Sample Exam 3 **Math 208** **Fall 2009**

Name:______________________________ **Score:**__________

Instructions: Show your work in the spaces provided below for full credit. Use the reverse side for additional space, *but clearly so indicate.* You must clearly identify answers and show supporting work to receive any credit. Exact answers (e.g., π) are preferred to inexact (e.g., 3.14). Make all obvious simplifications, e.g., 0 rather than $\sin\pi$. Point values of problems are given in parentheses. Point values of problems are given in parentheses. Notes or text in *any* form not allowed. The only electronic equipment allowed is a calculator.

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(14) **1.** Evaluate the integral $I = \int_0^1 \int_0^{3-3x} \int_0^{3-3x-y} dz\, dy\, dx$.

(18) **2.** Sketch the region D over which the iterated integral I below is calculated. Then express the integral in the order $dy\, dz\, dx$ and write a formula for the average value of $f(x, y, z)$ over D in terms of iterated integrals. Do NOT evaluate any integrals.

$$I = \int_0^4 \int_0^1 \int_{2y}^2 f(x, y, z)\, dx\, dy\, dz.$$

(18) **3.** Sketch the region R in the plane bounded by the curves $y = 0$, $y^2 = 2x$, and $x + y = 4$ and use iterated integrals to write formulas for the area and the first moment of R about the x-axis (assume density $\delta = y^2$) in terms of iterated integrals. Do NOT evaluate any integrals. (Arithmetic check: second and third curves intersect at $(2, 2)$.)

(20) **4.** A solid D is bounded by the surfaces $z = 1$ and $z = \sqrt{x^2 + y^2}$. Sketch it and express the integral $I = \iiint_D f(x, y, z)\, dV$ as an iterated integral in both cylindrical and spherical coordinates. Use one of these to express the moment of inertia I_z about the z-axis of a solid occupying D with density function $\delta = z$ as an iterated integral. Do NOT evaluate it.

(16) **5.** Evaluate the line integral $\int_C 1\, ds$ where C has position vector $\mathbf{r}(t) = \left\langle \cos t, \sin t, \frac{2}{3}t^{3/2} \right\rangle$, $0 \leq t \leq 1$.

(14) **6.** Let C be the curve $y = x^2$ traversed from $(0,0)$ to $(1,1)$, and $\mathbf{F} = \langle x, y \rangle$ a vector field. Express the flow (i.e., work) of $\mathbf{F}$ along C as a line integral and evaluate it.