13-2: Exponential Functions

We have learned that the rate of change for an exponential pattern is a common factor, or a number that we multiply by to get from term to term.

Does the following table represent exponential behavior? Why or why not? yes

x	0	5	10	15	20	25
y	64	32	16	8	4	2

Exponential Function: $y = a \cdot b^x$ (y-int: a; rate of change: b)

- b is called the base and $b \neq 1$ and b > 0
- x is called the exponent and the exponent will always be a variable
- a is called the y-intercept and $a \neq 0$

- Examples: $y = 2(3)^x$ $\quad f(x) = 4^x$ $\quad y = \left(\frac{1}{2}\right)^x$

Evaluate the following functions

1. $y = 2(3)^x$ for x=0 and x= 2

$2(3)^0$ $\quad 2(3)^2$

$2 \cdot 1$ $\quad 2(9)$

$= 2$ $\quad = 18$

2. Find f(3) given $f(x) = 4^x$

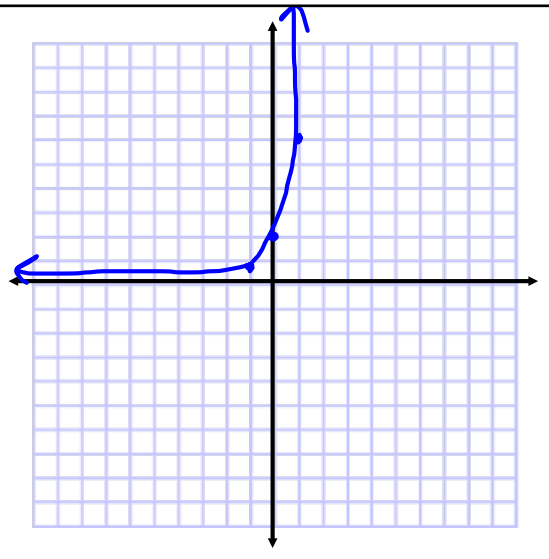
$f(3) = 4^3$

$= 64$

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

Graph $y = 2 \cdot 3^x$

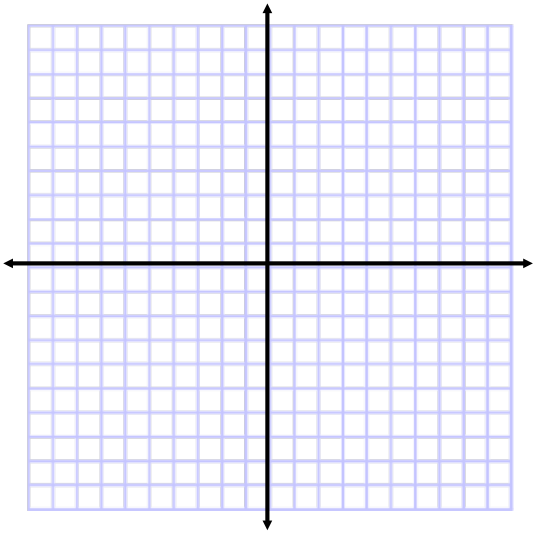
x	$y = 2 \cdot 3^x$	y
-1	$2 \cdot 3^{-1} = 2 \cdot \left(\frac{1}{3}\right)$	$\frac{2}{3}$
0	$2 \cdot 3^0 = 2 \cdot 1$	2
1	$2 \cdot 3^1 = 2 \cdot 3$	6



y-int: 2

y-intercept _____ Domain:_____ Range:_____

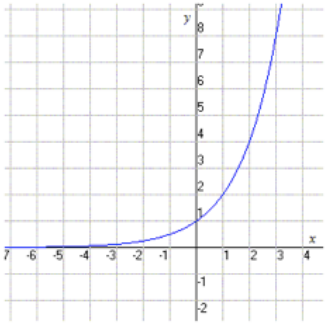
Graph $y=\left(\frac{1}{2}\right)^x-1$



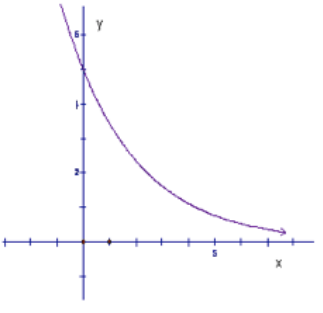
y-intercept _____ Domain:_____ Range:_____

Exponential equations are integral for the modeling of numerous real life applications. These applications come from manipulation of exponential growth and decay.

Exponential equations of the form $y=ab^x$ where $a>0$ and $b>1$ are called exponential GROWTH. We can see this in the graph because the graph grows or gets bigger from left to right.



Exponential equations of the form $y=a\cdot b^x$ where and $0<b<1$ are called exponential DECAY. We can see this in the graph because the graph Decays or gets smaller from left to right.



Example 1 : State whether the following equations are growth or decay

$y = 2 \cdot 3^x$ g

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

$y = \frac{3}{4} \cdot 5^x$ g Routy

$y = \frac{5}{3} \cdot \left(\frac{7}{4}\right)^x$ g

$y = 7 \cdot 0.8^x$ D

Exponential growth functions model important situations today such as:

a) The spread of viruses: _____

b) Human Population: _____

c) Nuclear Chain Reactions: _____

d) Economic Growth: _____

e) Finances: _____

f) Pyramid Schemes: _____

g) Processing power of Computers: _____

h) Internet traffic growth: _____

Exponential decay functions model important situations today such as:

a) Radioactivity: _____

b) Chemical Reactions: _____

c) Fluid Dynamics: _____

d) Pharmacology and Toxicology: _____

e) Electromagnetic radiation: _____

f) Heat Transfers: _____