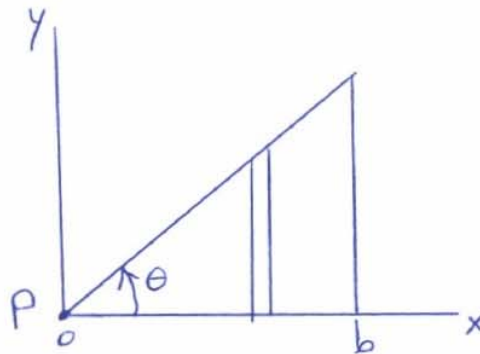


## Physics 2020 Assignment 5

1. A sphere the size of the earth has  $10^9$  esu of charge distributed evenly over its surface.
  - a) What is the electric field strength just outside the surface, in esu/cm?
  - b) What is the potential of the sphere, in statvolts with zero potential at infinity?
2. Consider a very long cylinder having uniform charge density and radius  $a$ .
  - a) Find an expression for the field inside the cylinder using Gauss's law.
  - b) Find the potential  $\phi$  as a function of  $r$ , both inside and outside the cylinder, taking  $\phi = 0$  at  $r = 0$ .
3. A thin rod extends along the  $z$  axis from  $z = -d$  to  $z=d$ . The rod has uniform charge per unit length  $\lambda$ . Find the potential at  $(0,0, 2d)$  and at  $(d, 0, 0)$ .
4. The right triangle with vertex  $P$  at the origin, base  $b$ , and altitude  $a$  has a uniform density of surface charge  $\sigma$ . Determine the potential at the vertex  $P$ . First, find the contribution of the vertical strip of width  $dx$  at  $x$ . Show that the potential at  $P$  can be written as  $\phi_P = \sigma b \ln[(1 + \sin \theta)/\cos \theta]$ .



5. A thin disk, radius 3 cm, has a circular hole of radius 1 cm in the middle. There is a uniform surface charge of  $-4$  esu/cm<sup>2</sup> on the disk.
  - a) What is the potential in statvolts at the center of the hole assuming zero potential at infinite distance?
  - b) An electron, starting from rest at the center of the hole, moves out along the axis, experiencing no forces except repulsion by the charges on the disk. What velocity does it ultimately attain?