MATH 220 **Final Examination** December 11, 2008

Name (print) ______________________ **Signature** __________________________

UIC ID ________________________________

(1) *Write* your name and your instructor's name on your examination booklet. (2) *Write* your answers in the exam booklet provided. (3) *Return* your copy of the examination with the examination booklet(s). (4) *Show* your work. **An unjustified answer receives no credit**. (4) There are **10** questions on this examination. Check to see that this copy is complete. (5) You may not use a calculator. (6) *You are expected to abide by the University's rules concerning academic honesty.*

(7) *Circle* your instructor's name and lecture hour:

Nenciu Kobotis

(8) *Circle* your discussion hour: 8AM 9AM 10AM 11AM 12PM 1PM 2PM 3PM

Do not write in this area.

1	2	3	4	5	6	7	8	9	10
20	**20**	**20**	**20**	**20**	**20**	**15**	**20**	**15**	**30**

SCORE __________ **/200**

1. (20) Solve the initial value problem:

$$3y + 2xy' - x^{-1/2}\ln x = 0 \quad y(1) = 1$$

2. (20) Solve the initial value problem:

$$y \ln x dx - x \ln y dy = 0 \quad y(1) = 1$$

3. (20) Find the general solution of the differential equation:

$$y^{(4)} + 4y^{(3)} + 10y'' + 12y' + 5y = 0$$

4. (20) Find the general solution of the differential equation:

$$y'' + y' = x + e^x$$

5. (20) Find the inverse Laplace transform of the function:

$$F(s) = \frac{s+1}{s^2+4}$$

6. (20) Find the Laplace transform of the function $f(t) = 3t^2e^{3t} - e^{2t}\sin(3t) + 2^t$.

7. (15) Consider the initial value problem:

$$y'' + xy^2 + x^2y = x \quad y(0) = 1 \quad y'(0) = 1$$

Find the 3rd degree Taylor approximation around 0 of the solution of this problem.

8. (20) Solve the initial value problem:

$$y'' + 4y' + 13y = 0 \quad y(0) = 0 \quad y'(0) = 6$$

9. (15) Use the elimination method in order to derive one second-order ordinary differential equation in x from the following system:

$$\begin{cases} 2y' - x' - x + 3y &= 3e^t \\ 3y' + 2x' + 3x - 2y &= e^t \end{cases}$$

Do not solve the derived equation!

10. (30) Use the method of separation of variables in order to solve the following initial-boundary value problem:

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} \quad 0 < x < \pi, \quad t > 0$$

$$u(0,t) = u(\pi,t) = 0 \quad t > 0$$

$$u(x,0) = 3\sin(2x) - 4\sin(5x)$$

Show all the work involved with the derivation of the solution.