Keeper # 38: Logarithmic Functions

Rewrite each equation in exponential form.

1.) $\log_3 81 = 4$ $3^4 = 81$	2.) $\log_y x = -8$ $y^{-8} = x$

Rewrite each equation in logarithmic form.

3.) $12^2 = 144$ $\log_{12} 144 = 2$	4.) $8^b = a$ $\log_8 a = b$

Evaluate. Round any decimal answers to the hundredths place.

5.) $\log_3 8$ 1.89	6.) $\log_2 8$ 3	7.) $\log 25$ 1.40 (1.398)

Keeper # 39: Properties of Logarithms

Expand the logarithm.

8.) $\log_2\left(2x^5\right)^3$ $\log_2 2^3 \cdot x^{15}$

$\log_2 2^3 + \log_2 x^{15}$

$3 + 15\log_2 x$

9.) $\log_3\left(\frac{xy}{5z^2}\right)$

$\log_3 x + \log_3 y - \log_3 5 - 2\log_3 z$

Condense the logarithm.

10.) $4\log x + \log y + 3\log z$

$\log(x^4 y z^3)$

11.) $7\log x - 4(\log q + \log r)$

$\log \frac{x^7}{q^4 r^4}$ or $\log \frac{x^7}{(qr)^4}$

Use the change of base formula to evaluate.

12.) $\log_5 98 - 4$

$\frac{\log 98}{\log 5}$

-1.15 $2.85 - 4$

13.) $2 \cdot \log_8 100$

4.43

Keeper # 40: Solving using Logs

Solve. Round your answer to the hundredths place if necessary.

16.) $2^x = 13$ $\log_2 13$ $x = 3.70$	17.) $8^{x+4} = 35$ $x = -2.29$
18.) $6^{2x} = 21$ $x = .85$	19.) $25^{2x+3} = 2000$ $x = -.32$
20.) $5\ln 2x = 29$ ✓ $x = 165.15$	21.) $4\log_5 -3x = 8$ ✓ $x = -8.33$
22.) $\log_5 6 + \log_5 2x^2 = \log_5 48$ ✓ $x = \pm 2$	23.) $\ln(2x-1) - \ln 4 = 3$ ✓ $x = 40.67$

(21) $\frac{4\log_5 -3x}{4} = \frac{8}{4}$

$\log_5 -3x = 2$

$5^2 = -3x$

$\frac{25}{-3} = \frac{-3x}{-3}$

$-8.33 = x$

$4\log_5 -3(-8.33)$

(23) $\ln(2x-1) - \ln 4 = 3$

$$\ln \frac{2x-1}{4} = 3$$

$$4 \cdot e^3 = \frac{2x-1}{4} \cdot 4$$

$$4e^3 = 2x - 1$$

$$+1 \qquad +1$$

$$\frac{4e^3 + 1}{2} = \frac{2x}{2}$$

$X = 40.67$

$$\frac{5\ln 2x}{5} = \frac{29}{5}$$

$$\ln 2x = 5.8$$

$$\frac{e^{5.8}}{2} = \frac{2x}{2}$$

$$165.15 = x$$

(23) $\ln(2x-1) - \ln 4 = 3$

$\ln \frac{2x-1}{4} = 3$

$e^3 = \frac{2x-1}{4}$

$4 \cdot 20.09 = \frac{2x-1}{4} \cdot 4$

$80.34 = 2x - 1$

$+1 \quad +1$

$81.34 = 2x \quad x = 40.67$

$\frac{81.34}{2} \quad \frac{2x}{2}$

Check

$\ln(2 \cdot 40.67 - 1) - \ln 4$

Determine the inverse.

24.) $y=\log_3(x-1)+7$	25.) $y=6^x-4$
$y^{-1}=3^{x-7}+1$	$y^{-1}=\log_6(x+4)$

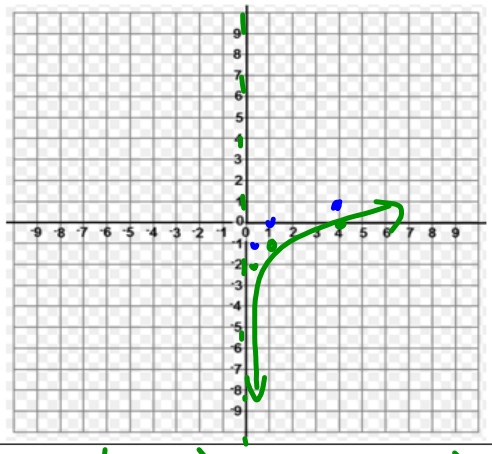
26.) $y=2e^x+4$	27.) $y=\ln x+3$
$y^{-1}=\ln\left(\frac{x-4}{2}\right)$	$y^{-1}=e^{(x-3)}$

(24)
$x=\log_3(y-1)+7$
$-7 \quad -7$
$x-7=\log_3(y-1)$
$3^{(x-7)}=y-1$
$+1 \quad +1$
$3^{(x-7)}+1=y^{-1}$

(26) $x=2e^y+4$
$-4 \quad -4$
$x-4=2e^y$
$\frac{2}{2} \quad \frac{2}{2}$
$\frac{x-4}{2}=e^y$
$\ln\left(\frac{x-4}{2}\right)=y^{-1}$

Graph the function. Then identify the characteristics.

14.) $f(x)=\log_4 x-1$



Domain: $(0,\infty)$ Range: $(-\infty,\infty)$

x-intercept: $(4,0)$ y-intercept: N/A

Asymptote: $x=0$

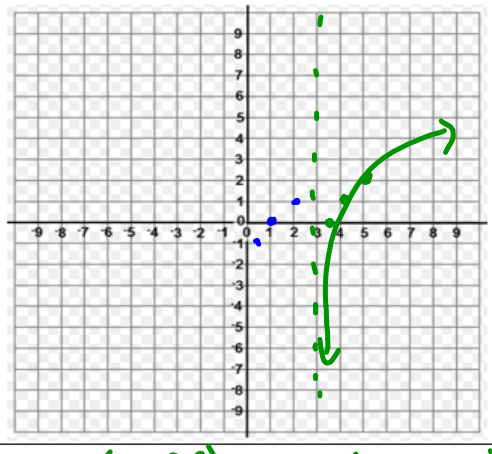
End Behavior:

as x $\to$ 0, f(x) $\to$ $-\infty$

as x $\to$ ∞, f(x) $\to$ ∞

Interval of Increase or Decrease: In

15.) $f(x)=\log_2(x-3)+1$



Domain: $(3,\infty)$ Range: $(-\infty,\infty)$

x-intercept: $(3.5,0)$ y-intercept: N/A

Asymptote: $x=3$

End Behavior:

as x $\to$ 3, f(x) $\to$ $-\infty$

as x $\to$ ∞, f(x) $\to$ ∞

Interval of Increase or Decrease: In

26.) Maryville was founded in 1950. At that time, 500 people lived in the town. The population growth in Maryville follows the equation $y = 500 + 1.5^t$, where t is the number of years since 1950.

A. Determine when the population had doubled since the founding.

$t = 15.32$ years

1965

B. In what year was the population predicted to reach 25,000 people?

$t = 24.9$ years

1975

27.) Tanisha has $100 to invest at 8% per year in an account that is compounded continuously.

A. How long will it be before she has $150?

$A = Pe^{rt}$

$150 = 100e^{.08t}$ $t = 5.07$ years

B. What rate would Tanisha need to invest her money in order to make $200 in 7 years?

$200 = 100e^{r(7)}$ 9.9%