Name_____ Date_____ Period_____

**Worksheet 4.3—Logarithmic Functions**

Show all work on a separate sheet of paper. All answers must be given as either simplified, exact answers. No calculator is permitted unless otherwise stated.

**Multiple Choice**

1. (Calculator permitted) What is the approximate value of the common log of 2?
(A) 0.10523 (B) 0.20000 (C) 0.30103 (D) 0.69315 (E) 3.32193

2. (Calculator permitted) Which statement is false?
(A) $\log 5 = 2.5 \log 2$ (B) $\log 5 = 1 - \log 2$ (C) $\log 5 > \log 2$
(D) $\log 5 < \log 10$ (E) $\log 5 = \log 10 - \log 2$

3. Which statement is false about $f(x) = \ln x$?
(A) It is monotonic increasing (B) It is an odd function (C) It is continuous over its domain
(D) Its range is all real numbers (E) It has a vertical asymptote

4. Which of the following is the inverse of $f(x) = 2 \cdot 3^x$?
(A) $f^{-1}(x) = \log_3\left(\frac{x}{2}\right)$ (B) $f^{-1}(x) = \log_3\left(\frac{x}{3}\right)$ (C) $f^{-1}(x) = 2\log_3 x$
(D) $f^{-1}(x) = 3\log_2 x$ (E) $f^{-1}(x) = 0.5\log_3 x$

$y = 2 \cdot 3^x$ $x = 2 \cdot 3^y$ $\log_3 3^y = \log_3 \frac{1}{2} x$

**Short Answer**

5. Express each of the following equations in exponential form.
(a) $\log 0.1 = -1$ (b) $\ln y = 5$ (c) $\log_2(x-1) = 4$

$10^{-1} = 0.1$ $e^5 = y$ $2^4 = x - 1$

$f(x)^{-1} = \frac{\log_{\frac{1}{2}} x}{\log_3}$ $f(x)^{-1} = \log_3 \frac{1}{2} x$

6. Express each of the following equations in logarithmic form.
(a) $4^{-3/2} = 0.125$ (b) $e^x = 2$ (c) $7^3 = 343$

a) $\log_4 0.25 = -\frac{3}{2}$ c. $\log_7 343 = 3$

b) $\ln_e 2 = x$

7. Evaluate the following expressions.

(a) $\log_{49} 7$ (b) $2^{\log_2 37}$ (c) $e^{\ln\sqrt{7}}$ (d) $\log_4 \sqrt{2}$ (e) $\log_4 8$ (f) $\log_6 1$ (g) $\ln\left(\frac{1}{e}\right)$

a) $49^x = 7$ b) 37 c) $\sqrt{7}$ D) e) $4^x = 8$ f) 0 g) $\ln e^{-1} = -1$

$7^{2x} = 7^1$

$2x = 1$

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

$4^x = \sqrt{2}$

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

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

$x = \frac{1}{4}$

$2^{2x} = 2^3$

$2x = 3$

$x = \frac{3}{2}$

8. Solve for $x$ in each of the following equations.

(a) $\log_2 16 = x$ (b) $\log_5(2x-1) = 2$ (c) $\log_x 16 = 4$ (d) $\log_2(\log_9 x) = -1$

$\log_2 2^4 = x$ b) $5^2 = 2x - 1$ $(x^4)^{1/4} = (16)^{1/4}$ $2^{-1} = \log_9 x$

$x = 4$

$25 = 2x - 1$

$24 = 2x$

$x = 12$

$x = 2$

$\frac{1}{2} = \log_9 x$

$9^{\frac{1}{2}} = x$

$3 = x$

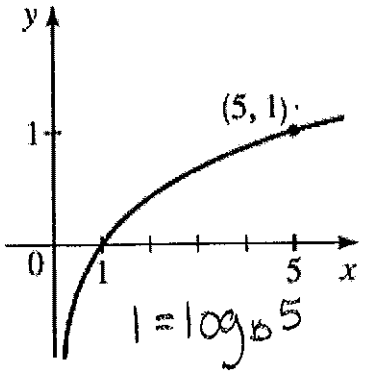
9. Use a calculator and possibly the change of base formula to evaluate the following correct to 3 decimal places.

(a) $\log(3\sqrt{2})$ (b) $\ln(\log 20)$ (c) $\log_6 13$ (d) $\frac{\log_{1/2} 5}{\log_5 e} = \frac{-2.322}{.621} = -3.737$

.628 .263 1.432

10. Find the equation of the function of the $y = \log_b x$ whose graph is given below.

(a)



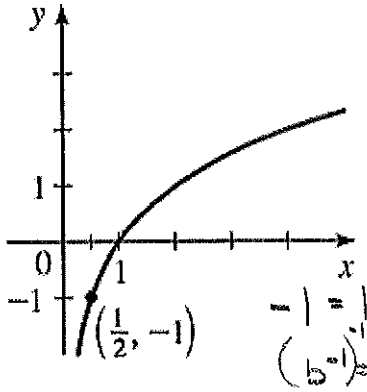

$1 = \log_b 5$

$b^1 = 5$

$b = 5$

$y = \log_5 x$

(b)




$-1 = \log_b \frac{1}{2}$

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

$b = 2$

$y = \log_2 x$

11. Find the domain of each of the following functions:

(a) $f(x)=\log_6(8-2x)$ (b) $f(x)=\ln x+\ln(2-x)$ (c) $f(x)=\log_4(x-x^2)$

(d) $k(x)=\sqrt{x-2}-\log_5(10-x)$ (e) $f(x)=\dfrac{5}{\ln(x^2-1)}$

$x^2-1>0$ & $(x^2-1)\neq 0$

a) $8-2x>0$

$-2x>-8$

$x<4$

D: $\{x \mid x<4\}$

b) $x>0$, $2-x>0$

$-x>-2$

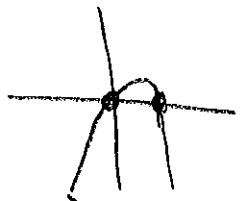
$x<2$

D: $(0,2)$

c) $x-x^2>0$

$-x^2+x>0$

$-x(x-1)$



D: $(0,1)$

D) $x-2\geq 0$, $10-x>0$

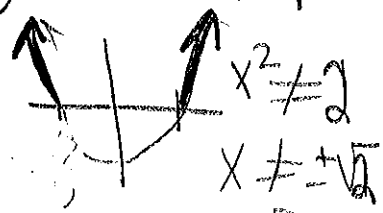
$x\geq 2$

$-x>-10$

$x<10$

D: $\{x \mid 2\leq x<10\}$

e) $x^2-1>0$ $x^2-1\neq 1$



$x^2\neq 2$

$x\neq\pm\sqrt{2}$

D: $\{x \mid x<-1 \cup x>1, x\neq\pm\sqrt{2}\}$

12. For each of the following functions, find the domain then find the inverse function $f^{-1}(x)$.

(a) $f(x) = \log_2(\log x)$ (b) $f(x) = \ln(\ln(\ln x))$

$x > 1$ $\ln x$

$x > 1$

$D: \{x \mid x > 1\}$

(c) The Beer-Lambert Law of absorption gives the light intensity $I$ (in lumens), in [illegible] it is modeled by $\log \frac{I}{12} = -0.00235x$. What is the intensity of the light at a [illegible] the intensity 5 lumens?

$\log \frac{5}{12} = -.00235x$

$.00235(30)$

$.0705$

$(12)$

$12$

$-.0705$

$10^{-.0705}$

$10.902$