6.5 Properties of Logarithms

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$\log_4(64) = 3$ $\quad 4^3 = 64$

$\log_3(20) = 2.73$ $\quad 3^{2.73} = 20$ $\quad 3^2 = 9$ $\quad 3^3 = 27$

Calculator:

$\log(62) = 1.79$ $\quad 10^{1.79} = 62$ $\quad 10^1 = 10$ $\quad 10^2 = 100$

$\ln(18) = 2.89$ $\quad e^{2.89} = 18$

Change of Base Formula:

$$\log_a(x) = \frac{\log(x)}{\log(a)}$$

$$\log_3(20) = \frac{\log(20)}{\log(3)} = 2.73$$

OR

$$\frac{\log(3)}{\log(20)} = 0.37$$

Log Properties:

① $\log(A \cdot B) = \log(A) + \log(B)$ (condensing / expanding)

$$\log(2 \cdot (x-1)) = \log(2) + \log(x-1)$$

② $\log\left(\frac{A}{B}\right) = \log(A) - \log(B)$ (condensing / expanding)

$$\log_2(x+3) - \log_2(x) = \log_2\left(\frac{x+3}{x}\right)$$

③ $\log(A^P) = P \cdot \log(A)$ (condensing / expanding)

$$5\ln(2x+1) = \ln((2x+1)^5)$$

ex Expand: $\log_4\left(\frac{5x^2}{x-2}\right)$

① Most logs possible

② No exponents

$\log_4(5 \cdot x^2) - \log_4(x-2)$ (Property #2)

$\log_4(5) + \log_4(x^2) - \log_4(x-2)$ (Property #1)

$\log_4(5) + 2\log_4(x) - \log_4(x-2)$ (Property #3)

ex Condense:

① Single log!

$3\log_2(x+1) - \log_2(x) + 2\log_2(y)$ (Property #3, Property #3)

$\log_2((x+1)^3) - \log_2(x) + \log_2(y^2)$

$$\log_2\left(\frac{(x+1)^3 \cdot y^2}{x}\right)$$ ← positive logs ← negative logs