Homework set 3, due Wed Jan 25

Please show your work. No credit is given for solutions without justification.

(1) Sketch the region of integration and evaluate by changing into polar coordinates
  (a)
$$\int\int (x^2 + y^2)\,dy\,dx; \quad -1 \le x \le 2, \quad 0 \le y \le \sqrt{4 - x^2}$$
  (b)
$$\int\int y(x^2 + y^2)^{-1}\,dA; \quad y \ge \frac{1}{2}, \quad x^2 + y^2 \le 1$$

(2) Let W be the region above the plane $z = 2$ and below the paraboloid $z = 6 - (x^2 + y^2)$.
  (a) Describe W in cylindrical coordinates.
  (b) Use cylindrical coordinates to compute the volume of W.

(3) Use spherical coordinates to find the volume of the region bounded below by the plane $z = 1$ and inside the sphere $x^2 + y^2 + z^2 = 4$.