

Name: _____ ID Number: _____

**MTH Make-up
Exam 2
October 7, 2008**

No calculators or any other devices are allowed on this exam.

Read each question carefully. If any question is not clear, ask for clarification.

Write your solutions clearly and legibly; no credit will be given for illegible solutions.

Answer each question completely, and show all your work.

- 1.** (20 points) Find the solution $y(x)$ to the initial value problem

$$2y'' + 8y' + 10y = 0, \quad y(0) = 1, \quad y'(0) = 0.$$

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- 2.** (20 points) Use the method of undetermined coefficients to find the general solution $y(x)$ of the inhomogeneous equation

$$y'' + 4y = 3 \sin(2x).$$

- 3.** (20 points) Use the method of variation of parameters to find a particular solution $y(x)$ to the inhomogeneous equation

$$(1 - x)y'' + xy' - y = 2(1 - x)^2e^x, \quad x \neq 1,$$

knowing that the functions $y_1(x) = e^x$ and $y_2(x) = x$ are solutions of the homogeneous equation

$$(1 - x)y'' + xy' - y = 0.$$

4. (20 points) Find the **recurrence relation** for the coefficients a_n of the power series expansion $y(x) = \sum_{n=0}^{\infty} a_n (x - x_0)^n$ centered at $x_0 = 3$ of the solution of the differential equation

$$2y'' + (x + 1)y' + 3y = 0.$$

You do not need to solve the recurrence relation.

5. (20 points) Find the general solution $y(x)$ of the Euler equation

$$x^2 y'' + 3x y' + 5y = 0.$$