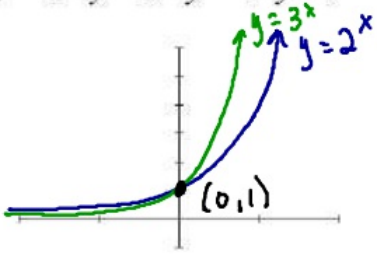
Sketch a graph of the following functions in the same viewing window [-2, 2] [-1, 6]

$y=2^x$ $y=3^x$ $y=4^x$ $y=5^x$



1) Determine the domain and range

D: $(-\infty, \infty)$

R: $(0, \infty)$

2) Is the function even, odd or neither

neither

3) Intervals of Increase or Decrease

$(-\infty, \infty)$

4) Find any extrema.

none

5) Determine the end behavior

$\lim_{x \to -\infty} f(x) = 0$ $\lim_{x \to \infty} f(x) = \infty$

6) Find any asymptotes

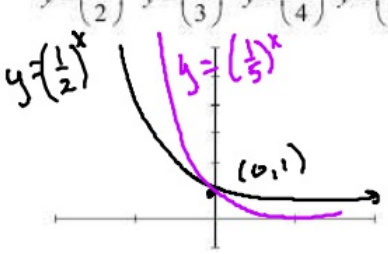
HA: $y=0$

7) Intervals of Concavity

up $(-\infty, \infty)$

$y=2^{-x}$ $y=3^{-x}$ $y=4^{-x}$

$y=\left(\frac{1}{2}\right)^x$ $y=\left(\frac{1}{3}\right)^x$ $y=\left(\frac{1}{4}\right)^x$ $y=\left(\frac{1}{5}\right)^x$



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up $(-\infty, \infty)$

Describe how to transform the graph of $\mathbf{f(x) = 2^x}$ into the graph of g

a) $g(x) = 2^{x-1}$

$g(x) = 2^{(x-1)}$

Right 1

b) $g(x) = 2^{-x}$

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

reflection over y-axis

c) $g(x) = 3 \cdot 2^x$

vertical stretch by a factor of 3

d) $g(x) = 2^{3-x}$

$g(x) = 2^{-x+3}$

$g(x) = 2^{3-x}$

reflection over y-axis

Right 3

Describe how to transform the graph of $\mathbf{f(x) = e^x}$ into the graph of g

$e = 2.718\ldots$

a) $g(x) = e^{4x}$

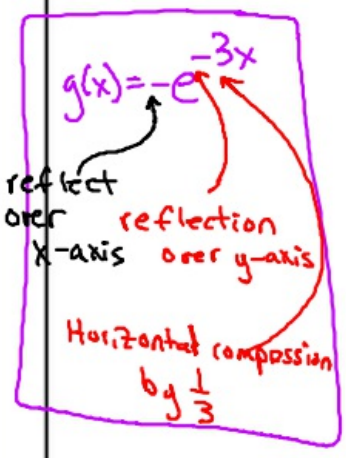
$g(x) = e^{4x}$

Horizontal Compression by a factor of $\frac{1}{4}$

b) $g(x) = e^{-4x}$

$g(x) = e^{-4x}$

reflection over y-axis



c) $g(x) = 3 \cdot e^x + 1$

vertical stretch by factor of 3

up 1

d) $g(x) = e^{2-2x}$

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

* reflection over y-axis

$g(x) = e^{2(1-x)}$

* Horizontal compression by factor of $\frac{1}{2}$

* Right 1

$\lim_{x\to-\infty} f(x) = \infty$ $\lim_{x\to\infty} f(x) = 0$

$\lim_{x\to-\infty} f(x) = 0$

$\lim_{x\to\infty} f(x) = \infty$

State whether the function is exponential growth or decay and describe its end behavior

$= 4^{-x}$ $f(x) = 4^{x}$

A) $f(x) = 2^{3x}$ B) $f(x) = 2^{-3x}$ C) $f(x) = \left(\frac{1}{4}\right)^{x}$ D) $f(x) = \left(\frac{1}{4}\right)^{-x}$

growth
- exp pos
- base > 1

Decay
- neg exp
- base > 1

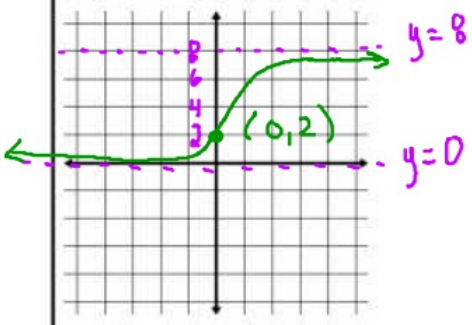
Decay
- pos exp
- base $0<b<1$

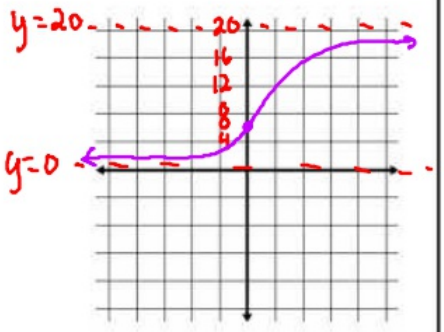
Growth
- neg exp
- base $0<b<1$

Graph the following functions on your calculator. Find the y-intercept and the horizontal asymptotes

Logistic Growth Functions

$f(x) = \frac{8}{1+3(0.7^{x})}$ $f(x) = \frac{20}{1+2(e^{-3x})}$





$f(0) = \frac{20}{1+2e^{0}} = \frac{20}{1+2} = \frac{20}{3}$