

**Class Problems and Homework**  
Physics 403: Mathematical Methods  
February 4, 2008

Problems: Instructor, group and homework.

1. Compute the volume and surface area of a sphere of radius  $R$  by computing the appropriate integrals.
2. Compute the volume and surface area of a cylinder of radius  $\rho$  and height  $\ell$  by computing the appropriate integrals.
3. Complete problems 6.40, 6.45, 6.50.
4. Compute the work done by the force  $\vec{F} = -2x\hat{x} - 3y\hat{y}$  when an object is moved from  $(x, y) = (0, 0)$  to  $(3, 2)$  along a straight line connecting these two points.
5. Compute the work done by the same force along a path from  $(0, 0)$  to  $(3, 0)$  to  $(3, 2)$ . Is this force conservative?
6. A particle of charge  $3 \times 10^{-6}$  C is held in place at the origin. A second particle of charge  $2.4 \times 10^{-6}$  C is moved along the line  $y = 3$  m. Compute the work done on the moving charge when it is moved from infinity to the point  $(x, y) = (0, 3)$ . ( $k = 8.99 \times 10^9$  N m<sup>2</sup>/C<sup>2</sup>.)