Log Operations

$\log_{10} 10^7 = 7$ $\quad \ln e^{101} = 101$ $\quad 6^{\log_6 39} = 39$

Solve. $\log_5 x = 4$

EXPONENTIATE!

$b > 0, b \neq 1$

$x > 0$

$5^{\log_5 x} = 5^4$

$x = 625$

$\log_x 64 = 2$

$x^{\log_x 64} = x^2$

$\sqrt{64} = \sqrt{x^2}$

$\pm 8 = x$

$\log_{25} \sqrt[4]{5} = x$

$25^{\log_{25} \sqrt[4]{5}} = 25^x$

$\sqrt[4]{5} = 25^x$

Make common bases!

$5^{1/4} = 5^{2x}$

$\frac{1}{2} \cdot \frac{1}{4} = 2x \cdot \frac{1}{2}$

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

Properties of Logs

$\log_b m + \log_b n = \log_b (m \cdot n)$

$\log_b m - \log_b n = \log_b \left(\frac{m}{n}\right)$

$\log_b m^p = p \cdot \log_b m$

$\log_7 7^5 = 5 \cdot \log_7 7^1$

$5 = 5 \cdot 1$

$\log_7 (x+5) + \log_7 (x-3) = 2\log_7 3$

$\log_7 ((x+5)(x-3)) = \log_7 3^2$

$\log_7 (x^2+2x-15) = \log_7 9$

$7^{\log_7 (x^2+2x-15)} = 7^{\log_7 9}$

$x^2+2x-15 = 9$

$-9 \quad -9$

$x^2+2x-24 = 0$

$(x+6)(x-4) = 0$

$x = -6 \quad x = 4$

$\log x - \log(x+3) = 1$

$\log\left(\frac{x}{x+3}\right) = 1$

$10^{\log\left(\frac{x}{x+3}\right)} = 10^1$

$(x+3)\frac{x}{x+3} = 10^1 (x+3)$

$x = 10x + 30$

$-30 = 9x$

$-\frac{30}{9} = x$

$-\frac{10}{3} = x$

no solution

$\ln 4x + \ln 3 - \ln 6 = 4$

$\ln\left(\frac{4x \cdot 3}{6}\right) = 4$

$\ln 2x = 4$

$e^{\ln 2x} = e^4$

$\frac{2x}{2} = \frac{e^4}{2}$

$x = 27.30$

Steps:

1) Use properties to reduce each side to a single term or log.

2) Exponentiate both sides and solve for x.

Don't forget to check solutions in original equation for log of a positive value!

$8^x = 117$

$\log 8^x = \log 117$

$x \cdot \log(8) = \log(117)$

$\frac{x \cdot \log(8)}{\log(8)} = \frac{\log(117)}{\log(8)}$

$x \approx 2.29$

log or ln

$\frac{7e^{3x+5}}{7} = \frac{14}{7}$

$e^{3x+5} = 2$

$\ln(e^{3x+5}) = \ln 2$

$3x + 5 = \ln(2)$

$\frac{3x}{3} = \frac{\ln(2) - 5}{3}$

$x \approx -1.44$