Name: _____ Date: _____ IB Math A&A SL

Lesson 3.1 - Properties and Graphs of Exponential Functions

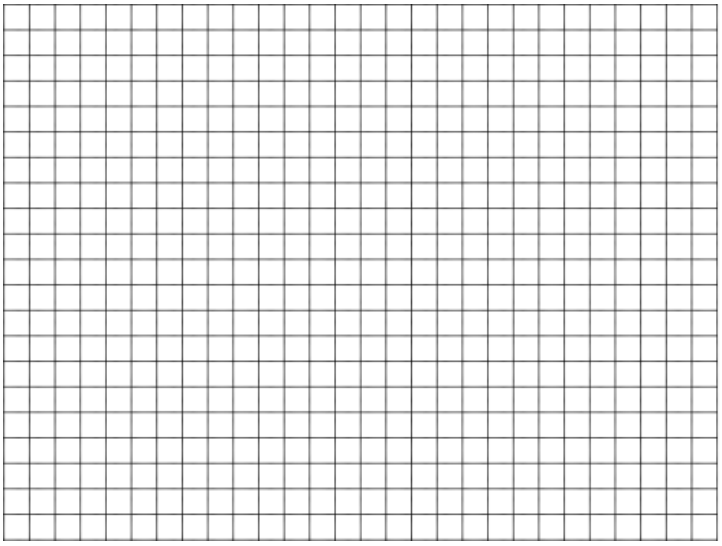
I. Graphs of Exponential Functions

Graph each of the following on the same plot and state the end behavior for each function. Specify at least 3 ordered pairs for each graph.

1. $y = 2^x$ Check Desmos

2. $y = \left(\frac{1}{2}\right)^x$ Check Desmos

3. $y = -2^{x+3} - 1$ Check Desmos



Exponential Functions

The simplest exponential function has the form

$y = b^x$ where $b > 0$, and $b \neq 1$.

(Why do we define $b > 0$?)

Let b be a negative number, and x be a fraction. Fractional exponents are the same as radicals. Having a negative base b underneath a radical is undefined).

(Why do we define $b \neq 1$?)

1 to any power is just 1 so you just get a line here.

(End behavior of an exponential function?)

If $b > 1$, this is called **exponential growth.**

As $x \to \infty, f(x) \to \infty$. As $x \to -\infty, f(x) \to$ horizontal asymptote. (*Give or take transformations to the function*)

If $0 < b < 1$, this is called **exponential decay.**

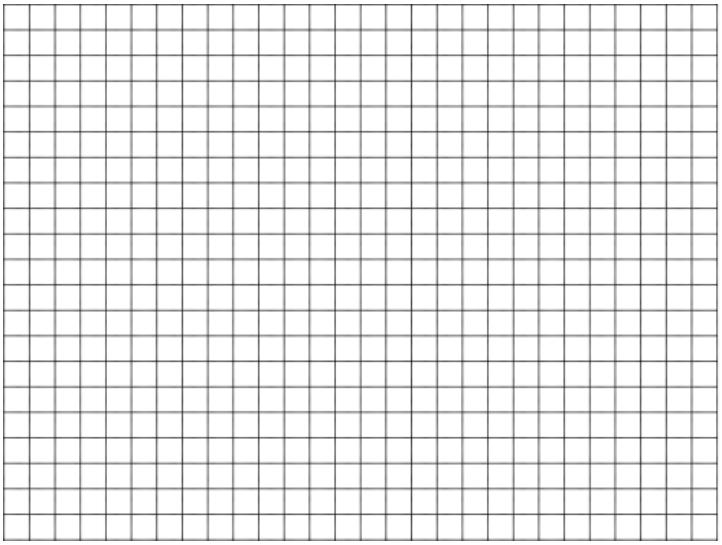
As $x \to \infty, f(x) \to$ horizontal asymptote. As $x \to -\infty, f(x) \to \infty$. (*Give or take transformations).*

II. Practice

Graph each of the following and state the end behavior for each function. They have been grouped to graph together on the same plot. Specify at least 3 ordered pairs for each graph, along with the equation for any asymptotes. Check you graphs using Desmos or a graphing calculator.

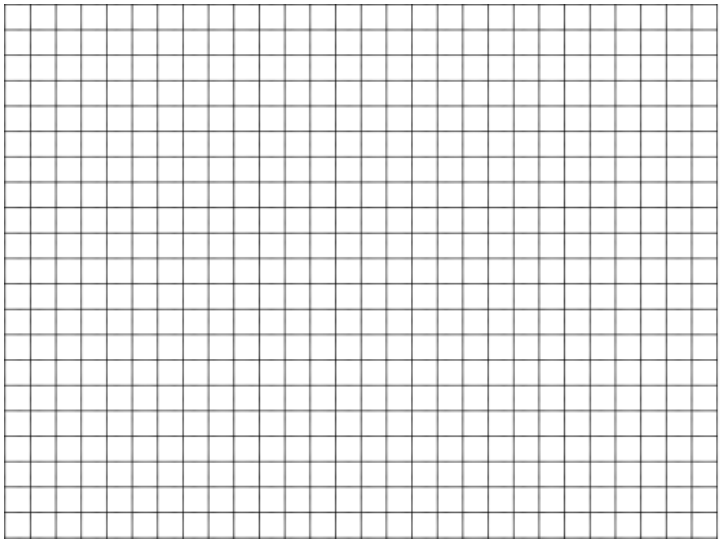
4. $y = 3^x$
5. $y = -(3^x)$
6. $y = 3^{-x}$
7. $y = \left(\frac{1}{3}\right)^x$

Check Desmos



8. $y = 2^x - 3$
9. $y = 2^{x-3}$
10. $y = 2^{-x}$

Check Desmos



11. $y = -2^{x+3} + 1$
12. $y = \left(\frac{1}{2}\right)^{x-3} - 4$

Check Desmos