Name_____
Student I.D._____

Math 2250−4
Quiz 1
January 13, 2012

1) Write down an initial value problem for the function $N(t)$, as described below. Do not attempt to find the actual solution function.

In a city with a population of 20 thousand people, the number of people *N* who have heard a certain rumor *t* days after the rumor began is increasing at a rate proportional to the product of the number who've heard the rumor and the number who haven't yet heard it. The rumor began when 3 thousand people heard it on the radio.

(4 points)

Translating the words into their mathematical equivalents yields

$$N'(t) = k \cdot N(t) \cdot (20 - N(t))$$

if my population units are thousands of people, or

$$N'(t) = k \cdot N(t) \cdot (20,000 - N(t))$$

if I choose to use individual people as population units. Thus for the IVP you could end up with either of

$$P'(t) = k\,P\,(20 - P)$$
$$P(0) = 3$$

or

$$P'(t) = k\,P\,(20,000 - P)$$
$$P(0) = 3,000$$

2) Find the position function $x(t)$ of a particle moving along a straight line, if the acceleration $a(t) = e^{-(0.5)\,t}\,\frac{m}{s^2}$, and the initial position and velocity are given by $x(0) = 0\ m$ and $v(0) = 3\ \frac{m}{s}$.

(6 points)

$$v'(t) = e^{-.5t}$$
$$v(t) = \int e^{-.5t}\,dt = -2\,e^{-.5\cdot t} + C$$
$$v(0) = 3 = -2 + C \Rightarrow C = 5 \Rightarrow v(t) = -2\,e^{-.5t} + 5 \quad \frac{m}{s}$$
$$x(t) = \int v(t)\,dt = \int -2\,e^{-.5t} + 5\,dt = 4\,e^{-.5t} + 5\,t + C$$
$$x(0) = 0 = 4 + 0 + C \Rightarrow C = -4$$
$$x(t) = 4\,e^{-.5t} + 5\,t - 4\ \ m$$