**Name:** _____ **Sec. Number:** _____

**TA:** _____ **Sec. Time:** _____

**Math 20D.**
**Quiz 1**
**April 11, 2008**

***Answer each question completely, and show your work.***
***If you use extra paper, write your name on each extra page,***
***and staple the question page and your own added pages together.***

1. A radioactive material desintegrates at a rate proportional to the amount currently present. Let $q(t)$ be the amount of material present at the time $t$, let $q'(t)$ be its time derivative and $r > 0$ be a real constant. Then, the amount of radioactive material satisfies the differential equation $q'(t) = -r\, q(t)$.

   (a) (25 points) The half-life $t_h$ of a radioactive material is the time required for an amount of this material to decay to $1/2$ of its original value at time $t = 0$. If the half-life is $t_h = 10$ years, find the rate of change constant $r$.

   (b) (25 points) Find the time required for the radioactive material to decay to $1/8$ of its original value at time $t = 0$.

2. (50 points) Find the solution $y(t)$ to the initial value problem

$$y'(t) - 4y(t) = e^{3t}, \qquad y(0) = 2.$$