What is the difference between $f(x)=x^2$ and $f(x)=2^x$

3.1 Exponential Functions #33

$$y = a \cdot b^x \qquad a \neq 0,\ b \neq 1$$

$$b > 0$$

Used for growth and decay of: bacteria, carbon, populations

$y = a_0 \cdot b^x$

a_0 is the inital value

b is the base

$b > 1$ growth

$0 < b < 1$ decay

Identifying Exponential Equations

Identify which of the following are exponential functions and which are not. If they are state the initial value and the base.

$f(x) = 3^x$

$h(x) = -2 \cdot 1.5^x$

$g(x) = 6x^{-4}$

$q(x) = 5 \cdot 6^{\pi}$

Review of exponents

2^0

2^3

2^{-2}

$4 \bullet 2^3$

$5 \bullet 3^{-2}$

3^{-2x}

3^{-x}

$\frac{1}{4}^{-x}$

$\frac{1}{4}^{x}$

Write an equation for each table:

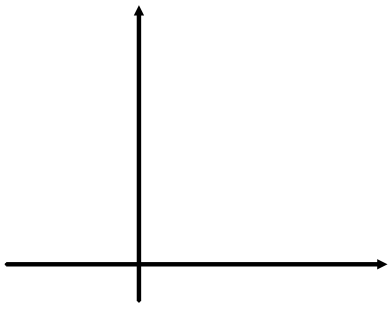
-2	4
-1	2
0	1
1	0.5
2	0.25
3	0.125

-2	0.222222
-1	0.6666
0	2
1	6
2	18

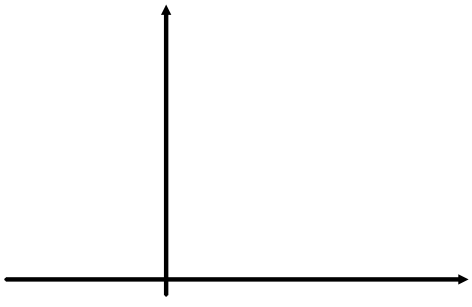
-2	27
-1	9
0	3
1	1
2	0.333
3	0.111

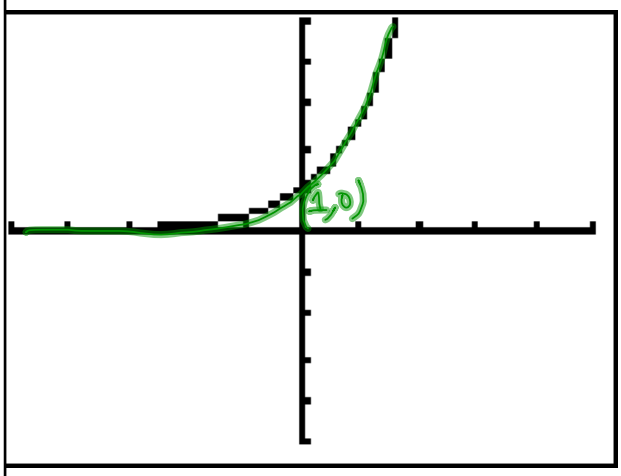
Growth and Decay

$b > 1$ growth



$0 < b < 1$ decay





Domain
Range
Continuous
Increasing
Decreasing
Constant
Left End
Right End
Symmetry
x-intercepts
y-intercepts
VA
HA
Bounded
Extrema

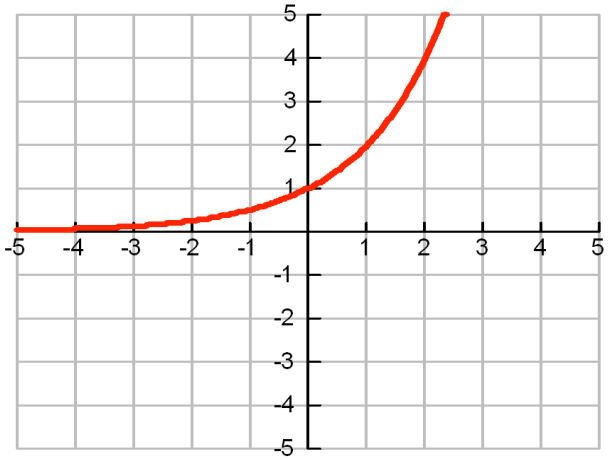
Graphs How does the initial value effect the graph?

How does the base effect the graph?

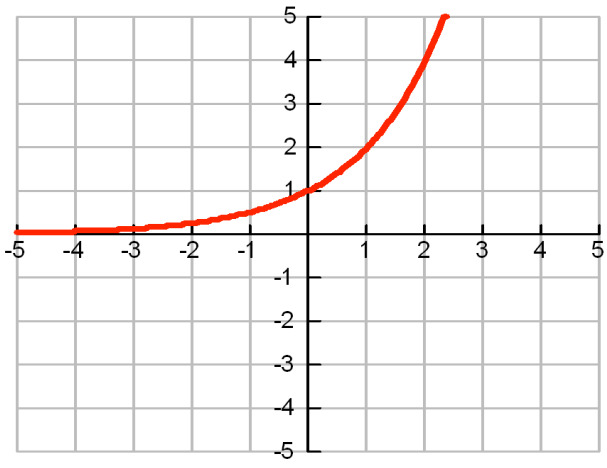
$f(x) = 2^x$

$f(x) = 3 \cdot 2^x$

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



$$f(x) = 2^x - 5$$



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

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

Transformations:

$$f(x) = 3 \cdot 4^{x-3}$$

$$f(x) = 4^{2x}$$

$$f(x) = 2 \cdot 4^{x+2} - 5$$

If the population of Salt Lake City in 1990 was 159,936 and in 2000 the population was 181,743. Assume the growth is exponential and find when the population will surpass 200,000.

"e" named for Euler

e = 2.71828281828459...

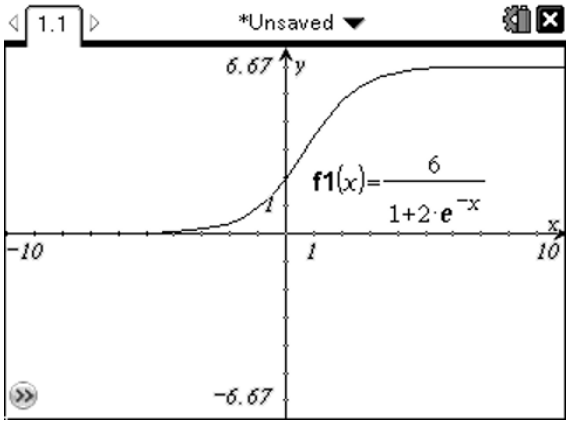
$f(x) = e^x$ natural exponential function

$$f(x) = 2 \cdot e^x$$

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

$$f(x) = \frac{1}{1+e^{-x}}$$

This is the type of function used for unsustainable growth or decay.



What was the population at time 0?

What was the population at t=5?

What is the max. sustainable pop.?