Quiz 11

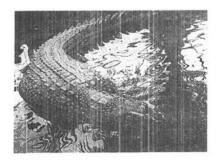
Name: Key

You must show your work to get full credit.

1. Define what it means for two functions f and g to be proportional.

2. The largest crocodile ever in captivity was Lolong a saltwater crocodile who lived in an ecotourism park in the Philippines. He was a 6.17 meters long and weighed 1,075kg (That is 20 feet 3 inches and 2,370 pounds.) Lolong is pictured to the right.

Sarcosuchus is a genus of extinct crocodile that lived 112 million years ago in Africa and South America and some of them were over 11 meters long. Assuming that Sarcosuchus had the same proportions as Lolong estimate the weight of a 11 meter specimen.



The magnicultura Factor
(=5cule factor) 13 $\lambda = \frac{1}{6.17} = 1.782$.

Estimated weight is 6,083-2 49 (=13,411 lbs)

Weight is proportional to (length)3, 40
Weight of surcosuchus = (1.782)3 (13075) = 6083.2 Ag

3. A cell has volume $V = 5 \times 10^{-6} \text{mm}^3$ and a surface area of $A = 8 \times 10^{-3} \text{mm}^2$. Assume that CO_2 passes through the cell menbraneat a rate of $.4(\text{mg/mm}^2)/\text{hr}$.

(a) What is the total amount of CO_2 coming into the cell per hour?

Amount of
$$CO_2/hour$$
 is $OO32 mg/hv$.

= .4 (8x103) mm² (mg/mm²)/h;

= -0032 mg/hr.

(b) If the cell needs $60 (\text{mg/mm}^3)/\text{hr}$ of CO_2 to survive, then how much can it be magnified before it dies from lack of CO_2 ? If we washift by

a foctor of χ than the average Magnification factor is 10.667.

The total amount of CO_2 is $4 \times (.4) = .0032 \lambda^2$ mg/hr.

The new volume is $V_{\chi} = 5 \times 10^6 \lambda^3$ mms. So $(Amount of CO_2)/Volume = <math>\frac{.0032 \lambda^2}{5 \times 10^6 \lambda^3} = \frac{640}{5} \text{ mg/mms}/\text{hr}$ The cut of is when 640 = 60, i.e. $\lambda = \frac{640}{60} = 10.667$

4. It is know that some mice were released on an island. Two years after the release there were 100 mice and three years after that there were 140 mice. Let P_t be the size of the mouse population tyears after there release, and assume that N_t grows exponentially.

(a) Give a formula for
$$N_t$$
. $N_t = N_0 \lambda^{\frac{1}{2}}$ $N_t = \frac{79.86 (1.119)^{\frac{1}{2}}}{N_0 = \frac{100}{32}}$ $N_t = \frac{79.86 (1.119)^{\frac{1}{2}}}{N_0 = \frac{100}{32}}$ $N_t = \frac{100}{32} = \frac{100}{11.119}$ $N_t = \frac{100}{32} = \frac{100}{11.119}$ $N_t = \frac{100}{32} = \frac{100}{11.119}$

(b) What is a good estimate for the original number of mice released?

- (c) What is the per capita growth rate? $\Gamma = \lambda 1$
- (d) How long until there are 10,000 mice? Time to 10,000 mice. 42.96 years (79.86) (1.119) + = 10,000 (1.119) t = 10000/79.86 ten (1.119) = lu (10000/79.86) t = In (10000/74.86) /ln (1.119)

5. A population of fish is a pond has size P_t and assume that it satisfies the discrete dynamical system

$$P_{t+1} = \frac{.5P_t^2}{1 + .001P_t^4}$$

Plot this function on your calculator with Xmin=0 and Xmax=20

(a) Assuming that $P_0 = 15$ find the following

$$P_1 = \frac{2.179}{1.00}$$
 $P_2 = \frac{2.322}{1.00}$
 $P_3 = \frac{2.620}{1.00}$

(b) Find the equilibrium points and determine which of them are stable and which are unstable.