MATH 156: Precalculus
Fall 2015
Worksheet §4.4: Laws of Logarithms

You must know all of the rules here by heart and you must know how to use them quickly.

1. $y = \log_a x \iff$

Example: Find x for $\ln x = -2$.

2. $\log_a(AB) =$

Example: Evaluate $\log_6 9 + \log_6 24$

3. $\log_a\left(\frac{A}{B}\right) =$

Example: Evaluate $\log_9 75 - \log_9 25$

4. $\log_a(A^c) =$

Example: Evaluate $\ln e^{-2/3}$

5. $\log_a A + \log_a B =$

Example: Simplify $\log_4(16x + 4y)$

6. $\frac{\log_a A}{\log_a B} =$

Example: Simplify $\frac{\log_3(x+1)}{\log_3(x-1)}$

7. $(\log_a A)(\log_a B) =$

Example: Simplify $(\log_3(x+1))(\log_3(x-1))$

8. Change of Base Formula

$$\log_a x =$$

Example: Use your calculator to find $\log_7 23$.

1. Evaluate

    (a) $\log_2 8^{20}$

    (b) $\log_3 \frac{1}{\sqrt{81}}$

    (c) $\log_5(\log_2 32^{25})$

2. Expand

    (a) $\ln(x\sqrt[3]{y})$

    (b) $\log_a\left(\frac{x^2}{2yz^3}\right)$

    (c) $\ln\sqrt{x\sqrt{y+1}}$

3. Combine and simplify, if possible.

   (a) $\frac{1}{3}\log_2 1000 - 3\log_2 5$

   (b) $\log(x^2 - 1) - \log(x - 1)$

   (c) $\frac{2}{5}\log_6(x + 1)^5 + \frac{1}{2}\left[\log_6(x^2 + 4x + 4) - \log_6(x + 2)\right]$

4. Change the logarithm $\log_{13} 49$ to base e.

5. Using the previous problem, explain the relationship between the graph of $y = log_{13}x$ and $y = \ln x$.