

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

1. By reversing the order of integration, evaluate

$$\int_0^1 \int_{\sqrt{x}}^1 \sqrt{1+y^3} dy dx.$$

2. Set up a triple integral for finding the volume  $V$  of the solid bounded on the top by the plane  $z = y$ , on the bottom by the  $xy$  plane and on the sides by the plane  $x + y = 5$  and the hyperbolic sheet  $xy = 4$ . Do not evaluate the integral.
3. An object occupies the region bounded above by the sphere  $x^2 + y^2 + z^2 = 1$  and below by the cone  $z = \sqrt{x^2 + y^2}$  and has mass density

$$\delta(x, y, z) = z\sqrt{x^2 + y^2 + z^2}.$$

- (a) Find the mass of the object.  
(b) Find the center of gravity of the object.
4. Find the surface area  $S$  of the portion of the surface  $z = xy$  that is inside the cylinder  $x^2 + y^2 = 1$ .
5. Compute  $\int \int_D y dA$  where  $D$  is the region bounded by  $y = 2x$ ,  $x = 2y$  and  $x + y = 3$  by making the change of variables  $x = 2u + v$ ,  $y = u + 2v$ .