MATH 263A–EXAM 2A

NAME: DATE:

OSU EMAIL (name.#): RECITATION TIME:

1. The first part of the following question is independent of the other two.

   a. Change the order of integration in order to solve the following integral

$$\int_0^2 \int_{x^2}^4 x^3 \sin(y^3)\, dy\, dx. \qquad [10 \text{ pts}]$$

   b. Set up (but DO NOT SOLVE) a double integral that computes the surface area of the part of the plane $4x + 6y + 2z = 12$ in the first octant. [12 pts]

   c. Set up (but DO NOT SOLVE) a triple integral that computes the volume of the region in the first octant below the plane $4x + 6y + 2z = 12$. [9 pts]

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2. Let D be planar region bounded by the curves $x = 0$, $y = 0$ and $x^2 + y^2 = 9$ and having density (mass per area) given by $\rho(x, y) = (x^2 + y^2 + 1)^{-2}$.

a. Find the total mass of the region D. [12 pts]

b. Set up (but DO NOT SOLVE) expressions to find the center of mass of D (your answer may be in any coordinate system of your choosing). [8 pts]

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3. Consider the region E inside the sphere $x^2 + y^2 + z^2 = 12$, above the cone $z = \sqrt{\frac{x^2+y^2}{3}}$ in the first octant.

a. Set up (but DO NOT SOLVE) the integral that computes the volume of region E using spherical coordinates. [10 pts]

b. Set up (but DO NOT SOLVE) the integral that computes the volume of region E using cylindrical coordinates. [10 pts]

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4. Let S be the region in the uv-plane bounded by $u = 0$, $v = 0$, $u^2 + v^2 = 4$, $u^2 + v^2 = 9$. Also let $(x, y) = T(u, v) = (u^2 + v^2, u^2 - v^2)$.

a. Sketch the region $D = T(S)$ in the xy-plane (on your sketch include all of the equations of curves that bound D). **Hint:** D should be a polygon. [15 pts]

b. Compute $\left|\frac{\partial(x,y)}{\partial(u,v)}\right|$. [8 pts]

c. Use a change of variables to set up (but DO NOT SOLVE) the integral

$$\iint_D (x + y)\, dA$$

as an integral in the variables u and v. Your answer does NOT need to be an iterated integral (so you can write it using a dA or as an iterated integral using du and dv). [6 pts]