United Arab Emirates University
Department of Mathematical Sciences
Differential Equations

FINAL EXAM
Spring 2010

Name: ID: 200

Instruction
i) No notes or books are allowed. Only simple scientific calculators are allowed.
ii) For full credit, you must present clear and detailed solutions.

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1) (2 pts) Consider the following ODE1 $y' - 2y = 2\,x^2$ and let $f(x) = e^{2x} - x^2 + ax - \frac{1}{2}$. Find the number a such that $f(x)$ is a solution of this differential equation.

2) (4pts) Classify the following first order differential equations as separable, linear or exact. Note that it may be possible that an equation is of more than one type.

(a) $x\,y' = x - y$ (b) $y\,x^2\,y' + x\,y^2 = e^x$ (c) $2\,x\,y\,y' = e^x$

3) (1+1+1+1pts) Consider the differential equation $y\,dx + (2xy - e^{-2y})\,dy = 0.$
 i) Show that differential equation is not exact.
ii) Verify that $\mu(y) = y^{-1}e^{2y}$ is an integrating factor for this differential equation.
iii) Find the general solution of the exact differential equation.

iv) What is the particular solution with $y(e^{-2}) = 1$.