

M427J: Differential Equations with Linear Algebra

Homework # 07

Handout: 03/07/2017, Tuesday

Due: 03/22/2017, Wednesday

• **Submission:** Please make your homework neat and **STAPLED**. You have to submit your homework **Wednesday** in the Problem Session. Note that *no late homework will be accepted*.

• **Assignments for Section 2.8 (III): Series Solution Near A Regular Singular Point**

In each of the following problems, find all singular points of the given equation and determine whether each one is regular or irregular.

1. $x^2(1-x)^2y'' + 2xy' + 4y = 0$
2. $x(1-x^2)^3y'' + (1-x^2)^2y' + 2(1+x)y = 0$
3. $x(3-x)y'' + (x+1)y' - 2y = 0$

In each of the following problems:

- (a) Show that the given differential equation has a regular singular point at $x = 0$.
- (b) Determine the indicial equation, the recurrence relation, and the roots of the indicial equation.
- (c) Find the series solution ($x > 0$) corresponding to the larger root.
- (d) If the roots are unequal and do not differ by an integer, find the series solution corresponding to the smaller root also.

4. $2xy'' + y' + xy = 0$
5. $xy'' + y = 0$.
6. $3x^2y'' + 2xy' + x^2y = 0$
7. $xy'' + (1-x)y' - y = 0$.