Exponential Equation

Range: $y>0$

Domain: Any real number

$y = b^x$

$b>0, b\neq 1$

Logarithmic Equation

$\log_b y = x$

Range: Any real number

Domain: $x > 0$

b: $b>0, b\neq 1$

Write in Logarithmic Form: $10^x = 125$

$LOG_{10}125 \rightarrow$ "LOG base 10 of 125" $\rightarrow$ LOG125 $\Rightarrow 2.1$

LOG_{10} is called the Common Logarithm and is written without the 10.

The button on the calculator LOG is for Common Logarithms LOG_{10}

Evaluate each: (hint: think of each as an exponential)

1. $\log_4 1 = 0$ $\quad 4^x = 1$

2. $\log_3 9 = 2$ $\quad 3^x = 9$

3. $\log_7(7) = 1$ $\quad 7^x = 7$

4. $\log_{25} 5 = \frac{1}{2}$ $\quad 25^x = 5$ $\quad \sqrt{25} = 5$ $\quad (25)^{\frac{1}{2}} = 5$

5. $\log_6(6^4) = 4$ $\quad 6^x = 6^4$

6. $\log_2(0.5) = -1$ $\quad 2^x = .5$ $\quad 2^x = \frac{1}{2}$ $\quad x = -1$

7. $\log 54 = 1.73$

You can now finish Hwk #25

Practice Sheet Sec 8-3

Solve each equation. Round to the nearest tenth.

1. $10^x = 1500$

$\log 1500 = x$

$x = 3.2$

2. $\frac{4(10)^x}{4} = \frac{570}{4}$

$10^x = 142.5$

$\log 142.5 = x$

$x = 2.2$

Solve: $\log_2 x = 3$

$2^3 = x$

$x = 8$

Solve: $4^x = 100$

You can use a graph or a table.

x = 3.32

Or, you can rewrite the exponential into a Logarithm.

$\log_4 100 = x$

To evaluate this see the next page.

Change of Base Formula:

Property	Change of Base Formula
For any positive numbers, M, b, and c, with $b \neq 1$ and $c \neq 1$, $\log_b M = \frac{\log_c M}{\log_c b} = \frac{\log_{10} M}{\log_{10} b} = \frac{\log M}{\log b}$	

$\log_4 100 = x$

$3.32 = \frac{\text{Log}100}{\text{Log}4} = x$

Solve each to the nearest hundredth.

1. $7^x = 60$

$\log_7 60 = x$

$x = \frac{\log 60}{\log 7} = 2.10$

2. $5(1.1)^x = 100$

$\frac{5(1.1)^x}{5} = \frac{100}{5}$

$1.1^x = 20$

$\log_{1.1} 20 = x$

$\frac{\log 20}{\log 1.1} = x$

$x = 31.43$

3. $\frac{24(0.95)^x}{24} = \frac{13}{24}$

$.95^x = 13/24$

$\log_{.95}(13/24) = x$

$11.95 = \frac{\log(13/24)}{\log(.85)} = x$

The value of a house has been decreasing 7.5% each year. The house was worth $180,000 in 2001.

In how many years will the value first fall below $45,000? Round to the nearest hundredth.

$\frac{45,000}{180,000} = \frac{180,000(0.925)^x}{180,000}$

$.25 = (.925)^x$

$\text{Log}_{.925}(.25) = x$

$\frac{\text{Log}(.25)}{\text{Log}(.925)} = x$

$x = 17.78$ yrs

Solve each.

1. $\text{Log}_5 x = 4$

$5^4 = x$

$x = 625$

2. $\text{Log}_x 80 = 3$

$\sqrt[3]{x^3} = \sqrt[3]{80}$

$x = 4.31$

3. $\text{Log}_7 20 = x$

$x = \frac{\text{Log } 20}{\text{Log } 7} = 1.54$