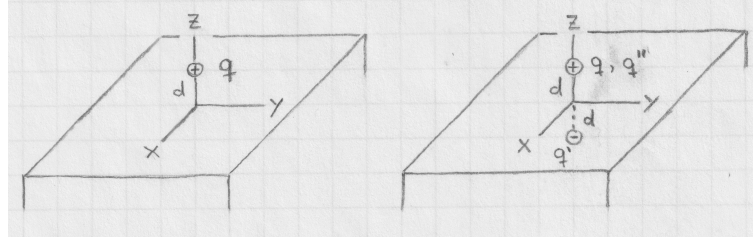


[lex48] Point charge near plane surface of dielectric II

A point charge $q > 0$ is positioned at $z = d > 0$ above the plane surface of a uniform dielectric with dielectric constant $\kappa > 1$. The polarization of the dielectric material modifies the electric field generated by the point charge at $z < 0$ inside the dielectric. In [lex32] we have calculated the electric field inside and outside the dielectric by using the method of image charges. Here we continue the analysis of this scenario.

- Calculate the induced (bound) surface charge density $\sigma(r)$, where $r = \sqrt{x^2 + y^2}$ from the discontinuity of the normal component of the electric field.
- Calculate the the total induced charge q_{ind} by integration.
- Calculate the force exerted by the field exerted on the charged surface by using the pressure formula, $P = \sigma^2/2\epsilon_0$, derived in [ln6].
- Show how the same forces can expressed as a Coulomb force between real and image charges.



Solution: