

## Exploring the World of Math

Name: \_\_\_\_\_ Date: \_\_\_\_\_

### Human Population Growth

1. In 1959, the world's population is just over 3 billion. 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 growth rate of 1.52%, 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 white tigers to be 1.8%. Using  $N = N_0 e^{rt}$  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  $1 \div 4$ , estimate how many new white tigers will join the group in a half of a year? Why do we use t equals  $1 \div 2$ ?

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

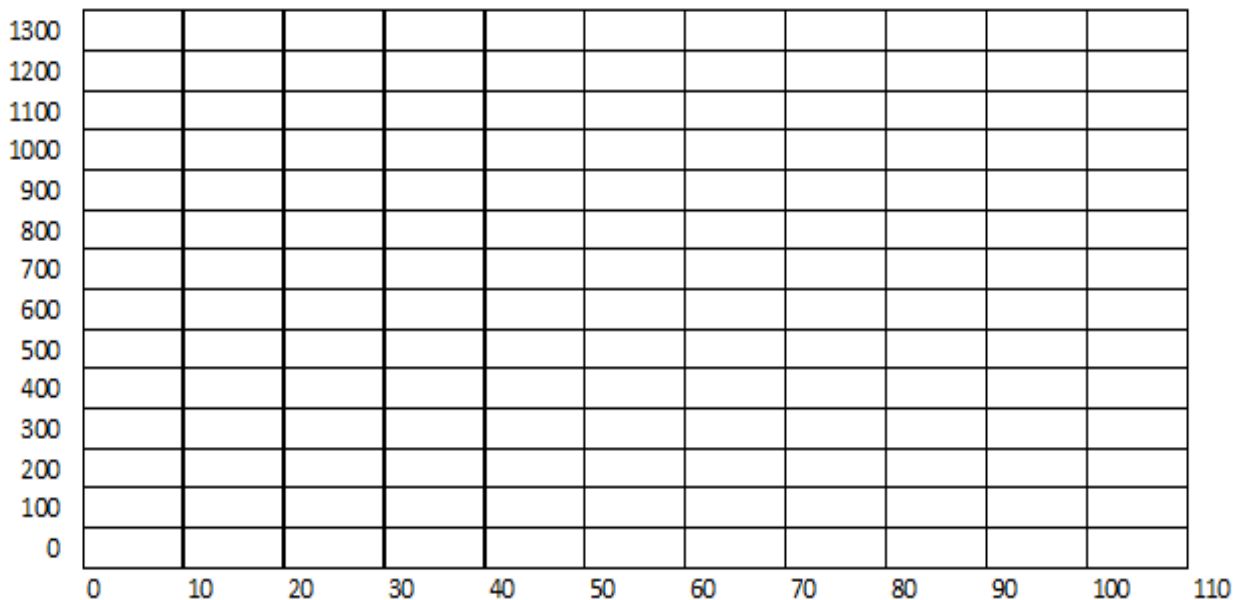
1800						
1600						
1400						
1200						
1000						
800						
600						
400						
200						
0						
	0	10	20	30	40	50

Formulas


## Exploring the World of Math

### Population Reduction

5. We estimate the rate of growth in the population of dolphins to be -3.5%. Using  $N = N_0 e^{rt}$  where the initial population in the area is 1280, 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 dolphin population based upon four calculations.



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### Population Density

10. Marsha counts the number of possum 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.

16													
		13										25	
					19								
										23			
					25								
	19											31	

### 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	105	63	42	
2006	32	21	11	
2007	41	26	15	
2008	72	40	32	
2009	78	28	50	
2010	68	25	43	
2011	65	24	41	
2012	82	48	34	

## 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 20,000 fish. We stock the tank with 3500 fish and we find the growth rate of our fish is around 3.5%. 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? :

What happens in the fifth year? :

What happens in the sixth year? :

Plot the graph for your data:

