4.3: Laws of Logs

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Recall: The Laws of Exponents

(1) $b^{A+B} = b^A \cdot b^B$

(2) $b^{A-B} = b^A / b^B$

(3) $(b^A)^C = b^{AC}$

provided $b > 0$ & $b \neq 1$, $A, B, C \in \mathbb{R}$

Laws of Logs

Assume $b > 0$ & $b \neq 1$, $A, B, C \in \mathbb{R}$, and $A, B > 0$

(1) $\log_b(AB) = \log_b A + \log_b(B)$

(2) $\log_b(A/B) = \log_b(A) - \log_b(B)$

(3) $\log_b(A^C) = C \log_b(A)$

proofs: let $\log_b A = u$ & $\log_b B = v$

ex 1: evaluate

a) $\log(4) + \log(25)$

b) $\log_2(160) - \log_2(5)$

c) $\log(\log(10^{1000}))$

ex2: expanding log expressions

a) $\log_3(9q)$

b) $\log_7(x^2 y^7)$

c) $\log\left(\frac{xy}{\sqrt{z}}\right)$

ex3: combining log expressions

a) $\log_2 A + \log_2 B - 2\log_2 C$

b) $\ln 5 + 2\ln x + 3\ln(x^2+5)$

change of base

ex4: evaluate $\log_7(40)$

formula: $\log_b(a) = \dfrac{\log_c(a)}{\log_c(b)}$