

**MATH 241 – CALCULUS III
THIRD MIDTERM EXAM**

Instructions. Answer each question on a separate answer sheet. Show all your work. Be sure your name, section number, and problem number are on each answer sheet, and that you have copied and signed the honor pledge on the first answer sheet. You may *not* use calculators, notes, or any other form of assistance on this exam.

(1) Evaluate the iterated integral: $\int_0^9 \int_{\sqrt{y}}^3 \sin(\pi x^3) dx dy$.

(2) Find the surface area of the portion of the parabolic sheet $z = x^2$ lying directly above the triangle with vertices $(0, 0, 0)$, $(1, 0, 0)$, and $(1, 1, 0)$.

(3) Find the volume of the solid region bounded above by the sphere $x^2 + y^2 + z^2 = 4$ and below by the cone $z^2 = x^2 + y^2$, $z \geq 0$.

(4) Use a change of variables to evaluate the integral

$$\iint_R \left(1 + \frac{x^2}{16} + \frac{y^2}{25}\right)^{3/2} dA$$

where R is the region inside the ellipse $\frac{x^2}{16} + \frac{y^2}{25} = 1$.

(5) What is the area of the largest rectangle that can be fit inside the ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$?