Lesson #18: Separation of Variables (Spherical Coordinates) **Name:** _____

Study section 3.3.2 and answer the following questions (be sure to show your work).

1. Show that the function $R(r) = Ar^{\ell} + \dfrac{B}{r^{\ell+1}}$ is a solution to Eq. 3.58.

2. Show by direct integration that the functions $P_1(x) = x$ and $P_2(x) = (3x^2 - 1)/2$ are orthogonal on the interval (-1, 1).

3. Use the Rodrigues formula (Eq.3.62) to generate the first three Legendre polynomials: $P_0(x)$, $P_1(x)$ and $P_2(x)$.

4. Two concentric, spherical conducting shells have radii R_1 and R_2 and potentials V_1 and V_2, respectively. If we want to find the potential in the region between the shells ($R_1 < r < R_2$), can we set either term (A_ℓ or B_ℓ) in Eq. 3.65 equal to zero, as was done in Examples 3.6 and 3.7? Explain.

5. In Example 3.6, suppose the boundary condition is $V_0(\theta) = V_0$ = constant. Use Eqs. 3.66 and 3.69 to find the potential $V(r,\theta)$ inside the spherical shell. Since you should already know the answer to this question, be sure to show all your work (use the back of this page).