule:	$\log_b(xy) = \log_b x + \log_b y$	Remember, if you multiply **inside** the parentheses, you **add** logs on the outside.
Division Rule:	$\log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y$	Remember, if you divide **inside** the parentheses, you **subtract** logs on the outside.
Power Rule:	$\log_b(x^p) = p\log_b x$	Remember, if you raise to a power **inside** the parentheses, you **multiply** by that power on the outside.
Change of Base Rule:	$\log_b(x) = \frac{\log_{10} x}{\log_{10} b}$ or $\log_b(x) = \frac{\ln x}{\ln b}$	Remember, put the larger number (argument) on top, the smaller (base) on bottom. This is useful for the calculator if you don't have the **LOGBASE** function.

Expanding Logs

1) $\log_4 \frac{5x^2}{y^3} = \log_4 5 + 2\log_4 x - 3\log_4 y$

2) $\ln \frac{\sqrt[3]{x+z}}{y} \rightarrow \ln \frac{(x+z)^{\frac{1}{3}}}{y}$

$\ln (x+z)^{\frac{1}{3}} - \ln y$

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

Condensing Logs

3) $3\log 2 + \frac{1}{2}\log x$

$\log 2^3 + \log x^{\frac{1}{2}}$

$\log 8 + \log \sqrt{x}$

$\log 8\sqrt{x}$

4) $\ln 5 - 2\ln x - \ln y$

$\ln \frac{5}{x^2 y}$

Expand or Condense

5) $\log_2 \frac{x^2\sqrt{y}}{z}$ → $\log_2 x^2 + \log_2 \sqrt{y} - \log_2 z$

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

6) $\frac{1}{2}[4\ln x - \ln(x+2) - 2\ln(x-3)]$

$\frac{1}{2}[\ln x^4 - \ln(x+2) - \ln(x-3)^2]$

$\frac{1}{2}\left[\ln \frac{x^4}{(x+2)(x-3)^2}\right]$

$\ln \sqrt[2]{\frac{x^4}{(x+2)(x-3)^2}}$

Homework:

Worksheet