

NDU
MAT 235
Ordinary Differential Equations
Final Exam

Duration: 2 hours

Name: _____

Section: _____

Instructor: _____

Grade: _____

MAT 235 – Final Exam; Friday June 18, 2004

Name:

Instructor:

**Please note that you have 10 questions and 11 pages
(your mobile must be turned off and unseen)**

1) (8 points) Solve the differential equation $xy' + y = x^3y^4$, for $x > 0$.

2) (6 points) Solve the initial-value problem $x \frac{dy}{dx} = -y + \sqrt{xy + 1}$; with $y(1) = 3$.

Hint: Let $xy + 1 = v$

3) (8 points) Solve $(x^4 + y^2 + \cos x)dx + (xy + y)dy = 0$.

4) (6 points) Solve the differential equation $x^3 y''' + 2x^2 y'' - xy' + y = 0$, for $x > 0$

5) (10 points) Solve the differential equation $y'' - 2y' + y = \frac{e^x}{(1-x)^2}$; for $x > 1$.

6) (8 points) Find the function $x(t)$ such that $x(t) = t^2 + \int_0^t \sin(t-u)x(u) du$.

7) (12 points) Use Laplace transform to solve $\begin{cases} y_1' = 4y_1 - 2y_2 \\ y_2' = 5y_1 + 2y_2 \end{cases}; y_1(0) = 2; y_2(0) = -2.$

8) (12 points) Use Laplace transform to solve $\frac{d^2y}{dt^2} + 25y = \begin{cases} 25; & 0 \leq t < 4 \\ 0; & t \geq 4 \end{cases}$; $y(0) = y'(0) = 0$.

9) (10 points) Use the eigenvalue-eigenvector method to solve

$$y_1' = -y_1 + 6y_2$$

$$y_2' = y_1 - 2y_2$$

10) (20 points) Given $x^2y'' + xy' + \left(x^2 - \frac{1}{4}\right)y = 0$, for $x > 0$.

- a) Show that $x_0 = 0$ is a regular singular point.
- b) Find the indicial roots.
- c) Use the method of Frobenius to find the generalized power series solution in powers of x .

