

Family Name: \_\_\_\_\_ Given Name: \_\_\_\_\_ I.D.# \_\_\_\_\_

## MAT3320 Assignment 1

**Total: 10 marks. Due date: Tuesday, May 23, on or before 4:00pm.**

In MATH Department (585 King Edward), there is a Drop-Box. You need to put your assignment into the box **on or before 4:00pm** on the due date. Late assignments will not be accepted.

1. (5 marks) Consider the following differential equation  $y'' + xy' - 2y = 0$ , near  $x_0 = 0$ . Note that  $x_0 = 0$  is an ordinary point, the equation has power series solution  $y(x) = \sum_{m=0}^{\infty} a_m x^m$ .

(i) (3 marks) Which of the following is the coefficient recursion relation? (You have to show your work!)

$$\begin{array}{lll} \text{(A)} \ a_{m+2} = \frac{(m-2)a_m}{(m+2)(m+1)} & \text{(B)} \ a_{m+2} = -\frac{(m-2)a_m}{(m+2)(m+1)} & \text{(C)} \ a_{m+2} = -\frac{(m-2)a_m}{(m+2)(m)} \\ \text{(D)} \ a_{m+2} = \frac{(m-2)a_m}{(m+2)(m)} & \text{(E)} \ a_{m+2} = \frac{(m-2)a_m}{(m+3)(m+1)} & \end{array}$$

(ii) (2 marks) Find two linearly independent solutions by solving the recursive relation.

2. (2 marks) Is  $y = 2 - x^3$  a solution of the Legendre's equation  $(1 - x^2)y'' - 2xy' + 6y = 0$ ? Verify your conclusion.
3. (3 marks) Let  $f(x) = x^3$ ,  $2 < x < 4$ . Find the Fourier-Legendre expansion.