

Properties of Logarithms - Expanding & Condensing
Honors Algebra 2

N A M E: _____
Date: _____ Period: _____

KEY

Expand.

1.) $\log_4 5x^3y$
 $\log_4 5 + \log_4 x^3 + \log_4 y$
 $\log_4 5 + 3\log_4 x + \log_4 y$

2.) $\ln \frac{\sqrt{3x-5}}{7}$
 $\ln \sqrt{3x-5} - \ln 7$
 $\ln (3x-5)^{1/2} - \ln 7$
 $1/2 \ln (3x-5) - \ln 7$

3.) $\ln \frac{x^2}{y^2z^3}$
 $\ln x^2 - \ln y^2 z^3$
 $\ln x^2 - (\ln y^2 + \ln z^3)$
 $2 \ln x - (2 \ln y + 3 \ln z)$
 OR $2 \ln x - 2 \ln y - 3 \ln z$

4.) $\ln \sqrt{\frac{x^2}{y^3}}$
 $\ln \left(\frac{x^2}{y^3}\right)^{1/2}$
 $1/2 \left[\ln \left(\frac{x^2}{y^3}\right) \right]$
 $1/2 [\ln x^2 - \ln y^3]$

$\rightarrow 1/2 [2 \ln x - 3 \ln y]$

5.) $\log \frac{y^4 \sqrt{x}}{z^4}$
 $\log y^4 \sqrt{x} - \log z^4$
 $\log y^4 + \log x^{1/2} - \log z^4$
 $4 \log y + 1/2 \log x - 4 \log z$

6.) $\log_2 \frac{xy^5}{z^2}$
 $\log_2 xy^5 - \log_2 z^2$
 $\log_2 x + \log_2 y^5 - \log_2 z^2$
 $\log_2 x + 5 \log_2 y - 2 \log_2 z$

7.) $\log_3 \left(\frac{3x^2}{yz}\right)$
 $\log_3 3x^2 - \log_3 yz$

$\log_3 3 + \log_3 x^2 - (\log_3 y + \log_3 z)$
 $1 + 2 \log_3 x - (\log_3 y + \log_3 z)$
 Condense. $1 + 2 \log_3 x - \log_3 y - \log_3 z$

8.) $\ln \left(\frac{\sqrt[3]{xy}}{t^{4/3}}\right)$
 $\ln (xy)^{1/3} - \ln t^{4/3}$
 $1/3 [\ln xy] - 4/3 \ln t$
 $1/3 [\ln x + \ln y] - 4/3 \ln t$
 OR $1/3 \ln x + 1/3 \ln y - 4/3 \ln t$

9.) $\log \frac{(x+1)^2(x^2+1)}{90xy}$
 $\log (x+1)^2(x^2+1) - \log 90xy$
 $\log (x+1)^2 + \log (x^2+1) - (\log 90 + \log x + \log y)$
 $2 \log (x+1) + \log (x^2+1) - (\log 90 + \log x + \log y)$
 OR $2 \log (x+1) + \log (x^2+1) - \log 90 + \log x - \log y$

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

11.) $3 \log_4 x + 2 \log_4 3 + \frac{1}{2} \log_4 y$
 $\log_4 x^3 + \log_4 3^2 + \log_4 y^{1/2}$
 $\log_4 9x^3 \sqrt{y}$

12.) $2 \log_9 + \log(3x-5)$
 $\log 9^2 + \log(3x-5)$
 $\log 81(3x-5)$

13.) $\frac{1}{3} [2 \ln(x+3) + \ln x - \ln(x^2-1)]$
 $\frac{1}{3} [\ln(x+3)^2 + \ln x - \ln(x^2-1)]$
 $\frac{1}{3} \left[\ln \frac{x(x+3)^2}{(x^2-1)} \right]$
 $\ln \left(\frac{x(x+3)^2}{(x^2-1)} \right)^{1/3}$ OR $\ln \sqrt[3]{\frac{x(x+3)^2}{(x^2-1)}}$

14.) $2 \ln 8 - 5 \ln 2$

$$\ln 8^2 - \ln 2^5$$

$$\ln \frac{8^2}{2^5}$$

$$\ln \frac{64}{32}$$

$$\ln 2$$

16.) $\frac{1}{2} \log x - \log y + \log z - \frac{1}{3} \log w$

$$\log x^{1/2} - \log y + \log z - \log w^{1/3}$$

$$\log \frac{\sqrt{x} \cdot z}{y \sqrt[3]{w}}$$

15.) $\log(2x - 3) + \log(3x - 4)$

$$\log (2x-3)(3x-4)$$

or

$$\log 6x^2 - 17x + 12$$

17.) $\ln e - 2(\ln x^2 + \ln y)$

$$\ln e - 2(\ln x^2 + \ln y)$$

$$\ln e - \ln(x^2 y)^2$$

$$1 - \ln(x^2 y)^2$$

Retro Question:

13.) $y = 3\left(\frac{1}{2}\right)^{x-4} - 3$

Parent Function: $y = \left(\frac{1}{2}\right)^x$

Growth/Decay: DECAY

Domain: $(-\infty, \infty)$

Range: $(-3, \infty)$

Asymptote: $y = -3$

End Behavior:

As $x \rightarrow -\infty, f(x) \rightarrow \infty$

As $x \rightarrow \infty, f(x) \rightarrow -3$

