Written Assignment 5

Due Tuesday, November 6th

1. Ch 3.3 # 32.

2. In this problem you will make the Bee model more realistic. Recall that the bee stays at each flower for a time t and has a travel time of τ between flowers. Let's suppose that the bee will fly to a farther flower if it has spent more time at the previous flower.

   (a) The last sentence says that $\tau = \tau(t)$ should be a function of t. Should τ be an increasing or decreasing function of t?

   (b) The simplest possible model here is a *linear* model. Assume that if the bee spends no time at a flower then it will fly for two seconds. Also, suppose that for each second the bee spends gathering food at the current flower it can fly an extra half a second. Find the equation of $\tau(t)$.

   (c) Again, the bee wants to maximize the rate per visit, $R(t) = \dfrac{F(t)}{t+\tau}$. Using the linear model $\tau(t)$ you found in (b), find the formula for $R(t)$. Assume, as in class, that the amount of food $F(t)$ is given by $F(t) = \dfrac{t}{t+1}$. [Your answer should be a pure function of time.]

   (d) Analyze the model: what is the optimal time for the bee to spend at a given flower?

3. Chapter 3.4, (a) # 16, (b) # 18, (c) # 20.

4. Find all local extrema for the following functions. Classify them as local minima or local maxima.

   (a) $F(x) = xe^{-x^2}$

   (b) $G(x) = e^x + e^{-2x}$ [Hint: this is NOT e^{-x}.]

   (c) $R(t) = \dfrac{t^2+1}{t}$

   (d) $S(x) = x^2 \cdot \ln(x)$

   (e) $K(s) = s^3 e^{-s}$

5. Chapter 3.3, (a) # 8, (b) # 10.