Name:_____ **Date:**_____ **Period:**_____

Exponential Models   **Show all work!**

Standards Addressed: A2. F.LE.A.1, A2. F.LE.B.3, A2.F.IF.B.5, A2. F.IF.A.2, A2.A.REI.D.6, A2.F.BF.B.3

Tier 1 (up to 70 points) Complete #1-4

Tier 2 (up to 90 points) Complete #1-6 Do not move up to Tier 2 if you have not completed all of Tier 1.

Tier 3 (up to 100 points) Complete #1-7 Do not move up to Tier 3 if you have not completed all of Tier 1 & Tier 2.

1. (10 points) In 2009, an earthquake of magnitude 6.7 shook the Kermadec Islands off the coast of New Zealand. Also in 2009, an earthquake of magnitude 5.1 occurred in the Alaska Peninsula. How many times stronger was the Kermadec earthquake than the Alaskan earthquake?

2. (20 points) A single-celled organism divides every hour. The number N of bacteria after t hours is given by the formula $\log_2 N = t$.
   a. Solve the equation algebraically to determine after how many hours will there be 64 bacteria?

   b. Solve the equation algebraically to determine how many bacteria will there be after 7 hours?

3. (20 points) The population of a certain animal species decreases at a rate of 3.5% per year. You have counted 80 animals currently in the habitat you are studying.
   a. Is an exponential model reasonable for this situation? Explain.

   b. What is the initial population?

   c. Would the function for this situation model exponential growth or decay? Explain.

d. Create a function $P(t)$ that models the change in the population.

e. Analyze the situation. What would be an appropriate domain and range for this situation? Explain.

f. Graph your function. Be sure to label the x- and y- axis. Include the appropriate scale.
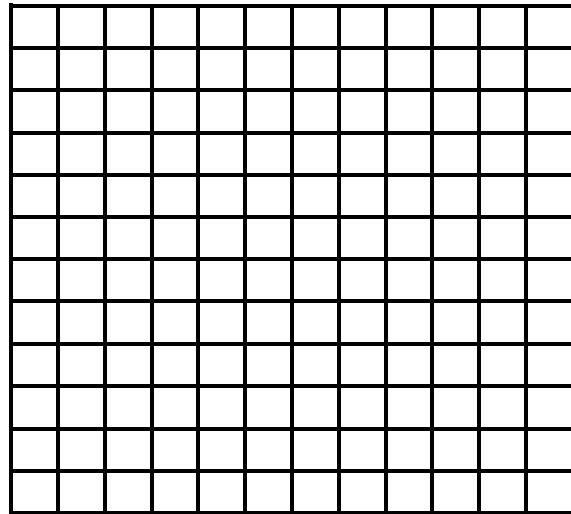
g. Use your graph to estimate the number of years until the population first drops below 15 animals.

4. (20 points) Suppose you invest $2000 at an annual interest rate of 5.5% compounded continuously.
    a. What is the formula used for continuously compounded interest in this situation?

    b. How much will you have in the account in 10 years?

    c. Your friend wants to invest $2000 in an account that pays 6% annual interest. Compare the two situations. Which account will reach $5000 first? How long will it take? Explain how you determined your answer.

5. (10 points) Suppose you deposit $2500 in a savings account that pays you 5% interest each year.
   a. Solve the equation algebraically to determine in what year you would double your money?

   b. Solve the equation algebraically to determine how many years will it take for your account to reach $8,000? Round to the nearest tenth.

6. (10 points) The sales of lawn mowers t years after a new model is introduced is given by the function $y = 5500 \ln(9t + 4)$, where y is the number of mowers sold.
   a. How many mowers will be sold 4 years after a model is introduced? Round appropriately.

   b. Solve the equation algebraically to determine how long will it take for 25000 lawn mowers to be sold? Round your answer to the nearest year.

7. (10 points) Suppose the population of a country is currently 8,100,000. Studies show this country's population is increasing 2% each year.
   a. What exponential function would be a good model for this country's population?

   b. Solve the equation from part (a) algebraically to determine in what year the country's population will reach 9 million?