

KING FAHD UNIVERSITY of PETROLIUM and MINERALS
Physics Department
Mathematical Physics (Phys-571)
Fall 2013

Issued: 5-9-2013	Project # 2	Due date 12-9-2013
------------------	-------------	--------------------

Use MATHEMATICA to check your answers in any problem.

Read and practice the solution of Example 9.6.4 (Page 586 in the text), then do the following problem:

1- For the Bessel differential equation of first order is defined as:

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

With the following information,

$$y_1(x) = J_1(x) = \frac{x}{2} - \frac{x^3}{2^4} + \frac{x^5}{2^7 \times 3} + \dots, \quad P(x) = \frac{1}{x},$$

Find the second independent solution using the formula: $y_2(x) = W(a)y_1(x) \int_a^x \frac{e^{-\int_a^v P(u)du}}{y_1^2(v)} dv$.

2- **Solve only one** of the following differential equation using two different methods to calculate the second solution.

- 1- $x(x-1)y'' + (3x-1)y' + y = 0$
- 2- $xy'' + y' + x^2y = 0$
- 3- $x(1-x^2)y'' + (1-3x^2)y' - xy = 0$
- 4- $x(1-x)y'' + (1-5x)y' - 4y = 0$
- 5- $xy'' + y' + xy = 0$
- 6- $x(x-1)y'' + xy' - y = 0$
- 7- $x^2y'' + y' + (x^2-4)y = 0$
- 8- $x^2y'' + 5xy' + x^2y = 0$
- 9- $xy'' + 4xy' + (x^2+2)y = 0$
- 10- $2xy'' + y' + y = 0$
- 11- $x(x-1)y'' + (3x-1)y' + 2y = 0$