

Physics 3513, Homework #11 (due 12/10)

The numbers in parentheses after the problem number indicate points for each problem.

P1(20) (Boas 1.5,7) Solve by series and by an elementary method and verify that the two solutions agree:

(a) $y'' = y$,

(b) $x^2y'' - 3xy' + 3y = 0$.

P2(20) (Boas 5.10,13) Express as a linear combination of Legendre polynomials:

(a) x^4 , (b) x^5 .

P3(20) (Boas 22.5) Solve the Hermite differential equation

$$y'' - 2xy' + 2py = 0$$

by power series. Show that the a_0 series terminates when p is an even integer, and the a_1 series terminates when p is an odd integer.

P4(20) (Boas 22.15) Solve the Laguerre differential equation

$$xy'' + (1-x)y' + py = 0$$

by power series. Show that the a_0 series terminates when p is an integer.

P5(20) (Boas 22.27)

(a) Using recursion relations, show that $R = lx - (1-x^2)\frac{d}{dx}$ and $L = lx + (1-x^2)\frac{d}{dx}$ are raising and lowering operators for Legendre polynomials.

(b) Given $P_0(x) = 1$, use raising operators to find $P_1(x)$ and $P_2(x)$.