EE 117A Spring 1996
Midterm II

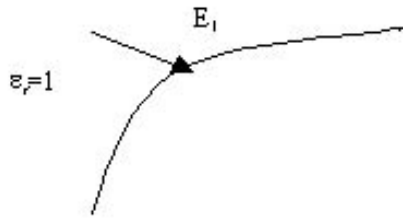
Problem 1 of 4 (25 points)

What is Stoke^Òs theorem (in words or formulas)?

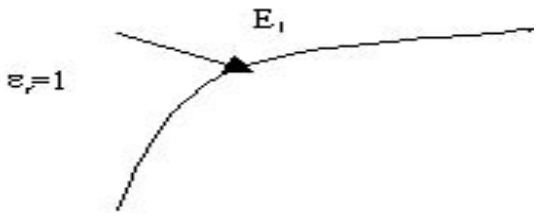
What is the divergence theorem (in words or formulas)?

How much energy do you need to move one electron from the positive plateto the negative plate of a 10μ F capacitor thatis holding a charge of 0.001 Cb?

Below you are given the intensity of the electric field at one pointof a boundary, inside material "1". Sketch the $\mathbf{F}_2$at the other side of the boundary. Both material are dielectrics



Sketch the forces (direction only, do not calculate size) exerted on thesquare loop by the infinitely long conductor. Sketch the direction of thetotal (net) force.



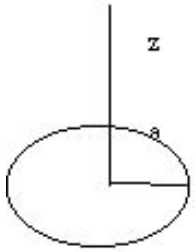
Problem 2 of 4 (25points)

a) Three point charges Q1=-9 (?C), Q2 (?C) and Q3 = -36 (?C)are arranged on a straight line. The distance between Q1 and Q3 is9 (cm). It is claimed that a location can be selected for Q2 suchthat each charge will experience a zero force. Find that location.

b) Find the energy needed to place the three charges at the locations specifiedin part (a). Assume that originally these three charges were at rest atinfinite distances from each other.

Problem 3 of 4 (25 points)

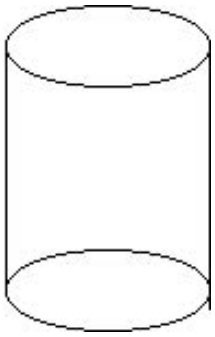
A circular insulating disk of radius a is charged with a uniform chargedensity of charge ρ_s (Cb/m^2).Find an expression for electrostatic potential, V(z) and field intensityE(z) at a point P on the axis distance z from the disk



Assume a slab of charge having infinite transverse extent, a finitethickness d, and charge density ρ_o (Cb/m^3).Using Gauss^Ò law, find the dependence of the potential difference acrossthe sheet on the thickness d.

Problem 4 of 4 (25 points)

a) A demonstration can be given that a thin metal tube can becrushed by magnetic forces by passing current through it. Take the radiusof the tube to be 2cm, and the magnetic field at which failure occurs as9Wb/m^2. What is the maximum current that can flow axially alongthe tube before failure due to magnetic forces?



b. What is the force per unit area on the surface of the tubing under thiscondition?
