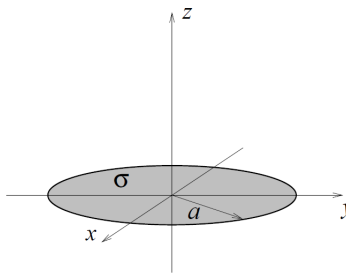


Electricity and Magnetism

Do two of the following three problems, each on a separate page (or pages) and write your name on every page you turn in.

Problem 1

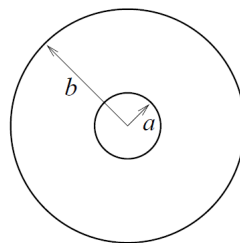
A thin insulating disk of radius a carries a uniform surface charge density σ . The disk is centered at the origin and lies in the $x - y$ plane.



- Calculate the electric field on the z -axis.
- Calculate the electric potential on the z -axis.
- Verify that $\vec{E} = -\nabla V$.

Problem 2

A small circular wire loop of radius a is located at the center of a much larger circular wire loop of radius b , as shown below. Find the mutual inductance of the loops assuming that $a \ll b$.



Problem 3

Two point charges, each of magnitude q , are situated a distance h and $h/2$, respectively, located above each other on an axis normal to an infinite conducting xy plane. What is the charge density σ on top of the plane as a function of the cylindrical radius s ?