1- (20 pts) $\vec{E} = \dfrac{A}{R^3}\cos\theta\,\vec{a_R} + \dfrac{B}{R^3}\sin\theta\,\vec{a_\theta}$
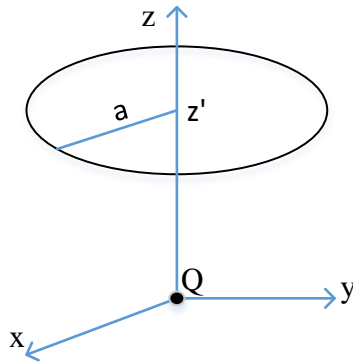
a) (10 pts)Determine the relation between A and B for the given electrostatic field $\vec{E}$?

b) (15 pts) Determine the electrostatic potential V?

2- (40 pts)

Charge Q is located at the origin. Determine the electric flux due to the charge Q through the circle centered at z=z' with radius a? (Circle is parallel to the xy plane)

3- (40 pts) An amount of charge $+Q$ is *uniformly* distributed over a *conducting sphere* with radius a. Conducting sphere is coated with a spherical medium with dielectric permittivity $3\varepsilon_0$ bewteen $a < R < b$ region and centered at origin. R>b region is free-space with dielectric permittivity ε_0.
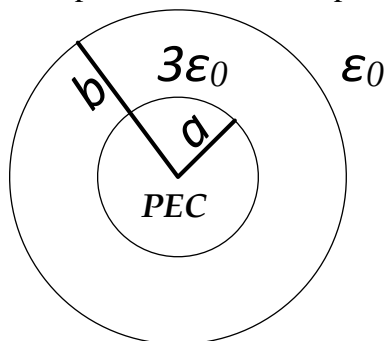
a) (15 pts) Determine the electric field intensity $\vec{E}$ field in whole space?

b) (20 pts) Determine the scalar electric potential V in whole space?

c) (5 pts) Determine the work to be performed to move a charge q from point $(x, y, z) = (0, b, 0)$ to point $(\rho, \phi, z) = (a, 0,0)$?