MATH 155. Homework 6.

1. (Adler, Section 2.4, Problems 32 and 34). A bear sets off in pursuit of a hiker. For each of the following descriptions do the following: On the same plot, graph the position of the bear and that of the hiker as functions of time. Mark clearly which graph corresponds to the bear and which to the hiker.

a. Both the hiker and the bear increase in speed until the bear catches the hiker. (The bear just wants to give the hiker a big, friendly hug.)

b. The bear runs at constant speed, while the hiker steadily runs faster and faster until the bear gives up and stops. The hiker slows down and stops soon after that.

2. A warm pitcher of tea is placed into a cold freezer. Sketch a graph of the temperature of the tea as a function of time. Compare the initial rate of change of the temperature to the rate of change after an hour; is it smaller or larger?

3. The invasion of non-native plants, animals, and pathogens has escalated dramatically over the past few decades. Overall economic costs associated with the impact of invasive species on, for exmaple, the quality of cropland and fisheries and real estate value is estimated to be \$1.4 Trillion annually across the globe. Mathematical models of the wave of advance of an invasive species into a region take into account the reproductive rate r and rate of random dispersal D. These models suggest that the speed at which an invasion wave advances is given by $S(r) = 2\sqrt{Dr}$. Calculate the derivative of the wave speed S with respect to the reproductive rate r. Explain the meaning of this derivative.