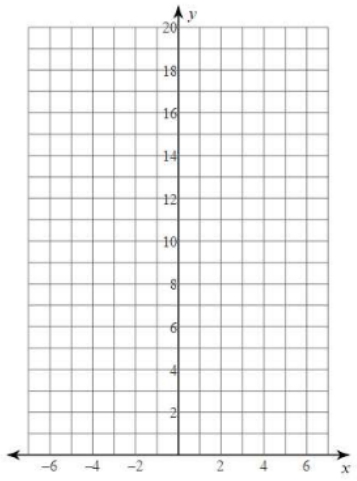
Good morning!

1. "Here"
2. Discuss homework/DeltaMath
3. Notes on Characteristics of Exponentials
4. Review for quiz that opens today:)

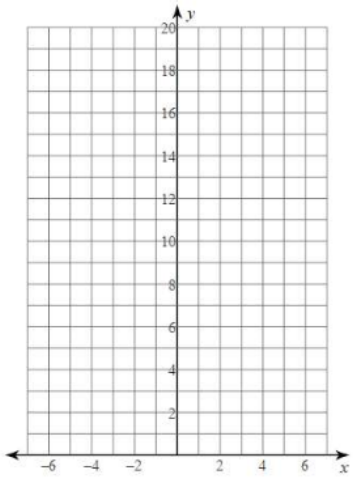

TODAY WE CONTINUE
GRAPHING EXPONENTIAL FUNCTIONS.

Graphing Exponentials Practice

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



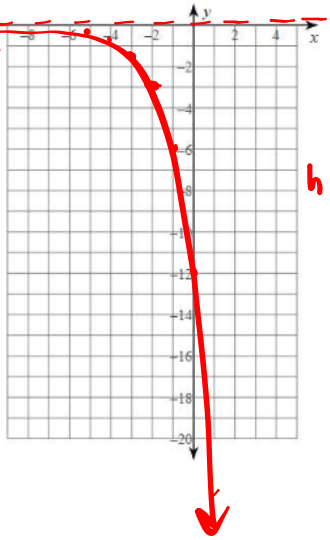
2) $y = \frac{1}{4} \cdot 3^x$



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

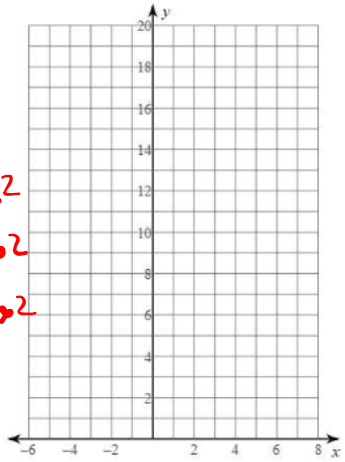
a = -3 h = -2
b = 2 (k = 0 asymptote)

y = 0

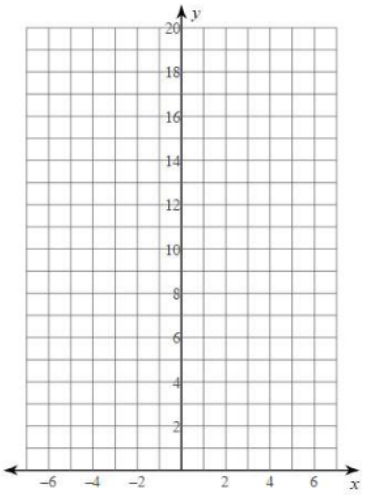


x	y	
-5	-.375	
-4	-.75	
-3	-1.5	
h -2	-3	×2
-1	-6	×2
0	-12	×2
1	-24	

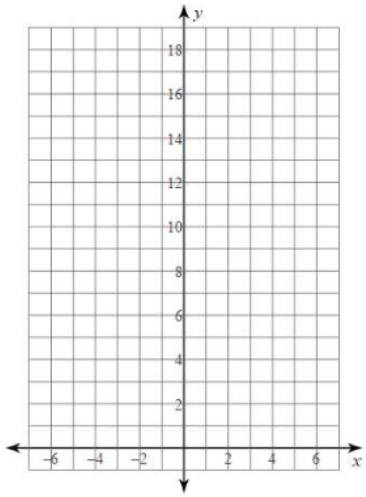
4) $y = 5 \cdot 2^{x-1}$



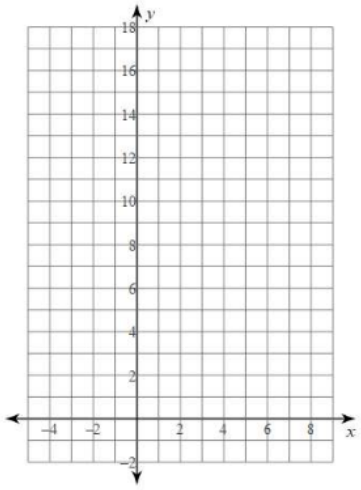
5) $y = 4 \cdot 2^x + 2$



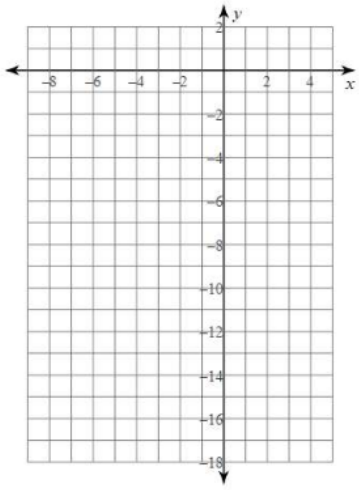
6) $y = 3(2)^x - 1$



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



8) $y = -5 \cdot \left(\frac{1}{2}\right)^{x+2} + 2$



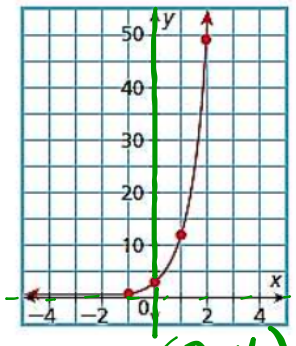
$y = a(b)^{(x-h)} + k$

Characteristics of Exponential Functions

Y-Intercepts and Asymptotes

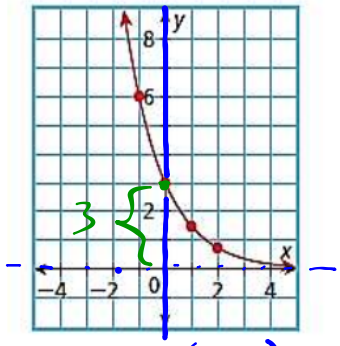
Y-Intercept		
Define: Point where the graph crosses the y-axis	**Think:** At what coordinate point does the graph cross the y-axis?	**Write:** (0, #) *look at graph or plug in 0 for x*
Asymptotes		
Define: A line that the graph get closer and closer to, but never touches or crosses.	**Define:** A line that the graph get closer and closer to, but never touches or crosses.	**Define:** A line that the graph get closer and closer to, but never touches or crosses.

$y = k$



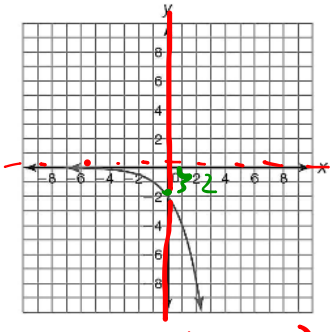
Y-intercept: (0,4)

Asymptote: $y = 0$



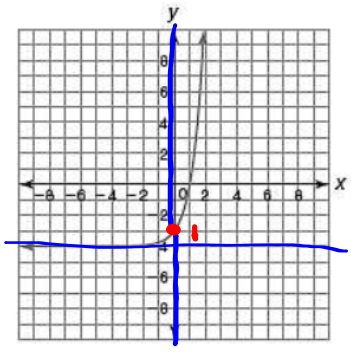
Y-intercept: (0,3)

Asymptote: $y = 0$



Y-intercept: (0,-2)

Asymptote: $Y = 0$

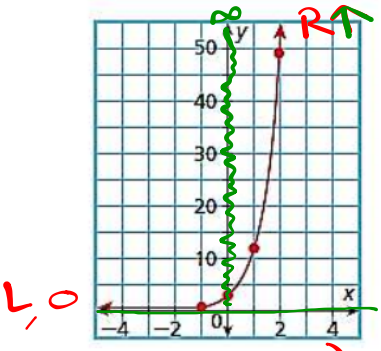


Y-intercept: (0,-3)

Asymptote: $y = -4$

Domain and Range

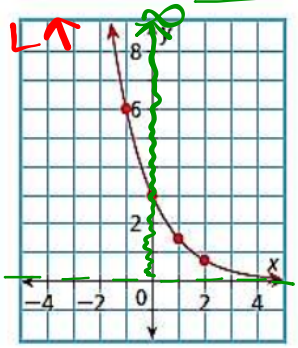
Domain		
Define: All possible values of x	**Think:** How far left to right does the graph go?	**Write:** $(-\infty, \infty)$ OR all real numbers
Range		
Define: All possible values of y	**Think:** How far down to how far up does the graph go?	**Write:** (#, #) *(lowest y value, highest y value)* *will involve the asymptote and ∞ or -∞*



L, 0 R ↑

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

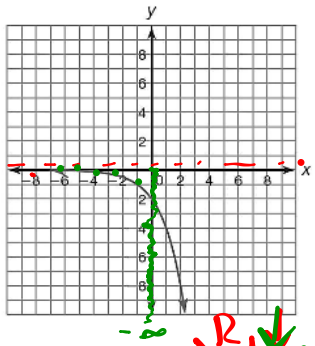
Range: $(0, \infty)$



L ↑ R, 0

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

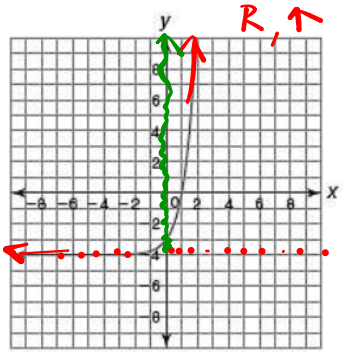
Range: $(0, \infty)$



L, 0 R, ↓

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

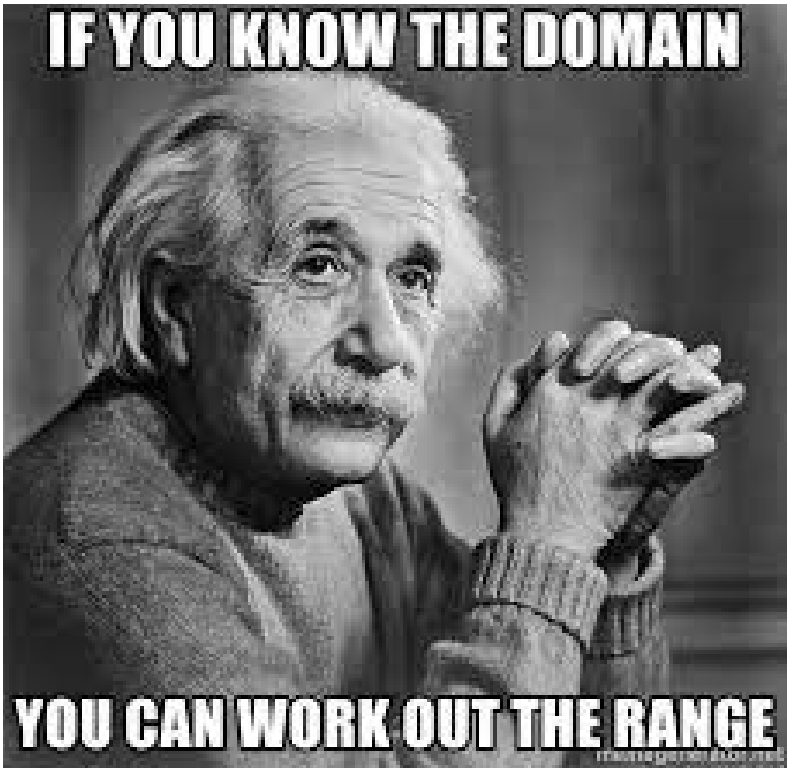
Range: $(-\infty, 0)$



L, -4 R, ↑

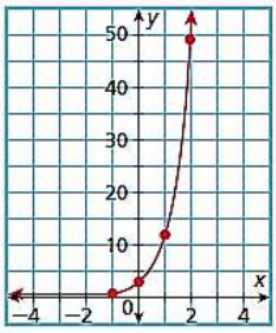
Domain: $(-\infty, \infty)$

Range: $(-4, \infty)$


IF YOU KNOW THE DOMAIN
YOU CAN WORK OUT THE RANGE

Intervals of Increase and Decrease

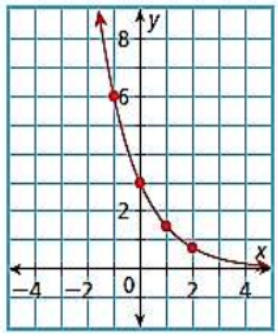
Interval of Increase		
Define: The part of the graph that is rising as you read left to right.	**Think:** From left to right, is my graph going up?	**Write:** Same as the domain or none
Interval of Decrease		
Define: The part of the graph that is falling as you read from left to right.	**Think:** From left to right, is my graph going down?	**Write:** Same as the domain or none
Exponential functions are either increasing or decreasing – they can't be both. Write none for whichever it is not.		



$-\infty$ ∞

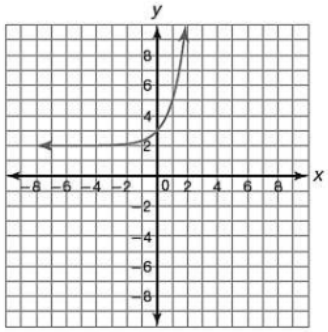
Interval of Increase: $(-\infty, \infty)$

Interval of Decrease: none



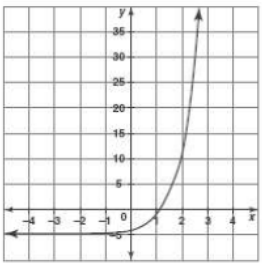
Interval of Increase: none

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



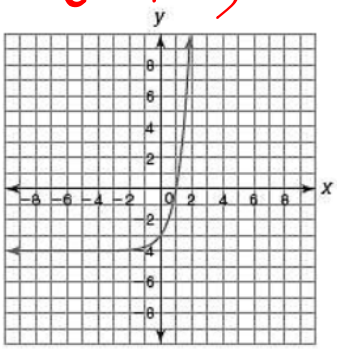
Interval of Increase: $(-\infty, \infty)$

Interval of Decrease: none



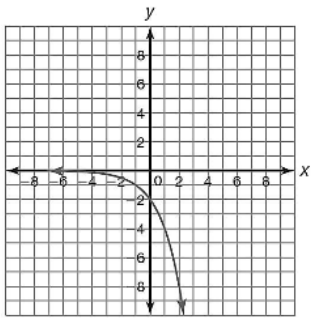
Interval of Increase: $(-\infty, \infty)$

Interval of Decrease: none



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

Interval of Decrease: none

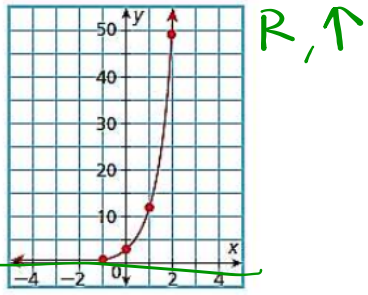


Interval of Increase: none

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

End Behavior

End Behavior	
Define: Behavior of the ends of the function (what happens to the y-values or f(x)) as x approaches positive or negative infinity. The arrows indicate the function goes on forever so we want to know where those ends go.	
Think: As x goes to the left (negative infinity), what direction does the left arrow go?	**Write:** As x → -∞, f(x) → _____ *will be ∞, -∞, or asymptote*
Think: As x goes to the right (positive infinity), what direction does the right arrow go?	**Write:** As x → ∞, f(x) → _____ *will be ∞, -∞, or asymptote*

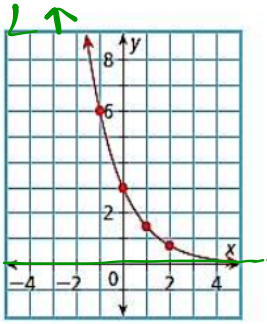


R, ↑

L, O

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

As $x \to \infty, f(x) \to$ ∞



L ↑

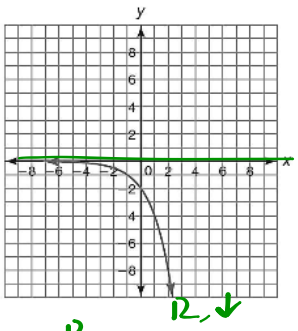
R, O

R

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

L

As $x \to -\infty, f(x) \to$ ∞



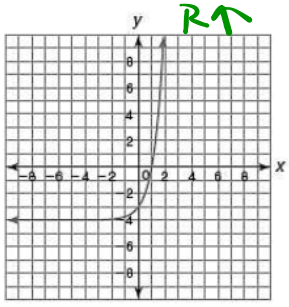
L, O

R, ↓

R

As $x \to \infty, f(x) \to$ -∞

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



L, -4

R ↑

L

As $x \to -\infty, f(x) \to$ -4

R

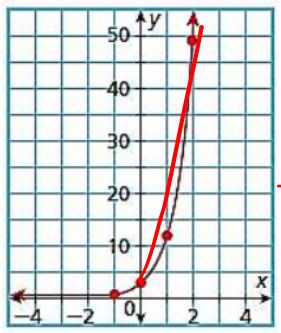
As $x \to \infty, f(x) \to$ ∞

Average Rate of Change (From a Graph)

Average Rate of Change: Rate of change or slope for a given interval on a graph. The given interval is written using the inequality notation $a \le x \le b$, where a and b represent the initial and final x-value of the interval. **Find the two points based on given x values and then use the slope formula.**

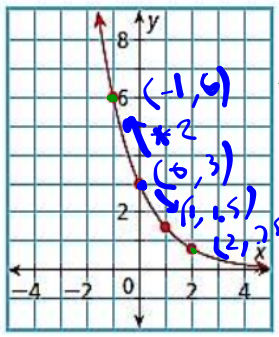
"Slope" $m = AROC = \frac{y_2 - y_1}{x_2 - x_1} = \frac{RISE}{RUN} = \frac{\Delta y}{\Delta x}$

Calculate the average rate of change for the interval $0 \le x \le 2$.



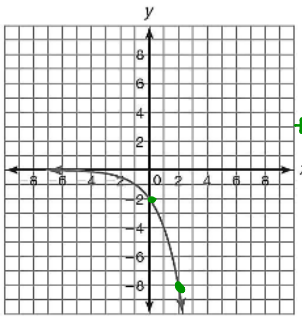
x_1 x_2 (2, 48) (0, 4) +2 +44 AROC $= \frac{44}{2} = 22$

Calculate the average rate of change for the interval $-1 \le x \le 2$.



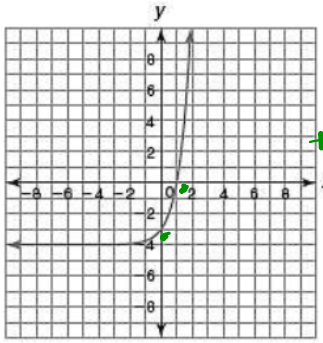
(−1, 6) (2, .75) +3 −5.25 AROC $= \frac{-5.25}{3} = -1.75$

Calculate the average rate of change for the interval $0 \le x \le 2$.



(0, −2) (2, −8) +2 −6 AROC $= \frac{-6}{2} = -3$

Calculate the average rate of change for the interval $0 \le x \le 1$.



(0, −3) (1, 0) +1 +3 AROC $= \frac{3}{1} = 3$

Average Rate of Change (From an Equation)

If you are given an equation of a function and asked to calculate the average rate of change for that function over a given interval, you will substitute the initial x-value and the final x-value into the function to create two sets of ordered pairs. Then using the ordered pairs, substitute into the slope formula.

a. $y = 3^x$; $1 \le x \le 3$

x	y
1	$3^1 = 3$
3	$3^3 = 27$

+2 +24 AROC $= \frac{24}{2} = 12$

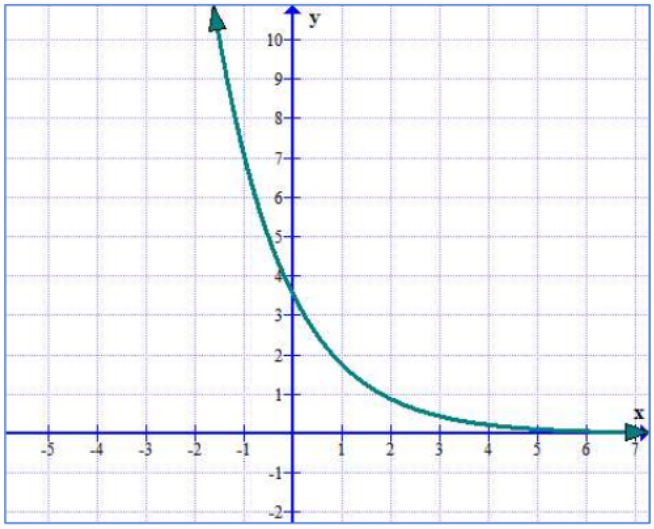
b. $y = 2\left(\frac{1}{2}\right)^x$; $-4 \le x \le 0$ $2\left(\frac{1}{2}\right)^0 = 2(1) = 2$

x	y
−4	32
0	2 ✓

+4 −30 AROC $= \frac{-30}{4} = -7.5$

$2\left(\frac{1}{2}\right)^{-4} = 2(2)^4 = 2(16) = 32$

Characteristics Practice



Domain:

Range:

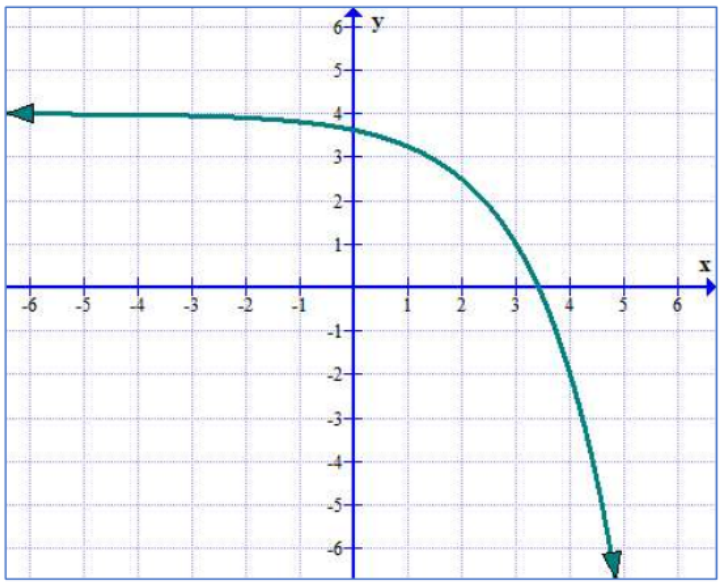
Y-Intercept:

Asymptote:

Interval of Increase:

Interval of Decrease:

Average Rate of Change over [-1, 3] As $x \to \infty, f(x) \to$ ____ As $x \to -\infty, f(x) \to$ ____



Domain:

Range:

Y-Intercept:

Asymptote:

Interval of Increase:

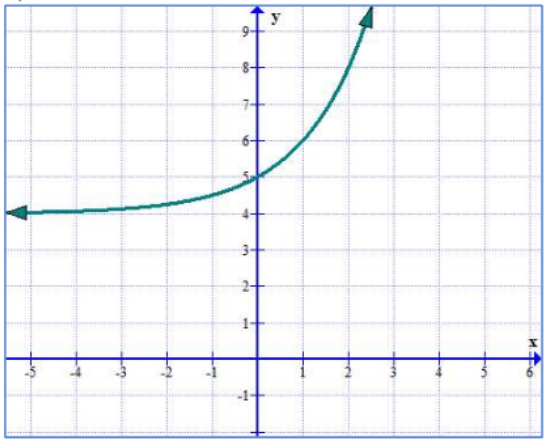
Interval of Decrease:

Average Rate of Change over [1, 4] As $x \to \infty, f(x) \to$ ____ As $x \to -\infty, f(x) \to$ ____

Characteristics of Exponentials – Matching

A: $(0, 4)$	B: $(0, 5)$	C: $(1.5, 0)$	D: $(0, -1.5)$	E: $(0, -3.5)$
F: $y = 6$	G: $y = 5$	H: $y = 4$	I: $y = 0$	J: $y = -2$
K: $y = -1.5$	L: $(-\infty, \infty)$	M: $(-\infty, -1.5)$	N: $(-\infty, -3.5)$	O: $(-\infty, 0)$
P: $(-\infty, 6)$	Q: $(6, \infty)$	R: $(1.5, \infty)$	S: $(-\infty, 4)$	T: $(4, \infty)$

1)

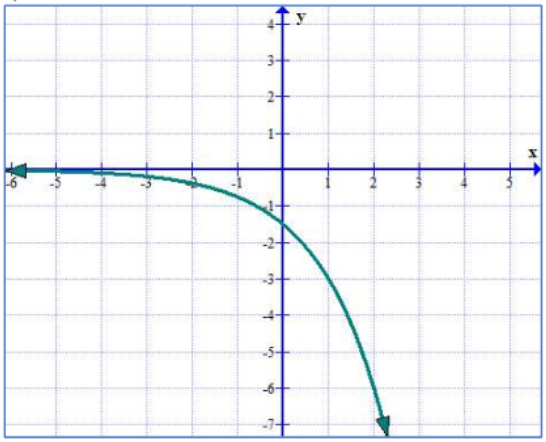


Range:

Y-Int:

Asymptote:

2)

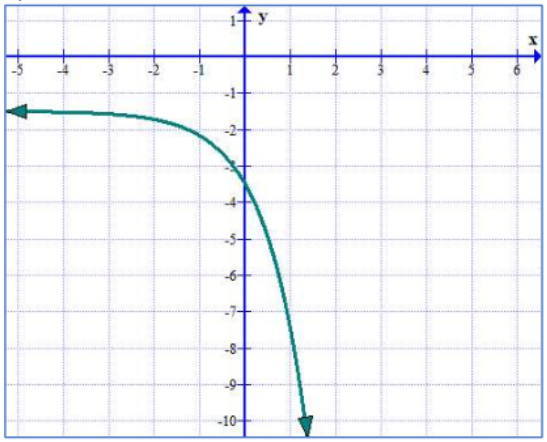


Range:

Y-Int:

Asymptote:

3)

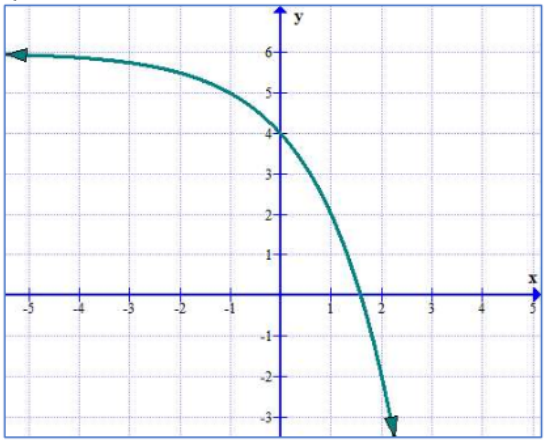


Range:

Y-Int:

Asymptote:

4)



Range:

Y-Int:

Asymptote:

Algebra 1 Name:
Unit 3 – Quiz Review

Given the parent function $f(x) = 3^x$, identify the transformations that have occurred for each of the following functions.

1) $g(x) = -2 \cdot 3^x - 5$

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

3) $g(x) = 2 \cdot 3^{(x+5)} + 7$

4) $g(x) = -\frac{1}{2} \cdot 3^{(x-4)} - 2$

✓ ✓ ✓ ✓

a: a<0 : V. reflection
|a|<1 : V. shrink
h: H. shift 4 right
k: -2 V. shift down 2

For each function below, determine whether it is an example of exponential growth or exponential decay. Also name the asymptote and y-intercept.

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

exponential growth or exponential decay

asymptote: _____

y-intercept: _____

6) $f(x) = \frac{3}{2} \cdot \frac{1}{2}^{x} + 4$

exponential growth or exponential decay

asymptote: _____

y-intercept: _____

7) $f(x) = -2 \cdot 3^{x+1} - 5$

exponential growth or exponential decay

asymptote: $y = -5$

y-intercept: $-2(3)^{0+1} - 5 = -11$

$-2(3)^1 - 5$

$-6 - 5 =$

8) $f(x) = 4^x + 1$

exponential growth or exponential decay

asymptote: _____

y-intercept: _____

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

exponential growth or exponential decay

asymptote: _____

y-intercept: _____

10) $f(x) = 4\left(\frac{1}{3}\right)^{x-2}$

exponential growth or exponential decay

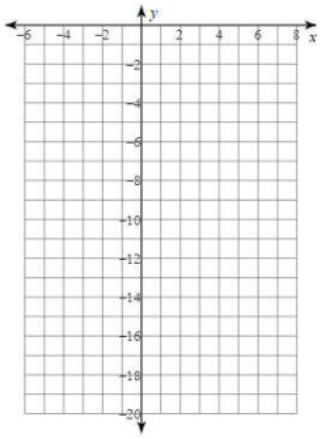
asymptote: _____

y-intercept: _____

Graph the following exponential functions.

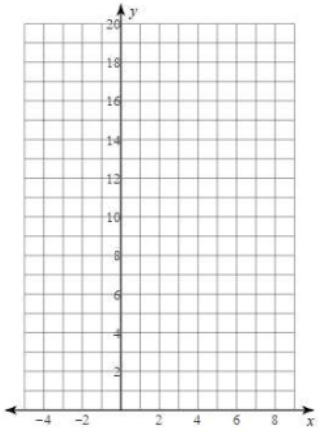
11) $y = -3\left(\frac{1}{2}\right)^{x-1} - 1$

x	y



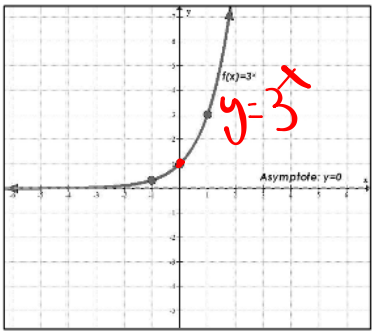
12) $y = 3^{x-2} + 1$

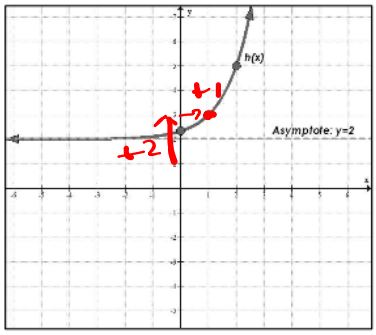
x	y



Identify the transformations that have occurred from the graph of the parent function to the graph of the new transformed function. Then, write the equation.

13)





Transformations:

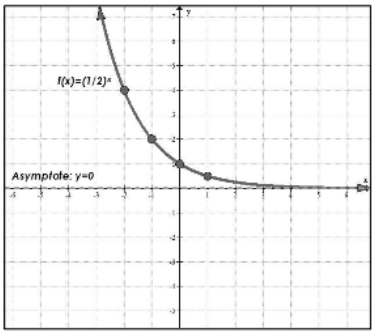
h = 1 Right 1

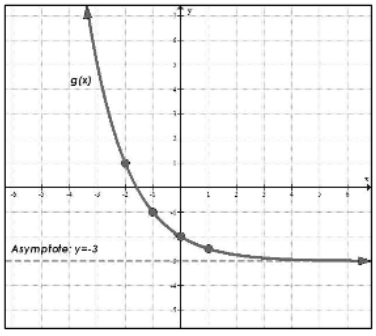
k = 2 up 2

New Equation:

$y = 1(3)^{x-1} + 2$

14)



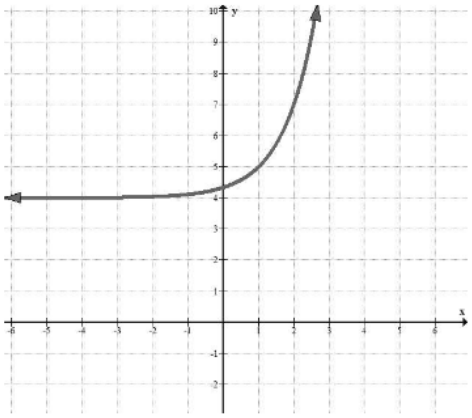


Transformations:

New Equation:

Identify the characteristics of the following exponential functions.

15)



Domain: _____

Range: _____

Asymptote: _____

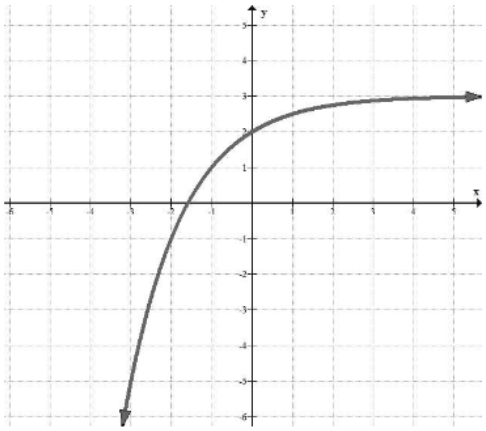
As $x \to -\infty, f(x) \to$____

As $x \to \infty, f(x) \to$____

Interval of Increase: _____

Interval of Decrease: _____

16)



Domain: _____

Range: _____

Asymptote: _____

Y-Intercept: _____

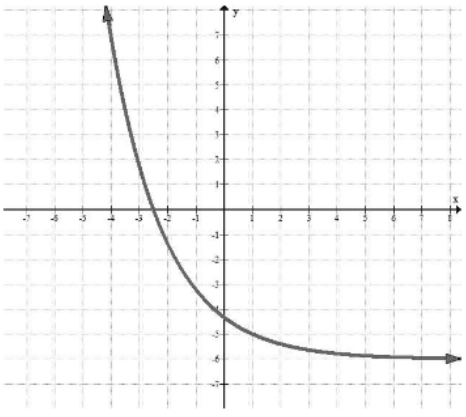
As $x \to -\infty, f(x) \to$____

As $x \to \infty, f(x) \to$____

Interval of Increase: _____

Interval of Decrease: _____

17)



Domain: _____

Range: _____

Asymptote: _____

Y-Intercept: _____

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

As $x \to \infty, f(x) \to$____

Interval of Increase: _____

Interval of Decrease: _____