Working with Exponentials, Logs, and Trig

I. Evaluating logarithms and exponentials: logarithms and exponentials are *inverses* of each other.

a. Logarithms: LOG is the common logarithm and LN is the natural logarithm. These are both logarithms, but of different bases. On your calculator, the inverse of the logarithm is written above the logarithm key. 10^x is the inverse of the common logarithm so 10^x is written above LOG .

So … what are the bases of LOG and LN ?

How do we find $\log_{10} 1000$ **?**

How do we find $\ln 250$ **?**

How do we find $\log_8 52$ **?**

What happens when we find $\log 0$? $\ln 0$?

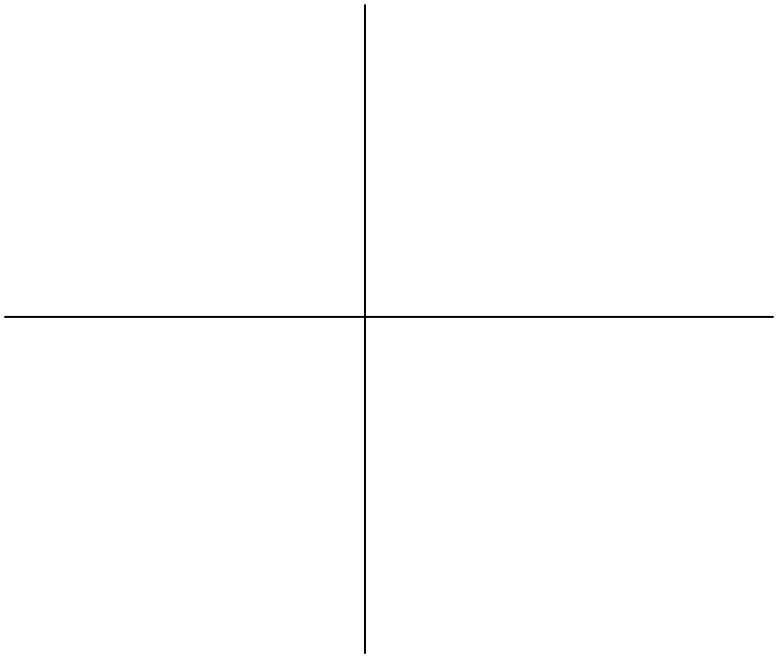
b. Exponentials: $[10^x]$ and $[e^x]$. These are each a base (10 or e) raised to a power x.

How do we find e^2 **?**

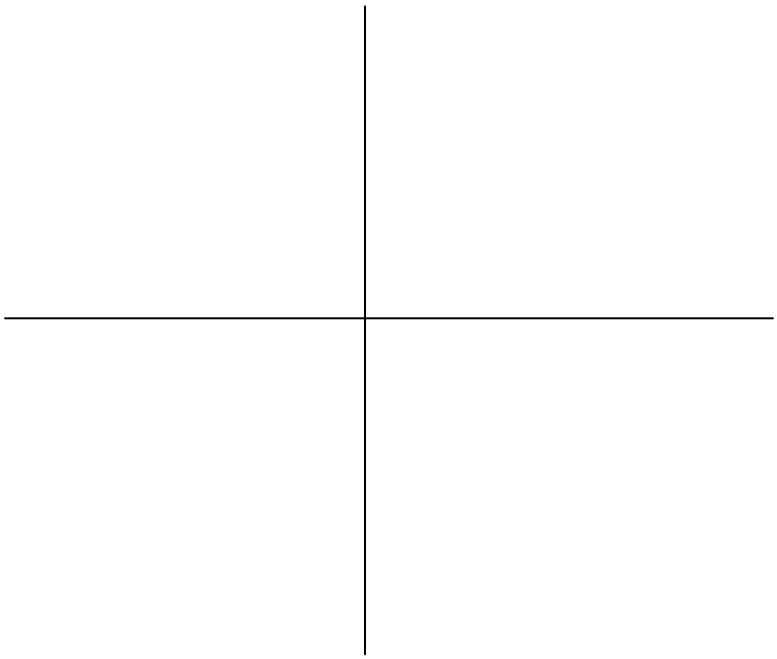
*** Remember the importance of using parentheses when calculating exponentials and logarithms, like any other calculations!**

II. Graphing and applying exponentials and logarithms:

First, graph $f(x) = e^x$ and sketch it here:



Graph $f(x) = \ln(x)$.



a. Find a viewing window that shows a complete graph of the function $f(x) = e^{-x^2}$.

Xmin =

Xmax =

Xscl =

Ymin =

Ymax =

Yscl =

b. A certain type of bacteria grows according to the function $f(x) = 5000e^{.4055x}$, where the time x is measured in hours.

*Hint: Before trying to actually read the answers, let's make educated guesses on what our windows should be set as.

Xmin =

Xmax =

Xscl =

Ymin =

Ymax =

Yscl =

(a) What will the population be in 8 hours?

(b) When will the population reach 1 million?

c. Based on data from 1989 to 1994, the number of aliens that landed each year in the United States is approximated by the function

$$k(x) = \frac{12{,}439}{1 + 4.76 * e^{-.4713x}}$$

where x = 1 corresponds to 1989.

… estimate a good window first …

Xmin =

Xmax =

Xscl =

Ymin =

Ymax =

Yscl =

(a) In what year did the number of aliens first exceed 8000?

(b) If this model remains accurate in the future, will the number of aliens ever reach 13,000 per year?

d. Let the percentage of knowledge retained after t weeks be represented by the function $P(t) = 40 + 60e^{-0.75t}$.

Xmin =

Xmax =

Xscl =

Ymin =

Ymax =

Yscl =

(a) What percentage is retained after 1 week? After 5 weeks?

(b) Predict the number of weeks until only 50% is retained.

(c) What happens to P as $t \to \infty$?

e. Graph the function $f(x) = \log_3(x) - \log_2(x)$.

Can you enter this into the calculator the way that it is?

III. Working with trigonometry

a. Be *really* careful about whether the calculator should be in Radian or Degree mode … **always** check your settings in the MODE menu before you start evaluating trig functions.

b. Finding sine, cosine, and tangent of an angle:

Press either SIN , COS , or TAN and then, in parentheses, the angle that you are evaluating. **These trig functions mean nothing w/o the angle!**

How do we find sin(90°) ?

How do we find cos(π)?

c. Finding secant, cosecant, and cotangent:
There are no keys to do these trig functions, so we'll have to get creative with this.

$\sec\theta =$

$\csc\theta =$

$\cot\theta =$

How do we find cot(30°)?

d. So what if we need to find out what the angle is? Use: [$\sin^{-1}$], [$\cos^{-1}$], and [$\tan^{-1}$].

Find the angle x if:

$\sin\theta = \frac{\sqrt{2}}{2} \qquad \theta = ?$

$\cos\theta = -1 \qquad \theta = ?$

WARNING! When we find $\sec\theta$, we are actually finding $\frac{1}{\cos\theta}$. This is NOT the [$\cos^{-1}$] function on your calculator. As you can see, [$\cos^{-1}$] is the cosine inverse function which helps you find out what the angle is. It is NOT the reciprocal $\left(\frac{1}{\cos\theta}\right)$ of $\cos\theta$.

IV. Graphing trig functions

a. Graph $f(x) = \sin(x)$. Can we make it look a little better? Use ZTrig. ZTrig will graph into a window that's useful for trig functions.

Window dimensions for ZTrig:

Xmin =

Xmax =

Xscl =

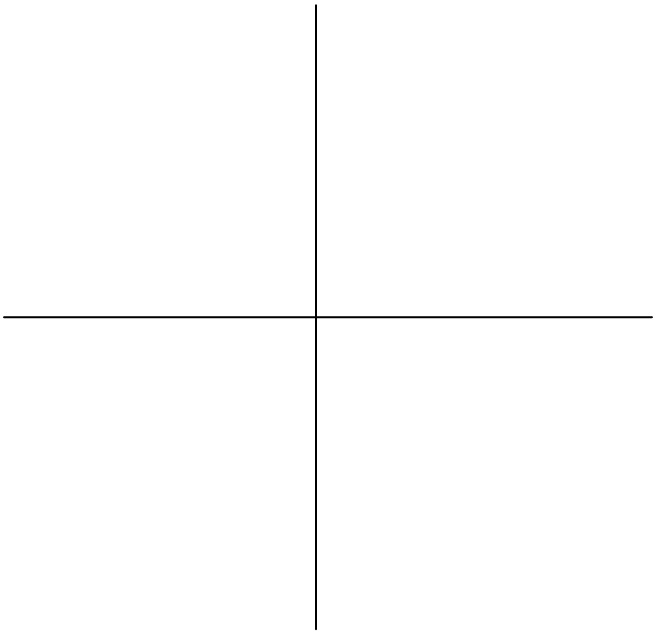
Ymin =

Ymax =

Yscl =

b. Graph $f(x) = \cos^2 x$. What does this strange notation mean?

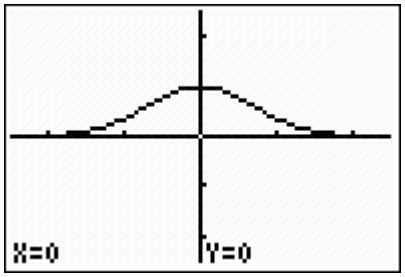
Find a maximum and a minimum for this function.



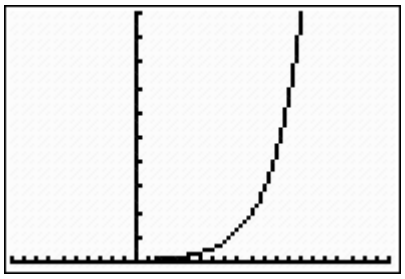
c. Is $\sin^2 x = 1 - \cos^2 x$?

Graphs of example problems:

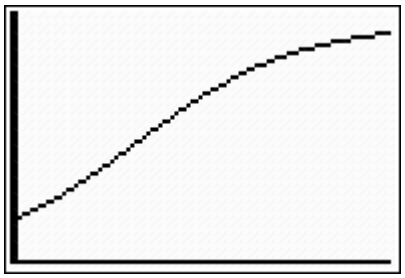
$f(x) = e^{-x^2}$



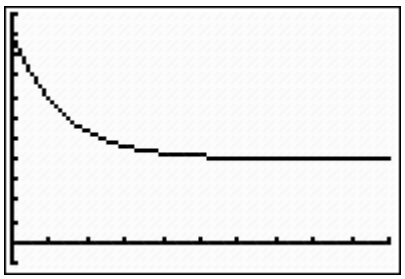
$f(x) = 5000e^{.4055x}$



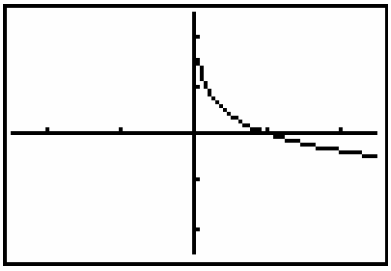
$k(x) = \dfrac{12{,}439}{1 + 4.76 * e^{-.4713x}}$



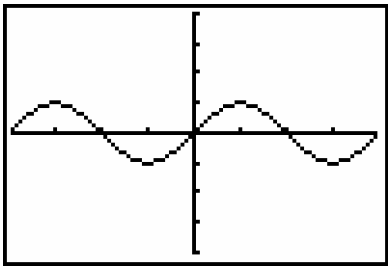
$P(t) = 40 + 60e^{-0.75t}$



$f(x) = \log_3 x - \log_2 x$



$f(x) = \sin x$



$f(x) = \cos^2 x$