Exploring the World of Math

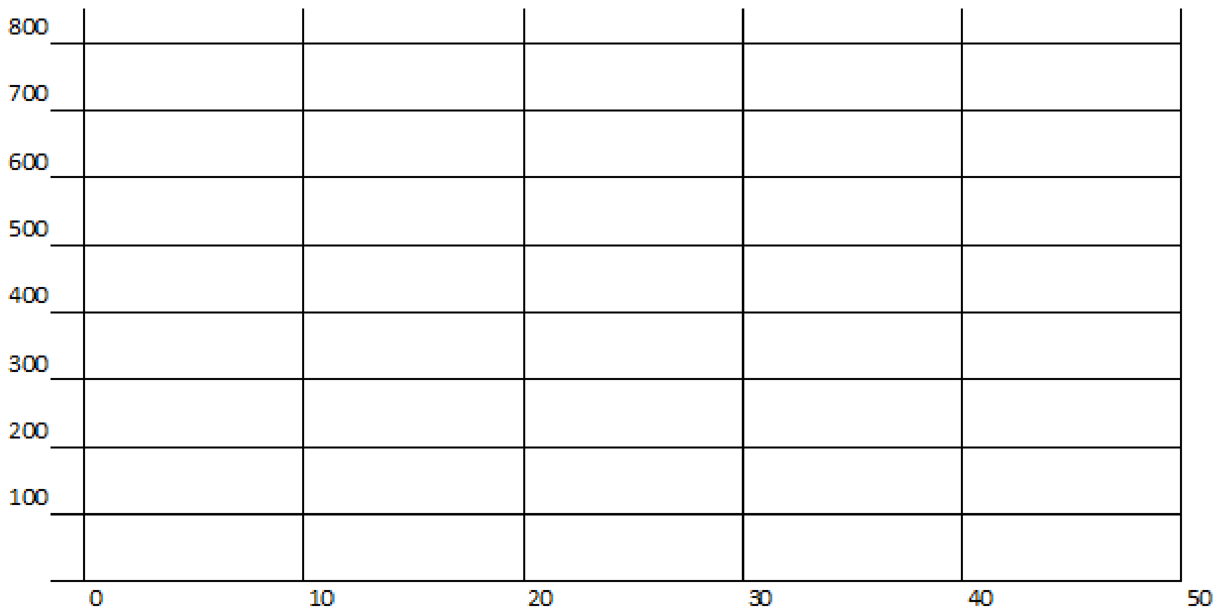
Name: ______________________________ Date: ______________

Population Growth

1. We estimate the rate of growth in the population of the pandas to be 1.6%. Using $N = N_0e^{rt}$ where the initial population is 375, what can we estimate the population to be in a ten years if this group is protected? e = 2.71828

2. If we calculate the rate of growth formula using t equals 1 ÷ 4, estimate how many new pandas will join the group in a quarter of a year? Why do we use t equals 1 ÷ 4?

3. Create a graph of the panda population at 10, 20. 30 and 40 years



4. 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 1.68%, what year will the world's population double?

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Population Reduction

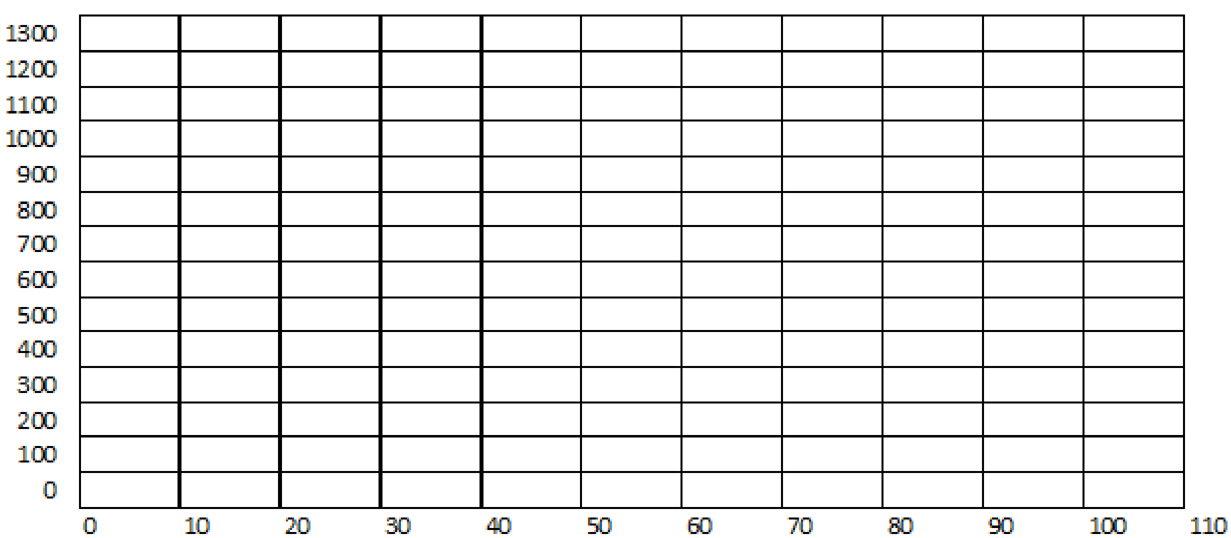
5. We estimate the rate of growth in the population of saltwater crocodile to be -2.5%. Using $N = N_0e^{rt}$ where the initial population in the area is 1250, what can we estimate the population to be in 10 years if this group's reduction stays the same? e = 2.71828

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

7. 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?

8. 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 to 500 crocodiles?

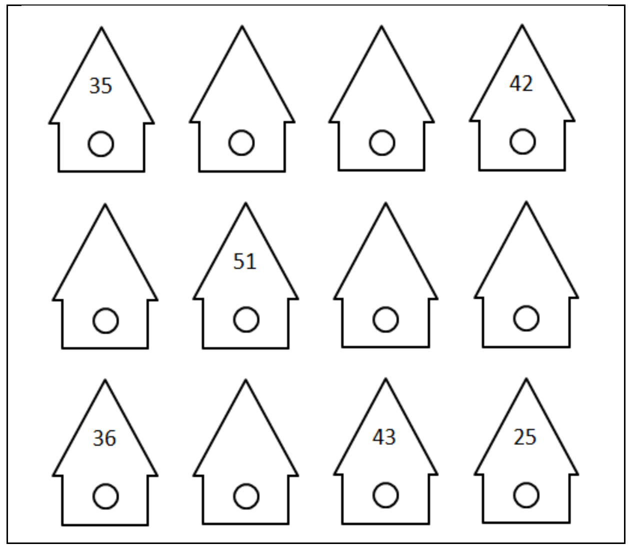
9. Create a graph of the saltwater crocodile's population based upon four calculations.



Population Density Review

10. Xenia measures the bacteria density to 125,000 per petri dish. She has nine trays that hold four columns by six rows of petri dishes. What would be the total number of bacteria grown on the trays?

11. Miranda counts the number of finch that live in our birdhouses. She has time to record the number of birds in six houses. Estimate the number in all of the houses.



Inbreeding Effective Size and Sex Ratio Correction Review

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

Year	Population
2007	308
2008	410
2009	301
2010	184
2011	325
2012	426

13. In the table, we can see the population of the turtles over a period of time. Calculate the Inbreeding Effective Size for the turtles 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	380	239	141	
2007	130	68	62	
2008	114	61	53	
2009	125	81	44	
2010	120	83	37	
2011	134	70	64	
2012	110	65	45	

<u>Logistic Growth Model Review</u>

14. 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 15,000 eels. We stock the tank with 5000 eels and we find the growth rate of our eels is around 2%. Calculate the population for the eels 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?

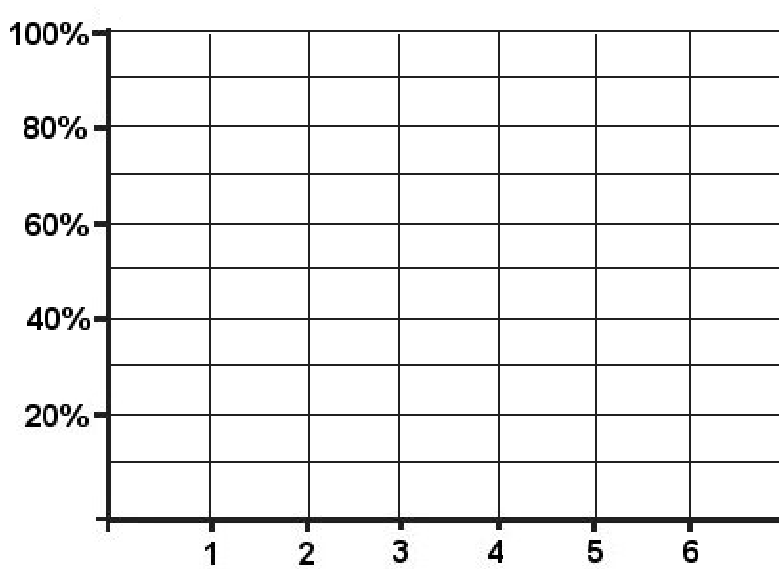
What happens in the second year?

What happens in the third year? :

What happens in the fourth year? :

What happens in the fifth year? :

Plot the graph for your data:



What can we do to increase the population in the closed habitat? Support your answer with a calculation.

Population Migration Review

15. Shade in the new Martian base.

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

16. New Earth is the oldest colony. Can you identify the portion of the map that has been colonized the longest?

a. Center Top b. Right side c. Lower left corner d. Upper left corner

17. Martian Land is the next oldest colony. Can you identify its portion of the map?

a. Center Top b. Right side c. Lower left corner d. Upper left corner

18. Redrock is the latest colony. Can you identify its portion of the map?

a. Center Top b. Right side c. Lower left corner d. Upper left corner