Math 172 Spring 2011 Worksheet 10

1. Consider a predator-prey model in with a victim population V and a predator population P. The following assumptions are in effect:

- V grows exponentially in the absence of the predators
- P declines exponentially in the absence of the victims
- the feeding rate per predator is linear a linear function of V.

Write the differential equations for $\frac{dV}{dt}, \frac{dP}{dt}$ that reflect these assumptions.

2. Consider a predator-prey model in with a victim population V and a predator population P. The following assumptions are in effect:

- V has a logistic behavior in the absence of the predators
- the feeding rate per predator is an unspecified function $R(V)$

Write the differential equation for $\frac{dV}{dt}$ that reflects these assumptions.

3. A predator population exhibits a type II functional response to prey, consuming prey at a rate of $R = R(V) = \frac{12V}{4+V}$.

a. Assume that the victim population V grows exponentially in the absence of the predators. Write the differential equation for $\frac{dV}{dt}$.

b. What is the maximal feeding rate of the predators?

c. When the size of the victim population is very small, the feeding rate of the predators R can be approximated by a linear function. What is that function?

d. For what size of the victim population is the feeding rate $R(V)$ equal to half of the maximal feeding rate?

e. Assume that $\frac{dP}{dt} = -qP + \beta VP$. Use the equation for $\frac{dV}{dt}$ that you found in a. to find the equations of the two isoclines. You may choose numerical values as you wish for the constants q, β and other constants that may appear in the equation of $\frac{dV}{dt}$.