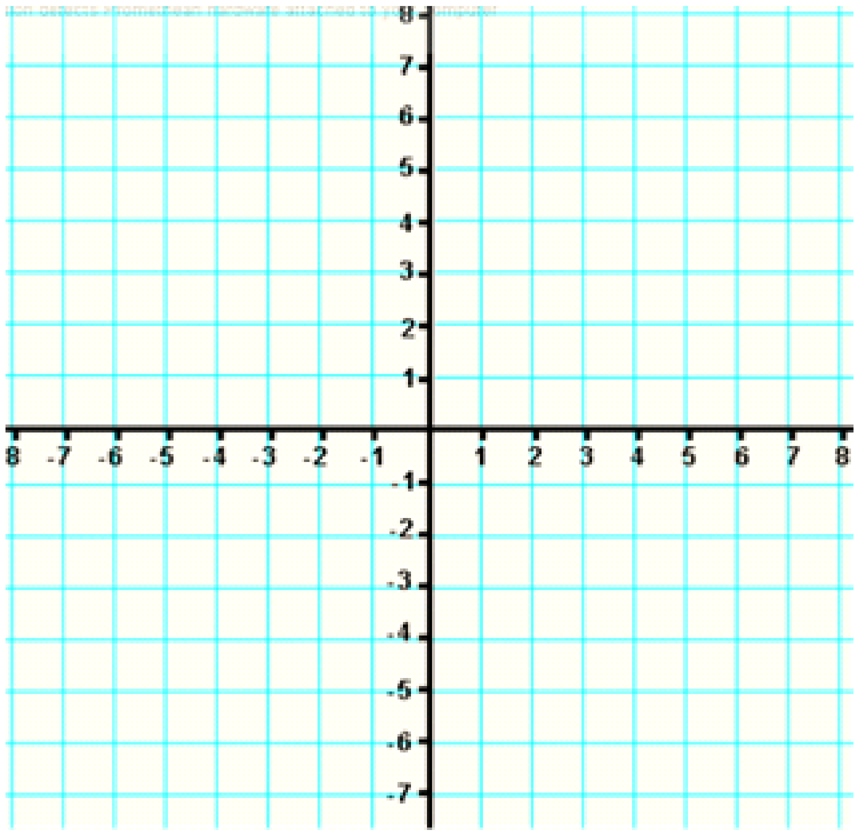
Bell: (1) Graph $f(x) = 2^x$

(2) Name 3 points on f(x)

(3) Graph y = x on same axes

(4) Graph $f^{-1}(x)$ (HINT: Use pts from #2!)



As x→0+, f(x) → ?

PC--Lesson 3.2---Logarithmic Functions and their Graphs

Solve: $2^x = 3$

In order to solve this equation we must "undo" the exponentiation in order to determine the x-value.

But how to we undo exponentiation? We must have the inverse operation. What IS the inverse operation of exponentiation?

Well, it's logarizing (NOTE: you will NOT find this word in your text)

RECALL: To find the inverse of a function, you (1)
variables and (2)

Let's do this for the exponential funtion $y = 2^x$

You do it (now)

$y = 2^x \rightarrow x = 2^y$ now what? How do you solve for y?

If we state the solution verbally we would say, "Y is the exponent that 2 is raised to to get x." But how do you write that mathematically?

Mathematicians did it this way a long time ago: $y = \log_2 x$

So the inverse of an exponential function is a logarithmic function.
(i.e., logarizing "undoes" exponentiation...and vice versa)

And a logarithm is just an exponent....say it with me:

" a logarithm is an exponent"

$x = a^y$ can be rewritten as $\log_a x = y$ $(a>0,\ a\neq 1,\ x>0)$

So any exponential expression can be written as a logarithmic expression and vice-versa.

REREAD!

Some examples: Rewrite in exponential form.

Any exponential expression can be written as a logarithmic expression and vice-versa.

$\log_2 8 = 3 \rightarrow$

$\log_3 81 = 4 \rightarrow$

$\log_{16} 4 = \frac{1}{2} \rightarrow$

Evaluate:

REMEMBER:
A logarithm is an exponent

$\log_2 16 =$ ___

THINK: "2 to what power gives me 16?"

$\log_3 27 =$ ___

$\log_2 2 =$ ___

$\log_{10} 1000 =$ ___

$2\log_3 1 =$

The "common logarithm" is a log with base of 10
The "natural logarithm" is a log with a base of *e*

If the base is 10, we don't write it. it's understood to be 10

ex: log100 = 2 (understood base is 10)

$\log_e 5$ will be written as ln5 ("ln" means the base is understood to be e)

so what is the value of lne?

Find these buttons on your calculators!

Some other important properties that always hold true:

$\log_a 1$ = ln1 =

$\log_a a$ = AE lne = AE

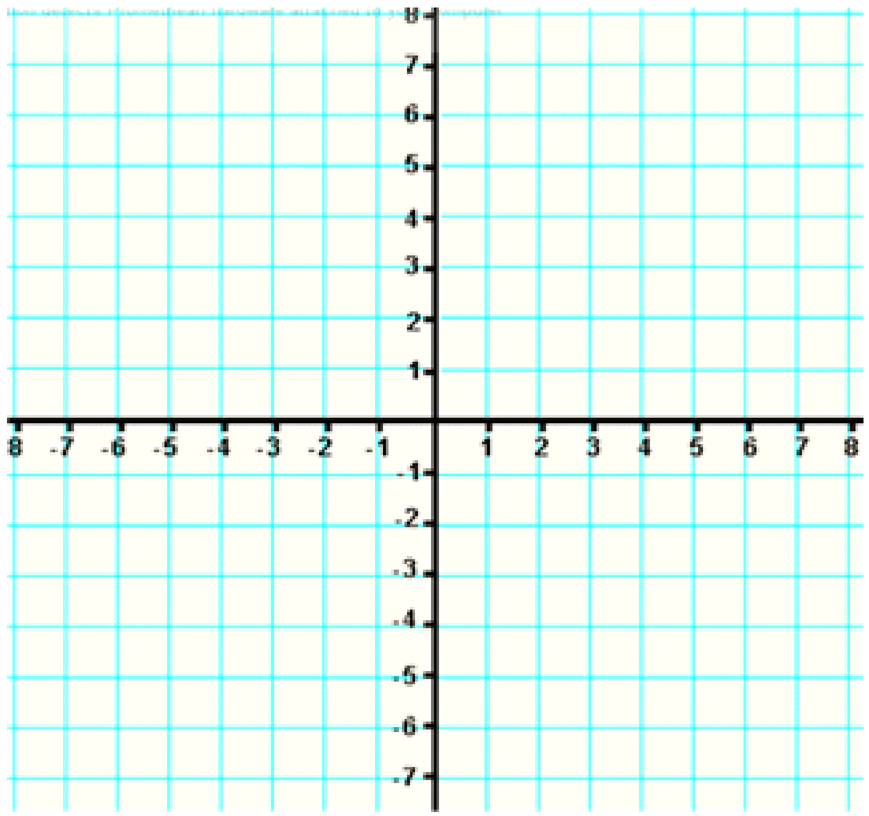
$\log_a a^x$ = $\ln e^x$ =

Be sure to write bases as bases and exponents as exponents

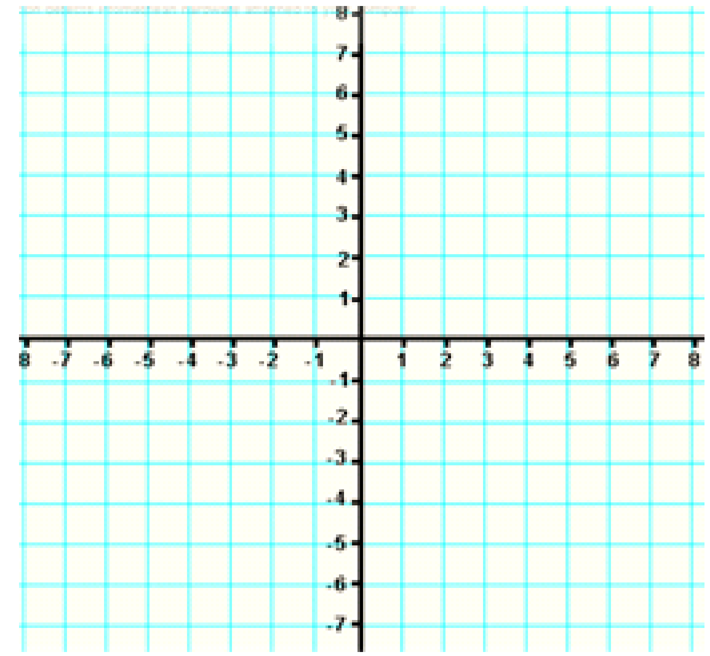
You should STUDY this!!

Let's talk about the graph of the log function: $y = \log_2 x$

Could you make a table of values for this function and graph it? Try it (now)



Can you graph $y = \log_3 x$?



If $f(x) = \log_2 x$ what is $g(x) = f(-x)$

$h(x) = -f(x)$

$k(x) = f(x \pm c)$

$p(x) = f(x) \pm c$

Is order important?

In sketch ALWAYS include asymptote and 1 major point

SKETCH:

1. $y = -\ln x$
2. $y = \ln(-x)$
3. $y = \ln(x-2)$
4. $y = \ln x - 2$ or $-2 + \ln x$
5. $y = \ln(2 - x)$

NOTE: if exponentiation and logarizing are inverse operations then

$\log_a a^x =$ and $a^{\log_a x} =$

Also,

IF $\log_a x = \log_a y$ THEN

How would you graph $y = \log_3(x - 2)$?!