## Mathematics 172 Homework

Islands off the cost of New Guinea are the homes of a species of fruit bat. The probability of an island having its population of bats going extinct is $p_{e}=.5$. The probability of a island with no bats being colonized by bats from a nearby island is $p_{i}=.8$ Let $f$ be the proportion, or fraction, of the islands that are populated by the bats.

1. Write down the rate equation satisfied by $f$. Answer:

$$
\frac{d f}{d t}=p_{i}(1-f)-p_{e} f=-\left(p_{i}+p_{e}\right) f+p_{i}=-(.5+.8) f+.8=-1.3 f+.8
$$

2. What is is equilibrium point for this equation? Answer: $\hat{f}=.8 / .13=$ $8 / 13=.61538$
3. If $f(0)=.3$ estimate $f(100)$. Answer: $f(100) \approx .61538$
4. If $f(0)=.3$ find the exact solution of the initial value problem

$$
\frac{d f}{d t}=-1.3 f+.8
$$

and use it to find $f(2), f(5)$ and $f(20)$.
Answer: $f(x)=.61538+(.3-.61538) e^{-1.3 t}=.61538-.31538 e^{-1.3 t}, f(2)=$ $.59195, f(5)=.61491, f(20)=.61538$.

