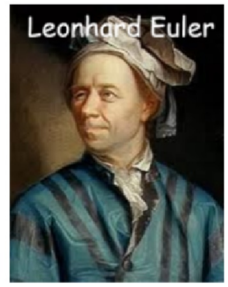
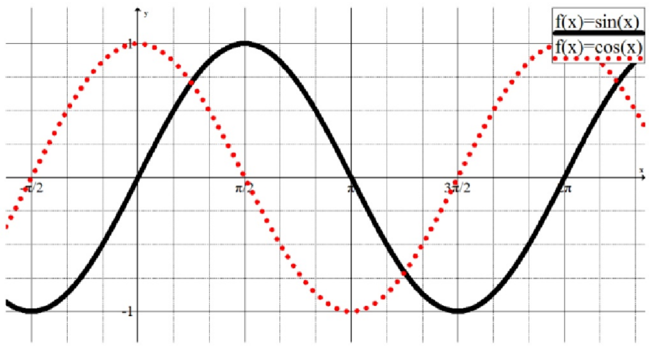
1.8 e^x & lnx



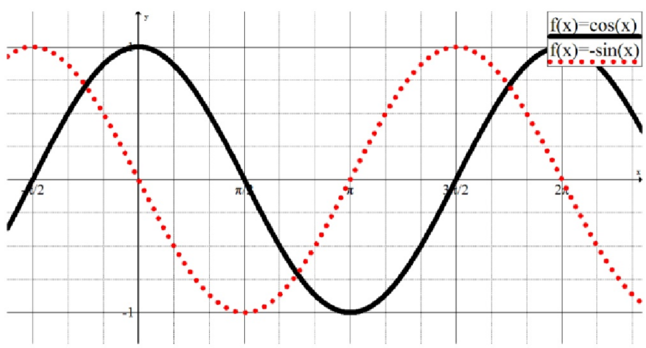
Summary from Investigating Trig and Exp Functions:

link to 1.7 investigation answers

IF f(x) = sinx then f'(x)= cosx



IF f(x) = cosx then f'(x)= - sinx



Effect of Transformations on Base Trig Functions:

vertical translation - no effect on derivative

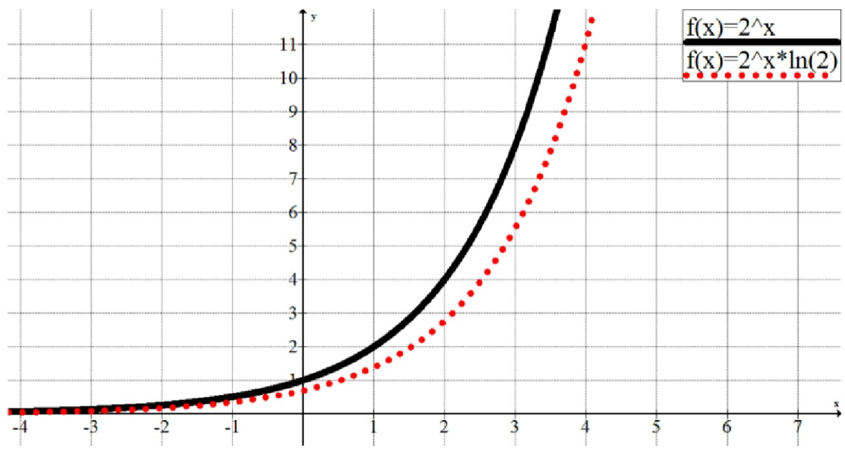
horizontal translation- derivative has same horizontal translation

vertical stretch/reflection - derivative has same vertical stretch/reflection

**horizontal stretch/reflection
-derivative has the same transformations BUT ALSO impacts the vertical stretch of the derivative function
-a shorter period results in steeper tangents, a longer period results in flatter tangents...this affects the amplitude of the derivative function

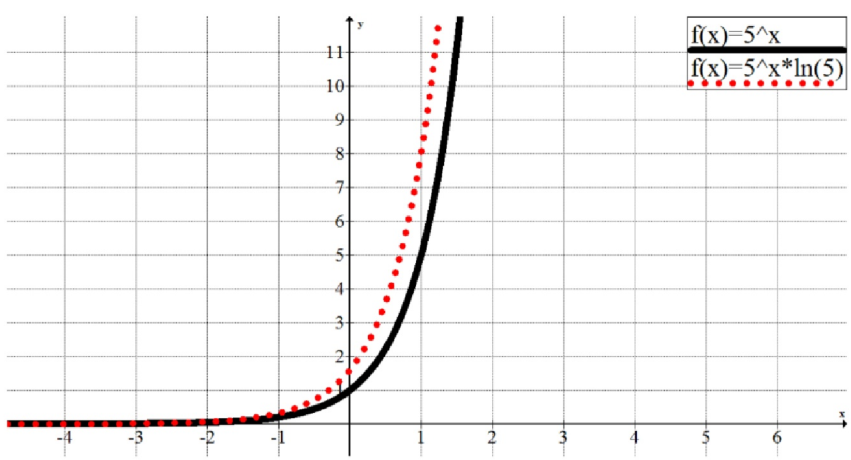
IF $f(x) = 2^x$, then $f'(x) = 2^x (k)$, where $k = \ln 2$.
This represents a vertical compression of f(x).

$$k = \frac{f'(x)}{f(x)} = \ln 2 = \_\_\_\_$$



IF $f(x) = 5^x$, then $f'(x) = 5^x (k)$, where $k = \ln 5$.
This represents a vertical stretch of f(x).

$$k = \frac{f'(x)}{f(x)} = \ln 5 = \_\_\_\_$$



Q: If $f(x) = a^x$, is there a value of "a" where the derivative function would result in the same curve as the original function?
(ie. no stretch or compression)

Link to Graph File   Link to Document Player

Graph of $f(x)=e^x$

When "a" is approximately equal to ___________, the derivative function is equivalent to the original function.

When $f(x)=2.72^x$, the derivative function $f'(x)=2.72^x$ (same as f(x))
When the base is close to 2.72 the value of k approaches 1 ...therefore, there is no compression or stretch.

Called Euler's Number (thus the "e").

This is one of <u>many</u> definitions of the number "e".

e = the base of an exponential function whose derivative function is itself

e = 2.718281828459045235360287471352662497757247093699959574966...

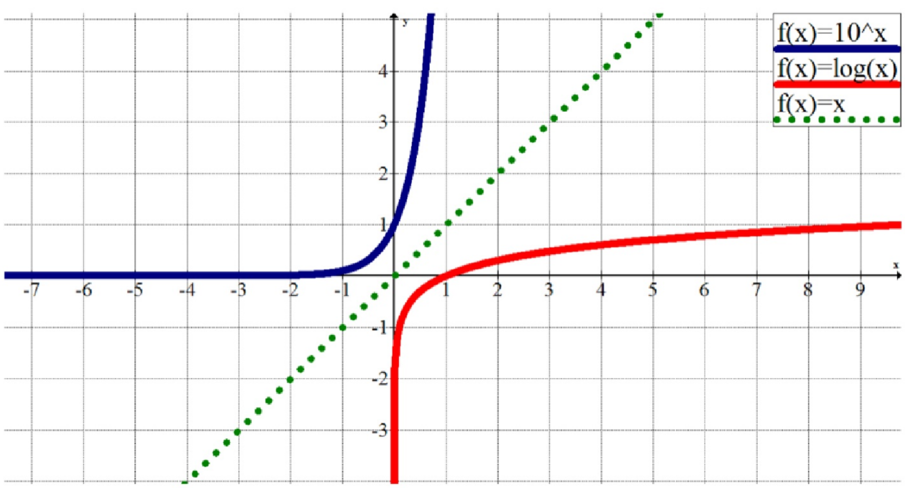
e is an irrational number (it cannot be written as a fraction, it never ends, there is no repeating pattern)

Recall: The inverse of $y=a^x$ can be written:

$x = a^y$ (exponential form)

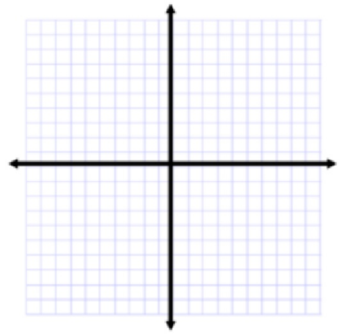
$y = \log_a x$ (logarithmic form)

Graphically: $y = a^x$ and $y = \log_a x$ are reflections in the line $y=x$.

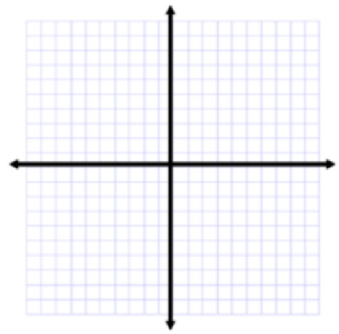


Ex. 1 Determine the inverse of each function.
Graph f(x) and f'(x).

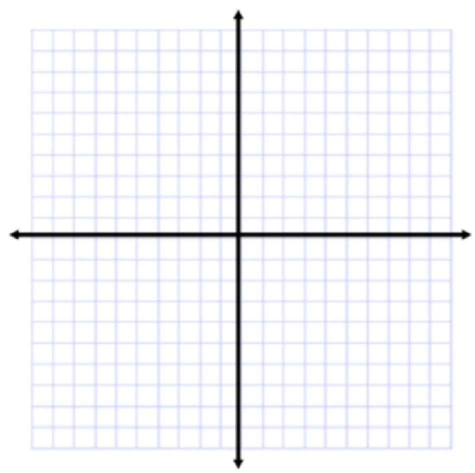
a) $f(x) = 3^x$



b) $f(x) = \left(\frac{1}{2}\right)^x$



c) $f(x) = e^x$



$\log_e x$ *is also known as* $\ln x$

$\log_e x = \ln x$

$\ln x$ *is a* $\log$ *with base equal to* e

$\therefore \ln x$ *is the inverse of* e^x

ln is also known as the natural log

Feb 16-9:56 AM

Log Laws:

$\log_a m + \log_a n = \log_a mn$

$\log_a\left(\frac{m}{n}\right) = \log_a m - \log_a n$

$\log_a m^p = p(\log_a m)$

$\log_a 1 = 0$

$\log_a a^x = x$

$a^{\log_a x} = x$

Change of Base Formula:

$recall: \quad \log_b a = \frac{\log_m a}{\log_m b}$

when m = e,

$\log_b a = \frac{\log_e a}{\log_e b}$

$= \frac{\ln a}{\ln b}$

Ex. 2 Simplify/evaluate each of the following.

$a)$ $\log_5 1$ $b)$ $\log_6 6^x$ $c)$ $6^{\log_6 x}$

$d)$ $\ln e$ $e)$ $\ln 1$ $f)$ $e^{\ln x}$ $g)$ $\ln e^x$

Ex. 3 Simplify and evaluate each of the following.

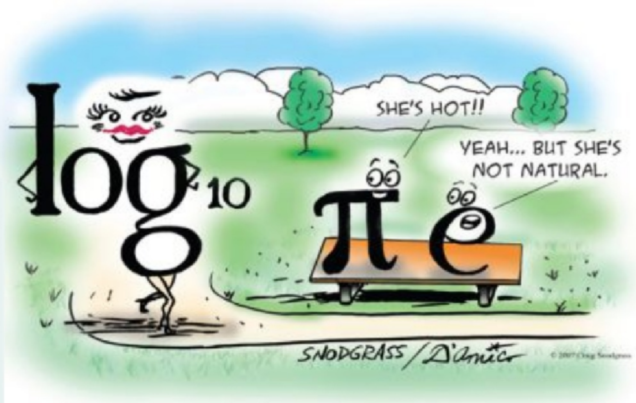
$a)$ $\log_6 2 + \log_6 3$ $b)$ $\log_2 24 - \log_2\left(\frac{3}{4}\right)$

$c)$ $2\log_2\sqrt{8} - 2\log_2 4$ $d)$ $3\ln 2 - 3\ln 5$

Ex. 4 Use your calculator to evaluate.

$a)$ $\log_2 18$ $b)$ $\log_5 3$ $c)$ $\log_e 10$

Homework: Handout



notsohumblepi.com