**Graphs of Exponential Functions Investigation**

You may use your graphing calculator to help you with your sketches

1. On the same set of axes, sketch the following functions:
	1. $y=2^{x}$ b. $y=3^{x}$ c. $y=10^{x}$ d. $y=1.3^{x}$



These functions are all members of the family $y=b^{x}$

1. What effect does changing b have on the shape of the graph?
2. What is the y-intercept of each graph?
3. What is the horizontal asymptote of each graph?
4. On the same set of axes, sketch the following functions:
	1. $y=2^{x}$ b. $y=2^{x}+1$ c. $y=2^{x}-2$



These functions are all members of the family $y=2^{x}+d$, where d is a constant

1. What effect does changing d have on the position of the graph?
2. What effect does changing d have on the shape of the graph?
3. What is the horizontal asymptote of each graph?
4. What is the horizontal asymptote of $y=2^{x}+d$
5. To graph $y=2^{x}+d$ from $y=2^{x}$ what transformation is used?
6. On the same set of axes, sketch the following functions:
	1. $y=2^{x}$ b. $y=2^{x-1}$ c. $y=2^{x+2}$ c. $y=2^{x-3}$



These functions are all members of the family $y=2^{x-c}$

1. What effect does changing c have on the position of the graph?
2. What effect does changing c have on the shape of the graph?
3. What is the horizontal asymptote of each graph?
4. What is the horizontal asymptote of $y=2^{x}+d$
5. To graph $y=2^{x-c}$ from $y=2^{x}$ what transformation is used?
6. On the same set of axes, sketch the following functions:
	1. $y=2^{x}$ b. $y=2^{-x}$



* 1. What is the y-intercept of each graph?
	2. What is the horizontal asymptote of each graph?
	3. What transformation moves $y=2^{x}$ to $=2^{-x}$ ?
1. On the same set of axes, sketch the following functions:
	1. $y=2^{x}$ b. $y=3×2^{x}$ c. $y=\frac{1}{2}×2^{x}$
	2. $y=-2^{x}$ e. $y=-3×2^{x}$ f. $y=-\frac{1}{2}×2^{x}$



These functions are all members of the family $y=2^{x-c}$

1. What effect does changing c have on the position of the graph?
2. What effect does changing c have on the shape of the graph?
3. What is the horizontal asymptote of each graph?
4. What is the horizontal asymptote of $y=2^{x}+d$
5. To graph $y=2^{x-c}$ from $y=2^{x}$ what transformation is used?

In general, fill out the following:

For the general exponential function $y=a×b^{x-c}+d$

* b controls\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* c controls\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* d controls\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* y = d is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

For each of the following state if they are increasing or decreasing and draw the shape of the graph

* if $a>0, b>1$, the function is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* if $a>0, 0<b<1$, the function is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* if $a<0, b>1$, the function is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* if $a<0,0< b<1$, the function is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Draw freehand sketches of the following pairs of graphs using your observations:



