1. A long metal cylinder with radius *a* is supported on an insulating stand on the axis of a long, hollow, metal tube with radius *b*. The positive charge per unit length on the inner cylinder is λ, and there is an equal negative charge per unit length on the outer cylinder. (a) calculate the potential $V(r)$ for (i) $r < a$; (ii) $a < r < b$; (iii) $r > b$. (Hint: The net potential is the sum of the potentials due to the individual conductors.) Take $V = 0$ at $r = b$. (b) Show that the potential of the inner cylinder with respect to the outer is

$$V_{ab} = \frac{\lambda}{2\pi\varepsilon_0} ln \frac{b}{a}$$

(c) Use the result from part (a) to show that the electric field at any point between the cylinders has magnitude

$$E(r) = \frac{V_{ab}}{ln(b/a)} \frac{1}{r}$$

2. Electric charge Q is distributed uniformly along a line or thin rod of length $2a$. Find the potential at a point *P* along the perpendicular bisector of the rod at a distance *x* from its center.