# 7.6 Solving Logarithmic Equations

This is so much fun that it's ridiculous, but there is a


Some solutions may have to be discarded as **INADMISSIBLE**

log's can only "process" positive arguements.

Remember: Given $f(x)=\log_a(x)$, then the domain is $D_f = (0,\infty)$

If a soln is outside the eqn's "domain" it is inadmissible

And now, for the lesson:

But First…

We will be making use of the following facts:

1) $\log_a(x) \Rightarrow n \neq 0,\ x>0$ , $a>0$
2) If $\log_a(M)=\log_a(N)$, then $M=N$
3) $\log_a(m)+\log_a(n)=\log_a(m\cdot n)$
4) $\log_a(m)-\log_a(n)=\log_a\left(\frac{m}{n}\right)$
5) $\log_a(m^n)=n\cdot\log_a(m)$
6) Given $x=\log_a(b)$, then $a^x=b$ (or vice-versa)

**Example 7.6.1** in the way

Solve $\log_2(x) = 2\log_2(5)$

**Admissible domain**

$x > 0$

$\Rightarrow \log_2(x) = \log_2(5^2)$

$\Rightarrow x = 25$

**Example 7.6.2**

Solve $\log(5x-2) = 3$

**Admissible domain**

$5x - 2 > 0$

$x > \frac{2}{5}$

Invert

$10^3 = 5x - 2$

$\Rightarrow 5x = 1002$

$x = \frac{1002}{5} = 200.4$

**Example 7.6.3**

$\log_x(0.04) = -2$

$x > 0$

$x^{-2} = 0.04 = \frac{1}{x^2} = 0.04$

$x^2 = \frac{1}{0.04}$

$x^2 = 25$

$x = \pm 5$ but $x > 0$

$\therefore x = +5$

**Example 7.6.4**

Solve $\log_2(x)+\log_2(3)=3$

**Admissible domain**

$x>0$

$\Rightarrow \log_2(3x)=3$

$2^3=3x \Rightarrow x=\frac{8}{3}$

**Example 7.6.5**

Solve $3\log(x)-\log(3)=2\log(3)$

**Admissible donain**

$x>0$

$\log(x^3)-\log(3)=\log(3^2)$

$\log\left(\frac{x^3}{3}\right)=\log(9)$

$\frac{x^3}{3}=9$

$x^3=27$

$x=3.$

**Example 7.6.6**

Solve $\log_6(x)+\log_6(x-5)=2$

**Admissible domain**

$x>0$ (simultaneously satisfied)

$x>5$

$\therefore x>5$

$\Rightarrow \log_6(x(x-5))=2$

$x(x-5)=6^2$

$x^2-5x=36$

$\Rightarrow x^2-5x-36=0$

$(x-9)(x+4)=0$

$\therefore x=9$ or $x=-4$ inadmissible

**Example 7.6.7** $x>-1$ $x>5$ **Admissible domain**

Solve $\log_7(x+1)+\log_7(x-5)=1$

$x>5$

$\log_7((x+1)(x-5)) = 1$

$(x+1)(x-5) = 7$

$x^2 - 4x - 5 = 7$

$x^2 - 4x - 12 = 0$

$(x-6)(x+2) = 0$

$\therefore \quad x = 6$ or $x = -2$ inadmissible

*Class/Homework for Section 7.6*

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