

This is the second test: there are three pages and a total of 100 points. Read carefully the questions and write your answers neatly. Good Luck.

1. (15 points) Draw the region of integration and change the order of integration of the following double integral:

$$\int_0^1 \int_{x^2}^x f(x, y) dy dx.$$

2. (15 points) Draw the region of integration and change the order of integration of the following double integral:

$$\int_{-2}^2 \int_{x^2}^{8-x^2} f(x, y) dy dx.$$

3. Let R be the region

$$R = \{(x, y) \mid 4 \leq x^2 + y^2 \leq 9, -x \leq y \leq x, x \geq 0\}.$$

(a) (5 points) Draw the region.

(b) (10 points) Set up the integral in polar coordinates $\iint_R y dA$.

4. (15 points) Use spherical coordinates to set up the integral, which computes the volume of the solid inside $x^2 + y^2 + z^2 = 81$ and outside $z^2 = x^2 + y^2$.

5. (20 points) Compute the volume of the solid bounded by $z = 0$, $z = y$, $x^2 + y^2 = 9$ and $x^2 + y^2 = 16$. (Draw the region, or the volume of integration).

6. (15 points) Set up the double integral that gives the volume of the solid bounded by the surfaces $z = e^x$, $z = 0$, $x + y = 1$, $y - x = -1$, $x = 0$.