Exploring the World of Math

Name: _____ Date: _____

Human Population Growth

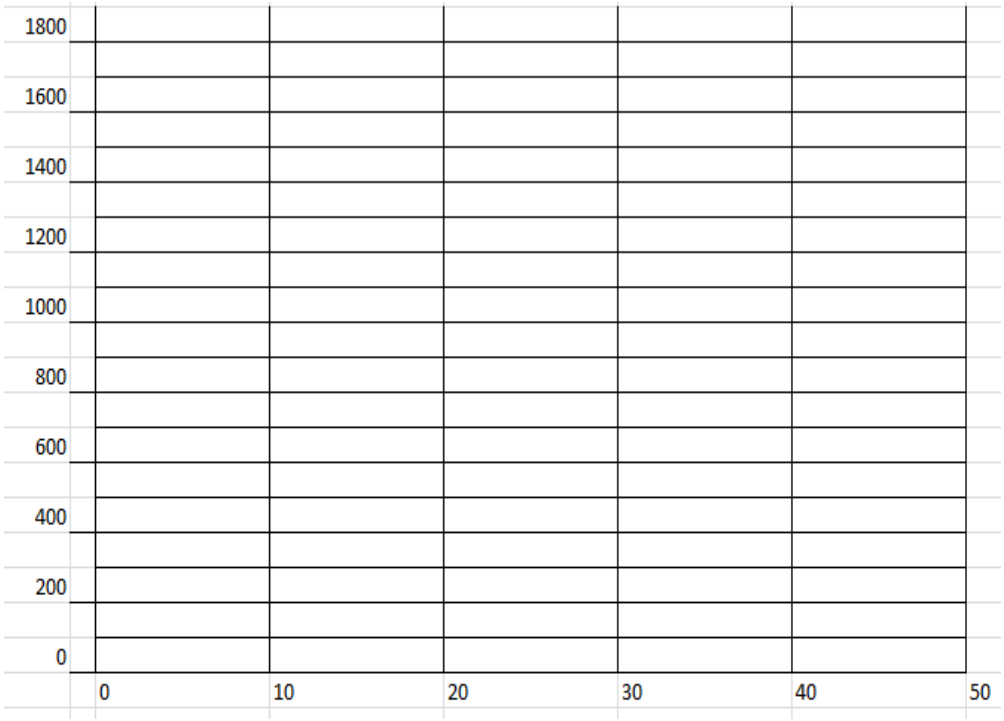
1. In 2000, the world's population is just over 6 billion. Using the formula, $t = \frac{\ln(\frac{N}{N0})}{r}$ where N is the new population and N_0 is the original population. At the growth rate of 1.3%, what year will the world's population reach 7 billion? Show your calculation.

Population Growth

2. We estimate the rate of growth in the population of the zebras to be 1.5%. Using $N = N_0e^{rt}$ where the initial population is 825, what can we estimate the population to be in a 20 years if this group is protected? e = 2.71828

3. If we calculate the rate of growth formula using t equals 1 ÷ 2, estimate how many new zebras will join the group in a half of a year? Why do we use t equals 1 ÷ 2?

4. Create a graph of the zebras population at 10, 20. 30 and 40 years



Formulas

Population Reduction

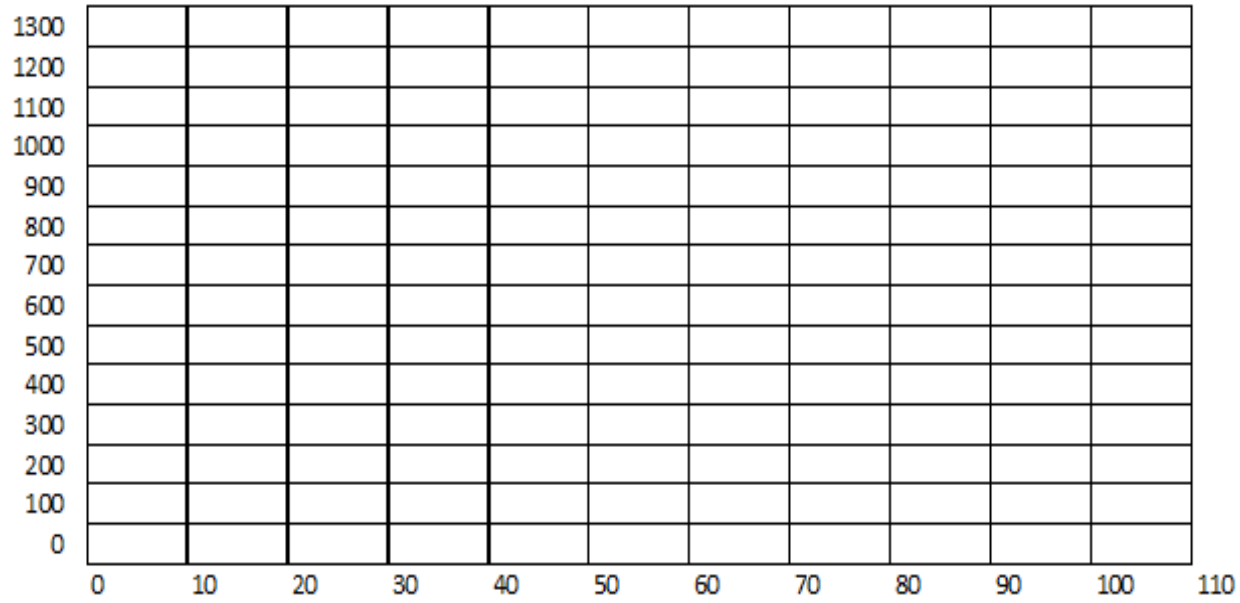
5. We estimate the rate of growth in the population of red wolf to be -4.5%. Using $N = N_0e^{rt}$ where the initial population in the area is 2000, what can we estimate the population to be in 10 years if this group's reduction stays the same? e = 2.71828

6. Using the formula, $t = \frac{\ln(\frac{N}{N_0})}{r}$ where N is the new population and N_0 is the original population. At the present rate of decline, how many years will pass for the population to be cut in half?

7. Using the formula, $t = \frac{\ln(\frac{N}{N_0})}{r}$ where N is the new population and N_0 is the original population. At the present rate of decline, how many years will pass for the population to be cut in a quarter?

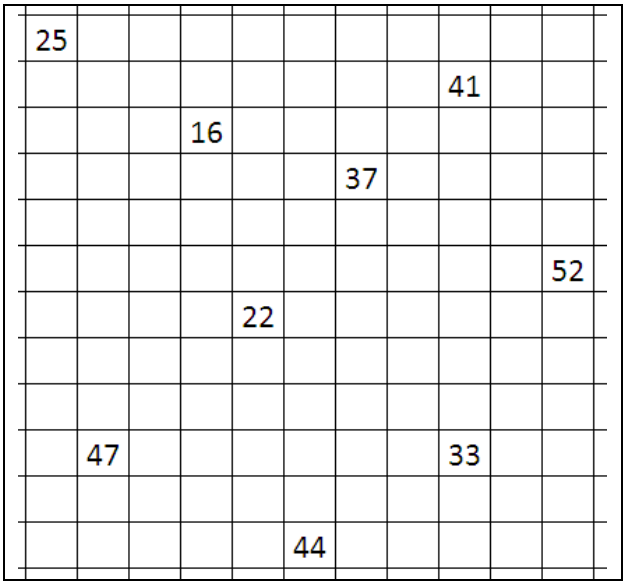
8. Using the formula, $t = \frac{\ln(\frac{N}{N_0})}{r}$ where N is the new population and N_0 is the original population. At the present rate of decline, how many years will pass for the population to be cut to 100 red wolves?

9. Create a graph of the red wolf population based upon four calculations.



Population Density

10. Roberta counts the number of rabbits that live in the wildlife preserve. She has time to record the following numbers per square kilometers. Estimate the number in all of the area.



Inbreeding Effective Size and Sex Ratio Correction

11. In the table, we can see the population of the reptiles over a period of time. Calculate the Inbreeding Effective Size for the reptiles using the population in the chart. Also, calculate the corrected population for 2005 to 2012

Year	Adult Population	Adult Females	Adult Males	Corrected Population
2005	515	375	140	
2006	154	81	73	
2007	130	75	55	
2008	210	105	105	
2009	237	83	154	
2010	201	70	131	
2011	177	65	112	
2012	266	145	121	

Logistic Growth Model

12. We will use a new formula called the Logistic Equation to look at populations in fixed areas. In our example, we acquire a tank that can hold 10,000 fish. We stock the tank with 1500 fish and we find the growth rate of our fish is around 3%. Calculate the population for the fish for each year for 5 years.

$$p_{N+1} = r \times (1 - p_N) \times p_N$$

where r is the growth rate as a percent and p_N is the decimal percent of the habitat's capacity

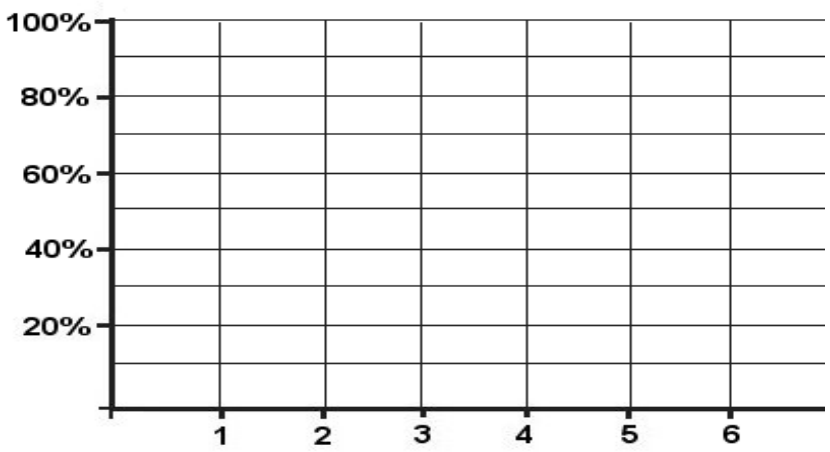
What happens in the first year?

What happens in the second year?

What happens in the third year? :

What happens in the fourth year? :

Plot the graph for your data:



Population Migration

13. From what direction is the major migration spreading?
    a. North
    b. South
    c. East
    d. West

14. From what direction is the minor migration spreading?
    a. North
    b. South
    c. East
    d. West

4	1	2	30	80	175	75	50	175	80	30	2	2	10
1	2	35	50	175	250	150	200	250	175	50	35	10	5
2	3	50	150	275	300	250	350	300	275	150	50	10	2
3	2	20	75	325	275	350	450	275	325	75	20	2	3
2	5	1	5	50	200	500	400	200	50	5	1	6	2
5	20	20	75	325	275	350	450	275	325	75	20	2	3
1	2	50	55	45	82	250	201	150	45	150	50	10	2
1	2	1	2	10	50	250	50	10	2	3	1	2	1
1	2	1	2	5	25	150	25	5	2	1	1	1	1
1	6	4	2	1	4	1	3	1	2	8	2	1	2
3	3	4	4	2	1	2	2	1	10	50	10	2	3
2	4	4	5	1	2	3	2	5	25	150	25	5	2
1	2	4	10	1	3	2	2	10	50	250	50	10	2