

$$\log_b x = y \longleftrightarrow b^y = x$$

3.4 Properties of Logarithms

Logarithmic & Exponential Properties

$$x^a x^b = x^{a+b}$$

$$\log(xy) = \log x + \log y$$

$$\frac{x^a}{x^b} = x^{a-b}$$

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

$$(x^a)^b = x^{ab}$$

$$\log(x^a) = a \log x$$

$$x^0 = 1$$

$$\log 1 = 0$$

$$\ln 1 = 0$$

$$\ln e = 1$$

$$\log_{10} 10 = 1$$

Inverse Properties

$$\underline{b}^{\log_b x} = x$$

$$\log_{\underline{b}}(\underline{b}^x) = x$$

Change of Base Formula

$$\boxed{\log_b x = \frac{\log x}{\log b} = \frac{\ln x}{\ln b}}$$

Ex #1 Expand $\log\left(\frac{3x}{4\sqrt{x^2-2}}\right)$.

$$\begin{aligned} &= \log(3x) - \log(4\sqrt{x^2-2}) \\ &= \log 3 + \log x - (\log 4 + \log \sqrt{x^2-2}) \\ &= \log 3 + \log x - \log 4 - \log \sqrt{x^2-2} \\ &= \log 3 + \log x - \log 4 - \log (x^2-2)^{1/2} \\ &= \boxed{\log 3 + \log x - \log 4 - \frac{1}{2} \log (x^2-2)} \end{aligned}$$

* cannot do anything w/ x^2-2

Ex #2 Condense $3 \ln x - 6 \ln (y-1)$.

$$\begin{aligned} &= \ln x^3 - \ln (y-1)^6 \\ &= \ln \left(\frac{x^3}{(y-1)^6} \right) \end{aligned}$$

Ex #3 Evaluate $\log_4 30$ on your calculator.

$$\log_4 30 = \frac{\log 30}{\log 4} \approx \boxed{2.453}$$
$$= \frac{\ln 30}{\ln 4} \approx 2.453$$

Ex #4 Evaluate $\log_3 6$.

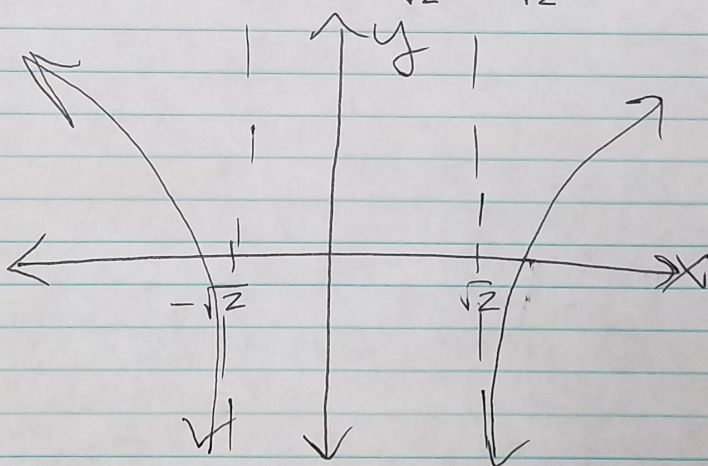
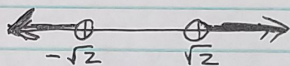
$$\log_3 6 = \frac{\log 6}{\log 3} \approx \boxed{1.631}$$

Ex #5 Graph $f(x) = \log(x^4 - 4)$.

$$x^4 - 4 > 0$$

$$x^4 > 4$$

$$x = \pm\sqrt{2}$$



$$x^2 - 2 > 0$$

$$x^2 > 2$$

$$x = \pm\sqrt{2}$$

