4.4 In-class Practice

1. Use the Laws of Logarithms to expand the expression.

a) $\log_3(x\sqrt{y})$　　b) $\log_2(xy)^{10}$　　c) $\log_a\left(\frac{x^2}{yz^3}\right)$

d) $\ln\sqrt{ab}$　　e) $\ln\sqrt[3]{3r^2s}$　　f) $\log\frac{a^2}{b^4\sqrt{c}}$

g) $\ln\left(\frac{x(x^2+1)}{\sqrt{x^2-1}}\right)$　　h) $\log_5\sqrt{\frac{x-1}{x+1}}$　　i) $\ln\left(x\sqrt{\frac{y}{z}}\right)$

2. Use the Laws of Logarithms to combine the expression.

a) $\log 12 + \frac{1}{2}\log 7 - \log 2$　　b) $\log_2 A + \log_2 B - 2\log_2 C$

b) $\log_5(x^2-1) - \log_5(x-1)$　　c) $4\ln x - \frac{1}{3}\ln(x^2+1) + 2\ln(x-1)$

d) $\log(a+b) + \log(a-b) - 2\log c$　　e) $\ln 5 - 2\ln x + \frac{1}{2}\ln(x-1)$

3. Simplify: $(\log_2 5)(\log_5 7)$

4. Evaluate.

a) $\log_\pi e$　　b) $\log_\pi\sqrt{2}$

5. Solve.

a) $10^{-x} = 4$　　b) $e^{3x} = 12$　　c) $3^{2x-1} = 5$

d) $2e^{12x} = 17$　　e) $e^{1-4x} = 2$　　f) $4(1+10^{5x}) = 9$

g) $4 + 3^{5x} = 8$　　h) $2^{3x} = 34$　　i) $e^{5x} = 3e^{2x}$

6. **Concept Check:** Evaluate:

a) Given $g(x) = e^x$, find　i) $g(\ln 4)$　ii) $g(\ln(5^2))$　iii) $g\left(\ln\frac{1}{e}\right)$

a) Given $f(x) = \ln x$, find　i) $f(e^6)$　ii) $f(e^{\ln 3})$　iii) $f(e^{2\ln 3})$

7. **True or False?** Discuss each equation and determine whether it is true for all possible values of the variables. (Ignore values of the variables for which any term is undefined.)

(a) $\log\left(\frac{x}{y}\right) = \frac{\log x}{\log y}$

(b) $\log_2(x-y) = \log_2 x - \log_2 y$

(c) $\log_5\left(\frac{a}{b^2}\right) = \log_5 a - 2\log_5 b$

(d) $\log 2^z = z\log 2$

(e) $(\log P)(\log Q) = \log P + \log Q$

(f) $\frac{\log a}{\log b} = \log a - \log b$

(g) $(\log_2 7)^x = x\log_2 7$

(h) $\log_a a^a = a$

(i) $\log(x-y) = \frac{\log x}{\log y}$

(j) $-\ln\left(\frac{1}{A}\right) = \ln A$

8. Explain the **error** in the following **"proof"** that $2 < 1$.

$$\frac{1}{9} < \frac{1}{3} \qquad \text{True statement}$$

$$\left(\frac{1}{3}\right)^2 < \frac{1}{3} \qquad \text{Rewrite the left side.}$$

$$\log\left(\frac{1}{3}\right)^2 < \log\frac{1}{3} \qquad \text{Take the logarithm on each side.}$$

$$2\log\frac{1}{3} < 1\log\frac{1}{3} \qquad \text{Property of logarithms; identity property}$$

$$2 < 1 \qquad \text{Divide each side by } \log\tfrac{1}{3}.$$