- Exponential Growth Functions are increasing.
- The Growth factor is a \# greater than 1 ( $b>1$ )
- The graph of the curve rises from left to right and approaches, but never reaches the $x$-axis on the left.

- Exponential Decay Functions are decreasing
- The growth factor is a fraction or a decimal $(0<b<1)$
- The graph is a curve that falls from left to right and approaches, but never reaches the $x$-axis.


Quick Refresher: Evaluate the following negative exponents. Convert your answers to decimals.

1. $3^{-1}$
2. Negative exponents result in $\qquad$ numbers when evaluated.

## Graphing Exponential Functions

To graph exponential functions, make a table, plot the points and connect them with a smooth curve. It is important to understand the basic shape of the exponential growth and decay graphs because the actual values that you will be able to plot will be relatively few. Plot the points that you can with ease (note: you should be able to estimate where to plot the decimal values of $0.25,0.5$, and 0.75 )


Let's create a chart for the following functions using the calculator, then graph them.

| $y=2^{x}$ |  |
| :---: | :---: |
| $x$ | $y$ |
| $-2^{*}$ |  |
| $-1^{*}$ |  |
| 0 |  |
| 1 |  |
| 2 |  |
| 3 |  | | $y=3^{x}$ |  |
| :---: | :---: | :---: | :---: |
| $-2^{*}$ |  |
| $-1^{*}$ |  |
| 0 |  |
| 1 |  |
| 2 |  |
| 3 |  | | $y=5^{x}$ |  |
| :---: | :---: | :---: |
| $-2^{*}$ |  |
| $-1^{*}$ |  |
| 0 |  |
| 1 |  |
| 2 |  |
| 3 |  |

*Remember that a negative exponent gives you a fraction/decimal!!
The graph of an exponential function will NEVER go below the $x$-axis. There is no value that you can substitute for $x$, where $y$ will equal zero or a negative number. It will get EXTREMELY close (increasingly small decimal \#s) but will never be zero.

REMINDER: GRAPHS SHOULD ALWAYS BE LABELED.

1. Complete the table and graph the exponential function $y=4^{x}$

| $x$ | $y$ |
| :---: | :---: |
| -2 |  |
| -1 |  |
| 0 |  |
| 1 |  |
| 2 |  |
| 3 |  |

What is the $y$-intercept of the function? $\qquad$

3. Complete the table and graph the exponential function
$f(x)=4 \bullet 2^{x}$

| $x$ | $y$ |
| :---: | :---: |
| -2 |  |
| -1 |  |
| 0 |  |
| 1 |  |
| 2 |  |
| 3 |  |


5. Complete the table and graph the exponential function $f(x)=\frac{1}{2} \bullet 3^{x}$

| $x$ | $y$ |
| :---: | :---: |
| -2 |  |
| -1 |  |
| 0 |  |
| 1 |  |
| 2 |  |
| 3 |  |


2. Complete the table and graph the exponential function $y=3\left(4^{x}\right)$

| $x$ | $y$ |
| :---: | :---: |
| -2 |  |
| -1 |  |
| 0 |  |
| 1 |  |
| 2 |  |
| 3 |  |

What is the $y$-intercept of the function? $\qquad$ Changing the coefficient of the $\left(4^{x}\right)$, changes the
$\qquad$ .

4. Complete the table and graph the exponential function
$f(x)=4 \bullet\left(\frac{1}{2}\right)^{x}$

| $x$ | $y$ |
| :---: | :---: |
| -2 |  |
| -1 |  |
| 0 |  |
| 1 |  |
| 2 |  |
| 3 |  |


6. Complete the table and graph the exponential function $f(x)=5 \bullet\left(\frac{1}{2}\right)^{x}$

| $x$ | $y$ |
| :---: | :---: |
| -2 |  |
| -1 |  |
| 0 |  |
| 1 |  |
| 2 |  |
| 3 |  |



