Lesson Title 6.3 Logarithmic Functions Notes **ALG 2** **Date** _____

OBJECTIVE 1: Logarithmic & Exponential Functions

- It is important to know that logarithms and exponentials are INVERSES of each other. On the calculator their button is the same except one needs the 2nd button pushed.
- They can convert back and forth with "I HEART LOGS"
- You graph an exponential function in y = on the calculator and then switch all the x's and y's to find the logarithmic coordinates because they are inverses.
- Inverses are a reflection over the line y = x.
- $\log_b y = x$ converts to and from $b^x = y$

There is a trick, remember "I HEART LOGS!"

$\log_b y = x$ $\quad b^x = y$

$b^x = y$ $\quad \log_b y = x$

TASK 1: Match the equations with their inverses using "I HEART LOGS"

F	a) $\log_3 81 = 4$	A) $\log_{25} 625 = 2$
I	b) $\log_{18} 324 = 2$	B) $3^3 = 27$
C	c) $9^3 = 729$	C) $\log_9 729 = 3$
G	d) $13^2 = 169$	D) $2^6 = 64$
H	e) $\log_4 256 = 4$	E) $\log_{12} 144 = 2$
J	f) $20^2 = 400$	F) $3^4 = 81$
B	g) $\log_3 27 = 3$	G) $\log_{13} 169 = 2$
D	h) $\log_2 64 = 6$	H) $4^4 = 256$
A	i) $25^2 = 625$	I) $18^2 = 324$
E	j) $12^2 = 144$	J) $\log_{20} 400 = 2$

OBJECTIVE 2: Common Logarithm VS Natural Logarithm

A common logarithm is a logarithmic function with a base of 10. If a number is not there it defaults to a 10 just like a radical without an index is a two which is called a square root.

$\log_{10} x = \log x$

A natural logarithm is a logarithmic function with a base of "e" (Euler's number) and is notated with an ln instead of log. LN not 1n but all lower case. Reminder $e \approx 2.718$

$\log_e x = \ln x$

TASK 2: Evaluate the logarithm. If necessary, use a calculator and round your answer to 3 places.

a) $\log_2 32$ $\quad 2^? = 32$ $\quad$ 5

b) $\log_{27} 3$ $\quad 27^? = 3$ $\quad \frac{1}{3}$

c) $\log 12$ $\quad 10^? = 12$ $\quad$ calc $\quad \approx 1.079$

d) $\ln 0.75$ $\quad e^? = 0.75$ $\quad$ calc $\quad \approx -0.288$

OBJECTIVE 3: Using Inverse Properties to Simplify or Solve Logs!

EXAMPLE 5 **Using Inverse Properties**

Simplify (a) $10^{\log 4}$ and (b) $\log_5 25^x$.

SOLUTION

a. $10^{\log 4} = 4$ — $b^{\log_b x} = x$

b. $\log_5 25^x = \log_5 (5^2)^x$ — Express 25 as a power with base 5.

$= \log_5 5^{2x}$ — Power of a Power Property

$= 2x$ — $\log_b b^x = x$

TASK 3: Use the example above to simplify the following logarithmic expressions.

a) $8^{\log_8 x}$ — X

b) $\log_7 7^{-3x}$ — $-3x$

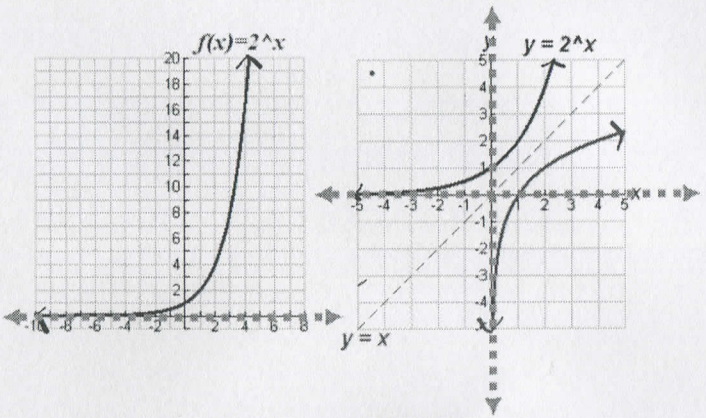
c) $\log_2 64^x$ — $\log_2 2^{6x}$ — $6x$

d) $e^{\ln 20}$ — 20

Most exponential graphs resemble this same shape.

$f(x) = 2^x$

x	$f(x) = y$
-2	$2^{-2} = 1/4$
-1	$2^{-1} = 1/2$
0	$2^0 = 1$
1	$2^1 = 2$
2	$2^2 = 4$
3	$2^3 = 8$



When the base is different than e or 10. Pick x values and make a T-chart.

OBJECTIVE 4: Graphing Exponential Functions & Their Inverses

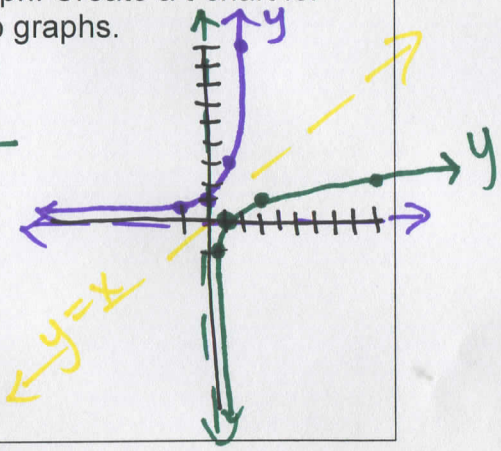
TASK 4: Sketch the exponential function and its inverse on the same graph. Create a t-chart for both first. Label your two graphs.

$y = 3^x$

x	y
-1	$\frac{1}{3}$
0	1
1	3
2	9

$\log_3 x = y$

x	y
$\frac{1}{3}$	-1
1	0
3	1
9	2



Still need help with: