Consider the functions $f(x) = e^x$ and $g(x) = \ln x$.
List all the properties you can of f, and identify corresponding properties for g.

	$f(x) = e^x$	$g(x) = \ln x$
Concavity	up	down
Inc/Dec	Increasing	Increasing
Intercepts		
x	none	(1, 0)
y	(0, 1)	none
POIs	None	None
Extrema	None	None
Domain	$\mathbb{R}$	$\mathbb{R}^+$
Range	$\mathbb{R}^+$	$\mathbb{R}$
$\lim_{x \to +\infty}$	$+\infty$, very fast	$+\infty$, very slowly

Note: If $\ln x > 1{,}000{,}000$
$x > e^{1{,}000{,}000}$
$e^{2.303} \approx 10 \Rightarrow e^{1{,}000{,}000} \approx (e^{2.303})^{1{,}000{,}000} \approx 10^{1{,}000{,}000}$

$\lim_{x \to -\infty}$	0 HA at $y = 0$	$\lim_{x \to 0^+} \ln x = -\infty$ VA at $x = 0$
Symmetry	—	—
1-1 ness	Yes	Yes

$e^{x_1 + x_2} = e^{x_1} \cdot e^{x_2}$ $\qquad \ln(x_1 \cdot x_2) = \ln x_1 + \ln x_2$

$f(x_1 + x_2) = f(x_1) \cdot f(x_2)$

$e^{x_1 - x_2} = e^{x_1} / e^{x_2}$

$x > 0 \Rightarrow e^x > 1$ $\qquad x > 1 \Rightarrow \ln x > 0$

$e^{-x_1} = \frac{1}{e^{x_1}}$ $\quad f(-x_1) = \frac{1}{f(x_1)}$ $\qquad \ln\left(\frac{1}{x_1}\right) = -\ln x_1$

$e^{x_1 x_2} = (e^{x_1})^{x_2}$

$\ln x_1^{x_2} = x_2 \cdot \ln x_1$

Solve for x exactly: $5^x = 17$

$x = \log_5 17$ equivalent

$\log_5 a = \frac{\ln a}{\ln b} = \frac{\log a}{\log b}$

$5^x = 17$

$\ln(5^x) = \ln 17$

$x \cdot \ln 5 = \ln 17 \Rightarrow x = \frac{\ln 17}{\ln 5}$

$\log_5 17$"

How can the graph of $f(x) = \log_2 (4x)$ be obtained from the graph of $y = \log_2 x$?

Whiteboard Problems!

Wednesday, November 12, 2008
10:55 AM

1. $\log 0.0001 = x$ $\quad -4$ $\qquad 10^x = .0001 \qquad x = -4$

2. $\ln 64 / \ln 8 = \dfrac{\ln 8^2}{\ln 8} = \dfrac{2 \cdot \ln 8}{\ln 8}$

$= \log_8 64 = 2.$

3. $(\ln \tfrac{1}{2}) / (\ln 2)$

-1

4. Translate into an exponential equation:

$\ln s = 2r$

$e^{2r} = s$

5. Evaluate:

$\ln\left(e^{\sqrt{1+x^2}}\right) = \sqrt{1+x^2}$

$\ln e^u = e^{\ln u} = u$

6. If $\ln u = 7$ and $\ln v = 19$, find $\ln (v/u^2)$

5

7. If $\log (x - 10) + \log (x + 5) = 2$, what is x?

8. Find the domain of $\log_2 (\log_3 (\log_4 x))$

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