Section 5.1/5.2 Exponential & Logarithmic Functions

Note Title 10/14/2009

Announcements:

Extra Credit

Translations Online HW extension

Exponential Functions

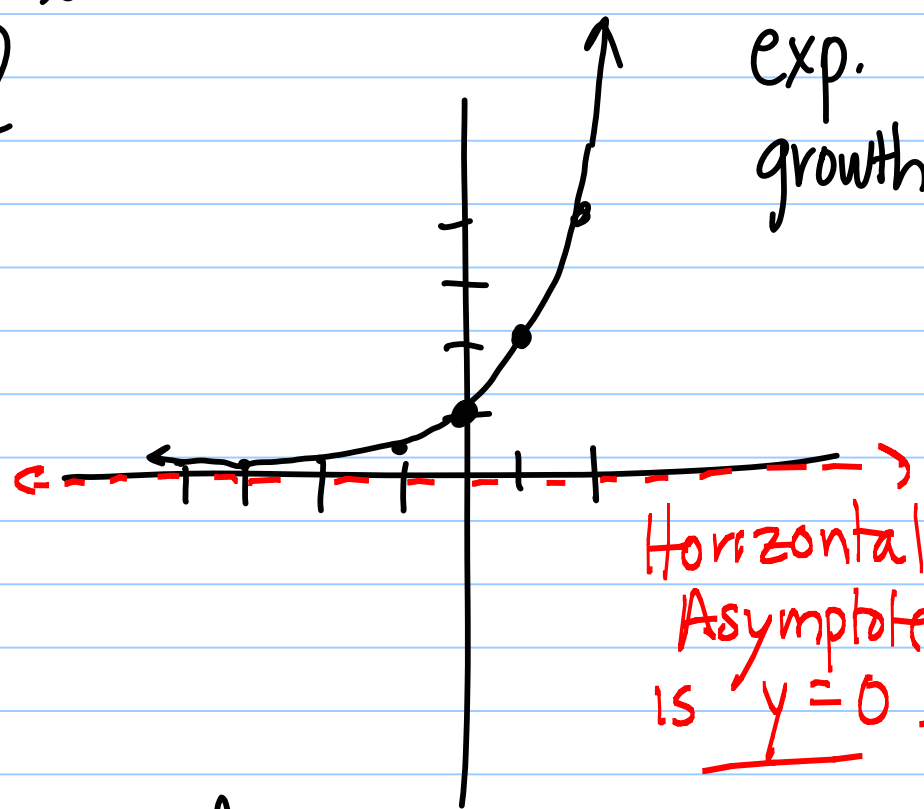
$$f(x) = a^x$$

some fixed value; "base"

(not to be confused with power functions: $g(x) = x^a$

Ex) $f(x) = 2^x$

x	$f(x)$	
0	1	$(0, 1)$
1	2	$(1, 2)$
2	4	$(2, 4)$
-1	$1/2$	$(-1, 1/2)$
-2	$1/4$	$(-2, 1/4)$
-3	$1/8$	$(-3, 1/8)$
-4	$1/16$	$(-4, 1/16)$



exp. growth

As x approaches positive infinity, f(x) approaches infinity.

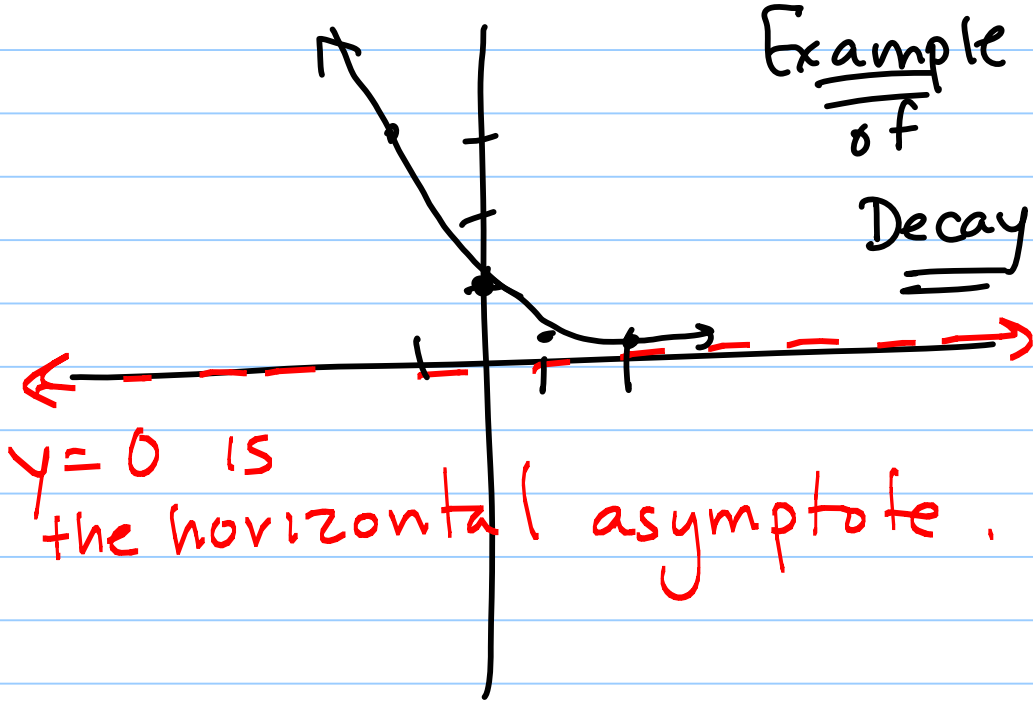
As x approaches negative infinity, $f(x)$ approaches 0.

As x tends to $+\infty$, $f(x)$ tends to ∞

x tends to $-\infty$, $f(x)$ tends to 0.

Ex] $f(x) = \left(\frac{1}{3}\right)^x$ (Note: the base is between 0 & 1)

x	$f(x)$
0	1
1	1/3
2	1/9
3	1/27
-1	3
-2	9
-3	27



Example of Decay

As $x \to \infty$, $f(x) \to \boxed{0}$

As $x \to -\infty$, $f(x) \to \boxed{\infty}$

<u>Question</u>: What will the horizontal asymptote of $\boxed{y=-2}$

$$g(x) = \left(\frac{1}{3}\right)^x - 2$$ be?

(From the earlier example, $f(x) = \left(\frac{1}{3}\right)^x$ had a h.a. of $y=0$.)

Example from Online HW

$$f(x) = 7^{3x} + 2$$

a) What is $f(-2)$? $f(-2) = \left(7^{-6}\right) + 2$

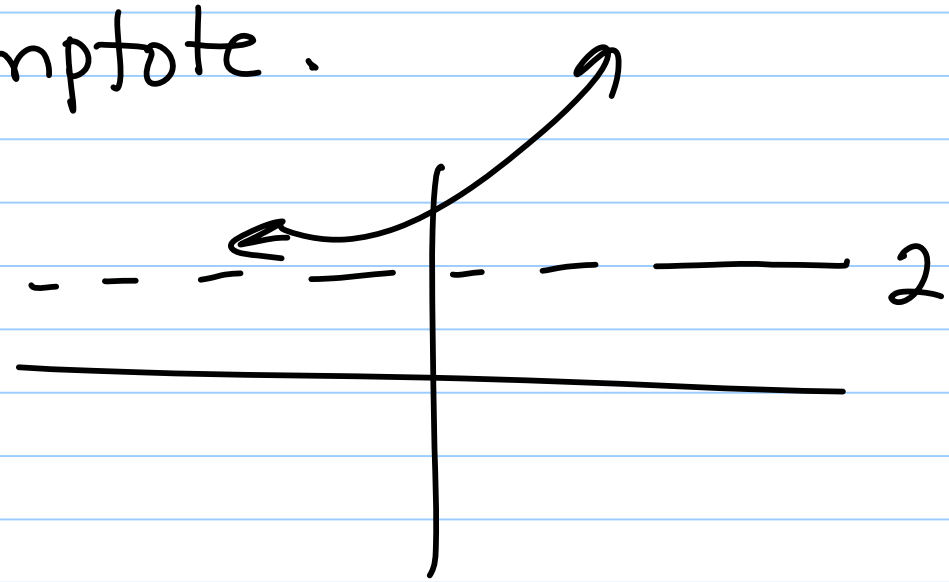
≈ 2.0000

b) What is $f(5/6)$? $7^{3\left(\frac{5}{6}\right)} + 2 = 7^{5/2} + 2$

≈ 131.6418

c) $f(x)$ has a horiz. asymptote at $\underline{y = 2}$.

d) As $x \to \boxed{-\infty}$, $f(x)$ approaches this asymptote.



A neat exponential function

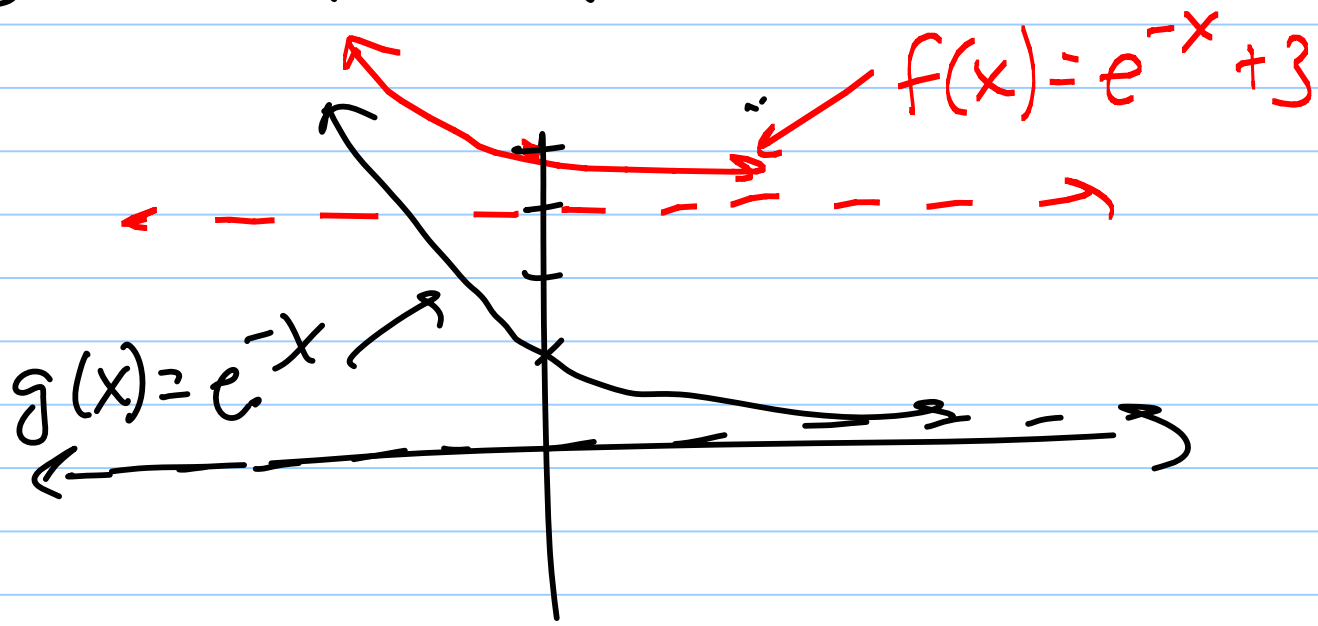
$$f(x) = e^{x}$$

e: Euler Number

$$e \approx 2.718281828459045\ldots$$

(How did I remember this....)

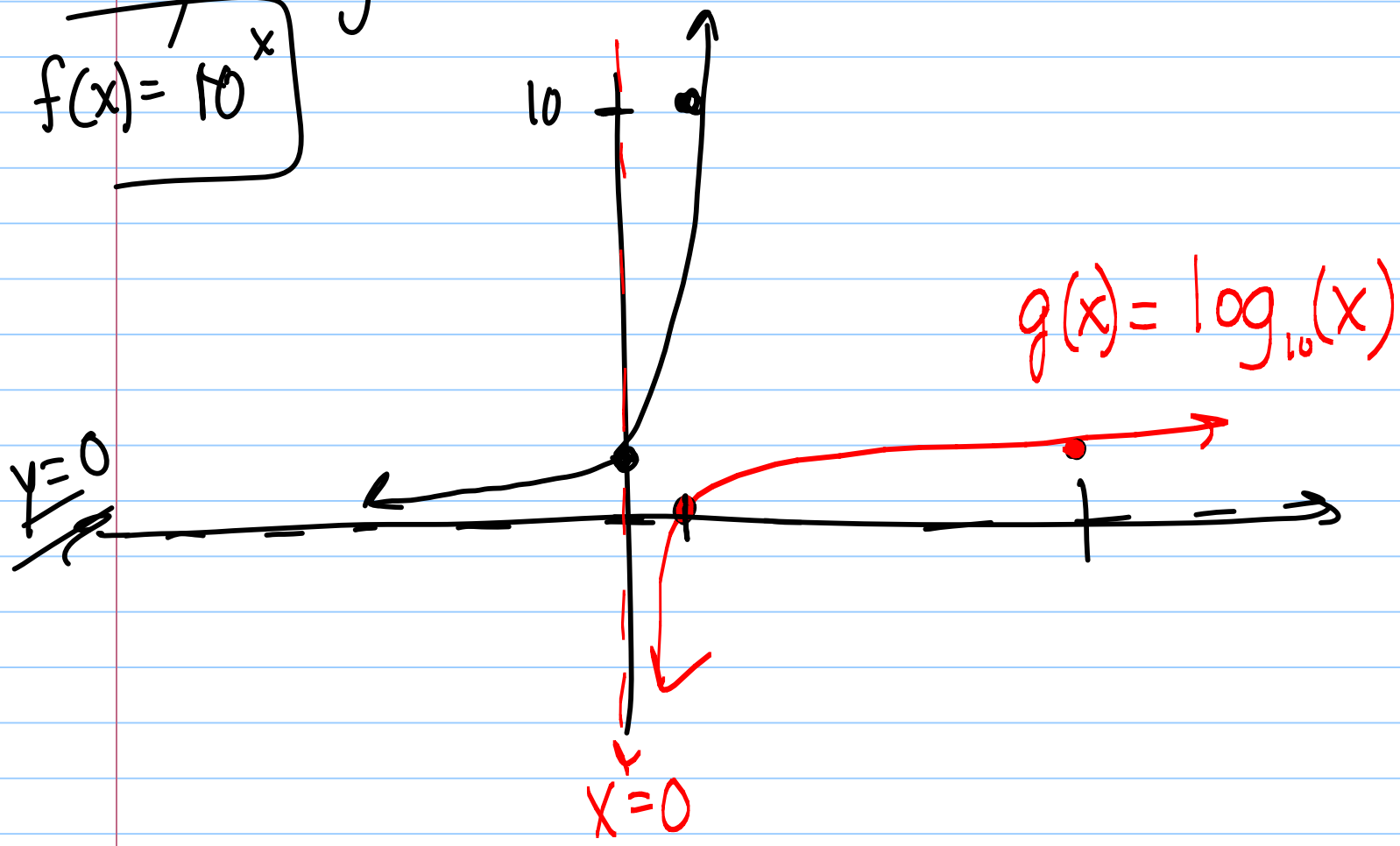
Ex) Graph $f(x) = e^{-x} + 3$



e^{3x} $\exp(3x)$

5.2 / Logarithmic Functions

$\boxed{f(x) = 10^x}$



$f(x) = 10^x$

Domain: All Real #'s

Range: $y > 0$

$g(x) = \log_{10}(x)$

Domain: $x > 0$

Range: All Real #'s

* One can only take the logarithm of a positive quantity.

* $f(x) = 10^x$ and $g(x) = \log_{10} x$ are inverses of each other

* When the base is e:
$f(x) = e^x$ and $g(x) = \ln x$ are inverses of each other

ln: natural logarithm (base e)

log: common logarithm: (base 10)

Ex) Find the domain of

$$g(x) = 2\ln(7-3x)$$

$$7-3x > 0$$

$$-3x > -7$$

Domain: $\boxed{x < 7/3}$

Ex) Find the domain of

$$h(x) = 3 + \log(x+2)$$

$$x+2 > 0$$

$$\boxed{x > -2}$$