Asymptotes of exponential and logarithmic functions and how to find them:

- Exponential functions: ONLY have horizontal asymptotes
  - How to find it→ if a number is being added or subtracted from the base in which x is part of the exponent, that number (and it's sign) is where there is a horizontal asymptote
  - Ex) $3^{x-7}+4$ horizontal asymptote is at $y=4$
  - Ex) $5^{x+1}-1$ horizontal asymptote is at $y=-1$
- Logarithmic functions: ONLY have vertical asymptotes
  - How to find it→ set what is inside of the parentheses equal to zero, and solve for x, that number (and sign) is your vertical asymptote
  - Ex) $\log_2(x-1)$ $x-1=0 \rightarrow x=1$ vertical asymptote is at $x=1$
  - Ex) $\log(x+3)$ $x+3=0 \rightarrow x=-3$ vertical asymptote is at $x=-3$

The domain of ANY exponential function: $(-\infty,\infty)$ ALWAYS!!!!!!

- Ex) Any exponential function like: $f(x)=7^x$, $g(x)=e^{2x}$, $k(x)=3^{8x-4}$ have a domain of $(-\infty,\infty)$

Inverses of exponentials and their graphs: $f(x)=a^x$ and $g(x)=\log_a x$ are *inverses.*

How to find the inverse of an exponential function:

1. Set the function equal to y
2. Isolate the part of the function that includes the x on one side of the equals sign
3. Swap x and y
4. Rewrite the exponential and the rest of the function as a logarithm (take the log of both sides- this will allow you to get the y out of the exponent)
5. Solve for y

Ex) Find the inverse of $k(x)=7^{x+1}-3$

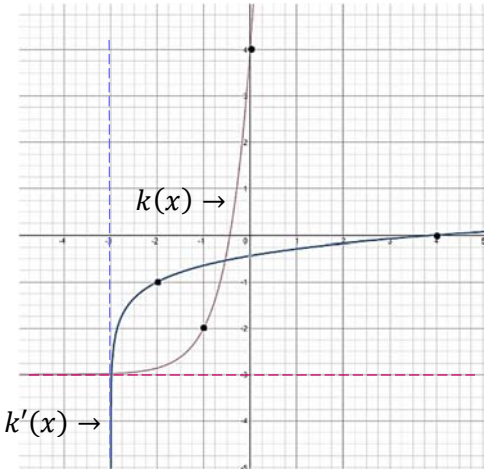
1. $y=7^{x+1}-3$
2. $y+3=7^{x+1}$
3. $x+3=7^{y+1}$
4. $\log_7(x+3)=7^{\log_7 y+1}$
5. $\log_7(x+3)=y+1$
6. $\log_7(x+3)-1=y$ we call the inverse of $k(x)$: $k'(x)$

How to graph $k(x)$ and its inverse

For $k(x) = 7^{x+1} - 3$

1. Figure out what the asymptote is, and draw it on the graph
   - $k(x)$ is an exponential, so it has a horizontal asymptote at $y = -3$
2. Choose a few (easy) points to plug in for x and solve for y to get a few points to plot

x	y
0	4
-1	-2



For the inverse of $k(x)$*, which is denoted* $k'(x)$ $k'(x) = log_7(x+3) - 1$

1. Figure out what the asymptote is, and draw it on the graph
   - $k'(x)$ is a logarithm, so its vertical asymptote is found by solving $x + 3 = 0$, and we get $x = -3$ (or, you could note that since $k(x)$ has a *horizontal asymptote* at $y = -3$, $k'(x)$ must have a *vertical asymptote* at $x = -3$ since the two are inverses)
2. Instead of plugging x values in, we can just take the coordinates we found for $k(x)$ and switch the x's and y's in each coordinate. (we can do this because $k'(x)$ is the inverse of is the inverse of $k(x)$)

x	y
4	0
-2	-1