PROBLEM SET #7 **NAME:**_____

Math 196L (Spring 2018)

Instructions: Read each problem. Write a sentence or two about the approach you might take to solve each problem. Draw a picture to illustrate the scenario. Write a formula that might be needed to help set up or solve the problem. **DO NOT SOLVE THE PROBLEMS**.

---

1. Consider the following transformation of a logarithm of base $b > 1$.

$$y = \log_b(Ax + B) + C$$

where A, B, and C are positive constants.

(A) Determine the exact values of all intercepts and asymptotes.

(B) Sketch an accurate graph of $y = \log_b(Ax + B) + C$, labeling all intercept(s) and asymptote(s).

(C) Find the inverse of $y = \log_b(Ax + B) + C$.

(D) Determine the exact values of all intercepts and asymptotes of the inverse function.

(E) Sketch an accurate graph of the inverse, labeling all intercept(s) and asymptote(s).

2. Consider three possible savings accounts. One offers an interest rate of 2.5% compounded annually, another offers 2.4% compounded quarterly, and the third offers 2.1% compounded continuously. Answer the following questions.

   (A) What is the relative/continuous growth rate for each investment? (the r value in the continuous model $y = Pe^{rt}$)

   (B) What is the effective (actual) percentage growth annually for each investment? (the r value in the periodic model $y = Pb^t$, where $b = 1 + r$)

   (C) What is the doubling time for each investment? (Round to the nearest month)

3. You just brought a new $50,000 Porsche with the loan you were supposed to use for your tuition.

   (A) Sadly you learn that this car loses 15% of its value every year. Write an equation to represent the value of your car as a function of time since you purchased it.

   (B) Suppose your insurance company calculates its premiums based on the value of a car. Instead of using your formula in part A, they assume that the value of the car will depreciate by $4,000 every year. Write an equation to represent their value of your car as a function of time since you purchased it.

   (C) Sketch a graph of both equations (including your window). Will the insurance company be over or under charging during the first few years?

Part 2

5. Consider the following population scenarios. In each, determine if an exponential, linear, or neither of these models would be a suitable fit. Explain your choice. If exponential or linear, find an equation to best describe the population as a function of time measured in years, assuming at $t = 0$ the population is 500,000.

a) each year, the town grows by roughly 1000 residents.

b) each year, the town grows by roughly 9%.

c) each year, the town is decreasing at a continuous rate of 4%.

d) each year, the town shrinks by roughly 15%.

e) each year, the town loses roughly 2500 residents.

6. Write the following expressions with no terms in the exponent and no negative exponents.
   a) 2^{x+3} b) 3^{2x-1} c) $\frac{1}{3^{x-3}}$ d) $2(5^{-x+2})$

7. Solve the following exactly:
   (A) $\log_2(1-x)+\log_2(4-x)=3$ (B) $e^{2x}-4e^{x}=5$

   (C) $18^{x}=3^{2x-1}$ (D) $2\log_4(3x+1)+4=9$

   (E) $\log(x)-2\log(x-3)=1$