

## The Use of Calculators Is Not Permitted On This Exam

1. Consider  $I = \int \int_R \sqrt{x^2 + y^2} dA$  where  $R$  is the region in the first quadrant bounded by  $y = x$ , the  $x$  axis and  $x^2 + y^2 = 4$ .

- Write  $I$  as an iterated integral or integrals (you may need more than one) with the order of integration first  $y$ , then  $x$ .
- Write  $I$  as an iterated integral or integrals with the order of integration first  $x$ , then  $y$ .
- Write  $I$  as an integral in polar coordinates.
- Evaluate  $I$ .

2. Find the area  $S$  of the portion of the surface  $z = x^2/2 + \sqrt{8}y$  which lies directly above the triangle with vertices  $(0, 0, 0)$ ,  $(4, 0, 0)$  and  $(4, 8, 0)$ .

3. Set up a triple integral for finding the volume  $V$  of the region in the first octant bounded above by the plane  $2x + y + z = 6$ , on the sides by the hyperbolic sheet  $xy = 4$  and below by the  $xy$  plane. Do not evaluate the integral.

4. A solid occupies the region in the first octant bounded above by the sphere  $x^2 + y^2 + z^2 = 4$ , below by the cone  $z = \sqrt{x^2 + y^2}$  and on the sides by the planes  $x = 0$  and  $y = 0$ . It has density  $\delta(x, y, z) = x^2 + y^2$ . Set up the integral for the moment  $M_{yz}$  of the solid about the  $yz$  plane:

- In rectangular coordinates.
- In cylindrical coordinates.
- In spherical coordinates.

DO NOT EVALUATE.

5. Compute  $I = \int \int_R y^2 dA$  where  $R$  is the region in the first quadrant bounded by the hyperbolas  $xy = 1$  and  $xy = 2$  and the lines  $y = x$  and  $y = 4x$  by making the change of variables  $x = u/v$ ,  $y = v$ . (Answer:  $I=9/4$ .)