6.5 Practice Problems

In problems 1 - 4, use the properties of logarithms to expand each logarithmic expression as much possible. Where possible, evaluate logarithmic expressions without using a calculator.

1. $\log(10000xy)$

$= \log 10000 + \log x + \log y$

$= 4 + \log x + \log y$

2. $\log_3\left(\frac{81}{x}\right)$

$= \log_3 81 - \log_3 x$

$= 4 - \log_3 x$

3. $\ln\left(\frac{e^3}{x}\right)$

$= \ln e^3 - \ln x$

$= 3\ln e - \ln x$

4. $\log_4\left(\frac{16x^2}{y^3}\right)$

$= \log_4 16 + \log_4 x^2 - \log_4 y^3$

$= 2 + 2\log_4 x - 3\log_4 y$

In problems 5 - 8, use properties of logarithms to condense each logarithmic expression. Write the expression as a single logarithm whose coefficient is 1.

5. $\log 25 + \log 4$

$= \log (25)(4)$

$= \log 100$

$= 2$

6. $\log_2 x - \log_2 y$

$= \log_2\left(\frac{x}{y}\right)$

7. $2\ln x + 4\ln y - 3\ln z$

$= \ln x^2 + \ln y^4 - \ln z^3$

$= \ln\left(\frac{x^2 y^4}{z^3}\right)$

8. $2\log_3 x - 3\log_3 y$

$= \log_3 x^2 - \log_3 y^3$

$= \log_3\left(\frac{x^2}{y^3}\right)$

In problems 9 - 10, use common logarithms or natural logarithms and a calculator to evaluate to four decimal places. (Use the change of base formula.)

9. $\log_8 25 = \frac{\log 25}{\log 8} = \frac{\ln 25}{\ln 8} \approx 1.548$

10. $\log_{27} 13 = \frac{\log 13}{\log 27} = \frac{\ln 13}{\ln 27} \approx .7782$

In problems 11 – 12, simplify using properties of logarithms.

11. $2^{\log_2(2x-9)}$

$= 2x-9$

12. $\log_9 9^{1-8x}$

$= 1-8x$

If $f(x) = \ln x$, $g(x) = e^{8x}$, and $h(x) = x^6$, find the following.

a. $(f \circ g)(x)$

$= \ln e^{8x} = 8x$

b. domain of $(f \circ g)(x)$

$(-\infty, \infty)$

c. $(f \circ g)(3)$

$8(3) = 24$

d. $(g \circ f)(x)$

$e^{8(\ln x)} = x^8$

e. domain of $(g \circ f)(x)$

$(0, \infty)$

f. $(f \circ h)(x)$

$\ln x^6$

g. domain of $(f \circ h)(x)$

$(-\infty, 0) \cup (0, \infty)$

h. $(f \circ h)(e)$

$\ln e^6 = 6\ln e$

$= 6(1)$

$= 6$