Math 1

Exponential Functions

SWBAT graph exponential functions and determine all vertical shifts.

Introduction to Exponential Functions

Nyasia has been hired by a company that pays her 2 cents on the first day and then doubles her pay each day after the first.

a) Complete the chart to determine how much Nyasia makes, in cents, each day.

Day	1	2	3	4	5	6	10	30	50
Pay									

b) Write a formula to calculate the pay, p, as a function of day, d.

This is an example of an **exponential function** since the independent variable (days) is the **exponent**. Notice how fast the values of the pay are increasing. This is what is known as exponential growth.

Rules of Exponential Functions

Exponential Form: $y = a(b)^x + k$

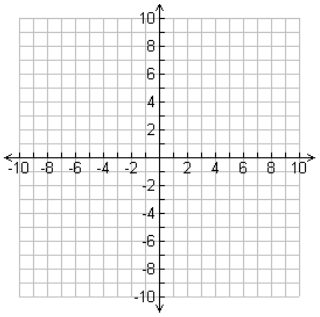
a = _____ or _____

b = Growth or Decay factor

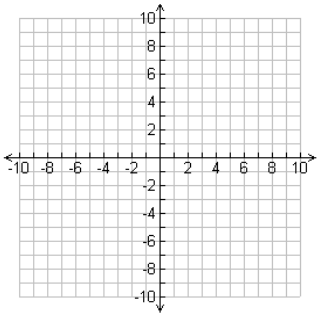
- Growth: _____
- Decay: _____

Key Point (y-intercept): _____

Exponential Growth



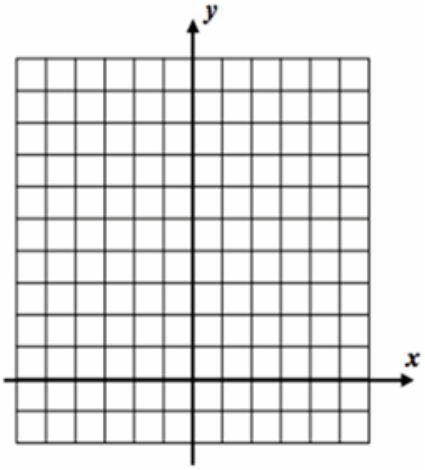
Exponential Decay



Graphing

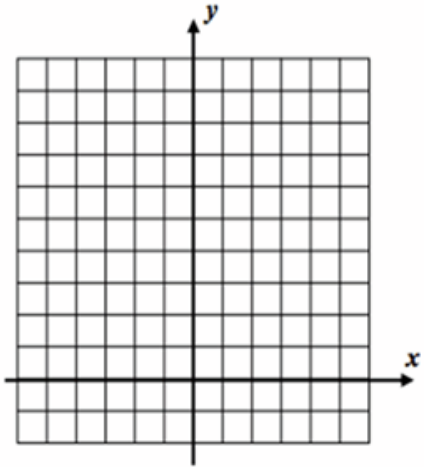
a) Consider the function $y = 2^x$

x	y
-3	
-2	
-1	
0	
1	
2	
3	



b) Consider the function $y = (1/2)^x$

x	y
-3	
-2	
-1	
0	
1	
2	
3	



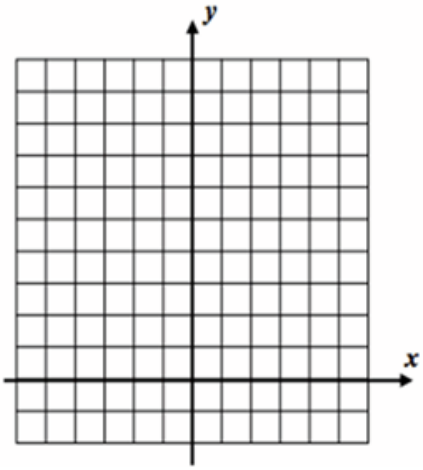
How do the two graphs compare to each other? What differences do you notice?

Graphing Vertical Shifts: All exponentials run through the point (0, 1) unless they have been vertically shifted.

a) Graph the function $f(x) = 2^x + 3$

Asymptote: _____

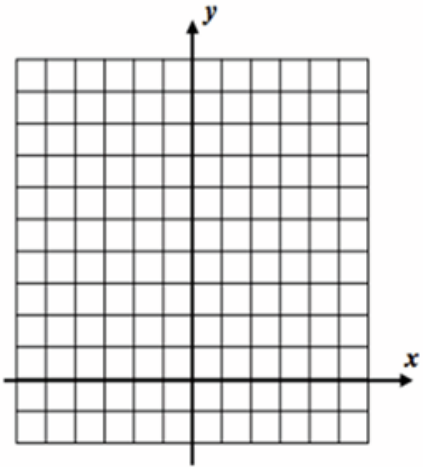
x	y
-1	
0	
1	
2	
3	
4	
5	



b) Graph the function $f(x) = 2^x - 1$

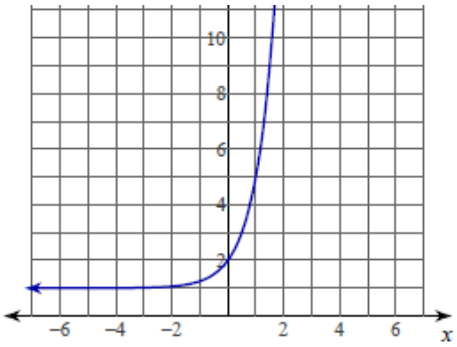
Asymptote: _____

x	y
-1	
0	
1	
2	
3	
4	
5	

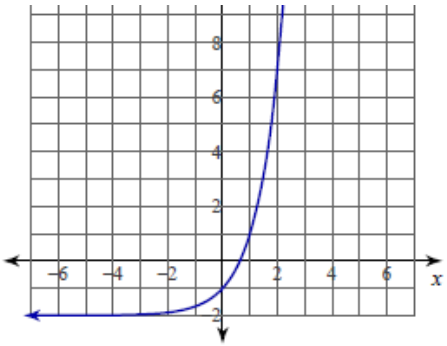


Vertical Shift EOC-Type Questions (non-calculator)

a) The function $f(x) = 4^x$ was replaced with $f(x) + k$, resulting in the function graphed to the right. What is the value of k?



b) The function $f(x) = 3^x$ was replaced with $f(x) + k$, resulting in the function graphed to the right. What is the value of k?



Determining Whether a Function is Exponential

Does the table or rule represent an exponential function? Explain.

a)

x	1	2	3	4
y	×1	1	3	5

b)

x	0	1	2	3
y	−1	−3	−9	−27

c) $y = 3x^2$

d) $y = 3 \cdot 6^x$

Evaluating an Exponential Function

Suppose 30 flour beetles are left undisturbed in a warehouse bin. The beetle population doubles each week. The function $f(x) = 30(2)^x$ give the population after x weeks. How many beetles will there be after 56 days?

An initial population of 20 rabbits triples every half year. The function $f(x) = 20(3)^x$ gives the population after x half-year periods. How many rabbits will there be after 3 years?

An investment of $5000 doubles in value every decade. How much is the investment worth after 30 years?

A population of 75 foxes in a wildlife preserve quadruples in size every 15 year. How many foxes will there be after 45 years?