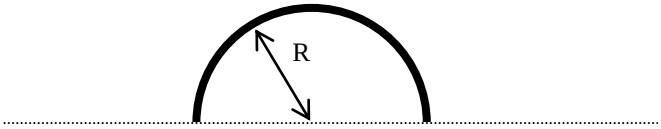
Workshop module 2 - Physics 114, Spring 2015

1) Consider a cubic surface with the area of each side of the cube being equal to 1 m^2. Let this cube be centered at the origin such that two sides are perpendicular to each of the three coordinate axes. Suppose a constant electric field of 2 N/C in the x direction permeates this region of space. What is the electric flux passing through each of the sides of the cube? What is the total flux passing through the cubical surface?

2) A flat, square surface with sides of length L is described by the equations x=L, 0<=y<=L, 0<=z<=L. (a) draw the square on a drawing of x, y, z axes (b) find the electric flux through the square due to a positive point charge q placed at the origin. *Hint: Think about the definition of flux and consider the total flux emanated from the charge.*

3) A total positive charge Q is uniformly distributed around a semicircle of radius R. Find the electric field (magnitude and direction) at the center of the semicircle (center of curvature).



4) Some modern aircraft are made primarily of composite materials (nonconductors). The U.S. Federal Aviation Administration requires that such aircraft have conducting wires imbedded into their surfaces. Why?

5) A conducting spherical shell with inner radius A and outer radius B has a positive charge of magnitude +2Q distributed evenly in its interior. The total charge on the shell is –3Q, and it is insulated from its surroundings That is to say, we have a spherical region with radius A that has a charge of +2Q spread evenly throughout which is surrounded by a conducting shell (inner radius A and outer radius B) holding a net charge of -3Q. (a) Where does the charge reside on the conducting shell? (b) Calculate the electric fields everywhere for this system. (c) Graph the electric field as a function of the radius. (d) How would this problem change if the charge distributed in the interior had a volume charge density given by $\rho(r)=(C/r^2)$, where C is a constant?