Logarithms:

A. Logarithms, usually called logs, can be a little complicated since there are so many properties to learn. To become good at the log problems requires lots of practice.

B. There are 2 basic logs: $\log_n$ and $\log_e$ (which is written as ln and means "natural log").

1. In general, $\log_b x = n$ means $b^n = x$ and $\ln x = n$ means, $e^n = x$.

2. If no 'b' is given, then it is assumed the value 10.

Ex [1] log 1000 = _____

a. Since no value 'b' is given, b = 10.

b. The problem is $10^x = 1000$. For this to be true, x = 3.

c. The answer is 3.

Ex [2] $\log_4 x = {}^3/_2$, then x = _____

a. The answer is $4^{3/2} = x$ or $8 = x$. The answer is 8.

Ex [3] $\log_b 81 = \log_2 16$, then b = _____

a. This means $b^{\log_2 16} = 81$. So the first thing to do is to find $\log_2 16$ which means $2^x = 16$. So x = 4. So $\log_2 16 = 4$.

b. So substituting we get $b^4 = 81$. So b = 3.

c. The answer is 3.

C. Properties Of Logs:

1. Below are the common properties of logs. All of these should be memorized and you should be very familiar with knowing how to manipulate them.

$\log_n n = 1$	$\log_n 1 = 0$	$\log a + \log b = \log ab$
$\log a - \log b = \log {}^a/_b$	$n^{\log_n a} = a$	$\log_n ({}^1/_x) = -\log_n x$
$\log_n a \times \log_a n = 1$	$\log n^a = a \times \log n$	$\log_n x = {}^{\log x}/_{\log n}$

2. There might be other properties, but these are the ones that show up on the number sense tests the most.

D. Examples Taken From Past UIL Tests

Ex [4] $\log_4 27 \div \log_4 3 =$ _____

a. In this problem, if we can make the 1st term be $\log_4 3$ then the problem would be easy.

b. Change $\log_4 27$ to $\log_4 3^3 = 3*\log_4 3$.

c. So now we have $3 \times \log_4 3 \div \log_4 3 = 3 \times 1 = 3$.

d. The answer is 3.

Ex [5] $\ln 5 + \ln 8 = \ln 10 - \ln x$, then $x =$ _____

a. $\ln 5 + \ln 8 = \ln 5*8 = \ln 40$.

b. $\ln 10 - \ln x = \ln {}^{10}/_{x}$.

c. So we have $\ln 40 = \ln {}^{10}/_{x}$. The only way for this to be true is if $40 = {}^{10}/_{x}$. So, solving for x we get $x = {}^{1}/_{4}$.

d. The answer is ${}^{1}/_{4}$.

Ex [6] $(\log_2 7)(\log_7 4) =$ _____

a. We know that $(\log_b a)(\log_a b) = 1$. So we need to change the 2nd term to be $\log_7 2$ to use this property.

b. Change $\log_7 4$ to $\log_7 2^2 = 2*\log_7 2$.

c. So we have $2 \times \log_2 7 \times \log_7 2 = 2 \times 1 = 2$.

d. The answer is 2.