Logarithmic Functions

Notes # Omega 4

| | Omega 4 | | |
|--|--|--|--|
| Exponential Function: A function of the form $y = a^x$, where a is a positive real number. | | | |
| <u>Logarithm</u> : The inverse of $y = a^x$ is $x = a^y$. In the function $x = a^y$, y is called the logarithm. It is usually written $y = \log_a x$ and is read y equals the log, base a, of x. | | | |
| <u>Logarithmic Function:</u> A function in the form $y = \log_a x$. | | | |
| Definition of Logarithmic Function: The logarithmic function $y = \log_a x$, where $a > 0$ and $a \neq 1$, is the inverse of the exponential function $y = a^x$. Therefore, $y = \log_a x$ iff $x = a^y$. | | | |
| <u>Properties of Logarithms:</u> Suppose m and n are positive numbers, b is a positive number other than 1, and p is any real number. Then the following properties are true. | | | |
| Product Property: $log_b mn = log_b m + log_b n$ Quotient Property: log_b | $\frac{m}{n} = \log_b m - \log_b n.$ | | |
| <u>Power Property:</u> $\log_b m^p = p \bullet \log_b m$ <u>Property of Equality:</u> If the second | $\log_b m = \log_b n$, then $m = n$. | | |
| <u>Log Identity 1:</u> $\log_a a^x = x$ <u>Log Identity 2:</u> $a^{\log_a x}$ | = <i>x</i> | | |
| | | | |

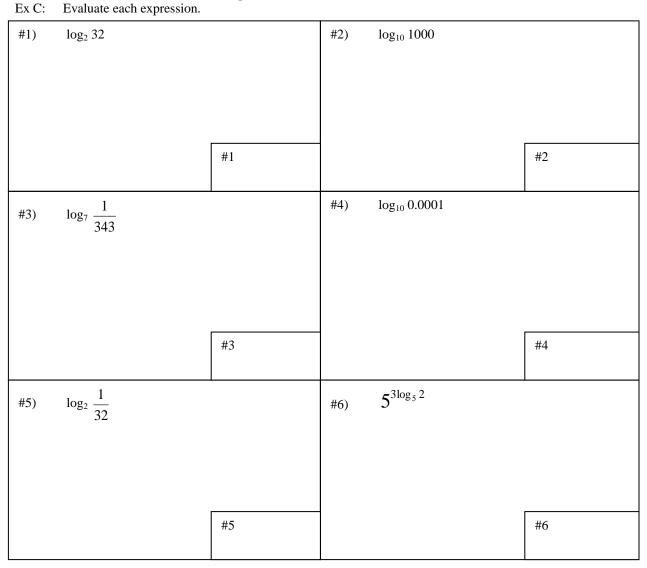
Ex A: Write each equation in logarithmic form.

| $(\#1)$ $4^3 = 64$ | $#2) \qquad 6^{-2} = \frac{1}{36}$ | $#3) \qquad 49^{\frac{1}{2}} = 7$ |
|--------------------|------------------------------------|-----------------------------------|
| #1 | #2 | #3 |

Ex B: Write each equation in exponential form.

| #1) $\log_{27} 3 = \frac{1}{3}$ | #2) $\log_{16} 4 = \frac{1}{2}$ | #3) $\log_9 27 = \frac{3}{2}$ |
|---------------------------------|---------------------------------|-------------------------------|
| #1 | #2 | #3 |

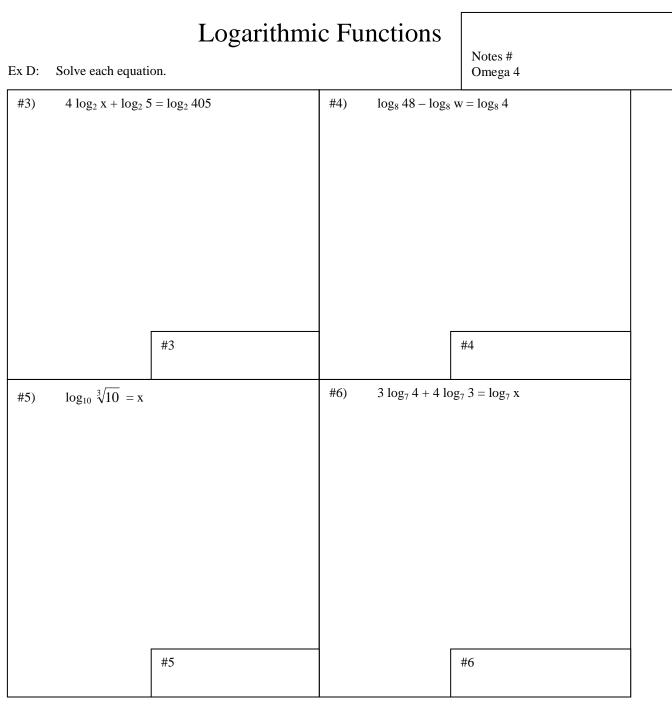
Logarithmic Functions



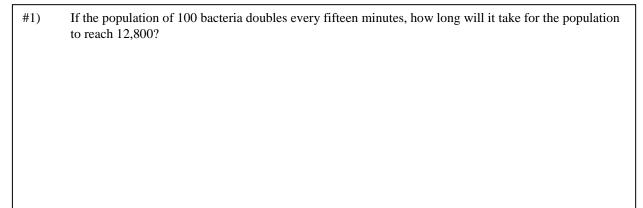
Ex D: Solve each equation.

| #1) | $\log_6 x + \log_6 9 =$ | log ₆ 54 | #2) | $\log_7 n = \frac{2}{3}\log_7 8$ | |
|-----|-------------------------|---------------------|-----|----------------------------------|----|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | #1 | | | #2 |

Exponential & Logarithmic Functions Page 2 of 4



Ex E: Word problems.



Logarithmic Functions

Ex F: Graph each equation or inequality.

| #1) | y = log ₃ (x + 1) | #1) Change to exponential form. #2) Solve your equation for x instead of y. #3) When doing your table substitute numbers into y instead of x. <i>Recall that</i> <i>exponential graphs</i> <i>have a horizontal</i> <i>asymptote. Therefore</i> <i>logarithmic graphs</i> <i>(inverse of</i> |
|-----|------------------------------|---|
| | | (inverse of exponential) have a vertical asymptote. |
| #2) | y < log ₂ x | |