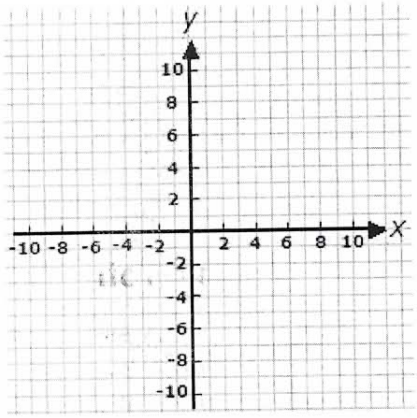
M3H Unit 5 Day 5 - Solving Logarithmic Equations

To solve a logarithmic equation:

1) Get all logs on one side of the equation
2) Use properties to condense into a single log
3) Isolate the log
4) Exponentiate
5) Solve for x



Extraneous Roots!

Think about the graph of y = log x...

Can you take the log of a negative number?

What about $x = -2$ for $\log x$? $\log(-2x)$?

Always CHECK!

Easy examples: (Isolate/Exponentiate/solve for x)

1. $\log 6x - 3 = -4$

$\log 6x = -1$

$6x = 10^{-1}$

$x = 1/60$

2. $3\log (x^2 + 1) = 5$

$\log(x^2+1) = 5/3$

$x^2+1 = 10^{5/3}$

$x^2 = 10^{5/3} - 1$

$x = \pm (10^{5/3}-1)^{1/2}$

$= \pm 6.74$

3. $2\ln (3x - 1) + 4 = 7$

$2\ln(3x-1) = 3$

$\ln(3x-1) = 3/2$

$3x - 1 = e^{3/2}$

$3x = e^{3/2}+1$

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

$x \approx 1.83$

Medium examples: (Steps 2 - 5)

1. $\log 2x - \log 3x = 7$

$\log \frac{2x}{3x} = 7$

$\log 2/3 \neq 7$

No Solution

2. $5\log (x + 1) + \log 4 = -2$

$\log 4(x+1)^5 = -2$

$4(x+1)^5 = \frac{1}{100}$

$(x+1)^5 = \frac{1}{400}$

$x = \left(\frac{1}{400}\right)^{\frac{1}{5}} - 1$

$\approx -.698$

More Complicated examples: (Steps 1 - 5)

1. $\log (4x - 5) = \log (2x - 1) + 4$

$\log \frac{(4x-5)}{(2x-1)} = 4$

$\frac{4x-5}{2x-1} = 10{,}000$

$4x - 5 = 10000(2x-1)$

$4x - 5 = 20{,}000x - 10000$

$9995 = 19{,}996x$

$x = .4998$

2. $\log_5 6 + \log_5 2x^2 = \log_5 48$

$\log_5 12x^2 = \log_5 48$

$\log_5 \frac{x^2}{4} = 0$

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

$x^2 = 4$

$x = \pm 2$