

Exponential & Logarithmic Functions

Note Title

10/14/2009

Exponential Function

$$f(x) = a^x \leftarrow \text{input}$$

some fixed constant
(base)

contrast to
Power Function

$$x^a$$

More generally

$$k \cdot a^{rx}$$

Computing Examples

$$f(x) = 3^{2x}$$

$$f(1) = 3^{2 \cdot 1} = 3^2 = 9$$

$$f(0) = 3^{2 \cdot 0} = 3^0 = 1$$

$$f(4) = 3^{2 \cdot 4} = 3^8 = 6561$$

$$f(-1) = 3^{2(-1)} = 3^{-2}$$

$$= \frac{1}{3^2} = \frac{1}{9}$$

$$f(-4) = 3^{2(-4)} = 3^{-8}$$
$$= \frac{1}{3^8} = \frac{1}{6561}$$

Gets as close
as you want to
0, but never quite
makes it.

$$(4, \frac{1}{6561}) \quad (-1, \frac{1}{9})$$

$$(0, 1)$$

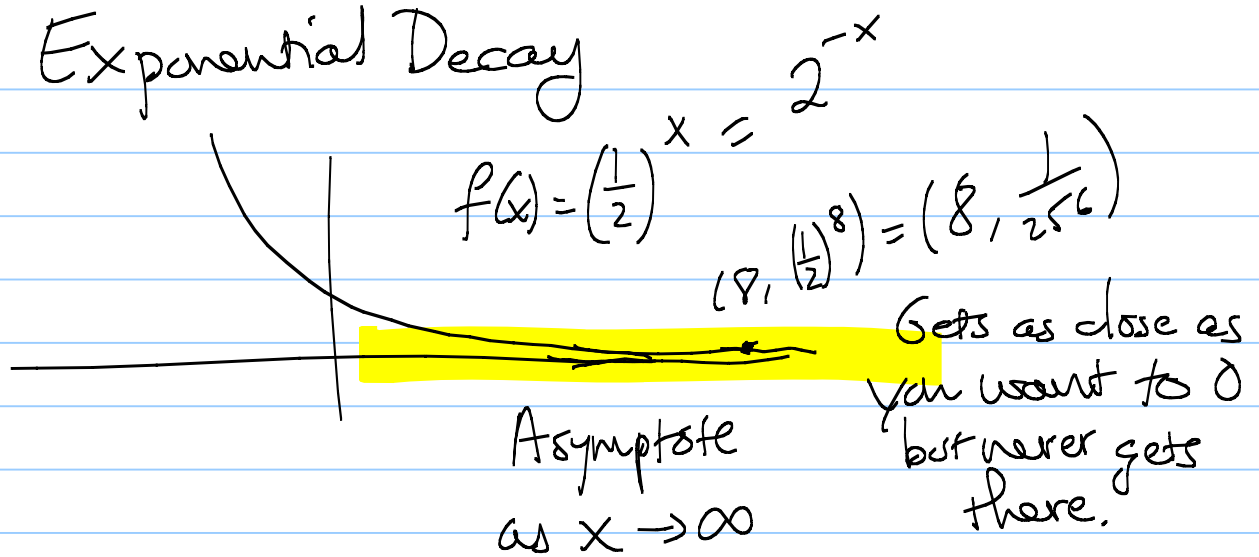
$$(1, 9)$$

$$(4, 6561)$$

Exponential Growth

Asymptote As $x \rightarrow -\infty$

Exponential Decay

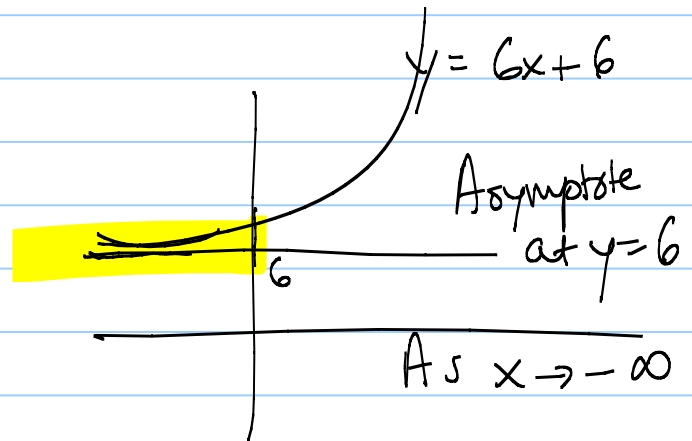
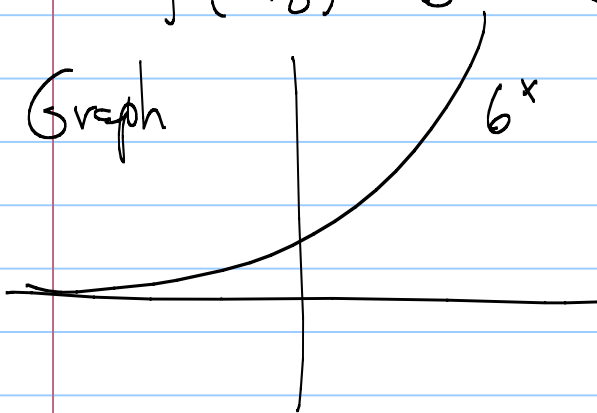


Online

$$f(x) = 6^x + 6$$

$$f(3) = 6^3 + 6 = 216 + 6 = 222$$

$$f\left(-\frac{2}{3}\right) = 6^{-2/3} + 6 = 6.302853432\dots$$



Euler's Number

$$e = 2.718281828459045, \dots \text{ ("Euler")}$$

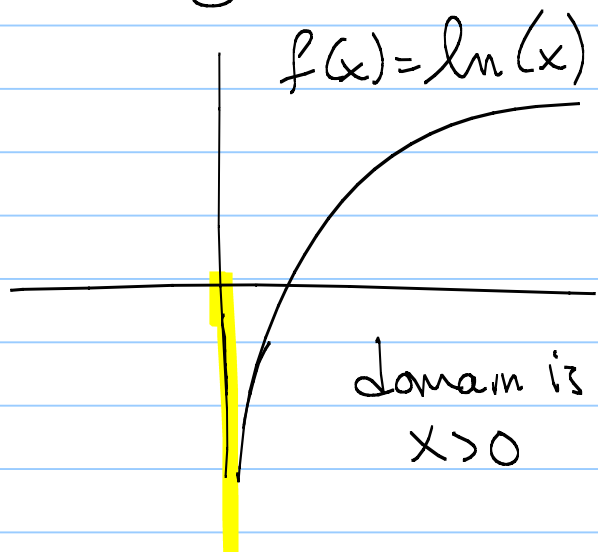
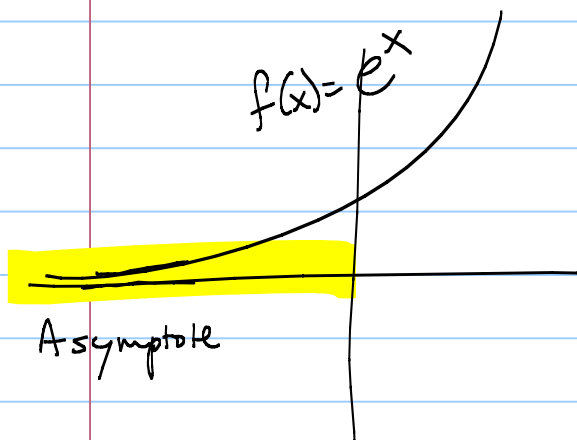
$$\pi = 3.14159265, \dots$$

$$f(x) = 3e^{-2x} - 5$$

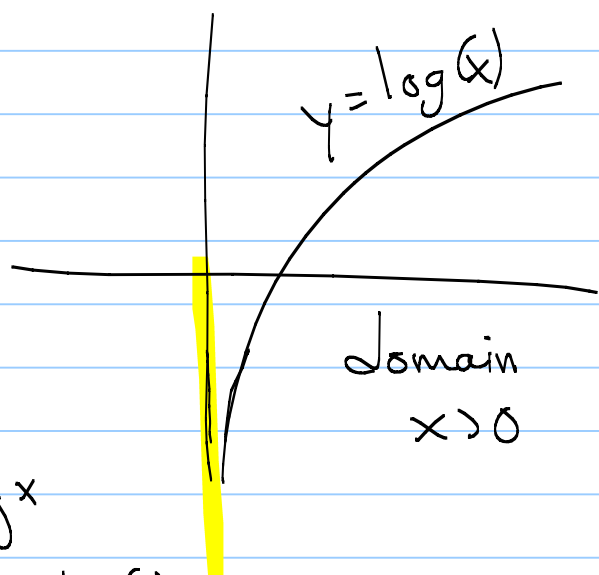
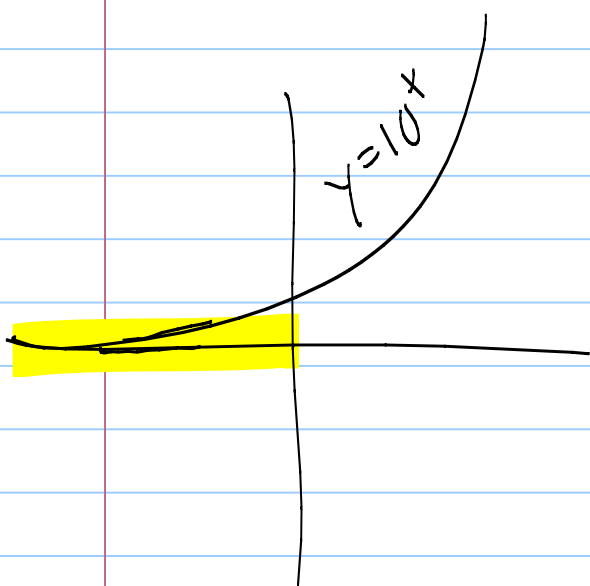
$$f(-1) = 3e^{(-2)(-1)} - 5 = 3e^2 - 5$$

Use e^x on your calculator
(usually on the LN key)

The inverse of an exponential function is called a logarithmic fct.



$\ln(x)$ the natural logarithm



Inverse of $f(x) = 10^x$
is the common log $f^{-1}(x) = \log(x)$

Online

$$f(x) = 3 \ln(2x - 3)$$

Must be > 0

$$\begin{aligned} f(-6) &= 3 \ln(2(-6) - 3) \\ &= 3 \ln(12 - 3) = 3 \ln(9) \end{aligned}$$

domain of $f(x)$ is ?

$$\begin{aligned} -2x - 3 &> 0 \\ -2x &> 3 \\ x &< -3/2 \end{aligned}$$