6.5 NOTES
Sum/Difference Properties

Write as a Sum/Difference
"EXPAND"

$$\ln\left(\frac{xy}{z^3}\right)$$

Is it multiply or divide?

$$\ln xy - \ln z^3$$

$$\ln x + \ln y - \ln z^3$$

(3 brought down in front)

$$\ln x + \ln y - 3\ln z$$

(2) $\log_5 x(\sqrt[3]{x-1})$

$\log_5 x + \log_5 \sqrt[3]{x-1}$

$\log_5 x + \log_5 (x-1)^{\frac{1}{3}}$

$\log_5 x + \frac{1}{3}\log_5 (x-1)$

CONDENSE:

$(\log_3 x) - (\frac{1}{3}\log_3 y) + (4\log_3 z)$

$\log_3 x - \log_3 y^{\frac{1}{3}} + \log_3 z^4$

$\log_3 \frac{x}{\sqrt[3]{y}} + \log_3 z^4$

$$\log_3 \frac{x}{\sqrt[3]{y}} \cdot \frac{z^{-1}}{1}$$

$$\log_3 \frac{xz^4}{\sqrt[3]{y}}$$

Condense:

① $2 \ln 3 - \ln x$

$$\ln\left(\frac{9}{x}\right)$$

(2) $\log_2 x + \log_2 y - 3\log_2 z$

$$\log_2\left(\frac{xy}{z^3}\right)$$

(3) Expand:

$$\ln\left(\frac{e^4}{x\sqrt{y}}\right)$$

$$4\ln e - \left(\ln x + \frac{1}{2}\ln y\right)$$

More Practice

Evaluate: No Calculator

① $\log 10$

$\log_{10} 10$

$10^x = 10$

1

② $\log_2 8$

$2^x = 8$

$\log_2 2^3$

3

③ $\log_5 13$

$\frac{\log 13}{\log 5}$

≈ 1.6

④ $\ln 1$

$\log_e 1 = x$

$e^x = 1$

0 ←

(5) $\log 1$ — 0

$\log_{10} 1 = x$

$10^x = 1$

(6) $\log_{\frac{1}{2}} 32$ — -5

$\frac{1}{2}^x = 32$

$\left(\frac{1}{2}\right)^x = 2^5$

$\left(\frac{2}{1}\right)^{-x} = 32$

$\left(\frac{1}{2}\right)^x = \frac{2^5}{1}$

$2^{-x} = 2^5$

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

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

(7) $\log_{\frac{1}{3}} 27$ — -3

$\frac{\log 27}{\log \frac{1}{3}}$

$\left(\frac{1}{3}\right)^x = 27$

$\left(\frac{1}{3}\right)^x = \frac{3^3}{1}$

$\left(\frac{1}{3}\right)^x = \left(\frac{1}{3}\right)^{-3}$

(8) $\log_5 \left(\frac{1}{25}\right)$ -2

$5^x = \frac{1}{25}$

$5^x = \frac{1}{5^2}$

$5^x = 5^{-2}$ // PHAT

9 $\log_7 \sqrt{7}$ $\frac{1}{2}$

$\log_7 7^{\frac{1}{2}}$

$\frac{1}{2}$

10 $12^{\log_{12} 5}$ 5

Solve:

$$\frac{5e^{.2x}}{5} = \frac{7}{5}$$

$$e^{.2x} = \frac{7}{5}$$

$$\frac{\log_e \frac{7}{5}}{.2} = \frac{.2x}{.2}$$

$$\frac{.2x}{.2} = \frac{\ln \frac{7}{5}}{.2}$$

$$\frac{\ln \frac{7}{5}}{.2} = x \quad \text{EXACT}$$

$$1.68 \approx x \quad \text{APPROX.}$$

..

#2 $4^x = 15$

① $\log_4 15 = x$ exact

$\frac{\log 15}{\log 4} = x$

$1.95 \approx x$ Approx.

② $\ln 4^x = \ln 15$

$x \ln 4 = \ln 15$

$\frac{x \ln 4}{\ln 4} = \frac{\ln 15}{\ln 4}$

$x = \frac{\ln 15}{\ln 4}$ Exact

③ $\log_4 4^x = \log_4 15$

$x = \log_4 15$

$x = \frac{\log 15}{\log 4}$ Exact.

$x \approx 1.95$ Approx.

#18) $\log_3 8 \cdot \log_8 9$

$\log_3 2^3 \cdot \log_8 3^2$

$\frac{\log 8}{\log 3} \cdot \frac{\log 9}{\log 8}$

$\frac{\log 9}{\log 3}$

$\log_3 9 \rightarrow \square$