Properties of Logs - NOTES

Name: Hey

Date: _____

Properties of Logs:

$\log_b$ of b^n Theorem

$\log_b b^n = n$ EX: $\log_5 5^2 = 2$

Logarithm of 1 Theorem

$\log_a 1 = 0$ EX: $\log_7 1 = 0$

Logarithm of a Product Theorem

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

$\log_a(xy)$: CONDENSED FORM

$\log_a x + \log_a y$: EXPANDED FORM

Logarithm of a Quotient Theorem

$\log_a \frac{x}{y} = \log_a x - \log_a y$

Logarithm of a Power Theorem

$\log_a x^n = n * \log_a x$

Examples

Expand each logarithm.

1) $\log_5\left(z^5\sqrt{x}\right)$

$\log_5 z^5 + \log_5 \sqrt{x}$

$5\log_5 z + \frac{1}{2}\log_5 x$

2) $\log \sqrt[3]{a \cdot b \cdot c}$

$\log(abc)^{1/3}$

$\frac{1}{3}\log a + \frac{1}{3}\log b + \frac{1}{3}\log c$

3) $\log_5\left(a^5 \cdot b\right)^4$

$4\log_5 a^5 + 4\log_5 b$

$20\log_5 a + 4\log_5 b$

4) $\log_2 \frac{x^4}{y^6}$

$\log_2 x^4 - \log_2 y^6$

$4\log_2 x - 6\log_2 y$

5) $\log_8\left(x^4 y^6\right)$

$\log_8 x^4 + \log_8 y^6$

$4\log_8 x + 6\log_8 y$

6) $\log_6\left(x^3 \cdot y\right)^5$

$5\log_6 x^3 + 5\log_6 y$

$15\log_6 x + 5\log_6 y$

7) $\log_4\left(z^6\sqrt{x}\right)$

$\log_4 z^6 + \log_4 \sqrt{x}$

$6\log_4 z + \frac{1}{2}\log_4 x$

8) $\log_9 \frac{a^3}{b^5}$

$\log_9 a^3 - \log_9 b^5$

$3\log_9 a - 5\log_9 b$

Condense each expression to a single logarithm.

9) $3\log_2 a - 3\log_2 b$

$\log_2 a^3 - \log_2 b^3$

$\log_2 \frac{a^3}{b^3} = \log_2\left(\frac{a}{b}\right)^3$

10) $\log u + \log v + 2\log w$

$\log u + \log v + \log w^2$

$\log(uvw^2)$

11) $\log_8 w + \frac{\log_8 u}{2} + \frac{\log_8 v}{2}$

$\log_8 w + \frac{1}{2}\log_8 u + \frac{1}{2}\log_8 v$

$\log_8 w + \log_8 u^{1/2} + \log_8 v^{1/2}$

$\log_8\left(w\sqrt{uv}\right)$

12) $4\log_6 x + 4\log_6 y$

$\log_6 x^4 + \log_6 y^4$

$\log_6 (xy)^4$

13) $\frac{\ln a}{2} + \frac{\ln b}{2} + \frac{\ln c}{2}$

$\frac{1}{2}\ln a + \frac{1}{2}\ln b + \frac{1}{2}\ln c$

$\ln a^{1/2} + \ln b^{1/2} + \ln c^{1/2}$

$\ln\left(\sqrt{abc}\right)$

14) $\log_7 x + \log_7 y + 3\log_7 z$

$\log_7 x + \log_7 y + \log_7 z^3$

$\log_7\left(xyz^3\right)$

15) $2\log a - 8\log b$

$\log a^2 - \log b^8$

$\log\left(\frac{a^2}{b^8}\right)$

16) $4\log_9 x - 2\log_9 y$

$\log_9 x^4 - \log_9 y^2$

$\log_9\left(\frac{x^4}{y^2}\right)$