Name:_____

Section:_____

Math 240
Final Exam
Dec. 19, 2002

Closed book. You may use a calculator and one 8 ½ × 11" sheet of handwritten notes (both sides). You must show your work to receive full credit. Write solutions in explicit form if possible. All problems have a solution that can be found using the techniques of this class.

Pledge:
On my honor, as a student, I have neither given nor received unauthorized aid on this examination: _____ _____

(signature) (date)

1. Solve the initial value problem,

$$\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = 0, \quad y(0) = 1, \; y'(0) = 1.$$

2. Solve the initial value problem $\frac{dy}{dx} = \frac{x^2y^3 + y}{x}, \quad y(1) = 2$

3. Solve the initial value problem

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 10y = \delta(x), \quad y(0) = 0, \; y'(0) = 0.$$

4. Find all solutions to $\frac{dy}{dx} = \frac{3x - 5y}{5x + 2y}$.

5. Find all solutions to

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 8y = 40\sin(4x).$$

6. Find all solutions to

$$2x^2\frac{d^2y}{dx^2} + 9x\frac{dy}{dx} + 6y = 0.$$

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7. Solve the following system

$$\frac{dx}{dt} = x - 4y, \qquad x(0) = 0,$$

$$\frac{dy}{dt} = x + y, \qquad y(0) = 1.$$

8. Suppose $\frac{dP}{dt} = \cos(P)$. If $\lim_{t\to\infty} P(t) = \pi/2$, what are the possible values for $\lim_{t\to-\infty} P(t)$?

9. A mass of 1kg is attached to an undamped spring causing it to stretch 20cm.While resting in the equilibrium position, the mass is then struck by a hammer and set in motion. How long will it take the mass to first return to the equilibrium position? (Use g = 980cm/sec. Note that when it returns to the equilibrium position it will be moving and will pass through that position without stopping).