PRINCE SULTAN UNIVERSITY

Department of Mathematical Sciences

(Term 151) MATH 225 First Major Exam

Sunday 11/10/2015

Time allowed: 50 minutes — Dr. Bahaa Eldin Abdalla

Maximum points: 45 — Section #

Student Name: — ID #

1. (4 points) If $f'(x) = -f(x)$ and $f(1) = 2$, then $f(3)$ can be written in the form ae^b. Determine a and b.

2. (25 points in total) Solve each of the following differential equations.
   (a) (6 points) $ty' + ty^2 = y$
   (b) (7 points) $(3xy + y^2) + (x^2 + xy)y' = 0$
   (c) (5 points) $t^2y'' + 7ty' + 10y = 0, \quad t > 0$
   (d) (7 points) $y'' - 2y' + y = -6e^x + 7$

3. (8 points) Use the method of successive approximations to find $\phi_1(t)$ and $\phi_2(t)$ for $y' = 1 - y^3, \quad y(0) = 0$. Give an approximation for $y(0.1)$. What is the equilibrium solution of $y' = 1 - y^3$.

4. (8 points) Find a fundamental set of solutions for $xy'' + (2 - 2x)y' + (x - 2)y = 0$ given that $y_1 = e^x$ is a solution.