Solving Exponential & Log Equations

Solving Exponential and Logarithmic Equations

Solving an Exponential Equation	Solving a Logarithmic Equation
If each side can be written using the same base, equate exponents. $3^{x+1} = 9^x$ $3^{x+1} = (3^2)^x$ $x + 1 = 2x$ $1 = x$	If the equation has the form $\log_b x = \log_b y$, use the fact that $x = y$. $\log_2 (4x - 2) = \log_2 3x$ $4x - 2 = 3x$ $x = 2$
If each side cannot be written using the same base, take a logarithm of each side. $6^x = 15$ $\log_6 6^x = \log_6 15$ $x = \frac{\log 15}{\log 6} \approx 1.511$	If a logarithm is set equal to a constant, exponentiate each side. $\log_5 (x + 1) = 2$ $x + 1 = 5^2$ $x = 24$

$4e^{-0.3x} - 7 = 13$

$+7 \quad +7$

$\frac{4e^{-0.3x}}{4} = \frac{20}{4}$

$e^{-0.3x} = 5$

$\ln e^{-0.3x} = \ln 5$

$\frac{-0.3x}{-0.3} = \frac{1.609}{-0.3}$

$x = -5.36$

Check

$4e^{-.3(-5.36)} - 7 = 13$

$4(5) - 7 = 13$ ✓

$\ln (7x - 4) = \ln (2x + 11)$

$7x - 4 = 2x + 11$

$5x = 15$

$x = 3$

$\ln(21 - 4) = \ln(6 + 11)$ ✓

Solving Exponential & Log Equations

$\log_2 (x - 6) = 5$

*DO NOT ADD NOW!

$2^{\log_2(x-6)} = 2^5$

$x - 6 = 32$

$+6 \quad +6$

$x = 38$

IT IS NOW OK TO ADD 6.

Check: $\log_2(38-6)=5$

$\log_2(32)=5$ ✓

$\log_4 (5x - 1) = 3$

$4^{\log_4(5x-1)} = 4^3$

$5x - 1 = 64$

$5x = 65$

$x = 13$

Check:

$\log_4(65-1)=3$ ✓

$\log 5x + \log (x - 1) = 2$

$\log 5x(x-1) = 2$

$10^{\log 5x(x-1)} = 10^2$

$5x(x-1) = 100$

$5x^2 - 5x = 100$

$5x^2 - 5x - 100 = 0$

$5(x^2 - x - 20) = 0$

$5(x+4)(x-5) = 0$

$x + 4 = 0$ $\quad$ $x - 5 = 0$

$x = -4$ * $\quad$ $x = 5$

$\log 5x + \log (x - 1) = 2$

Check:

$x = -4$ $\quad \log(-20) + \ldots$

* extraneous

$x = 5$ $\quad \log 25 + \log 4 = 2$

$\log 25 \cdot 4 = 2$

$\log 100 = 2$

$2 = 2$