Mathematics 172

Quiz # 12 Name: Key

You must show your work to get full credit.

1. If a 14 inch long red snapper weighs 1.2 pounds, then how much would a 24 inch long red snapper weigh?

3.527 lbs

2. A cell has volume $V = 5.3 \times 10^{-6}$ mm^3 and surface area 7.4×10^{-3}mm^2. Assume that oxygen, O_2, pass through the cell membrane at the rate of .37(mg/mm^2)/hr. If the cell needs 69(mg/mm^3)/hr to survive, then how much can it be magnified before it dies from lack of oxygen?

7.487 times

3. A strain of E. coli doubles every half hour. Start a colony with a single such E. coli with weight 10^{-15}kg.

(a) What is the weight, $W(t)$, of the colony after t hours?

$W = 10^{-15} \cdot 4^t$

(b) How long until the colony has a weight of 1,000kg?

29.90 hours

4. Solve the initial value problem $y' = -.25y$ and $y(0) = 100$.

$y(t) = 100e^{-.25t}$

5. The population size, N, of rats that escape from a ship onto an island satisfies

$$\frac{dN}{dt} = rN$$

for some intrinsic growth rate r measure in (rats/month)/rat. The initial population that escapes is 7 rats, and after 4 weeks there are 52 rats.

(a) Give a formula for $N(t)$.

$N(t) = 7e^{.5013t}$

(b) How long until there are 10,000 rats?

14.49 weeks

6. If

$$\frac{dN}{dt} = -.3N(N-10)(N-15)$$

(a) Estimate $N(100)$ for the solution with $N(0) = 17$.

$N(100) \approx 15$

(b) Estimate $N(100)$ for the solution with $N(0) = 7$.

$N(100) \approx 0$