Math 0290 **Midterm Exam 1**

Spring 2016 **Name:** _____

No calculators, no books. Show all your work (no work = no credit).
Write neatly. Simplify your answers when possible.

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1. (15 points) A hospital received 200 mg of the isotope Iodine 131. After 14 days only 60 mg remained. Find the half-life of the isotope. Write answer in exact form.

2. (15 points) Determine a type of the given differential equation and find the solution of the initial value problem.

$$(3+t)x' + x = \sin t, \qquad x(0) = 0$$

3. (15 points) Determine a type of the given differential equation and find its general solution.

$$y' = 2xe^{-y}, \quad \text{where } y' = \frac{dy}{dx}$$

4. (15 points) A 0.2 kg mass is attached to a spring having a spring constant 5 kg/s^2. The system is displaced 0.3 m from its equilibrium position and released from rest. If there is no dumping present, find the amplitude, frequency, and phase angle of the resulting motion.

5. Consider the equation $y'' - 6y' + 9y = e^{3t}$.

(a) (10 points) Find the fundamental set of solutions of the corresponding homogeneous equation.

(b) (10 points) Find a particular solution by using the method of variation of parameters.

(c) (10 points) Find a particular solution by using the method of undetermined coefficients.

(d) (10 points) Find the general solution.

bonus problem (15 points extra) Find the general solution of the equation $\dfrac{x'}{x} = \dfrac{1}{x} + \tan t.$