Mathematics 172

Quiz #28   Name: _____Key_____

You must show your work to get full credit.

Consider a species of beetle that lives on small islands in the amazon river. We assume that an island unpopulated by the beetle has a probability of

$$p_i = .2$$

of being colonized by the beetles in a given year and that a populated island has a probability of

$$p_e = .8$$

of having its beetle population go extinct in a year.

Let f be the fraction (or proportion) of the islands that are populated at a given time. We argued today in class that it is reasonable to assume that f satisfies the rate equation

$$\frac{df}{dt} = p_i(1 - f) - p_e f$$

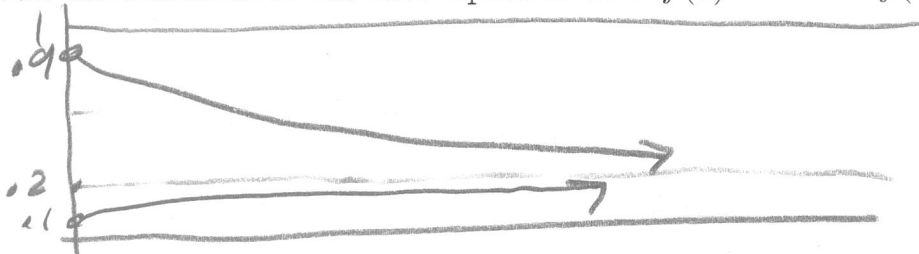1. Using the values of p_i and p_e above write the rate equation.

$$\frac{df}{dt} = .2(1-f) - .8f$$

2. Find the equilibrium points of the rate equation:

Equilibrium points are: _____.2_____

$$\text{set} \quad .2(1-f) - .8f = 0$$
$$.2 - 1.0f = 0$$
$$f = \frac{.2}{1.0} = .2$$

3. Draw the solutions to the rate equation with $f(0) = .1$ and $f(0) = .9$.

4. Assuming that $f(0) = .1$ estimate $f(50)$.

converge to the equilibrium value

$$f(50) \approx .2$$