Physics 161, spring 2015

HW # 3
Due Wednesday 4 February by the end of the day.
I will be in my office on Tuesday afternoon.

The first four problems are from Schey's chapter two. The following five are from Purcell and Morin (three from chapter two and two from chapter 3), while the last problem arose in class on Friday.

1. Schey II-20.

2. Schey II-21.

3. Schey II-23.

4. Schey II-24.

5. P&M 2.31.

6. P&M 2.43.

7. P&M 2.61.

8. P&M **3**.75.

9. P&M **3**.76.

10. Friday's problem. We considered a potential $\varphi(x,y) = x^2 - y^2$. This scalar function satisfies LaPlace's equation so Theorem 2.1 in P&M applies. *For a scalar function that satisfies LaPlace's equation, the average value of the function on the surface of any sphere is equal to the value of the function at the center of the sphere.*
    This is a 2D problem so a circle surrounding the point (x_0, y_0) serves as the sphere. Calculate the average value of ϕ on a circle of radius r centered at (x_0, y_0) by computing the value of the line integral $\oint \phi(x,y) dl$ around the circle and then dividing the value of the integral by the arc length $2\pi r$. (This integral is easier to do after converting to circular coordinates.)