**Name**_____
**Student I.D.**_____

# Math 2250-4
# Quiz 1 Solutions
# January 11, 2013

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

A flu virus is introduced into an isolated city with a population of eight thousand people. As the flu spreds, the time rate of change of the number $N(t)$ of infected people *is proportional to* the **product of the number who are infected with the number who are not infected** (because the probability that an infected person meets an uninfected person is also proportional to this product). On the day $t = 0$ that the flu epidemic becomes known to local authorities there are already one thousand people infected.

(4 points)

*underlined above:* $N'(t)$
*italicized above:* $= k \cdot$
*bolded above:* $N(t) \cdot (8000 - N(t))$
*underlined above:* $N(0) = 1000$.
*So the initial value problem is*

$$N'(t) = k\,N(t)\,(8000 - N(t))$$
$$N(0) = 1000$$

*If your units are thousands of people, then the IVP is*

$$N'(t) = k\,N(8 - N)$$
$$N(0) = 1.$$

*(Either IVP is correct, once you specify units.)*

2) Find the position function for an object moving along a line with acceleration $a(t) = 6\sin(3t)\ \frac{m}{s^2}$ if it's initial velocity is $v_0 = 0\ \frac{m}{s}$ and its initial position is $x_0 = 5\ m$.

(6 points)

$$x''(t) = 6\sin(3t)$$
$$\Rightarrow x'(t) = \int 6\sin(3t)\,dt = -2\cos(3t) + C.$$
$$x'(0) = 0 = -2 + C \Rightarrow C = 2.$$
$$x'(t) = -2\cos(3t) + 2$$
$$\Rightarrow x(t) = \int -2\cos(3t) + 2\,dt = -\frac{2}{3}\sin(3t) + 2t + C.$$
$$x(0) = 5 = 0 + 0 + C \Rightarrow C = 5.$$

*So*

$$x(t) = -\frac{2}{3}\sin(3t) + 2t + 5$$