5.3 Properties of Logarithms

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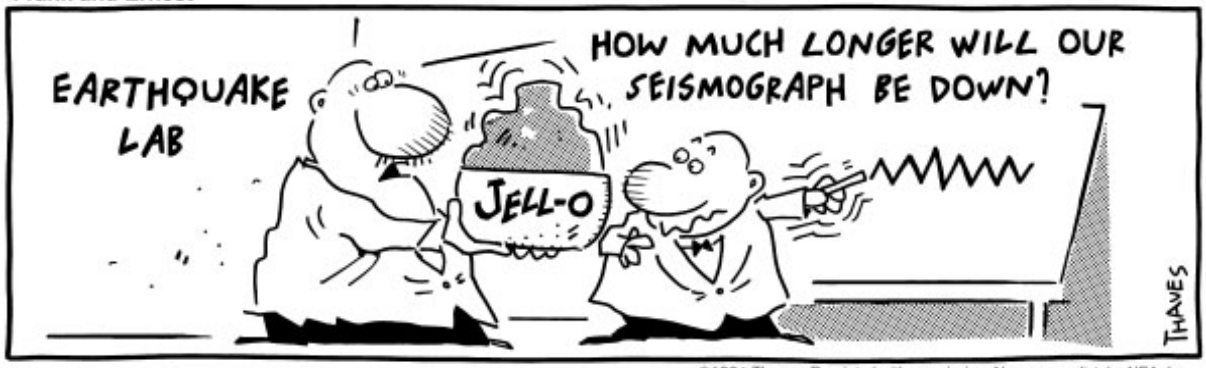

$\log_5 36$

$\log \quad 36$

Wade's

table

$10^{?} = 36$

Noys

calculators

* formula

common logs/ natural

You

calculator

Change of Base Formula

Base 10: $\log_a x = \frac{\log_{10} x}{\log_{10} a}$

$\log_4 25 = \frac{\log 25}{\log 4}$

$\log_4(25)$
2.321928095
$\log(25)/\log(4$
2.321928095

Change of Base Formula

Base e : $\log_a x = \frac{\ln x}{\ln a}$

$\log_4 25 = \frac{\ln 25}{\ln 4} =$

$\log_4(25)$
2.321928095
$\ln(25)/\ln(4$
2.321928095

Change of Base Formula

Base b : $\log_a x = \frac{\log_b x}{\log_b a}$

$\log_4 8 = \frac{\log_2 8}{\log_2 4} = \frac{3}{2}$

* common mistake :

$\log \frac{8}{4}$

$$\log_{25} \frac{1}{5} = \frac{\log_5 \frac{1}{5}}{\log_5 25} = \frac{-1}{2}$$

Properties of Logarithms

1. $\log_a(uv) = \log_a u + \log_a v$

   $\ln(uv) = \ln u + \ln v$

exponential

$3^5 \cdot 3^8 = 3^{13}$

$\log_4 8 =$

$\log_4(4 \cdot 2) = \log_4 4 + \log_4 2$

$= 1 + \frac{1}{2}$

$= 1\frac{1}{2}$

Properties of Logarithms

2. $\log_a \frac{u}{v} = \log_a u - \log_a v$

$\ln \frac{u}{v} = \ln u - \ln v$

$\log_3 (3/27) = \log_3 3 - \log_3 27$

$= 1 - 3 = -2$

$\log_4 24 - \log_4 6 = \log_4 \frac{24}{6} = 1$

$\frac{\log_4 24}{\log_4 6}$

Properties of Logarithms

3. $\log_a u^n = n \log_a u$

$\ln u^n = n \ln u$

$\log_2 (4^2 \cdot 3^4) = \log_2 4^2 + \log_2 3^4$

$= 2 \log_2 4 + 4 \log_2 3$

$= 4 + 4 \log_2 3$

Expand Logarithms

a) $\log_4(5x^3y) = \log_4 5 + 3\log_4 x + \log_4 y$

b) $\log_b \frac{(x^2)}{(y^2z^3)} = \log_b x^2 - \log_b(y^2z^3)$

$= 2\log_b x - (2\log_b y + 3\log_b z)$

Condense Logarithms

a) $2 \ln (x + 2) - \ln x = \ln \frac{(x+2)^2}{x}$

b) $\frac{1}{2} \log_{10} x + 3 \log_{10} (x + 1) =$

$\log_{10} \left[(\sqrt{x})(x+1)^3 \right]$

c) $\frac{1}{3} [\log_2 x + \log_2 (x - 4)]$

$\frac{1}{3} \left(\log_2 x^2 - 4x \right)$

$\log_2 (x^2 - 4x)^{1/3}$

$$2\log_3(x+4) - 2\log x$$

$$\underbrace{2\log_7\sqrt{56} - \log_7 8}_{\log_7\left(56^{1/2}\right)^2} + \log\sqrt[3]{\frac{100}{10^2}} + \log 10^{2/3}$$

$$\log_7 \frac{56}{8}$$

$$1 + \frac{2}{3}$$

$$\frac{5}{3}$$

HW: Pg 409 #3,7,11,15, 17-21 odds, 23 -37 odds, 39-77 every other odd