Section 5.2: Exponential Functions and Graphs

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1:18 PM

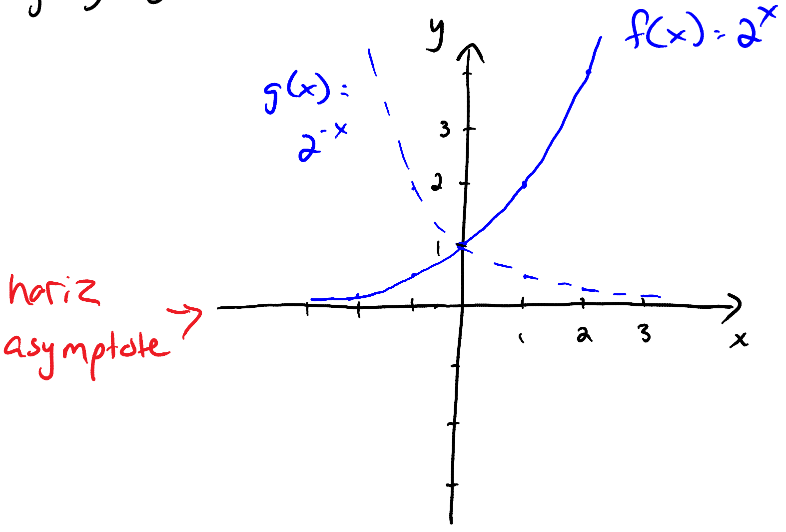
exponential function:

$f(x) = a^x$ where x is real

and a is a constant with $a > 0$ and $a \neq 1$

graph $f(x) = 2^x$ and $g(x) = 2^{-x}$

x	$y = 2^x$	$y = 2^{-x}$
-3	$1/8$	8
-2	$1/4$	4
-1	$1/2$	2
0	1	1
1	2	$1/2$
2	4	$1/4$
3	8	$1/8$



what about $h(x) = \left(\frac{1}{2}\right)^x$?

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

what would $y = 2^{x-1} + 3$ look like?

this is just $y = 2^x$ shifted to the right by 1 and up by 3 how about $y = -2^x$?

$\rightarrow$ flipped over x-axis

note: $-2^x \neq (-2)^x$

applications:

compound interest

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

where A = amount of investment / loan after time t

P = principal (amount of investment / loan at $t = 0$)

r = interest rate per year

n = number of compounding periods per year

t = time in years

example: An investment of \$1000 at 10% / year for 10 years is compounded monthly. What is the amount of the investment after the ten years have elapsed?

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

$$1000\left(1 + 0.1\right)^{12 \cdot 10}$$

$$= 1000\left(1 + \frac{0.1}{12}\right)^{10 \cdot 12}$$

$$= \$2707.04$$

notice on handout how the amount gets closer and closer to a certain value

there is a nice formula for that:

continuous compounding: $A = Pe^{rt}$

where e is a constant:

$$e = 2.718281828459045 2354 \ldots$$

irrational, like π and $\sqrt{2}$

calculator: e^1

$$e^{-0.67} = 0.511709$$

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digression:

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots$$

$$e = 1 + 1 + \frac{1}{2} + \frac{1}{6} + \cdots$$