4.8B – Properties of Logarithms

Using logarithmic properties can allow use to rewrite and possible simplify the graphing of some logarithmic functions

Ex. $y = \log_2 8x$ can be rewritten

$y = \log_2 2^3 x$
$y = \log_2 2^3 + \log_2 x$
$y = 3 + \log_2 x$
$y = \log_2 x + 3$

The advantage is that translations are easier to graph then stretches

Example 1: Re-write so that you could graph the following functions

a) $f(x) = \log_{10} 100x$

Would be difficult to graph this stretch without re-writing

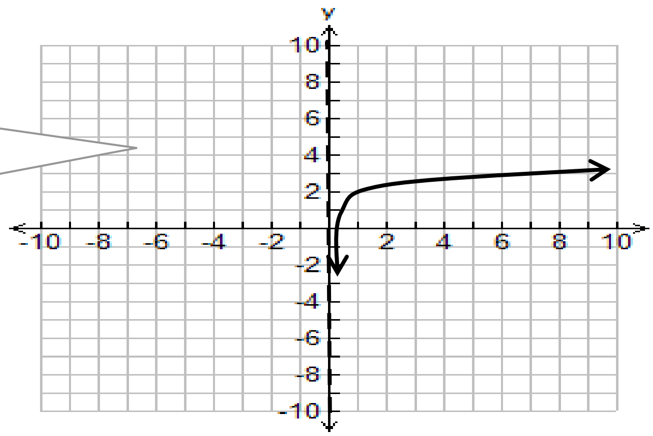
$f(x) = \log 100 + \log x$
$f(x) = \log 10^2 + \log x$
$f(x) = \log x + 2$

b) $g(x) = \log_5 x^2$

Would not even know what this transformation is without re-writing

$g(x) = 2 \log_5 x$

Base 10 graphs are difficult enough to fit points, but vertical translation of 2 up is more doable than horizontal strecth of 100



4.8B – Properties of Logarithms Practice Questions

1. How are the functions $y = \log_2 x^3$ and $y = 3\log_2 x$ related. Show any relationship both graphically and algebraically

2. Simplify and evaluate where possible

   a) $\log_2 40 + \log_2 (4/5)$ b) $\log_4 16 + \log_4 1$ c) $\log_2 \sqrt{5} - \log_2 \sqrt{40}$
   d) $\log_3 3 + \log_5 1$ e) $\log_5 5^3$ f) $2\log_4 16 + 2\log_4 8$
   g) $\log_4(2\cdot\sqrt{32}) + \log_{27}\sqrt{3}$ h) $\log_3(27\cdot\sqrt[3]{81}) + \log_5(125\cdot\sqrt[4]{5})$

3. Sketch the following

   a) $y = \log_3 x$ b) $y = \log_3 \sqrt{x}$ c) $y = \log_3 x^3$ d) $y = \log_3 x^2$
   e) $y = \log_3 (9x)$ f) $y = \log_3 (x/3)$ g) $y = \log_3 (27x)$ h) $y = \log_3 (x/9)$
   i) $y = \log_2 x^4$ j) $y = \log_2 (4x)$

4. The point (2, ½) lies on the graph $y = \log_b x$. Find b.

Answers **1.** same curve **2. a)** 5 **b)** 2 **c)** -3/2 **d)** 1 **e)** 3 **f)** 7 **g)** 23/12 **h)** 91/12 or 7 7/12 **4.** b=4

4.8B - Sketching Practice Sheets