Logarithms are similar to radicals in that knowing what the question is asking makes the problem easier. Although this is a topic that is completely new to Algebra II students, Logarithms are simple. For example, the question $\log_3 27 =$ ***is asking "To what power do you raise 3 to get 27?" In this particular problem, 3 is the base of the logarithm. When reading the logarithm, it is read "Log base 3 of 27 is…"***

Properties of Simple Logarithms

$\log_a 1 = 0$

$\log_a a = 1$

$\log_a a^x = x$ *and* $a^{\log_a x} = x$ (*inverse property*)

If $\log_a x = \log_a y$ *then* $x = y$

Properties of Natural Logarithms

$\ln 1 = 0$

$\ln e = 1$

$\ln e^x = x$ *and* $e^{\ln x} = x$ (*inverse property*)

If $\ln x = \ln y$ *then* $x = y$

A standard logarithm can have any positive number as its base except 1, whereas a natural log is always base e***. Since the natural log is always base*** e***, it will be necessary to use a calculator to evaluate natural logs unless one of the first three examples of the properties of natural logs is used. For anything such as*** $\ln 2 =$***, a calculator must be used.***

When dealing with logarithms, switching between exponential and Logarithmic form is often necessary.

Logarithmic form	**Exponential Form**
$\log_a b = c$	$a^c = b$

Write each of the following in exponential form.

A) $\log_4 16 = 2$ **B)** $\log_9 3 = \frac{1}{2}$ **C)** $\log_9 27 = \frac{3}{2}$ **E)** $\log_4 \frac{1}{16} = -2$

Write each of the following in logarithmic form.

A) $3^4 = 81$ **B)** $16^{1/4} = 2$ **C)** $36^{-1/2} = \frac{1}{6}$ **D)** $16^{5/4} = 32$

Simplifying Logarithms

Evaluate each of the following logarithms without the use of a calculator.

A) $\log_3 81 =$

B) $\log_4 \frac{1}{2} =$

C) $\log_{12} 144 =$

D) $\log_6 \frac{1}{36} =$

E) $\log_{\frac{2}{3}} \frac{9}{4} =$

F) $\log_{0.25} 4 =$

G) $\log_3 -3 =$

H) $\log_8 4 =$

I) $\log_{81} \frac{1}{27} =$

J) $\log_{\frac{1}{16}} 32 =$

K) $\log_4 0 =$

L) $\log_{10} 1 =$

M) $\log_4 \frac{1}{8} =$

N) $\log_{27} \frac{1}{3} =$

O) $\log_9 3 =$

P) $\log_6 6^{3x} =$

Q) $\log_{36} \frac{1}{6} =$

R) $\log_{128} 2 =$

S) $\log_{\frac{1}{4}} 16 =$

T) $\log_z z^{2x} =$

U) $\ln e^{12} =$

V) $3^{\log_3 5} =$

W) $\ln 1 =$

X) $e^{\ln 4x} =$

Y) $\log_2 16\sqrt{2} =$

Z) $\log_3 \sqrt[5]{9} =$

a) $\log_3 9\sqrt[3]{3} =$

b) $\log_5 \frac{1}{\sqrt[3]{25}} =$

c) $\log_{\frac{5}{6}} \sqrt[3]{\frac{36}{25}} =$

d) $e^{\ln 5x^2} =$