

## Homework Set 8

DUE: NOV 17, 2015 (IN CLASS)

1. Consider the Legendre equation

$$\frac{d}{dx} \left( (1-x^2) \frac{dP}{dx} \right) + \mu P = 0.$$

For  $n = 0, 1, 2, \dots$ , define the Legendre polynomials  $P_n(x)$  by

$$P_n(x) = \frac{1}{2^n n!} \frac{d^n}{dx^n} [(x^2 - 1)^n].$$

Show that the Legendre polynomials are eigenfunctions of the Legendre equation with eigenvalues

$$\mu_n = n(n+1).$$

HINT. Let  $v(x) = (x^2 - 1)^n$  and differentiate  $n+1$  times the equation  $(x^2 - 1)v' = 2nxv$ .

2. Haberman 7.10.1. (e), (f), (g)
3. Haberman 7.10.2 (a), (b)
4. Haberman 7.10.3 (a), (b)
5. Haberman 7.10.7
6. Haberman 7.10.10 (a)
7. Haberman 8.2.1 (a), (b), (c), (d)
8. Haberman 8.2.6 (a), (b)
9. Haberman 8.3.6
10. Haberman 8.3.7