

1. [4 pts] Evaluate the double integral

$$\int_0^2 \int_{x^2}^4 \frac{x}{e^{y^2}} dy dx.$$

2. Consider the integral

$$\iint_D \frac{dx dy}{(x^2 + y^2)^{1/2}}$$

where  $D$  is the disk  $D = \{(x, y) \mid (x - 1)^2 + y^2 \leq 1\}$ .

- (a) [4 pts] Describe the region  $D$  in polar coordinates.

- (b) [4 pts] Evaluate the double integral.

3. Consider the double integral

$$\mathbf{I} = \int_1^2 \int_0^{\sqrt{2-y}} \frac{\sin(\pi x)}{1-x^2} dx dy$$

(a) [4 pts] Sketch the region of integration for  $\mathbf{I}$ .

(b) [4 pts] Express the integral  $\mathbf{I}$  as an iterated integral with the reversed order of integration.

(c) [4 pts] Determine the value of  $\mathbf{I}$ .

4. Consider the paraboloid  $z = x^2 + y^2$  and the plane  $2x + 2y + z = 2$ .
- (a) [4 pts] Approximately sketch the solid  $\mathcal{S}$  bounded by the paraboloid and the plane. The plane bounds  $\mathcal{S}$  from above and the paraboloid bounds  $\mathcal{S}$  from below.
- (b) [4 pts] Express the volume of  $\mathcal{S}$  as a double integral over a region in the  $xy$ -plane.
- (c) [3 pts] Compute the volume of  $\mathcal{S}$ .