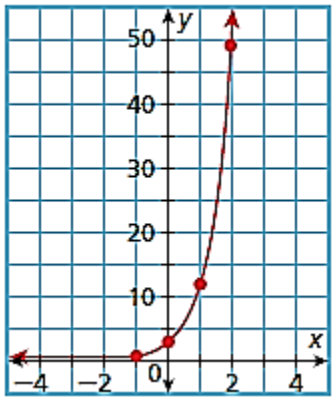
## Characteristics of Exponential Functions

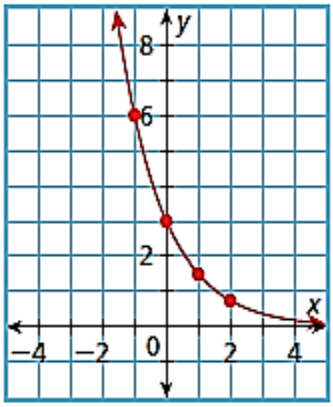
### Y-Intercepts and Asymptotes

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



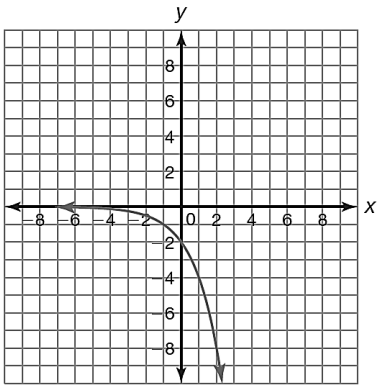

Y-intercept:

Asymptote:



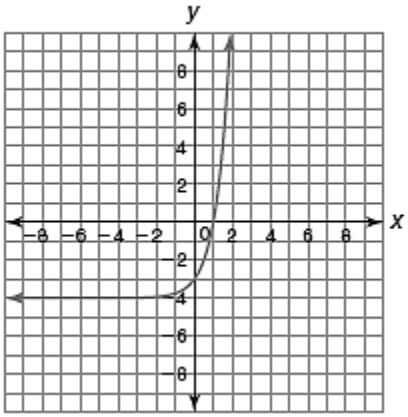

Y-intercept:

Asymptote:




Y-intercept:

Asymptote:

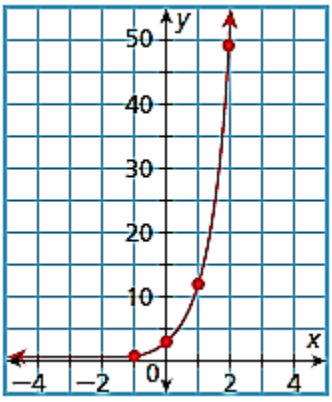



Y-intercept:

Asymptote:

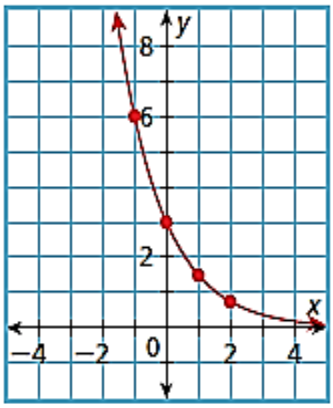
## Domain and Range

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




Domain:

Range:




Domain:

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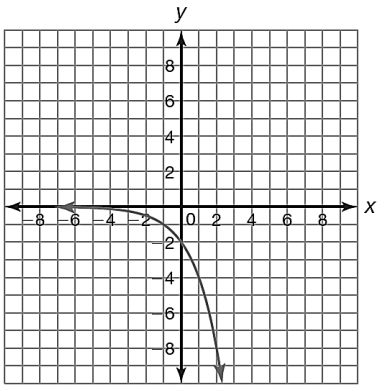


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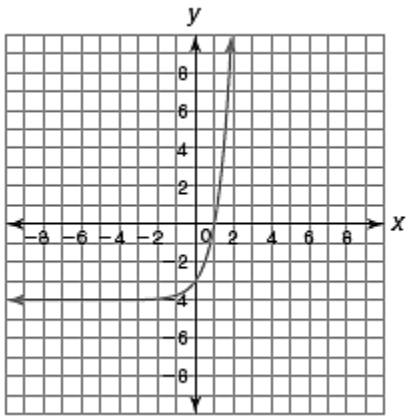
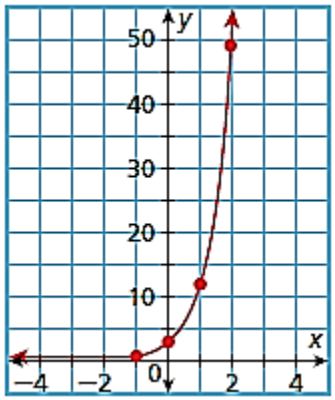



Domain:

Range:

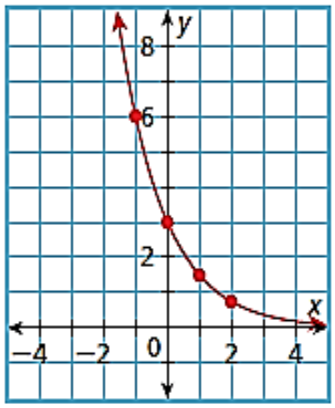
## Intervals of Increase and Decrease

| **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.*** | | |



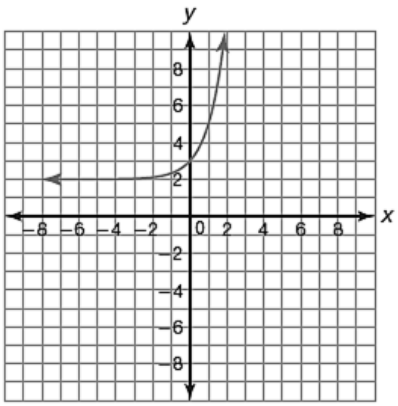
Interval of Increase:

Interval of Decrease:



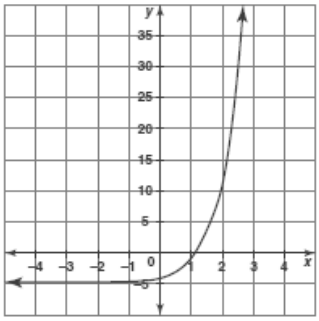
Interval of Increase:

Interval of Decrease:



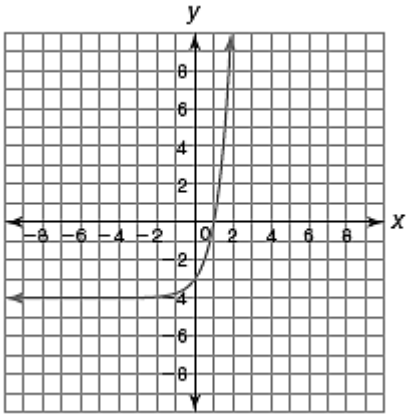
Interval of Increase:

Interval of Decrease:



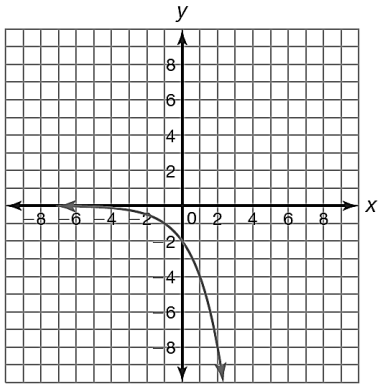
Interval of Increase:

Interval of Decrease:



Interval of Increase:

Interval of Decrease:

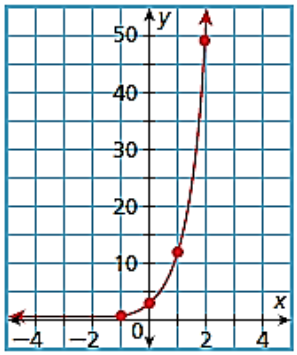


Interval of Increase:

Interval of Decrease:

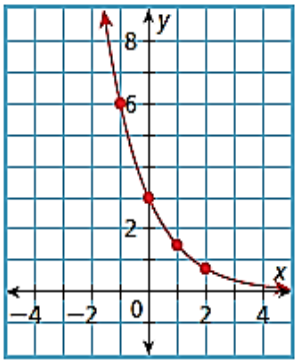
# End Behavior

| **End Behavior** | |
|---|---|
| **Define:**<br>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:**<br>As x goes to the left (negative infinity), what direction does the left arrow go? | **Write:**<br>As x → -∞, f(x) → _____<br>*will be ∞, -∞, or asymptote* |
| **Think:**<br>As x goes to the right (positive infinity), what direction does the right arrow go? | **Write:**<br>As x → ∞, f(x) → _____<br>*will be ∞, -∞, or asymptote* |



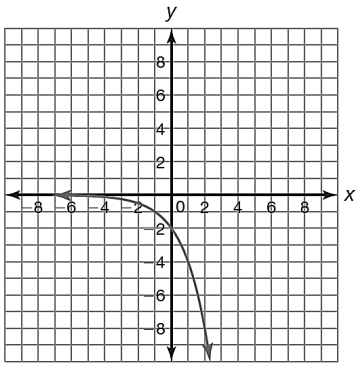

$As\ x \to -\infty, f(x) \to$ _____

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



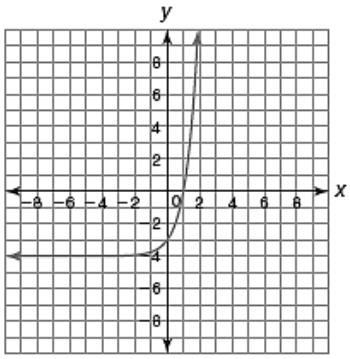

$As\ x \to \infty, f(x) \to$ _____

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




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

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




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

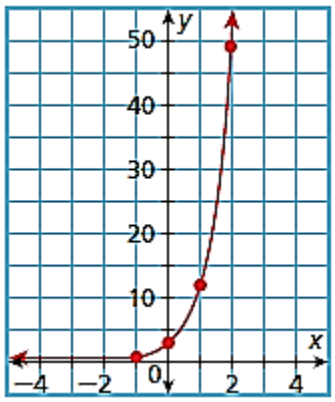
$As\ x \to \infty, f(x) \to$ _____

## Average Rate of Change (From a Graph)

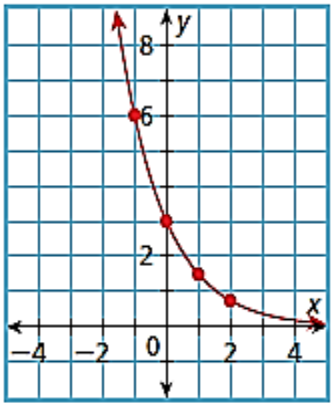
**Average Rate of Change:** Rate of change or slope for a given interval on a graph. The given interval is written using the inequality notation $a \le x \le b$, where *a* and *b* represent the initial and final x-value of the interval. **Find the two points based on given x values and then use the slope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

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

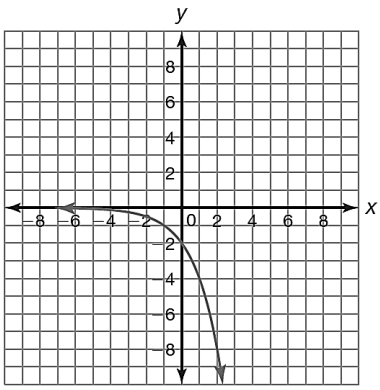
Calculate the average rate of change for the interval $0 \le x \le 2$.



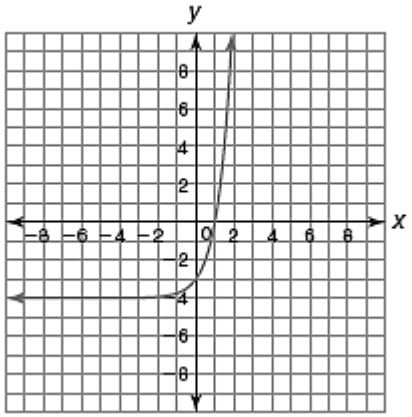

Calculate the average rate of change for the interval $-1 \le x \le 2$.




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




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



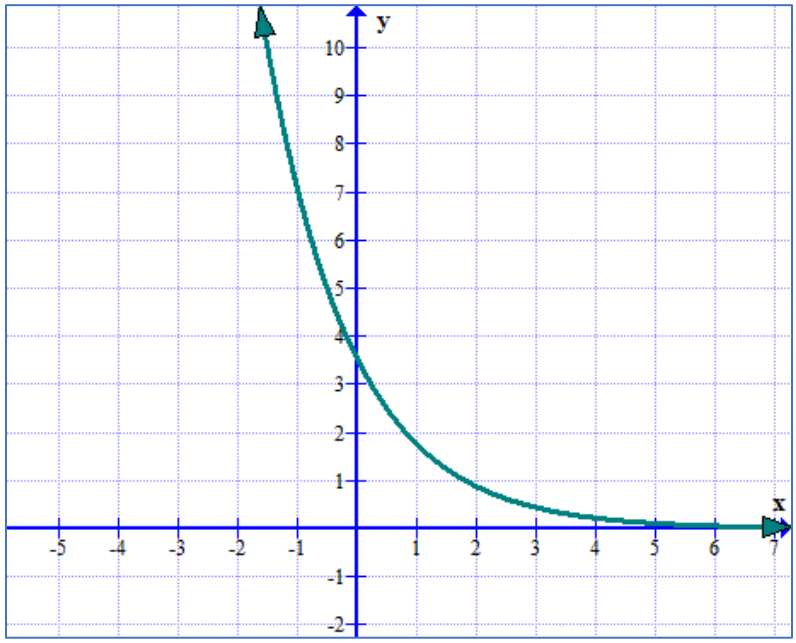

## Average Rate of Change (From an Equation)

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

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

**Characteristics Practice**




Domain:

Range:

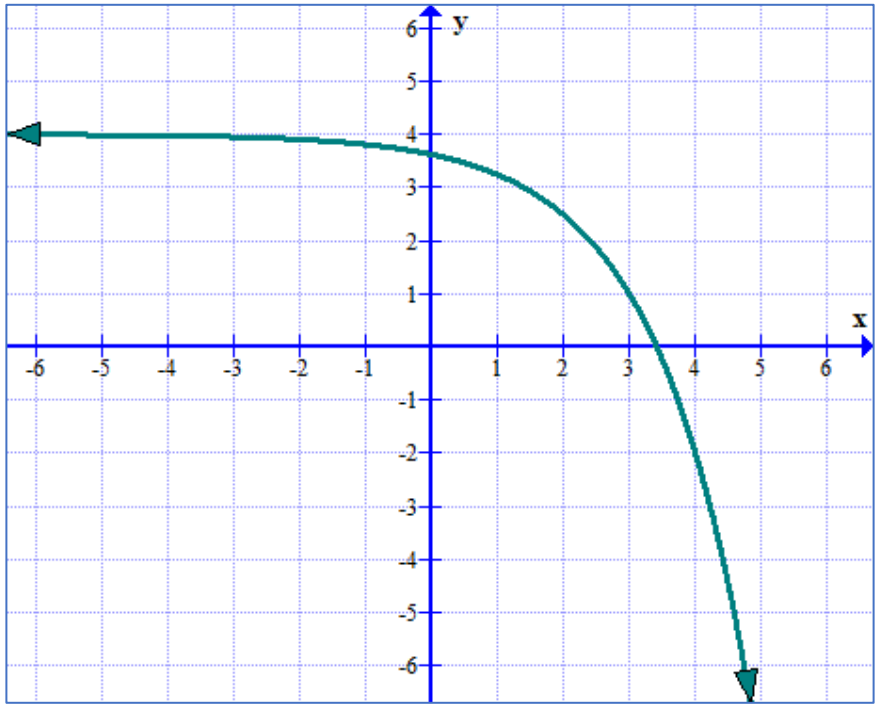
Y-Intercept:

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:

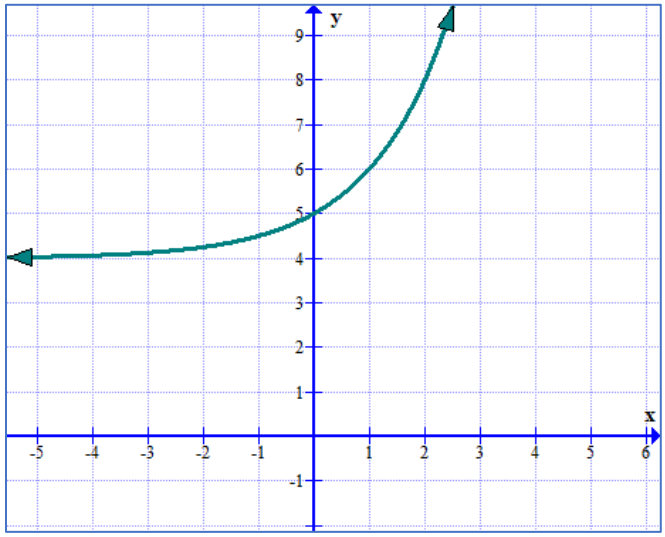
Interval of Decrease:

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)

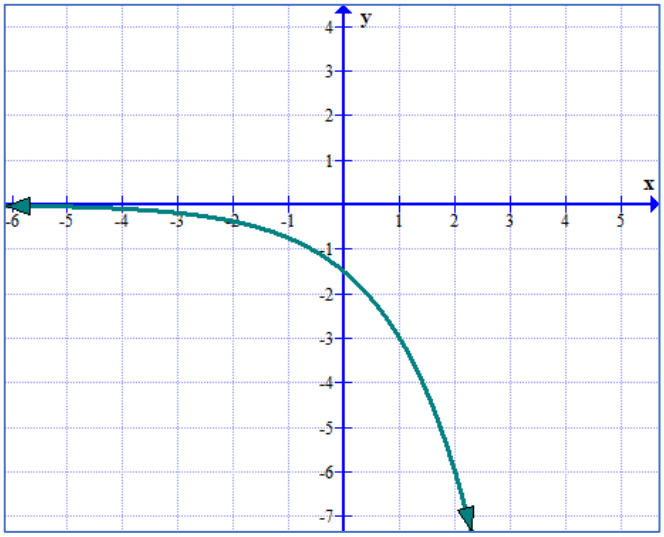



Range:

Y-Int:

Asymptote:

2)

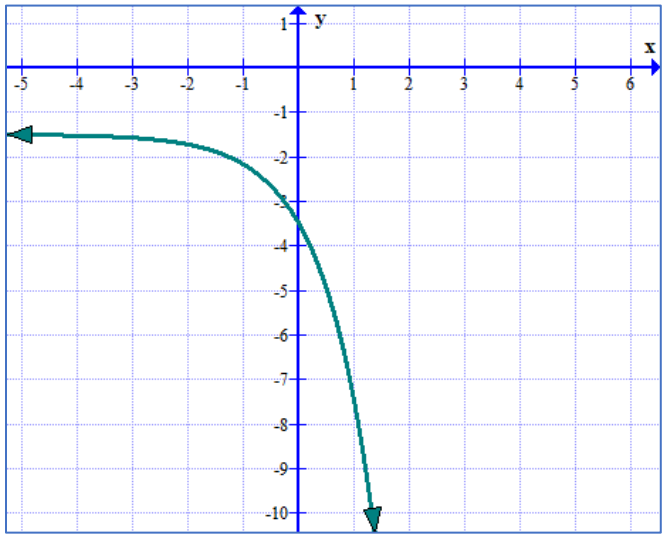



Range:

Y-Int:

Asymptote:

3)

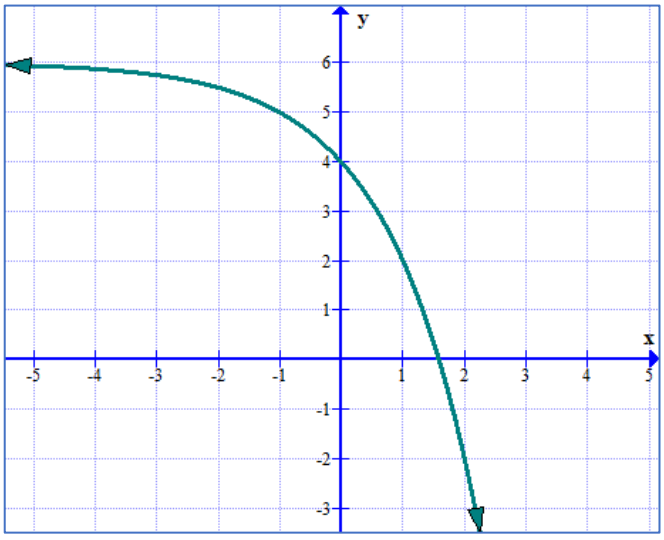



Range:

Y-Int:

Asymptote:

4)




Range:

Y-Int:

Asymptote: