

**KING SAUD UNIVERSITY  
COLLEGE OF SCIENCES  
MATHEMATICS DEPARTMENT**

MATH 204

Homework Assignment No 3

Due date: 20/04/2008

**Exercise 1:** Discuss the existence of a unique solution of the following I.V.P

$$\begin{cases} 6y'' + (x^2 + 2)y' + 10y = \sin x, \\ y(2) = -1, \\ y'(2) = +1. \end{cases}$$

**Exercise 2:** Find an interval around  $x = 1$  for which the I.V.P

$$\begin{cases} x(x - 2)y'' + x^2y' + 2y = 1 + x^2, \\ y(1) = -1, \\ y'(1) = 0, \end{cases}$$

will have a unique solution.

**Exercise 3:** (i) Determine whether the functions

$$f_1(x) = 4, f_2(x) = \cos^2(x), f_3(x) = \frac{1}{2} \sin^2(x)$$

are linearly dependent or linearly independent on  $\mathbb{R}$ .

(ii) Use the Wronskian to determine whether the functions:

$$f_1(x) = x, f_2(x) = x^2, f_3(x) = x \ln x$$

are linearly independent on  $(0, +\infty)$ .

**Exercise 4:** (i) Show that  $y = e^x$  is a solution of the following differential equation

$$xy'' - (1 + x)y' + y = 0, \quad x > 0.$$

(ii) Use the formula to find a second solution.

**Exercise 5:** If  $y = \sin(2x)$  is a solution of the following differential equation

$$y'' + 4y = 0,$$

by using the method of reduction of order, find the general solution of:

$$y'' + 4y = \sin x.$$

**Exercise 6:** By using the method of Undetermined coefficients

(i) Solve the following differential equation

$$y'' + y' = \cos x + \sin x + e^x.$$

(ii) Solve the following I.V.P

$$\begin{cases} y'' + 2y' - 3y = 5e^{2x}, \\ y(0) = 2, \\ y'(0) = 7. \end{cases}$$