MATH 319, Fall 2013, Assignment 8

Due date: Friday, November 8

Name (printed): _____

UW Student ID Number: _____

Discussion Section: (circle)

Liu Liu:	**301**	**302**	**303**	**304**
Huanyu Wen:	**305**	**306**	**323**	**324**
Dongfei Pei:	**325**	**326**	**329**	
Kai Hsu:	**327**	**328**		

Instructions

1. Fill out this cover page **completely** and affix it to the front of your submitted assignment.
2. **Staple** your assignment together and answer the questions in the order they appear on the assignment sheet.
3. You are encouraged to collaborate on assignment problems but you must write up your assignment independently. **Copying is strictly forbidden!**

Correctness
/20

Completeness
/5

Total:	/25
Bonus:	/3

Suggested problems:

Section 5.1: 1-7, 9-28
Section 5.2: 1-19, 23-28

Problems for submission:

Section 5.1: 2, 7, 23
Section 5.2: 5, 8 (parts (a), (b) and (d) only)
(Justify your answers for full marks!)

1. Consider the nonhomogeneous second-order differential equation

$$\frac{d^2y}{dx^2} - \frac{dy}{dx} = 1. \tag{1}$$

   (a) Find the general solution of (1) by using either the method of undetermined coefficients or variation of parameters.

   (b) Find the power series solution of (1). [**Hint:** Due to the nonhomogeneity, you will have a different recursion relation on the coefficients for $n = 0$ and $n \geq 1$. Also note that the recursion does not include the term a_0!]

   (c) Rearrange the series found in part (b) to give the general solution found in part (a). [**Hint:** This is challenging! You should, however, be able to identify a piece of the Taylor series expansion of e^x in the series solution in (b). By adding and subtracting terms appropriately to complete the summation, you should be able to obtain the solution in part (a)!]

Bonus! Reconsider the initial value problem

$$\frac{dy}{dx} = x^2 + y^2, \quad y(0) = 0$$

from the first week of class. Find the first four non-trivial terms in the power series and use this to estimate the value of $y(1.5)$. How does this compare with the "true" solution of $y(1.5) = 1.517447537$? [**Hint:** This differs from the examples in class because we will have to *multiply* the power series expansions $y(x)$ together to obtain y^2. This can be accomplished by multiplying the series term-by-term.]