King Fahd University of Petroleum & Minerals

Math 202 - 4 & 5

Dr. Jawad Y. Abuihlail

First Major Exam **Semester 042** **75 Minutes**
Name: **ID #:** **Section #:**

Q1. (10 Points - Suggested time: 5 minutes) State if each of the following statements is true or false:

1. If y_1 and y_2 are solutions of some linear ODE, then $c_1y_1 + c_2y_2$ is also a solution of the same ODE.
2. The number of integrating factors for a non-exact first-order ODE is infinite (provided it has one).
3. Every IVP of the first-order has a unique solution.
4. Every Bernoulli first-order ODE can be transformed into a linear ODE.
5. Every separable first-order ODE $\frac{dy}{dx} = g(x)h(y)$ is exact.

Q2. (20 Points - Suggested time: 10 minutes) Solve the following IVP:

$$(y-1)\,dx + x\,dy = 0,\ y(1) = 2.$$

Q3. (60 Points - Suggested time: 50 minutes) Solve each of the following ODE's (showing all details).

1. $(x^2 - y^2)\, dx + (xy)\, dy = 0.$

2. $(4x^2 - 4xy + y^2 - 3)dx - dy = 0.$

3. $(x^2y - xy^3)\,dx + \,dy = 0.$

4. $(x^2 + y^2 - 1)dx \ - (y + xy)\ dy = 0$

Q4. (10 Points - Suggested time: 10 minutes) Show that any linear differential equation

$$y' + p(x)y = f(x),$$

(with $p(x)$ and $f(x)$ continuous functions) becomes exact after being multiplied with $\mu(x) = e^{\int p(x)dx}$.