Consider an infinite straight line charge of linear charge density λ.

a) Calculate the electric field everywhere outside the line charge. (The electric field is undefined at the line charge.)

b) Calculate the electric potential everywhere outside the line charge, up to an arbitrary constant. (The potential is undefined at the line charge.)

A second infinite straight line charge is now added, parallel to the first one, and a distance d away from it. The second line charge has linear charge density $-\lambda$. The figure shows the two parallel line charges in the transverse plane.

c) Show that a surface of constant potential V is a circular cylinder (a circle in the transverse plane) and find the coordinates of the axis of the cylinder and its radius in terms of d and $C \equiv \exp(V/2\lambda)$.

d) Copy (in your exam booklet) the figure below, and sketch several surfaces of constant potential in your figure. Choosing $V = 0$ at the origin, sketch surfaces of both positive and negative V.

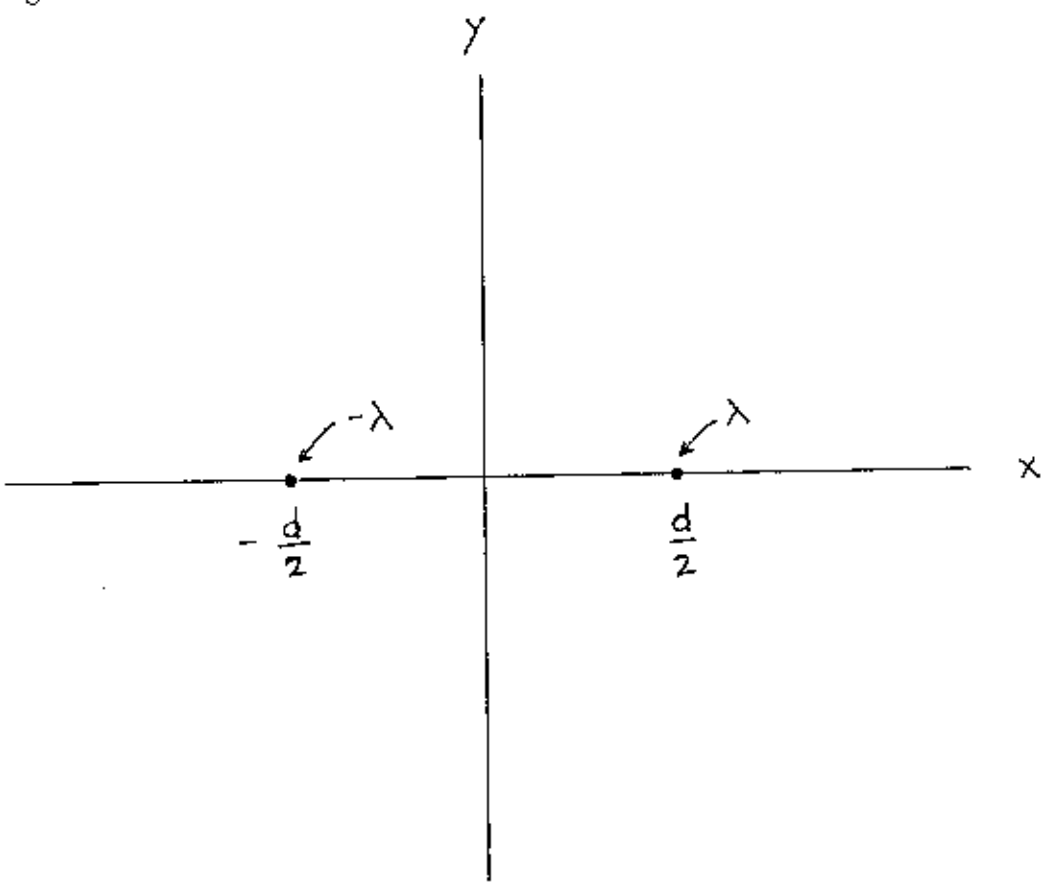

Figure for parts c) and d) only