PHYSICS 555

Home Work Assignment # 5 10/20/2006

Due: Thurs., Oct. 26, 2006

All the numbered problems are from the text book by Griffiths.

1. (a) Show that \( \nabla \cdot \left( \frac{\hat{R}}{R^2} \right) = 4\pi \delta^3(R) \) where \( \hat{R} = r - r' \). Note that Griffiths uses the symbol “script” \( r \) for what I call \( R \) here. All the derivatives here and below are with respect to the variable \( r \).

(b) Next use the result of part (a) and Problem 1.13 (which you solved in HW # 2) to show that \( \nabla^2 \left( \frac{1}{R} \right) = -4\pi \delta^3(R) \).

(c) Use the result of part (b) to show that

\[
V(r) = \frac{1}{4\pi \epsilon_0} \int d\tau' \frac{\rho(r')}{R}
\]

satisfies Poisson’s equation.

2. Problem 2.30. In part (a) check only examples 2.4 & 2.5 [omit problem 2.11]. Do part (b). [Read part (c) but it is not necessary to do it].

3. Problem 2.31 (a) and (b)

4. Problem 2.32 (a), (b) and (c). In part (c) the radius of the spherical volume \( a > R \), the radius of the solid sphere. [Read Problem 2.33 but it is not necessary to solve it].