Problem 1. *Use the laws of exponents to simplify the following as much as possible:*

(a) $\frac{4^{-3}}{2^{-8}}$

(b) $\frac{6^5}{2^3 \cdot 3^6 \cdot 5}$

(c) $\frac{(6y^3)^4}{2y^5}$

(d) $\sqrt{a\sqrt[2]{b\sqrt[4]{2}}}$

Problem 2. *Sketch the following sets of functions on the same graph:*

(a) $f(x) = 2^x, g(x) = 3^x, h(x) = 10^x$

(b) $f(x) = 2^x, g(x) = 1^x, h(x) = (1/2)^x$

(c) $f(x) = 2^x, g(x) = 2 \cdot 2^x, h(x) = 4 \cdot 2^x$

Problem 3. *A bacterial culture starts with 500 bacteria and doubles in size every half hour.*

(a) How many bacteria are there after 3 *hours?*

(b) How many bacteria are there after 40 *minutes?*

(c) How many bacteria are there after t hours? What is the base *of the exponential function here?*

(d) How many bacteria are there after d days? How is this exponential function related to the one you wrote for (c)?

Problem 4. *Starting with the graph of $y = e^x$, find the equation of the graph that results from*

(a) reflecting about the line $y = 4$

(b) reflecting about the line $x = 2$

Problem 5. *Show that the function*

$$f(x) = \frac{1 - e^{1/x}}{1 + e^{1/x}}$$

is odd.

Problem 6. *Can you approximate 2^{100} without a calculator? What about 3^{500}?*