

**PHYSICS 404**  
**FALL 2019**  
**1<sup>st</sup> HOMEWORK**  
**Dr. V. Lempesis**

**Hand in: Tuesday 24<sup>th</sup> of February 2019**

1. Use the Rodrigues formula and find the Legendre polynomial  $P_4(x)$ .

2. Show that:

$$(1-x^2)P_n'(x) = nP_{n-1}(x) - nxP_n'(x).$$

Hint: use the recurrence relations:  $P_{n+1}'(x) = (n+1)P_n'(x) + xP_n''(x)$  and  $P_{n-1}'(x) = -nP_n'(x) + xP_n''(x)$ .

3. Calculate the integral  $\int_{-1}^1 (x^2-1)P_n'(x)P_{n+1}(x)dx$ . (Hint: use the first and last recurrence relations in slide 15 of Lecture 1)

4. Find the general solution of the differential equation  $(1-x^2)y'' - 2xy' + 6y = 0$