PHYSICS 404
1ˢᵗ HOMEWORK
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Hand in: Tuesday 17ᵗʰ of October 2017

1. Show that for Dirac delta function we have $\delta(1+x) = \sum_{n=0}^{\infty}(-1)^n \frac{2n+1}{2} P_n(x)$

2. Show that for the Legendre polynomials we have:
$$P'_{n+1}(x) = (n+1)P_n(x) + xP'_n(x).$$

Hint: use the recurence relations: $P'_{n+1}(x) + P'_{n-1}(x) = 2xP'_n(x) + P_n(x)$ and $(n+1)P_{n+1}(x) = (2n+1)xP_n(x) - nP_{n-1}(x)$.

3. Find the associated Legendre functions $P^1_2(x)$ and $P^1_3(x)$ starting from the Legendre polynomials $P_2(x)$ and $P_3(x)$.

4. Using your answers from question 3, show that the functions $P^1_2(x)$ and $P^1_3(x)$ are orthogonal i.e. $\int_{-1}^{1} P^1_2(x)P^1_3(x)dx = 0$.