Logistic Growth Worksheet

Name ___________________________________

I. Classroom Logistic Growth Simulation of a Contagious Disease

A) Introduction: Population growth can many times be modeled by the equation $P = P_0e^{rt}$ where
P = the population after t time; P_0 = the initial population; r = rate of growth; t = time
Using this model, the current size of the population determines how fast the growth occurs and assumes that the growth is boundless. In many cases, the size of the population is limited by a variety of factors: food, available land, number of population affected or not affected, etc. A more realistic growth model is the logistic growth model that says that a population grows at a rate proportional to both size of the population and some limiting factor.

B) The Problem: The class has been exposed to a rare and highly contagious disease. Each infected person will come in contact with another person and infect another person every hour. (Note: It is possible, and likely, that the contacted person could already have the disease and therefore can not be infected again.)

C) Organize the data (gathered in class or given to you by your teacher) in the table below:

Hours	1	2	3	4	5	6	7	8	9	10	11	12	13
Number Infected													

D) Calculator Setup for TI83's:
1) CLEAR all equations in [Y=];
2) in [STAT PLOT] ENTER Plot 1 and turn it On;
3) in [STAT] select EDIT and CLEAR all data in L1 and L2
4) Enter *only* the first **5** columns of data in L1 and L2 where
 (Note: L1 is the hours and L2 is the number infected)
5) Graph the data by doing: select [ZOOM] 9 i.e. ZoomStat and press ENTER
6) Find the exponential graph of best fit and store it in Y_1 by doing: select [STAT] then move over to CALC and then move down to 0:ExpReg and press ENTER then after the ExpReg press [VARS] move over to Y-VARS select 1:Function by pressing ENTER then select 1:Y_1 and press ENTER one more time
(Note: In [Y=] in Y_1 should be the exponential regression equation of best fit.)
7) Press [GRAPH]
8) Write the exponential equation that is in Y_1, rounding to *thousandths* place.

8) Y_1 = ______________________

E) Using the exponential graph from above, answer the following:
1) At 15 hours how many people will be infected? (Round down to the nearest person.)

1) ______________________

2) Using the equation in Y_1 and the Change-of-Base Property, find, to the nearest hundredth of a day, how long it will take to infect 1,000,000 people. Show <u>all</u> work and log equations used to solve this.

2) ______________________

F) New Calculator Setup for TI83's:
1) Enter the rest of the data from C) above in L1 and L2
2) Graph the data by doing: select [ZOOM] 9 i.e. ZoomStat and press ENTER
3) Find the logistic graph of best fit and store it in Y_2 by doing: select [STAT] then move over to CALC and then move down to B:Logistic and press ENTER then after the word Logistic press [VARS] move over to Y-VARS select 1:Function by pressing ENTER then select 2:Y_2 and press ENTER one more time
(Note: In [Y=] in Y_2 should be the logistic regression equation of best fit.)
4) Press [GRAPH]

G) Using the logistic graph from above, answer the following:
1) At 15 hours how many people will be infected? (Round down to the nearest person.)

1) ______________________

Logistic Growth Worksheet continued

II. Population Problem

A) Given below are the world population estimates.

Year	1950	1960	1970	1980	1990	2000	2010	2020	2030	2040	2050
Population (in billions)	2.52	3.02	3.70	4.44	5.27	6.06	6.79	7.50	8.11	8.58	8.91

Source: United Nations as reported in the Chicago Tribune Newspaper (years 2010-2050 projections)

Decide which equation - exponential or logistic - is the best equation to model this data and extrapolate the data past the years that are given. Then answer the following.

1) Which equation did you pick (exponential or logistic) ? 1) ______________________

2) Write the regression equation from #1) above, rounding to *thousandths* place. 2) y = ______________________________________

B) Another scientist came up with population projections listed in the table below

Year	1950	1975	1990	2000	2025	2050	2075	2100	2125	2150
Population (in billions)	2.52	4.079	5.311	6.463	10.978	21.161	46.261	109.405	271.138	694.213

Source: reported in the Discover November 1992 magazine (years 2025-2150 projections)

1) Which equation - linear, exponential, or logistic - was used to get the values at the end of the table? 1) ______________________

2) Which population projection - A) or B) from above - do you feel will be the most accurate for predicting population in the 21st and 22nd centuries? 2) __________

3) Using complete sentences explain why you feel the answer in #2) above is the best from which to make future population predictions?

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