Section B. Electricity and Magnetism

1. **Conducting plane with bulge**

   (a) A spherical conductor of radius a is at potential $V = 0$ with respect to infinity. A charge $Q = q$ is brought to a distance $p > a$ from the center of the sphere and you are asked to find the force on the charge. Show that this can be determined with the help of a notional image charge $Q' = -\frac{a}{p}q$ located a distance $\frac{a^2}{p}$ from the center of the sphere.

   (b) Use what you have learned in a) about image charges in a sphere to analyze the following more complicated situation: A conductor at potential $V = 0$ 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 place (distance $p - a$ from the top of the bulge). What is the force on the charge?