Midterm Exam I ENGR 213
Applied Ordinary Differential Equations

Fall 2010 **October 25, 2010** **Time allowed: 1h 15min**

[10 points] **Problem 1.**

For each of the following first-order differential equations, state whether it is separable, linear, homogeneous, or none of the above. You do not need to explain your answer.

Each equation may correspond to more than one listed type (in which case you must list all types) or none of them

(a) $\frac{dy}{dx} = (x-1)(x+1)$;

(b) $y' = y\sqrt{1-\frac{y}{x}}$;

(c) $\frac{dy}{dx} = y\sqrt{1-x^2}$;

(d) $x + 3y - xy' = 0$;

(e) $x\frac{dy}{dx} = \sqrt{x^2-y^2}$.

[10 points] **Problem 2.**

Find the general solution of the first-order linear differential equation

$$y' + 2y = e^{2x}.$$

Problem 3.

Given the differential equation

$$(\sqrt{x} + \frac{y}{x})dx + (y^2 + \ln(2x))dy = 0, \quad x > 0.$$

(a) [5 points] Verify that this is an exact differential equation.

(b) [5 points] Solve the equation leaving the general solution in implicit form.

See reverse side →

Problem 4.

Suppose that $A(t)$ (with t in months), the fish population in a lake contaminated by chemicals, satisfies the differential equation

$$\frac{da}{dt} = -kA(t), \quad k > 0.$$

(a) [5 points] Find the general solution of this differential equation.

(b) [5 points] Suppose today there are 500 fish in the lake, and we know that in month there will be 400 fish in the lake. How many fish will be there 1 year?

[10 points] **Problem 5.**

Given complex number $z = 8 + 8\sqrt{3}i$. Find $\sqrt[4]{z}$.