Logarithms

Logarithm means Exponent.

$\log_{\text{Base}} b^{\text{Ans.}} = x^{\text{Exp}} \longleftrightarrow a^x = b$

I. Converting between log form and Exp. form

	Log Form	Exp Form	
①	$\log_7 x = 3$	$7^3 = x$	$x = 343$
②	$\log_{16} 4 = \frac{1}{2}$	$16^{1/2} = 4$	
③	$\log_5 25 = 2$	$5^2 = 25$	
④	$\log_{36} 216 = \frac{3}{2}$	$36^{3/2} = 216$	
⑤	$\log_6 \frac{1}{36} = -2$	$6^{-2} = \frac{1}{36}$	
⑥	$\log_{64} 512 = \frac{3}{2}$	$64^{3/2} = 512$	

II. Solving logarithmic Equations

Solve for x:

① $\log_8 \frac{1}{4} = x$

$8^x = \frac{1}{4}$

$8^x = 4^{-1}$

$(2^3)^x = (2^2)^{-1}$

$2^{3x} = 2^{-2}$

$3x = -2$

$x = -\frac{2}{3}$

② $\log_x 8 = \frac{3}{2}$

$(2^3)^{\frac{2}{3}} = x^{\frac{3}{2}\cdot\frac{2}{3}}$

$8 = x^{6/6}$

$8 = x$

$2^3 = x$

③ $\log_4 \frac{1}{64} = x$

$4^x = \frac{1}{64}$

$4^x = 64^{-1}$

$(2^2)^x = (2^6)^{-1}$

$2^{2x} = 2^{-6}$

$2x = -6$

$x = -3$

④ $\log_x 27 = \frac{3}{4}$

$x^{3/4} = 27$

$x^{(3/4)(4/3)} = 27^{4/3}$

$x^{12/12} = (\sqrt[3]{27})^4$

$x = 3^4$

$x = 81$

(5) $\log_6 x = \log_6 54 - \log_6 9$

$\log_6 x = \log_6 \frac{54}{9}$

$\log_6 x = \log_6 6$

Equal

$x = 6$

Log Rules

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

(2) $\log_c A - \log_c B = \log_c \frac{A}{B}$

(3) $\log_c A^b = b(\log_c A)$

$x^3 \cdot x^5 = x^{3+5} = x^8$

$\frac{x^5}{x^3} = x^{5-3} = x^2$

⑥ $(\log_9 3 + \log_9 x) - \log_9 3 = \log_9 81$

$\log_9 \frac{(3 \cdot x)}{3} = \log_9 81$

$x = 81$

(7) $\log_3 9^{50} = x$ (A: 50, B: 3, E: x)

$50(\log_3 9) = x$

$3^? = 9$

$50(2) = x$

$100 = x$

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$3^x = 9^{50}$

$3^x = (3^2)^{50}$

$x = 100$

⑧ $\log_2(x+4) + \log_2 8 = 4$

$\log_2 8(x+4) = 4$

$\log_2(8x+32) = 4$

$2^4 = 8x+32$

$-32 \quad -32$

$\frac{-16}{8} = \frac{8x}{8}$

$-2 = x$

⑨ Evaluate $10^{3\log 2} = x$

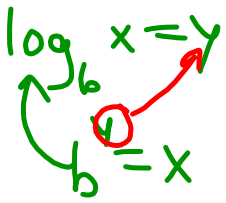
$\log A^b$

$3\log_{10} 2 = \log_{10} x$

$\log_{10} 2^3 = \log_{10} x$

$2^3 = x$

$8 = x$



(10) $\log_3(x^2-4)-\log_3(x+2)=2$

$\log_3 \frac{x^2-4}{x+2} = 2$

$3^2 = \frac{x^2-4}{x+2}$

FACTOR, THEN CANCEL

$9 = \frac{(x^2-4)}{(x+2)}$

$9 = \frac{(x-2)(x+2)}{x+2}$

$9 = x-2$

$11 = x$

(11) Evaluate:

$\log_5 .2 = x$

HW Pg. 123 #20-52 even

$5^x = .2$

$5^x = \frac{2}{10}$

$5^x = \frac{1}{5}$

$5^x = 5^{-1}$

$x = -1$