Name_____
Student I.D._____

Math 2250-4
Quiz 1 Makeup - Solutions
January 15, 2013

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 5 thousand people heard it** on the radio.

(4 points)

first bold: $N'(t) =$
first italics: $k\cdot$
second underline, also using first underline: $N(20,000 - N)$.
second bold: $N(0) = 5000$.
So the initial value problem for $N(t)$ *is*

$$N'(t) = kN(20,000 - N).$$
$$N(0) = 5000.$$

If you use people units of thousands of people, then the equivalent (and also correct) IVP is

$$N'(t) = kN(20 - N)$$
$$N(0) = 5$$

2) Find the position function $x(t)$ of a particle moving along a straight line, if the acceleration $a(t) = e^{-(0.2)t}\ \frac{m}{s^2}$, and the initial position and velocity are given by $x(0) = 0\ m$ and $v(0) = 3\ \frac{m}{s}$.

(6 points)

$$x''(t) = e^{-.02t}$$
$$\Rightarrow x'(t) = \int e^{-0.2t}dt = \frac{1}{-.2}e^{-.2t} + C = -5e^{-.2t} + C.$$
$$x'(0) = 3 = -5 + C \Rightarrow C = 8$$
$$x'(t) = -5e^{-.2t} + 8$$
$$\Rightarrow x(t) = \int -5e^{-.2t} + 8\,dt = 25e^{-.2t} + 8t + C.$$
$$x(0) = 0 = 25 + C \Rightarrow C = -25.$$
$$x(t) = 25e^{-.2t} + 8t - 25.$$