MAC1105 College Algebra
5.3 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. $\log_3 \frac{81}{x}$

$= \log_3 81 - \log_3 x$

$= 4 - \log_3 x$

3. $\ln \frac{e^3}{x}$

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

$= 3\ln e - \ln x$

$= 3(1) - \ln x$

$= 3 - \ln x$

4. $\log_4 \frac{16x^2}{y^3}$

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

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

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. $\log 25 + \log 4$

$= \log(100)$

$= 2$

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. $\log_8 25$

$= \frac{\log 25}{\log 8}$ or $= \frac{\ln 25}{\ln 8}$

≈ 1.55

10. $\log_{27} 13$

$\frac{\log 13}{\log 27}$ or $\frac{\ln 13}{\ln 27}$

≈ 0.78

Solving the following logarithmic equations. Use property of equality

11. $\log_2(x-5) = \log_2 17$

$x - 5 = 17$

$+5 \quad +5$

$x = 22$

Check

$\log_2(22-5) = \log_2(17)$ ✓

12. $\log(x-9) = \log(x+4) + \log 3$

$\log(x-9) = \log[3(x+4)]$

$x - 9 = 3x + 12$

$-x \quad -x$

$-9 = 2x + 12$

$-12 \quad -12$

$\frac{-21}{2} = \frac{2x}{2}$ ~~$x = \frac{-21}{2}$~~

Check

$\log(\frac{-21}{2} - 9)$

can't take log of negative

No solution

13. $2\log_7 x = \log_7 64$

Power rule: $\log_7 x^2 = \log_7 64$

$x^2 = 64$

$\sqrt{x^2} = \sqrt{64}$

$x = \pm 8$

$x = 8$

Check

$2\log_7 8$ ok $\quad 2\log(-8)$ ← no

~~14. $\log(x-9) = \log(x+4) + \log 3$~~

15. $\log(x+3) + \log(x-2) = \log 14$

Condense $\log[(x+3)(x-2)] = \log 14$

$(x+3)(x-2) = 14$

$x^2 - 2x + 3x - 6 = 14$

$x^2 + x - 20 = 0$

$(x+5)(x-4) = 0$

$x + 5 = 0 \quad x - 4 = 0$

~~$x = -5$~~ $\quad x = 4$

Check:

$x = -5$ $\quad \log(-5+3) = \log(-2)$ ← no

$x = 4$ $\quad \log(4+3) = \log(7)$ ← ok

$\log(4-2) = \log(2)$ ← ok

$x = 4$