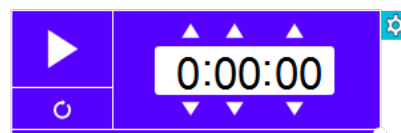# Warm-Up   3/21/18

0:00:00

- Pick up both papers on the front desk
- Grab an i-respond
- Have Day 2 HW on your desk
- Answer 5 questions on the Quick Checks: Start with Y-intercept & Asymptote (#1-3), and Transformations (# 4-5).

Quick Check 3/21/18

1. What is the asymptote of the function: $f(x) = (1/3)^x - 2$?

    A. $y = 2$
    B. $x = 0$
    C. $y = -2$
    D. $x = 1/3$

2. What is the asymptote of the graph of the function $f(x) = 2(½)^x$?

    A. $y = 2$
    B. $x = 0$
    C. $y = -2$
    D. $y = 0$

3. What is the y-intercept of the function whose equation is $y = 2(3)^x$?

    A. 1
    B. 3
    C. 6
    D. 2

$$2(3)^0 = 2(1) = 2$$

$+4$

1. Which of the following equations represents a reflection over the x-axis, horizontal shift left 4 units, vertical shift up 8 units, and a shrink from the parent function $f(x) = 2^x$?

$+8$

   A. $f(x) = 2^{x-4} - 8$
   B. $f(x) = -3/4 \, (2)^{\,x-4} + 8$
   C. $f(x) = -3/4 \, (2)^{x+4} + 8$
   D. $f(x) = -5(2)^{x+4} + 8$

2. Given $f(x) = 3^x$ and $g(x) = -2(3)^x + 4$, describe the transformations performed on $f(x)$ to get $g(x)$.

   A. Vertical Shrink by a factor of -2, Vertical Shift up 4
   B. Reflection over the x-axis, Vertical Stretch by a factor of 2, Vertical Shift up 4
   C. Reflection over the x-axis, Vertical Stretch by a factor of 2, Vertical Shift down 4
   D. Reflection over the x-axis, Vertical Shrink by a factor of ½, Vertical Shift up 4

Home Work Review   3/21/18

Day 2 Transformations

Bring out your HW!

0:00:00
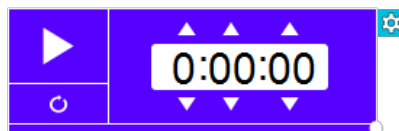
Day 2: Transforming Exponential Functions Practice (h & k)

Directions: Describe the transformations from the given function to the transformed function. Then name the y-intercept and asymptote.

1. $f(x) = 2^x \rightarrow f(x) = 2^{x-2}$

Transformations:

Y-intercept:

Asymptote:

2. $y = \frac{1}{2}(8)^x \rightarrow y = \frac{1}{2}(8)^x + 6$

Transformations: **Up by 6 units**

Y-intercept: $\frac{1}{2}(8)^0 + 6$ **(0, 6.5)**

Asymptote: **y = 6**

3. $y = 4(0.6)^x \rightarrow y = 4(0.6)^x - 3$

Transformations:

Y-intercept:

Asymptote:

4. $f(x) = 4^x \rightarrow f(x) = 4^{x+3} - 8$

Transformations:

Y-intercept:

Asymptote:

Directions: Using the graphs of f(x) and g(x), described the transformations from f(x) to g(x). F(x) is the solid line and g(x) is the dotted line.
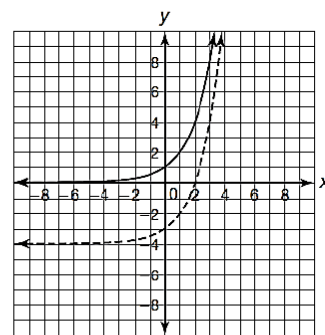
5.

6.

7.
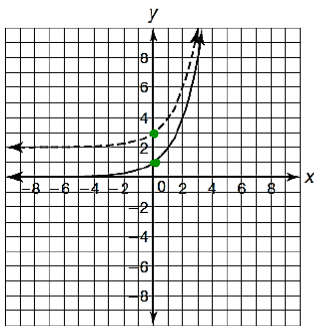
up by 2 units
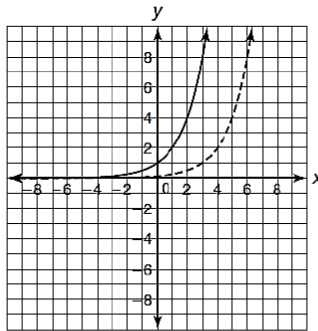
Directions: Using the function g(x) = 4^x, create a new function h(x) given the following transformations:

k   −3

k+4   h +2

8. down 3 units   9. right 8 units   10. up 4 units and left 2 units

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

$h(x) = 4^{x+2} + 4$

11. left 5 units   12. up 2 units   13. down 1 unit and right 4 units

3/21/18

DAY 4 & 5: CHARACTERISTICS

Unit 4: Exponential Functions

Pages 14 - 20

Essential Question   3/21/18

How can I describe an Exponential Function?

Standard:

MGSE9-12.F.IF.4 Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.

Domain and Range   3/21/18

Domain		
Define:	*Think:*	*Write:*
All possible values of x	How far left to right does the graph go?	Smallest x ≤ x ≤ Biggest x *use < if the circles are open*
Range		
Define:	*Think:*	*Write:*
All possible values of y	How far down to how far up does the graph go?	y ≤ highest y value (opens down) y ≥ lowest y value (opens up)
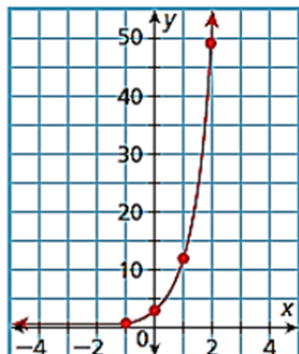
Domain: $(-\infty, \infty)$ ℝ
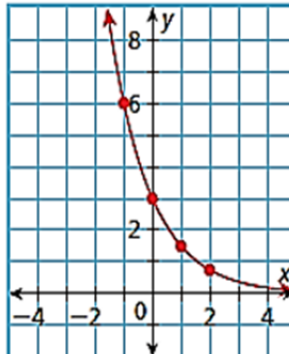
Range: $(0, \infty)$

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

Range: $(0, \infty)$

Domain and Range
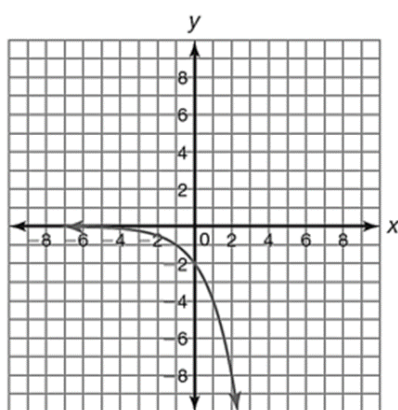
Domain: $(-\infty, \infty)$ ℝ

Range: $y < 0$

or $(-\infty, 0)$
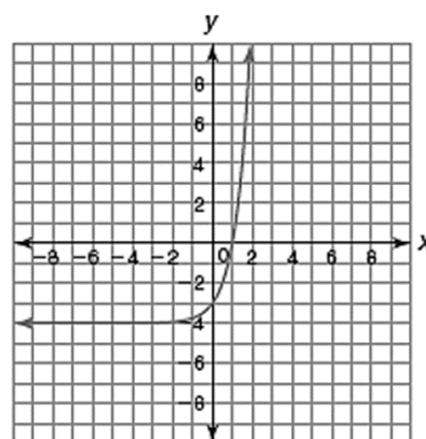
Domain: $(-\infty, \infty)$ / ℝ

Range: $(-4, \infty)$

Intercepts and Zeros

Y-Intercept		
Define:	**Think:**	**Write:**
Point where the graph crosses the y-axis	At what coordinate point does the graph cross the y-axis?	(0, b)
X-Intercept		
Define:	**Think:**	**Write:**
Point where the graph crosses the x-axis	At what coordinate point does the graph cross the x-axis?	(a, 0)
Zero		
Define:	**Think:**	**Write:**
Where the function (y-value) equals 0	At what x-value does the graph cross the x-axis?	x = ____
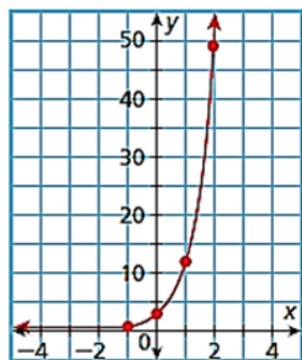
X-intercept: *none*   Zero: *none*

Y-intercept: *(0,4)*
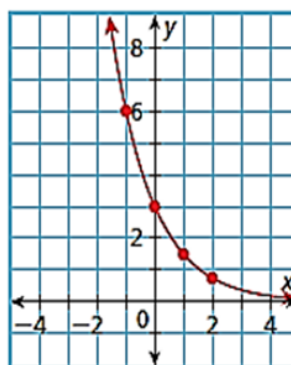
X-intercept: *none*   Zero: *none*

Y-intercept: *(0,3)*

Intercepts and Zeros
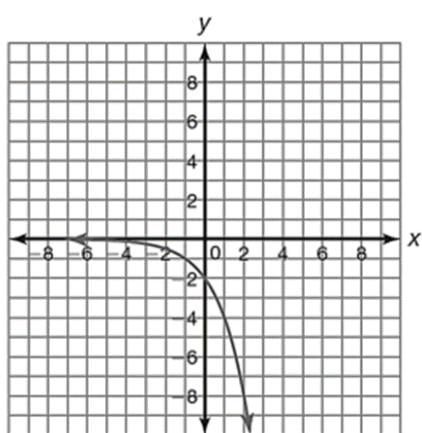
X-intercept: none

Y-intercept: $(0, -2)$

Zero: none
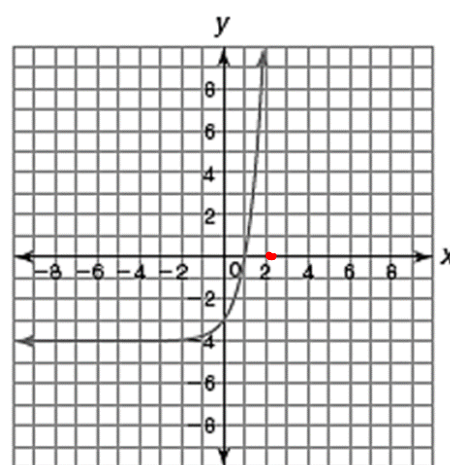
X-intercept: $(1, 0)$

Y-intercept: $(0, -3)$

Zero: $X = 1$

Extremas and Asymptotes

Maximum		
Define: Highest point of a function.	**Think:** What is my highest point on my graph?	**Write:** y =
Minimum		
Define: Lowest point of a function.	**Think:** What is the lowest point on my graph?	**Write:** y =
Asymptotes		
Define: A line that the graph get closer and closer to, but never touches or crosses.	**Think:** What values does my graph begin to flat line towards?	**Write:** y =
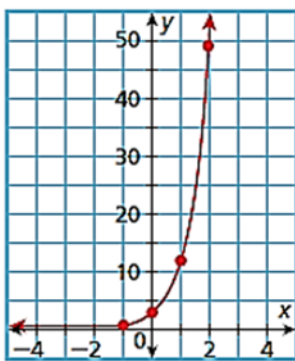
Maximum: none   Minimum: y=0
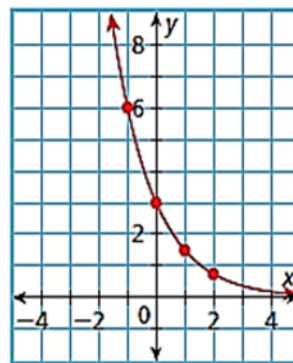
Asymptote: y=0

Maximum: none   Minimum: y=0

Asymptote: y=0

Extremas and Asymptotes
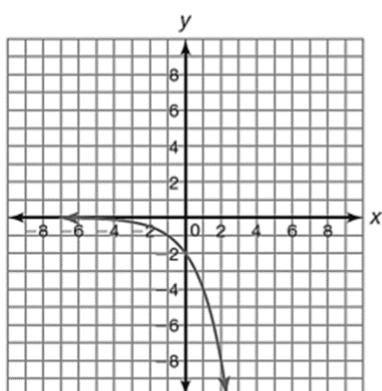
Maximum: $y=0$ Minimum: none

Asymptote: $y=0$
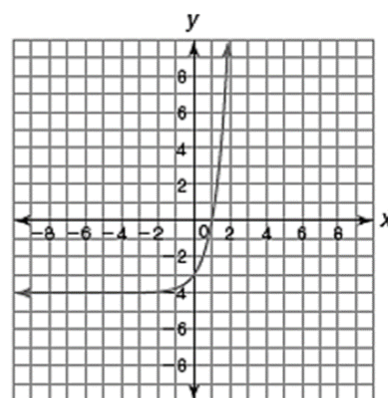
Maximum: none   Minimum:

$y=-4$

Asymptote:

$y=-4$

Intervals of Increase & Decrease

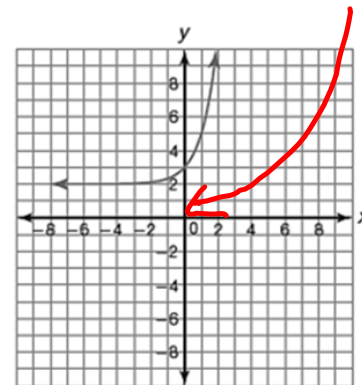| Interval of Increase		
Define:	*Think:*	*Write:*
The part of the graph that is rising as you read left to right.	From left to right, is my graph going up?	An inequality using the x-value of the vertex
Interval of Decrease		
Define:	*Think:*	*Write:*
The part of the graph that is falling as you read from left to right.	From left to right, is my graph going down?	An inequality using the x-value of the vertex
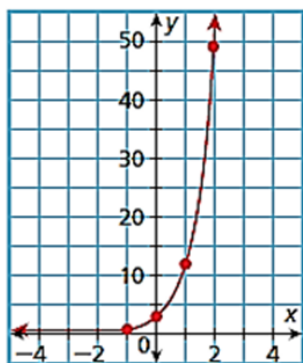
Interval of Increase: $(-\infty, \infty)$
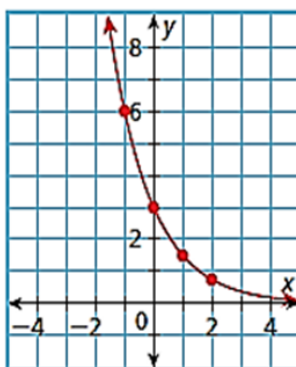
Interval of Decrease: None

Interval of Increase: None

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

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

Interval of Decrease: None

Intervals of Increase & Decrease
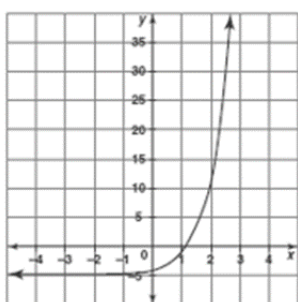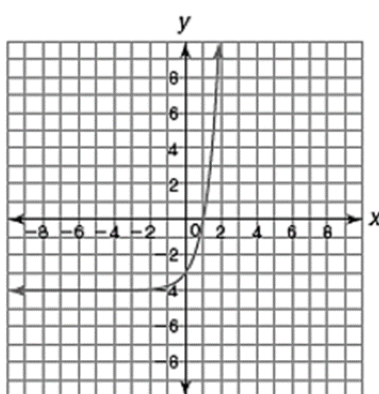
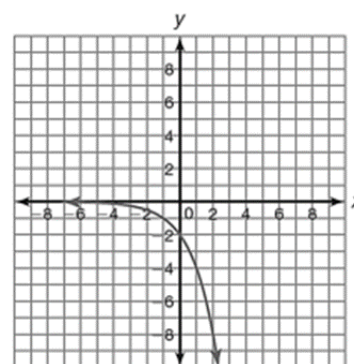Interval of Increase: $(-\infty, \infty)$

Interval of Decrease:

(none)

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

Interval of Decrease:

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) → _____
Think: As x goes to the right (positive infinity), what direction does the right arrow go?	*Write:* As x → ∞, f(x) → _____
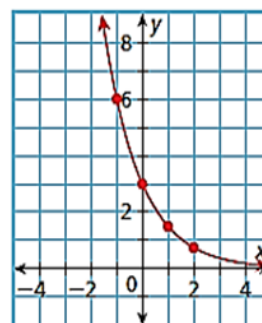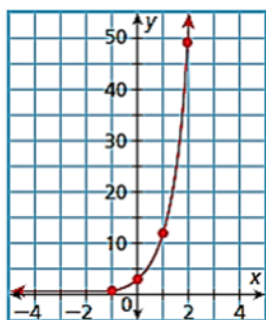
As x approaches -∞, f(x) approaches __0__ .

As x approaches ∞, f(x) approaches __∞__ .

As x approaches -∞, f(x) approaches __∞__ .
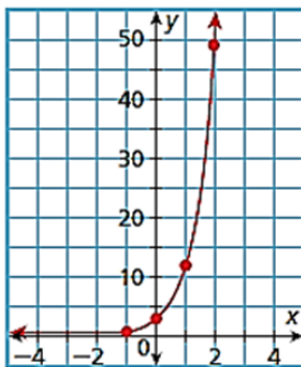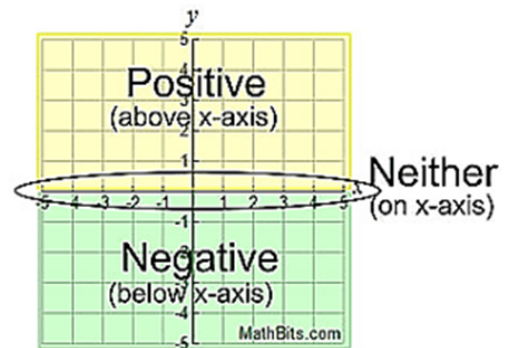
As x approaches ∞, f(x) approaches __0__ .

End Behavior
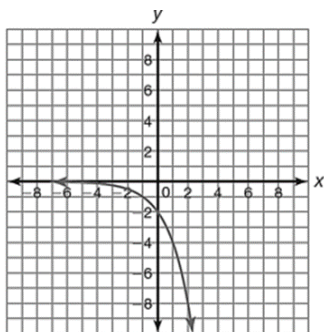
As x approaches -∞, f(x) approaches _____ 0

As x approaches ∞, f(x) approaches _____. −∞
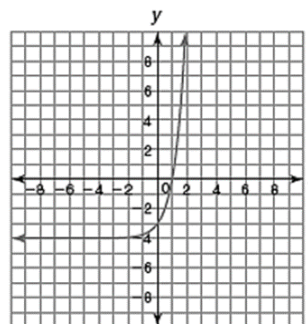
As x approaches -∞, f(x) approaches _____. −4

As x approaches ∞, f(x) approaches _____. ∞

Positive and Negative

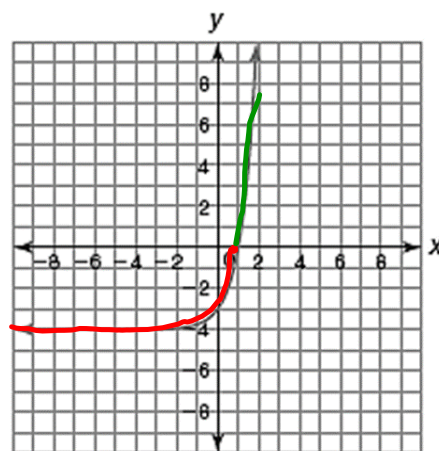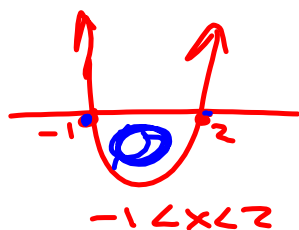| Positive		
Define:	*Think:*	*Write:*
The part of the function that is above the x-axis.	Which part of the function is in the positive region and where?	Inequality using the zeros value (x)
Negative		
Define:	*Think:*	*Write:*
The part of the function that is below the x-axis.	Which part of the function is in the negative region and where?	Inequality using the zero values (x)

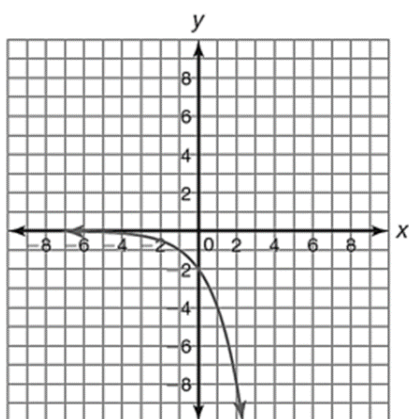Positive (above x-axis)

Neither (on x-axis)

Negative (below x-axis)

MathBits.com

Positive (-∞, ∞)
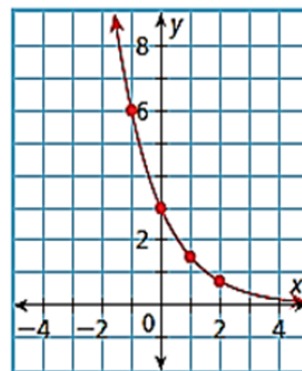
Negative: none

Positive: (-∞, ∞)

Negative: none

Positive and Negative

Positive   none

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

$-1 < x < 2$

Positive: $x > 1$

Negative: $x < 1$
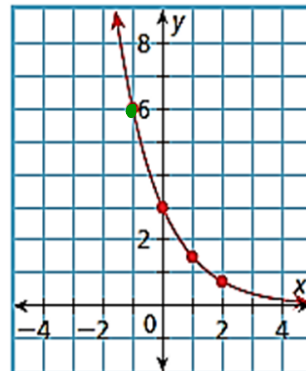
Average Rate of Change from Graph

Average Rate of Change: Rate of change or slope for a given interval on a graph. The given interval is writter using the inequality notation $a \le x \le b$, where a and b represent the initial and final x-value of the interval.
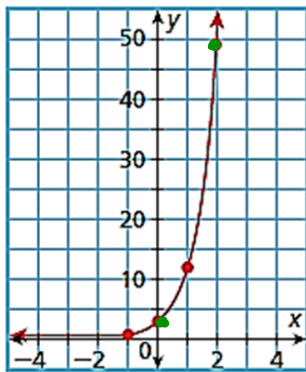
Calculate the average rate of change for the interval $0 \le x \le 2$

$(0, 4) \quad (2, 50)$

$x_1 \quad y_1 \qquad x_2 \quad y_2$

$AROC = \dfrac{y_2 - y_1}{x_2 - x_1}$

$= \dfrac{50 - 4}{2 - 0}$

$= \dfrac{46}{2} = \boxed{23}$

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

$(-1, 6) \quad (2, 1)$
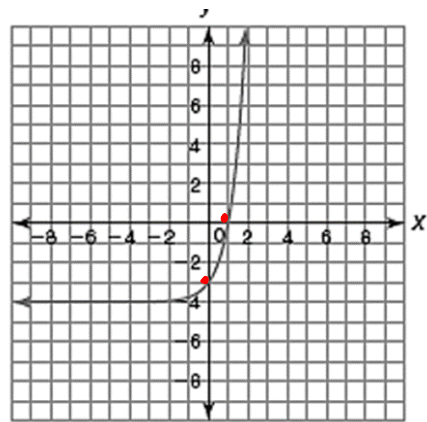
$x_1 \quad y_1 \qquad x_2 \quad y_2$

$AROC = \dfrac{1 - 6}{2 - (-1)} = \boxed{\dfrac{-5}{3}}$

Average Rate of Change from Graph
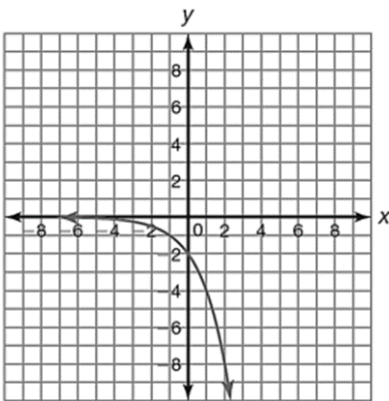
$$\frac{y_2 - y_1}{x_2 - x_1}$$

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

$(0, -2)(2, -8)$
$x_1 \; y_1 \quad x_2 \; y_2$

$\frac{-8 - -2}{2 - 0} =$

$\frac{-6}{2} = \boxed{-3}$

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

$(0, -3)(1, 0)$
$x_1 \; y_1 \; x_2 \; y_2$

$\frac{0 - (-3)}{1 - 0} = \frac{3}{1}$

$\boxed{3}$

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. $y = 3^x$; $1 \leq x \leq 3$

b. $y = 2(1/2)^x$; $-4 \leq x \leq 0$

$f(1) = 3^1 = 3$ $(1, 3)$ x_1 y_1

$f(3) = 3^3 = 27$ $(3, 27)$ x_2 y_2

$AROC = \dfrac{27-3}{3-1} = \dfrac{24}{2}$

$= \boxed{12}$

$f(-4) = 2(½)^{(-4)} = 32$

$f(0) = 2(½)^{(0)}$ $(-4, 32)$ x_1 y_1

$(0, 2)$ x_2 y_2

$\dfrac{2-32}{0-(-4)} = \dfrac{-30}{4} = -7.5$

Class Work/Home Work 3/21/18
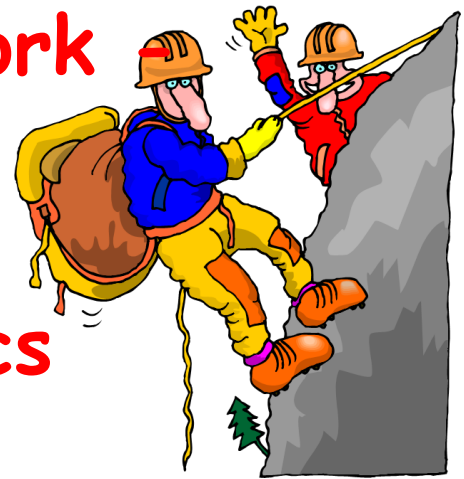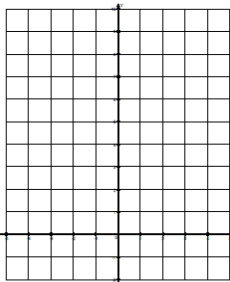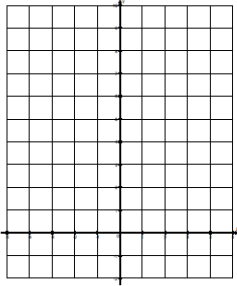
Day 3: Characteristics Practice

Due tomorrow - Wednesday 3/21/18

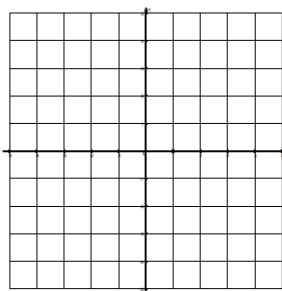**Day 3 – Characteristics Practice**

Name: _____

For each of the following problems, create a graph using the given table of values. Be sure to place the horizontal asymptote at the appropriate location. Once you are finished with your graph, complete the characteristics of the function accordingly.

1. $f(x) = 3^x$

x	y
-2	
-1	
0	
1	
2	

Domain: _____   Range: _____

X-intercept: _____   y-intercept: _____

Interval of Increase: _____   Interval of Decrease: _____

Maximum(s): _____   Minimum(s): _____

Asymptote: _____

End- Behavior: as x → −∞, f(x) → _____
                        as x → ∞, f(x) → _____

Positive: _____   Negative: _____

Find the average rate of change from x=0 to x=2: _____

Find the average rate of change from x=0 to x=2: _____

2. $g(x) = \left(\dfrac{1}{3}\right)^x$

x	y
-2	
-1	
0	
1	
2	

Domain: _____   Range: _____

X-intercept: _____   y-intercept: _____

Interval of Increase: _____   Interval of Decrease: _____

Maximum(s): _____   Minimum(s): _____

Asymptote: _____

End- Behavior: as $x \to -\infty$, $f(x) \to$ _____
as $x \to \infty$, $f(x) \to$ _____

Positive: _____   Negative: _____

Find the average rate of change from x=-2 to x=0: _____

3. $h(x) = 2^x - 4$

x	y
-2	
-1	
0	
1	
2	

Domain: _____   Range: _____

X-intercept: _____   y-intercept: _____

Interval of Increase: _____   Interval of Decrease: _____
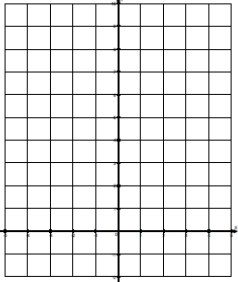
Maximum(s): _____   Minimum(s): _____

Asymptote: _____

End- Behavior:
as x → −∞, f(x) → _____
as x → ∞, f(x) → _____

Positive: _____   Negative: _____

Find the average rate of change from x=0 to x=2: _____

4. $p(x) = 2^{x+4}$

x	y
-5	
-4	
-3	
-2	
-1	
0	
1	
2	

Domain: _____   Range: _____

X-intercept: _____   y-intercept: _____

Interval of Increase: _____   Interval of Decrease: _____

Maximum(s): _____   Minimum(s): _____

Asymptote: _____

End- Behavior: as x → −∞, f(x) → _____
                as x → ∞, f(x) → _____

Positive: _____   Negative: _____

Find the average rate of change from x=-4 to x=-1: _____