

Class Problems and Homework
Physics 403: Mathematical Methods
February 13, 2008

Note that this material will be on Short Exam 2.

Problems: Instructor, group and homework.

1. Perform the Taylor series expansion of $g(t, x) = (1 - 2xt + t^2)^{-1/2}$ about $t = 0$ up to fourth order in t . Then identify the first five Legendre polynomials.
2. Compute $P_4(x)$ and $P_6(x)$ using the recursion relation

$$(2n + 1)xP_n(x) = (n + 1)P_{n+1}(x) + nP_{n-1}(x)$$

and $n = 3$ and $n = 5$.

3. Explicitly show that

$$\int_{-1}^{+1} P_2(x) P_4(x) dx = 0$$

and

$$\int_{-1}^{+1} P_3(x) P_3(x) dx = \frac{2}{7}.$$

4. Find the coefficients in the Legendre expansion of

$$f(x) = x + 3$$

and

$$f(x) = 6x^2 + 2x - 1.$$