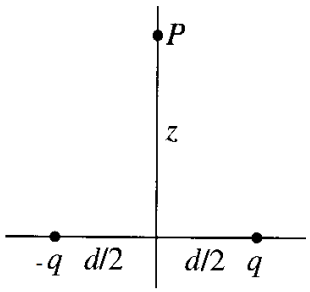
PHYS305 Homework# 2

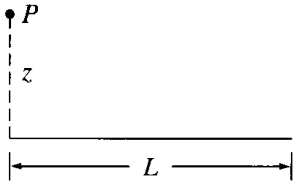
Due on 10 Oct 2021

Q#1:

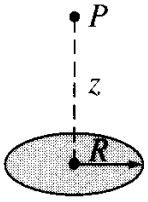
Find the electric field a distance z above the midpoint between two equal but opposite charges q and –q as shown in the figure. Check your answers for z>>d and z=0.



Q#2: Find the electric field a distance z above one end of a straight line segment of length L, which carrier a uniform line charge λ. Check your results for z>>L.



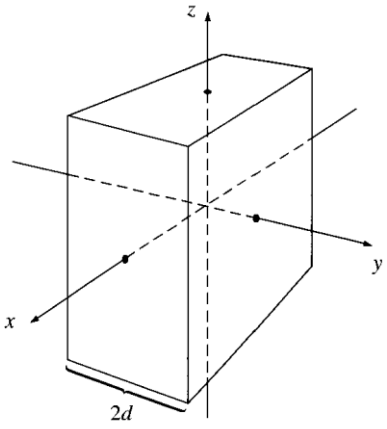
Q#3: Find the electric field a distance z above the center of a flat circular disc of radius R, which carrier a uniform surface charge density σ. Check your answer for $z \gg R$. What does your formula give for $R \to \infty$.



Q#4: Find the electric field inside and outside a sphere of radius R, which carries a uniform volume charge density ρ. Express your answer interms of the total charge of the sphere q, and draw a graph of $|\vec{E}|$ as a function of the distance from the center.

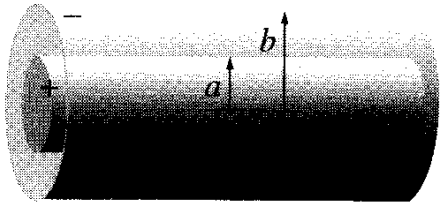
Q#5: Find the electric field inside a sphere which carries a charge density proportional to the distance from the origin, $\rho = kr$, where k is a constant. (Use Gauss's law)

Q#6: An infinite plane slab, of thickness 2d, carries a uniform volume charge density ρ as shown in the figure. Find the electric field, as a function of y, where y=0 at the center. Plot E versus y, take E positive in the +y direction.

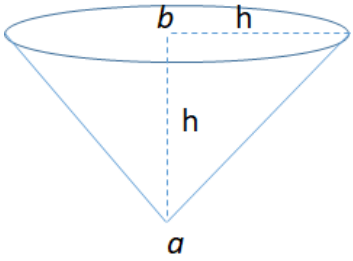


Q#7: Find the electric potential a distance s from an infinitely long straight wire that carries a uniform line charge λ. Compute the gradient of the potential to check if you get the correct electric field.

Q#8: A long coaxial cable carries a uniform volume charge density ρ on the inner cylinder of raidus ***a*** and uniform surface charge density $-\sigma$ on the outer cylindrical sheel of radius ***b*** as shown in the figure. The cable as a whole is electrically neutral. Find the potential difference between a point on the axis and a point on the outer cylinder.



Q#9: A conical surface (like an empty ice-cream cone) carries a uniform surface charge density σ. The height of the cone is h, as is the radius of the top. Find the potential difference between points a (the vertex) and b (the center of the top.)



Q#10: Find the energy stored in a uniformly charged solid sphere of radius R and charge q.

Q#11: Two spherical cavities of radii a and b, are hollowed out from the interior of a neutral conducting sphere of radius R. At the center of each cavity a point charge is placed q_a and q_b respectively. Find the surface charges σ_a, σ_b and σ_R. What is the electric field outside the conductor. What is the electric field within each cavity. What is the force on q_a and q_b.