Name:_____

Student ID:_____

Section:_____

Instructor: Dr. Dang

Math 2320 (Differential Equations)
Practice Exam 2

Instructions:

- Work on scratch paper will not be graded.
- Show all your work in the space provided. Full credit will be given only if the necessary work is shown justifying your answer.
- **Please write neatly. If I cannot read your handwriting, you will not receive credit.**
- Simplify your answers as much as possible. Expressions such as $\ln(1)$, e^0, $\sin(\pi/2)$, etc. must be simplified for full credit.

Show all work in the space provided. Full credit will be given only if all steps are shown justifying your answer. Please write neatly and carefully, if I cannot read your handwriting, you will receive NO credit.

1. (10 points) Solve the nonhomogeneous equation using the method of undetermined coefficients:

$$y'' - 2y' + 2y = e^{2x}(\cos x - 3\sin x).$$

2. (10 points) Given that $y_1 = e^x$ and $y_2 = e^x \ln x$ are linearly independent solution of the associated homogeneous equation. Use variation of parameters to find a particular solution and then find the general solution of the equation

$$xy'' + (1 - 2x)y' + (x - 1)y = xe^x.$$

3. (10 points) Find the first four nonzero terms in a power series solution centered at 0 for the IVP:

$$y'' + 3xy' - y = 0, y(0) = 2, y'(0) = 0$$

4. (10 points)

(a) Use the definition of the Laplace transform $\mathscr{L}\{f(x)\} = \int_0^\infty e^{-sx} f(x)dx$ to find the Laplace transform of $f(x) = x^2 e^{-2x}$. (Any method other than using the definition will receive NO credit).

(b) Use a trig identity, and then use the table of basic Laplace transform to find the Laplace transform of $f(x) = \sin(2x)\sin(5x)$.

5. (10 points) Find the inverse Laplace transform:

(a) $\mathscr{L}^{-1}\left\{\dfrac{s+1}{s^2+2}\right\}$

(b) $\mathscr{L}^{-1}\left\{\dfrac{s}{(s-2)(s-3)(s-6)}\right\}$.

6. (10 points) Use the Laplace transform to solve the IVP

$$y''' + 2y'' - y' - 2y = \sin(3x), y(0) = 0, y'(0) = 0, y''(0) = 1.$$

END OF EXAM