

Recall the Rules of Exponents.

(1)  $a^0 = 1$  (when  $a \neq 0$ )

(5)  $(a \cdot b)^n = a^n \cdot b^n$

(2)  $a^m \cdot a^n = a^{m+n}$

(6)  $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$  (when  $b \neq 0$ )

(3)  $\frac{a^m}{a^n} = a^{m-n}$  (when  $a \neq 0$ )

(7)  $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n$  (when  $a, b \neq 0$ )

(4)  $(a^m)^n = a^{m \cdot n}$

Recall the Rules of Logarithms.

(1)  $\log_a x = y \iff a^y = x$

(5)  $\log_a M^r = r \log_a M$

(2)  $a^{\log_a M} = M$

(6)  $\log_a(M \cdot N) = \log_a M + \log_a N$

(3)  $\log_a a = 1$

(7)  $\log_a\left(\frac{M}{N}\right) = \log_a M - \log_a N$

(4)  $\log_a 1 = 0$

(8)  $\log_a M = \frac{\log_b M}{\log_b a}$  (Change of Base)

1. Solve for  $x$ . (Remember that you cannot put a negative or zero into a log, so check that your solutions are valid.)

(a)  $\log_{10}(x + 5) = 2$

(b)  $\log_2(\log_2 x) = 1$

(c)  $\ln(\ln x) = 0$

(d)  $\log_2(\log_4 x) = -1$

(e)  $\log_6(x^2 - 5x) = 1$

(f)  $\log_2 x + \log_2(x + 1) = 1$

(g)  $\log_{10}(x + 1) = 2 \log_{10}(x - 1)$

(h)  $\ln(x - 4) + \ln(x + 1) = \ln 6$

2. Solve for  $x$ .

(a)  $2^x = 32$

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

(c)  $3^x = 9^{1-2x}$

(d)  $a^{2x} = a^8$

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

(f)  $2^{x-1} = 5$

(g)  $e^{3x+1} = 6$

(h)  $7^{2x} = 3^{x+1}$