

MATHEMATICS 234-CALCULUS III-MIDTERM II

Tuesday, November 14, 2006

Instructor: Paul Milewski

NAME (print): _____

Instructions:

1. Write your name on each page.
2. Circle the name of your TA from the list below.

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3. Closed Book. Closed notes. No calculators.
4. Answer your questions on the exam paper. There are some extra pages in the back if you need them.
5. Show all your work. Partial credit is given only if your work is clear.
6. Time allowed: 75 minutes. GOOD LUCK!

1. _____(20)

2. _____(20)

3. _____(20)

4. _____(20)

5. _____(20)

Total. _____(100)

NAME (print): _____

1) Consider the bounded domain D in the first quadrant of the xy plane between the curves $y = x^3$ and $y = x^{1/3}$.

(a) Calculate the area of D . [10 points]

(b) If the domain D corresponds to a slab (lamina) with variable density $\rho(x, y) = xy$, what is the mass of the slab and what are the coordinates of its center of mass? [10 points]

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2) (a) Sketch the region of integration and evaluate the integral. [10 points]

$$\int_0^1 \int_0^{\sqrt{1-y^2}} \frac{1}{2x^2 + 2y^2 + 1} dx dy.$$

(b) Sketch the region of integration and evaluate the integral. [10 points]

$$\int_0^{\pi/4} \int_0^{\sec \theta} r^2 \cos \theta dr d\theta$$

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3) Consider the solid S in the first octant bounded by $y = 9 - x^2$, $2z + y = 10$, and the coordinate planes.

(a) Draw a sketch of the solid. [7 points]

(b) Write two different double integrals for the volume of S . [6 points]

(c) Compute the volume of S . [7 points]

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4) Sketch the surface [5 points] and find the area [15 points] of the part of the sphere $x^2 + y^2 + z^2 = a^2$ inside the circular cylinder $x^2 + y^2 = ay$ (written $r = a \sin \theta$ in polar coordinates) where $0 < a$.

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5) (a) Find the maximum and minimum values of $f(x, y) = \sqrt{x^2 + y^2}$ subject to the constraint that $x^2 - 2x + y^2 - 4y = 0$. [10 points]

(b) Sketch the constraint curve and, by explaining what $f(x, y)$ means, interpret geometrically your result in part (a). [10 points]

NAME (print): _____

SCRATCH WORK

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SCRATCH WORK