

Write the given exponential equation as a logarithmic equation

1.  $4^2 = 16$

2.  $e^{17} = a$

3.  $10^4 = 10,000$

4.  $b^p = a$

$2 = \log_4 16$

$17 = \ln a$

$4 = \log 10,000$

$p = \log_b a$

Write the given logarithmic equation as an exponential equation

5.  $\log_7 x = 10$

6.  $\ln x = 32$

7.  $\log 1000 = 3$

8.  $\log_\Delta \Phi = \Psi$

$7^{10} = x$

$e^{32} = x$

$10^3 = 1000$

$\Delta^\Psi = \Phi$

9. Evaluate without using a calculator: if  $f(x) = \log_5 x$ , find  $f(125)$ ,  $f\left(\frac{1}{25}\right)$ ,  $f(\sqrt{5})$

$\log_5 125$   
 $\log_5 5^3$   
3

$\log_5 \frac{1}{25}$   
 $\log_5 5^{-2}$   
-2

$\log_5 \sqrt{5}$   
 $\log_5 5^{1/2}$   
1/2

10. Evaluate without using a calculator: if  $f(x) = \log_3 x$  find  $f(27)$ ,  $f(3)$ ,  $f(\sqrt{3})$

$\log_3 27$   
3

$\log_3 3$   
1

$\log_3 \sqrt{3}$   
1/2

Evaluate the following without a calculator:

11.  $\log_4 1$

12.  $\ln e$

13.  $\log_5 5$

14.  $7^{\log_7 12}$

0

1

1

12

15.  $\log_{12} 12^{15}$

16.  $\ln e^{32}$

17.  $10^{\log 14}$

17.  $\log_5 \sqrt{5}$

15

32

14

1/2

Write each as a single logarithm. Assume that all variables are positive.

18.  $3\log_4 2 + \log_4 6$

$$\log_4 8 + \log_4 6$$

$$\boxed{\log_4 48}$$

19.  $\frac{1}{3}\log_7 y - 6\log_7 z$

$$\boxed{\log_7 \frac{\sqrt[3]{y}}{z^6}}$$

20.  $(3\log_2 x + \frac{1}{2}\log_2 y) - 2\log_2(xz)$

$$\log_2 \frac{x^3 \sqrt{y}}{x^2 z^2} = \boxed{\log_2 \frac{x\sqrt{y}}{z}}$$

Use the properties of logarithms to expand the following. Express all exponents as coefficients.

21.  $\log_3 x^2 y^4$

$$\boxed{2\log_3 x + 4\log_3 y}$$

22.  $\log_{12} \frac{\sqrt{x}}{y^2}$

$$\boxed{\frac{1}{2}\log_{12} x - 2\log_{12} y}$$

23.  $\log_4 \frac{x\sqrt{y}}{z^{12}w^2}$

$$\boxed{\log_4 x + \frac{1}{2}\log_4 y - 12\log_4 z - 2\log_4 w}$$

Use the Change-of-Base to rewrite the following expressions as natural logarithms.

24.  $\log_5 3$

$$\frac{\ln 3}{\ln 5}$$

25.  $\log_{12} 13$

$$\frac{\ln 13}{\ln 12}$$

26.  $\log 80000$

$$\frac{\ln 80000}{\ln 10}$$

Solve the following. Round your answer to the nearest hundredth. Check for extraneous solutions.

27.  $4^{2x+10} + 6 = 262$

$$4^{2x+10} = 256$$

$$2x+10 = \log_4 256$$

$$2x+10 = 4$$

$$2x = -6$$

$$\boxed{x = -3}$$

29.  $\log_2 x - \log_2 3 = 4$

$$\log \frac{x}{3} = 4$$

$$3 \cdot 10^4 = \frac{x}{3} \cdot 3$$

$$\boxed{30000 = x}$$

28.  $7e^{\frac{x}{7}} = \frac{500}{7}$

$$4 \cdot \frac{x}{4} = \left( \ln \frac{500}{7} \right) \cdot 4$$

$$\boxed{x = 17.07}$$

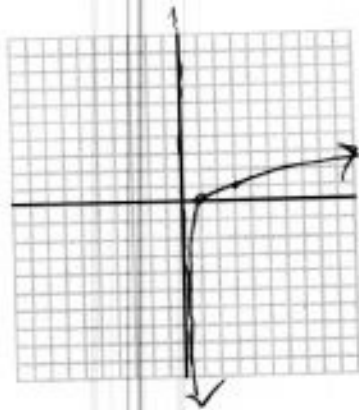
30.  $\ln(x-1) = 8$

$$e^8 = x-1$$

$$\boxed{x = 2981.96}$$

Without a calculator, graph the following, list the transformations (if any), asymptote and two points:

31.  $f(x) = \log_3 x$



Transformations:

none

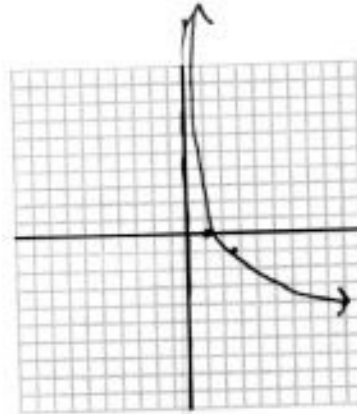
Points:

x	y
1	0
3	1

Asymptote:

$x = 0$

32.  $f(x) = -\ln x$



Transformations:

v. reflection

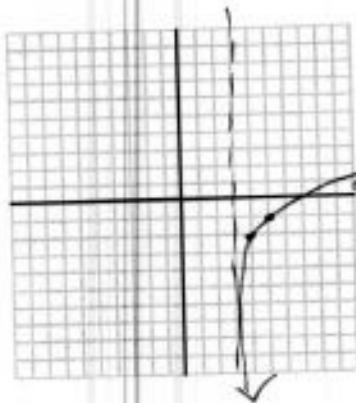
Points:

x	y
1	0
e	-1

Asymptote:

$x = 0$

33.  $f(x) = \log_2(x-3) - 2$



Transformations:

R 3  
down 2

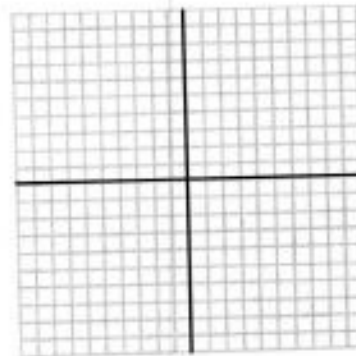
Points:

x	y
4	-2
5	-1

Asymptote:

$x = 3$

34.  $f(x) = 2 \log_3(x+2) + 2$



Transformations:

LF + 2 v. stretch  
up 2 of 2

Points:

x	y

Asymptote:

$x = -2$

35. The pH of orange juice is 3.2, and the pH of milk is 6.1.

$pH = -\log[H^+]$  What are the hydrogen-ion concentrations of orange juice and milk?

OJ: ~~3.2~~  $3.2 = -\log[H^+]$   $6.3 \times 10^{-4}$   
 $-3.2 = \log[H^+]$   
 $10^{-3.2} = [H^+] \rightarrow$  ~~6.3 x 10^-4~~

$6.1 = -\log[H^+]$   
 $-6.1 = \log[H^+]$   
 $[H^+] = 10^{-6.1} = 7.9 \times 10^{-7}$

36. If Bob invests \$5,000 with a 4% interest rate compounded monthly, how long will it take until his investment has grown to \$7,000?

$A = P \left(1 + \frac{r}{n}\right)^{nt}$

$7000 = 5000 \left(1 + \frac{0.04}{12}\right)^{12t}$

$\frac{7}{5} = \left(1 + \frac{0.04}{12}\right)^{12t}$

$12t = \log_{\left(1 + \frac{0.04}{12}\right)} \frac{7}{5}$

$t = 8.4 \text{ years}$