Department of Mathematics

Wisconsin Lutheran College

EXAM 3

MAT 223

Name ______________________________

November 14, 2007

- You have 50 minutes to complete the exam.
- Partial credit will be given so you must SHOW ALL OF YOUR WORK. Put all of your work and answers in the space provided. Scratch paper is not allowed.
- Place your books, notebooks, etc. on the floor. The only items on your desk should be this exam and pencil/eraser/pen. Calculators are not allowed.

Problem	Points	Points per part	Points Earned
True-False	10	2	
1	9		
2	9		
3	12		
4	12		
5	9		
6	12		
7	12		
8	15		
TOTAL	100		

I. True – False

T F a. Fubini's theorem provides conditions under which a multiple integral can be evaluated as an iterated integral.

T F b. The surface area element for a function $z = f(x, y)$ is $dS = \sqrt{1 + f_x^2 + f_y^2} dA$.

T F c. The moment of inertia of a point mass about a line is a measure of its tendancy to resist change in rotational motion.

T F d. Cylindrical coordinates are well suited for computing the volume of a cylinder.

T F e. The iterated integral $\int_0^1 \int_0^1 xydydx = \left(\int_0^1 xdx\right)\left(\int_0^1 ydy\right)$.

II. Applications

1. Evaluate $\int\int_R xy^2 \; dA$ where R is the triangle with vertices $(0, 0)$, $(1, 0)$, $(0, 1)$.

2. For the following integral, reverse the order of integration. *Do not integrate!*
$\int_0^1 \int_0^{\sqrt{x}} x \cos y \; dydx$.

3. Evaluate by converting to polar coordinates: $\int_0^a \int_0^{\sqrt{a^2-x^2}} x \; dydx$

4. Find the moment M_y of the rectangular planar lamina with vertices $(0, 0)$, $(1, 0)$, $(1, 1)$, $(0, 1)$ and density function $\rho(x, y) = x^2y$.

5. Compute the Jacobian $\frac{\partial(x,y)}{\partial(u,v)}$ where $x = 4u - 2v$ and $y = 5u + 2v$.

6. Find the surface area of $f(x, y) = 4x + 2y$ over the region bounded by $y = 0$, $y = x^3$, and $x = 1$.

7. Set up the triple integral for the volume of the upper half of the sphere $x^2 + y^2 + z^2 = 9$ in rectangular coordinates. *Do not integrate!* A sketch will help.

8. Use spherical coordinates to compute the volume of the cone which is bounded above by a sphere of radius 4 and which makes an angle of $\varphi = \frac{\pi}{3}$ with the z-axis. (Hint: $dV = \rho^2 \sin\varphi \ d\rho d\varphi d\theta$)