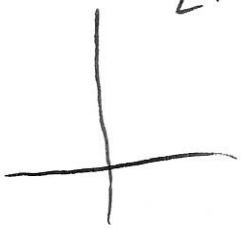
Today: Logarithms

(and a quiz - make sure you have half of a yellow sheet!)

Announcements

- Graphing in MML:

$2+4^x$ ← to get 4^x, change 4 "e" to "4"



- If MML problem: email me problem #'s.

$\log_a x$ = "to what power should I raise a to get x?"

e.g. $\log_2 8 = 3$: (because $2^3 = 8$)

$\log_a x = y$ means $a^y = x$.

#1 $\log_2 8 = 3$

$\log_5 125 = 3 \quad (5^3 = 5 \cdot 25 = 125)$

$\log_3 81 = 4$

$\log_{16} 4 = \frac{1}{2} \qquad 16^{1/2} = \sqrt{16} = 4.$

$\log 0.01 = \log_{10} 0.01 = \log_{10} \frac{1}{100} = -2 \quad (10^{-2} = 0.01)$

$\ln\left(\frac{1}{\sqrt{e}}\right) = \log_e\left(\frac{1}{\sqrt{e}}\right) = -\log_e(\sqrt{e}) = -\frac{1}{2}.$

$\left(e^{-\frac{1}{2}} = \frac{1}{\sqrt{e}}\right)$

#2 $\log_a 1 = 0$ (this means $a^0 = 1$)

$\log_a a = 1 \quad (a \neq 0) \quad (a^1 = a)$

$\log 10^{12} = \log_{10} 10^{12} = \underline{12}$

$\log_a a^x = x$

$10^{\log 1000} = 10^3 = 1000.$

$a^{\log_a x} = x$ | $\log_a x = y$

$a^{\log_a x} = a^y = x$

$\boxed{a^{\log_a x} = x}$

DISCLAIMER:

you can't always simplify expressions with log.

ex $\log_2 3$

nothing to be done...

Math 121 (Lesieutre); §5.3; September 13, 2017

also:

1. Remember that

$$\log_a x = y \iff a^y = x \qquad "a^{\log_a x}."$$

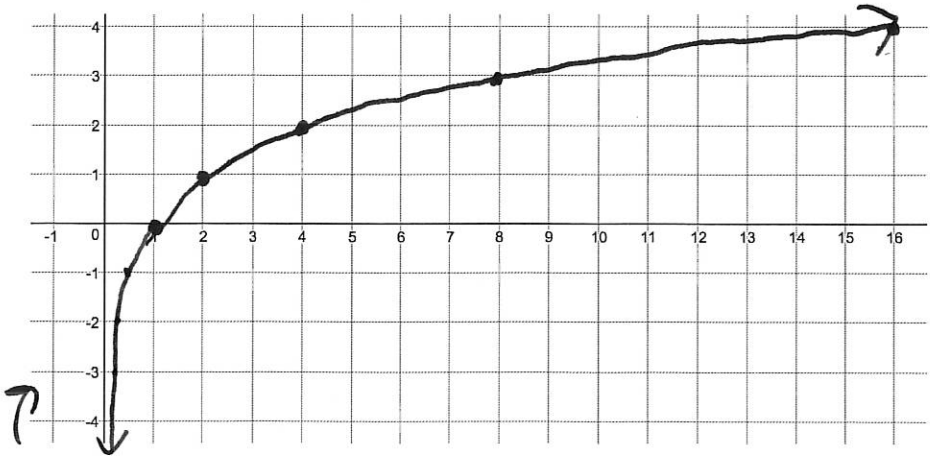
When you see "log" without an a subscript, it means $\log_{10}$. When you see ln, it means $\log_e$. Use this to evaluate the following logarithmic expressions:

$\log_2 8$, $\log_5 125$, $\log_3 81$, $\log_{16} 4$, $\log 0.01$, $\ln\left(\frac{1}{\sqrt{e}}\right)$

2. Evaluate:

$\log_a 1$, $\log_a a$, $\log 10^{12}$, $\log_a a^x$, $10^{\log 1000}$, $a^{\log_a x}$

3. Sketch the graph of $\log_2(x)$ by plotting some points and interpolating. What are the domain and range, and are there any asymptotes?



x	$\log_2 x$
1	0
2	1
4	2
8	3
16	4
$\frac{1}{2}$	-1
$\frac{1}{4}$	-2
$\frac{1}{8}$	-3

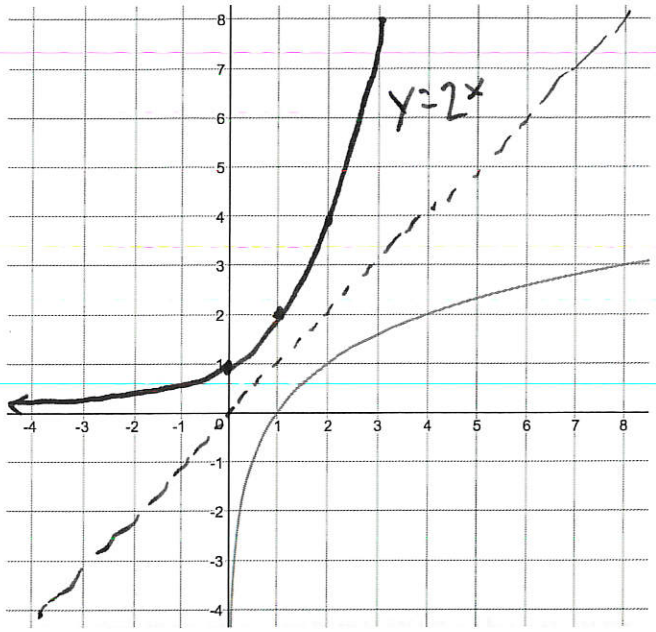
$(2^{-1} = \frac{1}{2})$

VERT. ASY. $x=0$

DOMAIN: $(0, \infty)$ (not including 0!)

RANGE: all real #s.

4. What is the inverse function of $f(x) = \log_2 x$? f is sketched below, sketch $f^{-1}(x)$ on the same plane.



$y = \log_2 x$

switch x & y

$x = \log_2 y$

solve for y.

$2^x = y.$

So inverse function is 2^x.

5. To solve logarithmic equations, rewrite them using exponentials. $\log_2(2x+1) = 3$, $\log(5x+80) = 3$, $\log_6 36 = 5x+3$.

6. $\log_5(x^2+4x+4) = 2$, $\ln e^{-2x} = 8$

7. We can also use logarithms to solve exponential equations. $e^{3x} = 10$, $2e^{2x+5} = 16$, $5^{3x-1} = 11$, $2 \cdot 10^{x-2} = 5$

#5 $\log_2(2x+1) = 3$.

$2^{\text{both sides}}$

$2^{\log_2(2x+1)} = 2^3$

$2x+1 = 8$

$2x = 7$

$x = 7/2$.

$\log(5x+80) = 3$.

$10^{\log(5x+80)} = 10^3$

$5x+80 = 1000$

$5x = 920$

$x = 184$.

Quiz 1

#1 Name

#2 Solve for x:

$$2^{2x-3} = \frac{1}{2}$$