Name_____ ID_____ Section_____

MATH 253 Exam 1 Spring 2004

Sections 504-506 P. Yasskin

On the front of the Blue Book, on the Scantron and on this sheet
write your Name, your University ID, your Section and "Exam 1."
On the front of the Blue Book copy the Grading Grid shown at the right.
Enter your Multiple Choice answers on the Scantron
and CIRCLE them on this sheet.

1-8	/48
9	/15
10	/15
11	/15
12	/15
Total	/108

Multiple Choice: (6 points each. No part credit.)

1. Find the area of the triangle with vertices $A = (1,1,1)$, $B = (3,1,4)$ and $C = (2,0,3)$.

a. 1

b. $2\sqrt{3}$

c. $\sqrt{3}$

d. $\sqrt{14}$

e. $\frac{1}{2}\sqrt{14}$

2. Find the intersection of the line $\vec{r}(t) = (1+2t, 3+4t, 5+6t)$ and the plane $5x + 4y + 3z = 54$.

a. $(2,4,6)$

b. $(1,3,5)$

c. $(2,5,8)$

d. $(-2,4,-2)$

e. $(2,4,2)$

3. A satellite is orbiting from East to West directly above the equator. In which direction does the binormal $\hat{B}$ point?

a. North

b. South

c. Up

d. Down

e. West

4. Find the arclength of the parametric curve $\vec{r}(t) = (2t^2, t^2, t^3)$ between the points $(0,0,0)$ and $(2,1,1)$.

a. $\frac{1}{27}(29^{3/2} - 20^{3/2})$

b. $12(29^{3/2} - 20^{3/2})$

c. $12(56^{3/2} - 20^{3/2})$

d. $\frac{1}{12}(56^{3/2} - 20^{3/2})$

e. $\frac{1}{27}(56^{3/2} - 29^{3/2})$

5. If $f(x,y) = g(x)h(y)$, then

a. $f_{xy}(x,y) = g'(x)h'(y)$

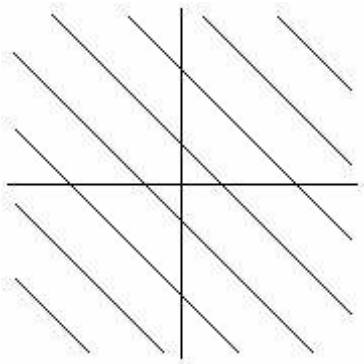
b. $f_{xy}(x,y) = g'(x)h(y) + g(x)h'(y)$

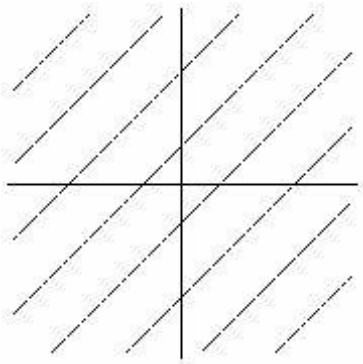
c. $f_{xy}(x,y) = g'(x)h(y) - g(x)h'(y)$

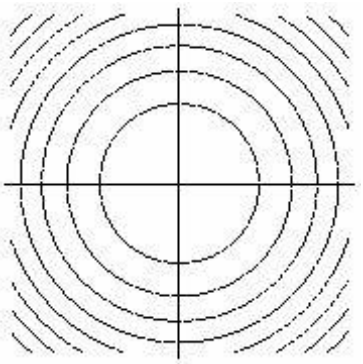
d. $f_{xy}(x,y) = g'(y)h(x) + g(y)h'(x)$

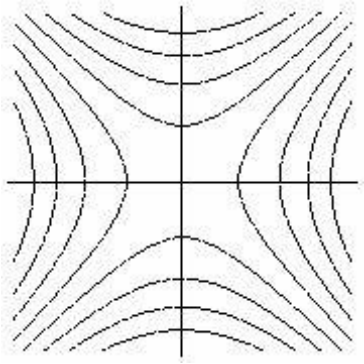
e. $f_{xy}(x,y) = 0$

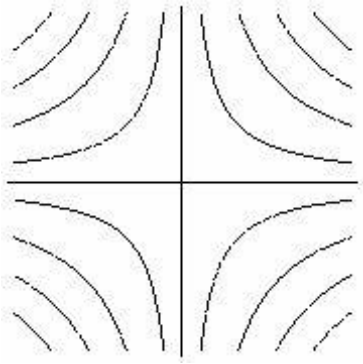
6. Which of the following is the contour plot of $f(x,y) = x^2 - y^2$?

a. 

b. 

c. 

d. 

e. 

7. If $g(x,y) = x^3\cos(xy)$, find $\dfrac{\partial g}{\partial x}$.

a. $3x^2\cos(xy) + x^3y\sin(xy)$

b. $3x^2\cos(xy) - x^3y\sin(xy)$

c. $-3x^2\sin(y)$

d. $-3x^2y\sin(xy)$

e. $-3x^2\sin(xy)$

8. If $g(x,y) = x^3\cos(xy)$, find $\dfrac{\partial^3 g}{\partial x \partial y^2}$.

a. $-5x^4\sin(xy) + x^5y\cos(xy)$

b. $5x^4\sin(xy) - x^5y\cos(xy)$

c. $-5x^4\cos(xy) + x^5y\sin(xy)$

d. $5x^4\cos(xy) - x^5y\sin(xy)$

e. $5x^4\sin(xy) + x^5y\cos(xy)$

Work Out: (15 points each. Part credit possible.)

Start each problem on a new page of the Blue Book. Number the problem. Show all work.

9. (15 points) Consider the two parametric lines $\vec{r}_1(s) = (s, 5-s, 6-2s)$ and $\vec{r}_2(t) = (4-2t, 2+t, 3-t)$.

a. Find the point where the two lines intersect.

b. Find the normal equation of the plane containing the two lines.

10. (15 points) Consider the function $f(x,y) = e^{xy}$.

a. Find the equation of the plane tangent to the graph of $z = f(x,y)$ at the point $\left(2, \frac{1}{2}\right)$.

b. Use the linear approximation to $f(x,y)$ to estimate $f(2.4, 0.6)$.
(Express the answer as a multiple of e.)

11. (15 points) The surface $xz^2 + z\cos y = \frac{15}{2}$ implicitly defines z as a function of x and y. Find $\frac{\partial z}{\partial y}$ at the point $(x,y,z) = \left(2, \frac{\pi}{6}, \sqrt{3}\right)$.

Note: $\sin\frac{\pi}{6} = \frac{1}{2}$ $\cos\frac{\pi}{6} = \frac{\sqrt{3}}{2}$

12. (15 points) Determine whether each of the following limits exists and say why or why not. If the limit exists, find it.

a. $\lim\limits_{(x,y)\to(0,0)} \dfrac{x^2y^2}{(x^2+y^2)^2}$

b. $\lim\limits_{(x,y)\to(0,0)} \dfrac{x^2y^3}{(x^2+y^2)^2}$