Reading assignment: Jackson chap 2
J # refers to a problem number from Jackson.
Problems:

1. [10 pts] A conductor at potential $\Phi = 0$ has the shape of an infinite plane except for a hemispherical bulge of radius $a$. A charge $q$ is placed above the center of the bulge, a distance $p$ from the plane (or $p - a$) from the top of the bulge. What is the force on the charge?

2. [10 pts] J 2.5

3. [10 pts] J 2.7

4. [20 pts] a) A rectangular box has sides of length $a, b, c$ along the $x, y,$ and $z$ axes respectively. The Green’s function for the Dirichlet (D) problem may be expanded as

$$G(x, x') = \sum_{m=1}^{\infty} \sum_{n=1}^{\infty} g_{mn}(z, z') \sin \frac{m\pi x}{a} \sin \frac{m\pi x'}{a} \sin \frac{n\pi y}{b} \sin \frac{n\pi y'}{b}. $$

Find the differential equation that $g_{mn}(z, z')$ must satisfy. b) Solve this equation subject to D boundary conditions and write down the result for $G(x, x')$. c) Find the potential $\Phi$ inside the box when $\Phi(x, y, c) = V(x, y)$ and $\Phi = 0$ on the other five sides using the Green’s function above.