GAUSS'S LAW

Each group will be given one of the charge distributions given below: (α and k are constants with appropriate dimensions.)

(a) A positively charged (dielectric) spherical shell of inner radius a and outer radius b with a spherically symmetric internal charge density $\rho(\vec{r}) = \alpha\, r^3$.

(b) A positively charged (dielectric) spherical shell of inner radius a and outer radius b with a spherically symmetric internal charge density $\rho(\vec{r}) = \alpha\, 3e^{(kr)^3}$.

(c) A positively charged (dielectric) spherical shell of inner radius a and outer radius b with a spherically symmetric internal charge density $\rho(\vec{r}) = \alpha\, \frac{1}{r^2}\, e^{kr}$.

(d) A positively charged (dielectric) cylindrical shell of inner radius a and outer radius b with a cylindrically symmetric internal charge density $\rho(\vec{r}) = \alpha\, r^3$.

(e) A positively charged (dielectric) cylindrical shell of inner radius a and outer radius b with a cylindrically symmetric internal charge density $\rho(\vec{r}) = \alpha\, 3e^{(kr)^2}$.

(f) A positively charged (dielectric) cylindrical shell of inner radius a and outer radius b with a cylindrically symmetric internal charge density $\rho(\vec{r}) = \alpha\, \frac{1}{r}\, e^{kr}$.

1) Use Gauss's Law and symmetry arguments to find the electric field at each of the three regions given below:

(a) $r < a$

(b) $a < r < b$

(c) $r > b$

2) For $\alpha = 1$, $k = 1$, sketch the magnitude of the electric field as a function of r.

3) What dimensions do α and k have?