COLLEGE ALGEBRA NAME: Holly Gosper

GPS # 27 **3.2** **LOGARITHMIC FUNCTIONS I** Class Time: T/Th 11:30 Date: 3-6-08

20/20 Good Work!

Useful Guidelines:

* The logarithmic function to the base a, where $a > 0$ and $a \neq 1$: $y = \log_a x$ if and only if $x = a^y$;
* Properties of the logarithmic Function $y = \log_a x$ (where $a > 0$ and $a \neq 1$):
  (1) Domain: the interval $(0, \infty)$; Range: the interval $(-\infty, \infty)$;
  (2) x-intercepts: 1; y-intercept: none;
  (3) Vertical asymptote: $x = 0$;
  (4) $f(x) = \log_a x, a > 1$, is an increasing, one-to-one, smooth and continuous function;
  $f(x) = \log_a x, 0 < a < 1$, is a decreasing, one-to-one, smooth and continuous function;
  (5) The points $(1,0), (a,1)$, and $(\frac{1}{a}, -1)$ are always on the graph of f.
* Natural logarithm function: $y = \log_e x = \ln x$ if and only if $x = e^y$.
* Common logarithm function: $y = \log x$ if and only if $x = 10^y$.

ln = log e

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

find base

1. Change each logarithmic expression to an equivalent expression involving an exponent.

a) $\log_{10} m = 5$ (+10 +10) $m = 10^5$

b) $\log_e b = 4$ (+e +e) $b = e^4$

c) $\log_p 3 = x$ (+p +p) $3 = p^x$

d) $\log_2 M = c$ (+2 +2) $m = 2^c$

e) $\ln 5 = x$ — $\log_e(5) = x$ (+e +e) $5 = e^x$

f) $\ln x = 3$ — $\log_e(x) = 3$ (+e +e) $x = e^3$

2. Find the exact value of the following:

a) $y = \log_3 27$
$y = \log_3(3^3)$
$= 3\log_3(3)$
$= 3 \cdot 1$
$= 3$

b) $y = \log_{10} 100$
$y = \log_{10}(10^2)$
$y = 2\log_{10}(10)$
$y = 2 \cdot 1$
$= 2$

c) $y = \log_3 \frac{1}{9}$
$y = \log_3(3^{-2})$
$y = -2\log_3(3)$
$y = -2 \cdot 1$
$= -2$

d) $y = \log_{10} \frac{1}{1000}$
$y = \log_{10}(10^{-3})$
$y = -3\log_{10}(10)$
$y = -3 \cdot 1$
$= -3$

e) $y = \ln(e^4)$
$y = \log_e(e^4)$
$y = 4\log_e(e)$
$= 4$

f) $y = \ln(\sqrt{e})$
$y = \log_e(e^{\frac{1}{2}})$
$y = \frac{1}{2}\log_e(e)$
$y = \frac{1}{2} \cdot 1$
$= \frac{1}{2}$

3. Find the domain of each function.

look for input

a) $f(x) = \log_3(x+1)$
$x + 1 > 0$; $x > -1$
D: $\{x \mid x > -1\}$

b) $g(x) = 4 + 2\ln(5x)$
$\frac{5x}{5} > \frac{0}{5}$; $x > 0$
D: $\{x \mid x > 0\}$

c) $f(x) = \sqrt{\ln x}$
$e^{\ln(x)} \geq e^0$; $x \geq 1$
D: $\{x \mid x \geq 1\}$

d) $g(x) = \frac{1}{\ln x}$
$x > 0$; $e^{\ln(x)} \neq e^0$; $x \neq 1$
D: $\{x \mid x > 0, x \neq 1\}$