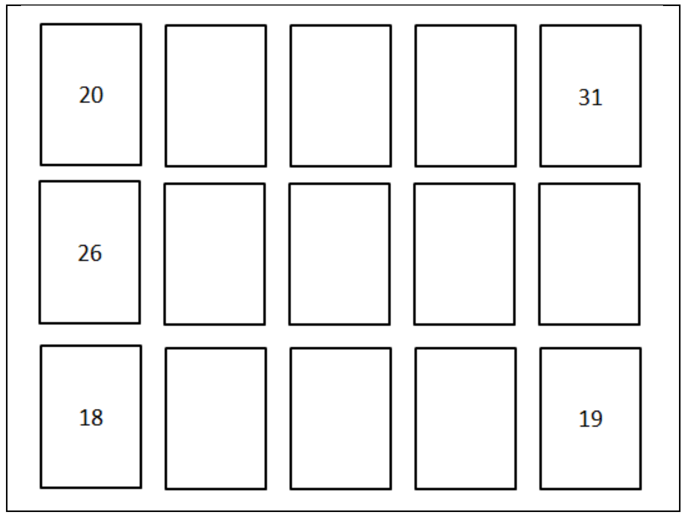
Exploring the World of Math

Name: ______________________________ Date: ______________

Population Density

1. Nelson measures the acreage of the wildlife preserve at 325 acres. On the northeast side of the marsh, he counts 17 deer per square mile. What is the estimated number of deer on the preserve? There are 640 acres in a square mile.

2. Mercy counts the number of saltwater crocodiles, an endangered animal that is bred in pens. She has time to record the number of crocs in five pens. Estimate the number in all of the pens.



Inbreeding Effective Size and Sex Ratio Correction

3. In the table, we can see the population of the lizards over a period of time. Calculate the Inbreeding Effective Size for the lizards using the population in the chart.

Year	Population
2007	210
2008	348
2009	205
2010	95
2011	250
2012	325

4. In the table, we can see the population of the snakes over a period of time. Calculate the Inbreeding Effective Size for the snakes using the population in the chart. Also, calculate the corrected population for 2006 to 2012

Year	Adult Population	Adult Females	Adult Males	Corrected Population
2006	152	95	57	
2007	51	26	25	
2008	45	23	22	
2009	50	31	19	
2010	48	32	16	
2011	53	27	26	
2012	44	26	18	

Logistic Growth Model

5. 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 25,000 fish. We stock the tank with 5000 fish and we find the growth rate of our fish is around 2.5%. 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 and p_N is the decimal percent of the habitat's capacity

The first year calculation is: $P_1 = 2.5 \times (1 - 0.2) \times 0.2 = 0.4$

The second year calculation is: $P_2 = 2.5 \times (1 - 0.4) \times 0.4 = 0.6$

What happens in the third year? :

What happens in the fourth year? :

What happens in the fifth year? :

What is happening to the population?

6. In our next example, we again use a tank that can hold 25,000 fish. We stock the tank this time with 7000 fish and we find the growth rate of our fish is around 2.5%. 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 and p_N is the decimal percent of the habitat's capacity

The first year calculation is:

The second year calculation is:

The third year calculation is:

The fourth year calculation is:

The fifth year calculation is:

What is happening to the population?

<u>Population Growth</u>

7. We estimate the rate of growth in the population of the gorilla to be 2.5%. Using $N = N_0e^{rt}$ where the initial population is 550, what can we estimate the population to be in a dozen years if this group is protected? e = 2.71828

8. If we calculate the rate of growth formula using t equals 1 ÷ 12, estimate how many new gorillas will join the group in a month? Why are using t equals 1 ÷ 12?

9. Create a graph of the gorilla population at 10, 20. 30 and 40 years

10. Today, the world's population is 7.052 billion. If the present rate of growth is 1.75% and is expected to maintain at that level, what will the estimated population be in thirty years?

11. Today, the world's population is just over 7 billion. Using the formula, $t = \frac{\ln\left(\frac{N}{N0}\right)}{r}$ where N is the new population and N_0 is the original population. At the current growth rate of 1.75%, what year will the world's population triple?

Population Reduction

12. We estimate the rate of growth in the population of bison to be -3.5%. Using $N = N_0e^{rt}$ where the initial population in the area is 6530, what can we estimate the population to be in 5 years if this group is protected? e = 2.71828

13. Using the formula, $t = \frac{\ln\left(\frac{N}{N0}\right)}{r}$ 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?

14. Using the formula, $t = \frac{\ln\left(\frac{N}{N0}\right)}{r}$ 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?

15. Using the formula, $t = \frac{\ln\left(\frac{N}{N0}\right)}{r}$ 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 tenth?

16. Create a graph of the bison population based upon four calculations.