# PHYS 301
# HOMEWORK #8

## Due : 5 April 2017

1. Find the recursion relation and general solution near x = 2 of the differential equation :

$$y'' - (x-2)\, y' + 2\, y = 0$$

In this case, the solution will be of the form:

$$y = \sum_{n=0}^{\infty} a_n (x-2)^n$$

(Hint: Is there a simple substitution you can make that will simplify this problem?)

2. Consider the differential equation :

$$\left(\frac{dy}{dx}\right)^2 - y = x \qquad y(0) = 1$$

Find the series solutions for this equation (there are two solutions). It is probably easier to write out the series expansion explicitly and solve for the various coefficients (rather than work with closed summation symbols). (One solution truncates quickly, the other is an infinite expansion). Find the coefficients out to $a_4$ for the non-truncating solution; find the entire solution for the branch that truncates quickly.

3. The Legendre differential equation is :

$$\left(1 - x^2\right) y'' - 2\, x\, y' + m\,(m+1)\, y = 0$$

Set x = cos $\theta$ and show that the equation becomes :

$$\frac{d^2 y}{d\theta^2} + \cot\theta \frac{dy}{d\theta} + m\,(m+1)\, y = 0$$

4. Problem 12.64 from p. 679 of the text. All parts (part a = 10 points, part b = 20 pts, c and d = 10 pts each).