PAP Precalculus Name: Key

HW – Properties of Logs

Rewrite $\ln(20)$ in terms of $\ln(4)$ and $\ln(5)$.

$$\ln 4\cdot 5 = \boxed{\ln 4 + \ln 5}$$

2. Use the properties of logarithms to rewrite and simplify the logarithmic expression.

a) $\ln 5e^6$

$$\ln 5 + \ln e^6$$

$$\ln 5 + 6\cancel{\ln e}$$

$$\boxed{\ln 5 + 6}$$

b) $\ln \frac{e^5}{7}$

$$\ln e^5 - \ln 7$$

$$5\cancel{\ln e} - \ln 7$$

$$\boxed{5 - \ln 7}$$

3. Use the properties of logarithms to expand the expression as a sum, difference, and/or constant multiple of logarithms.

a) $\log_{10} 5x$

$$\boxed{\log_{10} 5 + \log_{10} x}$$

b) $\log_{10} \frac{x}{8}$

$$\boxed{\log_{10} x - \log_{10} 8}$$

c) $\ln \sqrt{z}$

$$\ln z^{1/2}$$

$$\boxed{\frac{1}{2}\ln z}$$

d) $\ln \sqrt{\frac{x^2}{y^3}}$

$$\ln\left(\frac{x^2}{y^3}\right)^{1/2}$$

$$\ln \frac{x}{y^{3/2}}$$

$$\boxed{\ln x - \frac{3}{2}\ln y}$$

e) $\ln \frac{x^2-1}{x^3},\ x > 1$

$$\ln(x^2-1) - \ln x^3$$

$$\boxed{\ln(x^2-1) - 3\ln x}$$

f) $\ln \frac{x^4\sqrt{y}}{z^5}$

$$\ln x^4 + \ln\sqrt{y} - \ln z^5$$

$$\boxed{4\ln x + \frac{1}{2}\ln y - 5\ln z}$$

4. Condense the expression to a single logarithm.

a) $2\log_2(x+3)$

$\boxed{\log_2(x+3)^2}$

b) $2\ln x + \ln(x+1)$

$\ln x^2 + \ln(x+1)$

$\boxed{\ln x^2(x+1)}$

c) $4[\ln z + \ln(z+5)] - 2\ln(z-5)$

$\boxed{\ln \frac{(z(z+5))^4}{(z-5)^2}}$

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

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

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

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

5. Find the exact value of the logarithm without using a calculator. If this is not possible, state the reason.

a) $\log_6 \sqrt[3]{6}$

$\log_6 6^{1/3}$

$\frac{1}{3}\cancel{\log_6 6} = \boxed{\frac{1}{3}}$

b) $\log_4(-16)$

No solution

c) $\ln e^6 - 2\ln e^5$

$6\cancel{\ln e} - 10\cancel{\ln e}$

$6 - 10 = \boxed{-4}$

d) $\ln \frac{1}{\sqrt{e}}$

$\ln 1 - \ln e^{1/2}$

$\ln 1 - \frac{1}{2}\cancel{\ln e}$

$0 - \frac{1}{2} = \boxed{-\frac{1}{2}}$