Name: _____

MATH 213 – Fall 2007

THIRD EXAM

This exam contains 10 problems, worth a total of 100 points.
For the first 6 problems I will give no partial credit, just fill your answers out in the table below.
For the last 4 problems write out complete solutions and circle or box your answers.
The use of books, calculators, cell phones, computers, notes, cheat sheets, and all similar aids is strictly prohibited.

SHOW YOUR WORK.

Problem	Your answer	Points
1	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	10
2	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	10
3	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	10
4	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	10
5	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	10
6	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	10
TOTAL		

Problem	Points	Score
1-6	60	
7	10	
8	10	
9	10	
10	10	
TOTAL	100	

This page is for scratch work.

Problem 1. (10 pts) Find the derivative of $f(x, y) = x \sin(xy)$ at $(1, \pi)$ in the direction of $\vec{i} + \vec{j}$.

A. $\langle 1, \pi \rangle$

B. $-\sqrt{2}\pi$

C. $2\vec{i} + \pi\vec{j}$

D. $-(1 + \pi)/\sqrt{2}$

E. None of the above

Problem 2. (10 pts) Find the tangent vector at the point $(e, 0, 1)$ to the path $\vec{r}(t) = \langle te^t, t \ln t, t^2 \rangle$.

A. $\langle e^t, \ln t, 2t \rangle$

B. $\langle 2e, 1, 2 \rangle$

C. $\langle 2, 2, 1 \rangle$

D. $\langle e, 0, 2 \rangle$

E. None of the above

Problem 3. (10 pts) Find the minimum value of

$$f(x, y) = x^2 + y^2 - xy - x + 2y + 1$$

A. $(-1, 0)$
B. 1
C. 0
D. -1
E. None of the above

Problem 4. (10 pts) $f(x, y) = x \ln(xy)$**. Use differentials and** $f(1, 1)$ **to approximate** $f(0.9, 1.2)$**:**
A. 0.1
B. -0.1
C. 0.2
D. -0.2
E. None of the above

Problem 5. (10 pts) Evaluate $\int_0^1 \int_0^x x^2 e^{xy} dy dx$.

A. 1
B. $(e/2) - 1$
C. e
D. $e^2 - 1$
E. None of the above

Problem 6. (10 pts) Find the centroid for the region

$$\{-1 \leq x \leq 1; y \leq 2 - 2x^2\}.$$

A. $(0, 4/5)$
B. 1
C. $(1, 0)$
D. $(0, 2/3)$
E. None of the above

Problem 7. (10 pts) Evaluate by changing to polar coordinates

$$\int_{-1}^{1}\int_{0}^{\sqrt{1-x^2}} \frac{1}{1+x^2+y^2}dydx$$

Problem 8. (10 pts) Reverse the order of integration in

$$\int_0^1 \int_0^{2x} (3x+1)dydx$$

Problem 9. (10 pts) Use spherical coordinates to compute the volume of the region between two spheres centered at the origin of radius 1 and 2, above the xy-plane, and below the cone of opening $\pi/4$ about the z-axis.

Problem 10. (10 pts) $f(x, y, z) = 2x^2 + y^2 + z^2 - xy$.
(a) Find the equation of a plane tangent to the level-surface $\{f(x, y, z) = 3\}$ **at the point** $P(1, 1, 1)$.

(b) Set the gradient of f **parallel to** $\vec{j}$ **and find the two points on the the ellipsoid** $\{f(x, y, z) = 3\}$ **where the tangent plane is parallel to the** xz**-plane.**