

MTH 30 LECTURE NOTES (Ojakian)

Topic 16: Log Properties

OUTLINE

(References: 4.5)

1. Log Rules

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- (a) $\log_b(1) = 0$
- (b) $\log_b(b) = 1$
- (c) $\log_b(b^u) = u$
- (d) $b^{(\log_b(u))} = u$
- (e) $\log_b(M \cdot N) = \log_b(M) + \log_b(N)$ (product rule for log)
- (f) $\log_b(M/N) = \log_b(M) - \log_b(N)$ (quotient rule for log)
- (g) $\log_b(M^n) = n \log_b(M)$ (power rule for log)

2. Log Rules in 2 directions

- (a) Expanding ...
- (b) Combining/Condensing ...

3. Earthquake Calculations

PROBLEM 1. *The Richter scale is used to measure the magnitude of an earthquake. The key equation is this:*

$$M = \log_{10}(a/C),$$

where M is Richter's **magnitude**, a is the **intensity** of its shock waves, and C is a constant

- (a) *Compare an earthquake of magnitude 5 to one with magnitude 4: How much more intense is the one with magnitude 5?*
- (b) *Likewise, compare the earthquake in Bio-Bio to the one in San Francisco. Note that the one in Bio-Bio had a magnitude of 9.5, while the one in San Francisco had a magnitude of 7.8.*

4. PH level in chemistry

- (a) See PH description at beginning of Section 4.5.
- (b) Measure concentration by “molarity” = number of moles per liter
(1 mole = $6.022 \cdot 10^{23}$ particles, known as “Avogadro’s number”)
- (c) Example: Suppose the concentration of hydrogen ions in a liquid has molarity $10^{-7.4}$. What is its PH? What might you guess the liquid to be?
- (d) Example: Suppose the PH of a liquid is 3. What is the concentration of hydrogen ions in the liquid? (i.e. its molarity) What might the liquid be?
- (e) Section 4.5. Example 12 (p. 482)

5. Problems

Section 4.5: 7, 9, 13, 17, 21