Welcome! Happy Friday!!

-All cell phones in holder at front.

Unit 6 Exponential Functions

Exponential Growth and Decay

General Formula: $y = a b^{x-h} + k$ $y = ab^x$

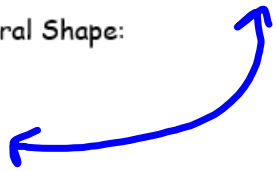
b = base

When the base is: $b > 1$,

the graph is: growth

This means it increases over the entire interval

General Shape:



When the base is: $0 < b < 1$,

the graph is: decay

This means it decreases over the entire interval

General Shape:

Examples: State whether the given is exponential growth or decay.

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

Growth

2. $f(x) = 4(.2)^x$

Decay

3. $f(x) = 3\left(\frac{4}{3}\right)^{x-3}$

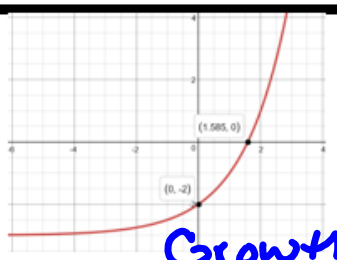
Growth

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

$-1 \cdot 5^x - 2$

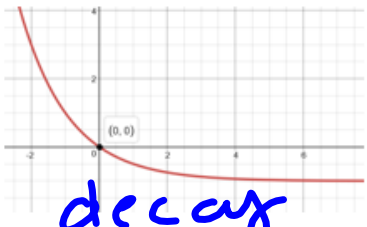
Growth

5.



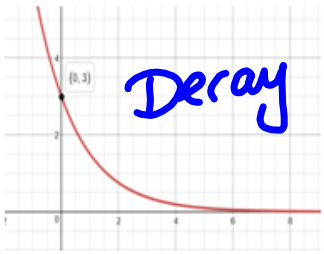
Growth

6.



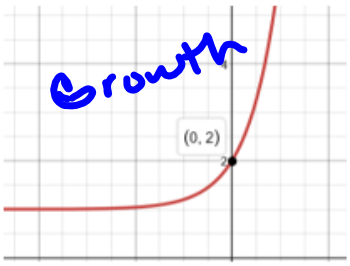
decay

7.



Decay

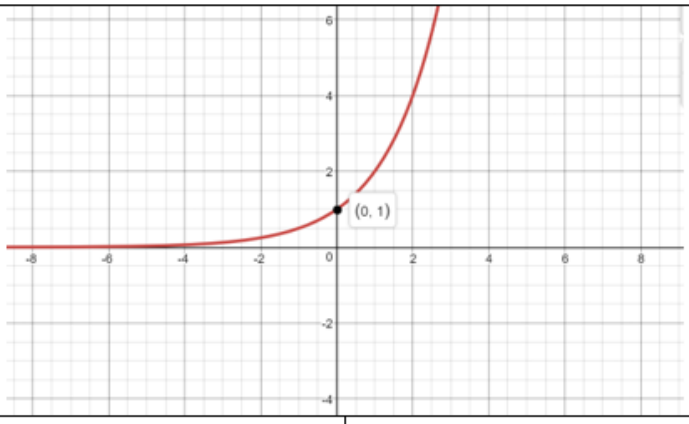
8.



Growth

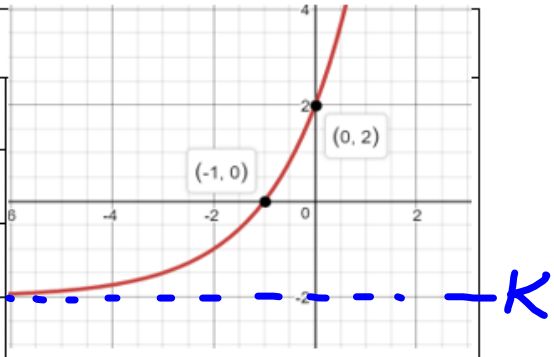
Characteristic of Exponentials

$f(x) = 2^x$



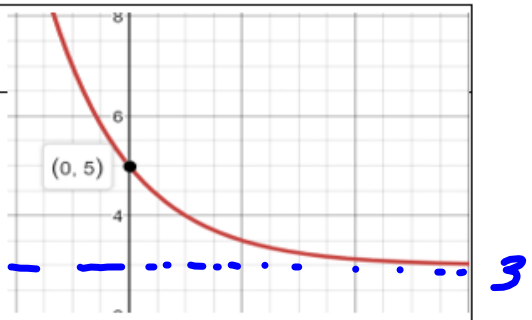
Domain: Set of all x value Should be all real numbers	Range: Set of all y values Will be y > k or y < k
x-intercept: Where graph crosses the x axis. Need to solve equations (x , 0)	y-intercept: Where the graph crosses the y-intercept Plug in 0 for x and simplify (0,y)
Interval of Increase: When the graph goes up.	Interval of Decrease: When the graph goes down.
Asymptote: The LINE the graph approaches but does not cross. *should be written as a line Horizontal: y = k	End Behavior: $x \to -\infty, f(x) \to$ _____ Left $x \to \infty, f(x) \to$ _____ Right K, ∞, -∞

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



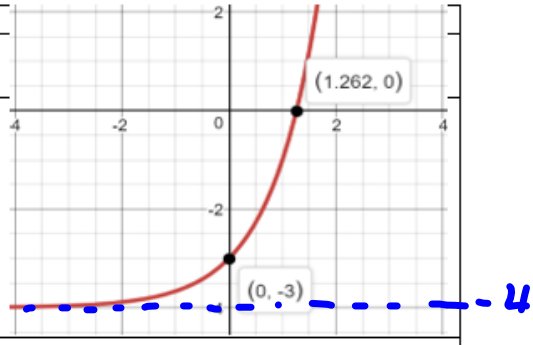
Domain: $\mathbb{R}$	
Range: $y > -2$	
x-intercept: $(-1, 0)$	
y-intercept: $(0, 2)$	
Interval of Increase: $(-\infty, \infty)$	**Interval of Decrease:** None
Asymptote: $y = -2$	**End Behavior:** $x \to -\infty, f(x) \to -2$; $x \to \infty, f(x) \to \infty$

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



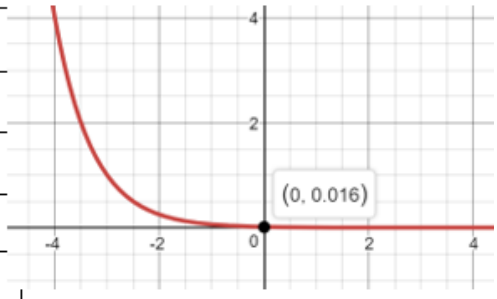
Domain: R	
Range: $y > 3$	
x-intercept: None	
y-intercept: (0,5)	
Interval of Increase: None	Interval of Decrease: $(-\infty, \infty)$
Asymptote: $y = 3$	End Behavior: $x \to -\infty, f(x) \to \infty$ $x \to \infty, f(x) \to 3$

$f(x) = 3^x - 4$



Domain: $\mathbb{R}$	
Range: $y > -4$	
x-intercept: $(1.262, 0)$	
y-intercept: $(0, -3)$	
Interval of Increase: $(-\infty, \infty)$	**Interval of Decrease:** None
Asymptote: $y = -4$	**End Behavior:** $x \to -\infty, f(x) \to -4$ $x \to \infty, f(x) \to \infty$

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



Domain: $\mathbb{R}$

Range: $y > 0$

x-intercept: (None

y-intercept: (0, 0.016)

Interval of Increase: None

Interval of Decrease: $(-\infty, \infty)$

Asymptote: $y = 0$

End Behavior:

$x \to -\infty, f(x) \to \infty$

$x \to \infty, f(x) \to 0$

Exponential Graphing and Transformations

Parent Function is $f(x) = b^x$

Transformation:	Will appear:	Description:
Reflection	$f(x) = -b^x$	Vertical Reflection across the x-axis
	$f(x) = b^{-x}$	Horizontal Reflection across the y-axis
Horizontal Shift	$f(x) = b^{x+h}$	Horizontal Shift left by h.
	$f(x) = b^{x-h}$	Horizontal Shift Right by h.
Vertical Shift	$f(x) = b^x + k$	Vertical Shift up by k.
	$f(x) = b^x - k$	Vertical Shift down by k.

Example # 1: Identify the transformations for the functions below.

$f(x) = -2 \cdot 4^{x+2} - 6$			
Vertical Reflection?	**Horizontal Reflection?**	**Horizontal Shift: Direction? How many?**	**Vertical Shift: Direction? How many?**
Yes	No	Left 2	down 6

Example # 2: Identify the transformations for the functions below.

$f(x) = 2^{-x} + 4$			
Vertical Reflection?	**Horizontal Reflection?**	**Horizontal Shift: Direction? How many?**	**Vertical Shift: Direction? How many?**
No	Yes	None	up 4

Graphing Exponential Functions:

Step 1: Create the points (0, a) and (1, ab).

Step 2: State and graph the asymptote (y = k).

Step 3: Plot the points from Step 1 and move based on the transformations.

Step 4: Connect the points with a smooth curve.

Example # 3: Graph the function using transformations.

$$y = 3 \cdot 2^x$$

Step 1: Create the points (0, 3) and (1, 6).
a ab

Step 2: State & graph the asymptote (y = 0).
k

Step 3: Plot the points from Step 1 and move based on the transformations.

Vertical Reflection?	Horizontal Reflection?	Horizontal Shift: Direction? How many?	Vertical Shift: Direction? How many?
NO	NO	NO	NO