Midterm 3, Math 30, April 28, 2008

1) Average waiting time in a sandwich shop is 2 min. The manager placed an ad offering customers waiting for more than 5 min free drink. What percentage of customers will get a free drink? *(Hint: Probability density function for waiting time is* $p(t) = \frac{1}{\mu} e^{-\frac{t}{\mu}}$ *where μ is the average time.)* **(10 pts)**

2) Find the function f(x) that passes through a point (1,-1) and whose slope at (x,y) is y^2x. **(10 pts)**

3) Trout population in the lake is modeled by the equation.

$$\frac{dP}{dt} = P^2(P - 1500)(2000 - P)$$

a) Plot the fish population over time if the starting population is 1000. **(5 pts)**
b) Plot the fish population over time if the starting population is 2100. **(5 pts)**
(Note: In your drawing clearly label the numbers for the starting and final populations after a long time)

4) Write down but don't solve differential equation for following problems.

a) A virus infects cells at the rate proportional to the product of the fraction of the infected cells and the fraction of healthy cells. Let I(t) be the fraction of infected cells. **(5 pts)**

b) Radioactive atoms decay at the rate proportional to their number. Let N(t) be the number of radioactive atoms. **(5 pts)**

5) Bacteria culture grows at the rate of $\frac{dP}{dt} = \lambda P$. If λ = .01/hour, how long will it take for the population to double? **(10 pts)**