Name____________________ ID__________ Section_____

1-8	/64
9	/18
10	/18

MATH 253 Honors EXAM 1 Fall 2002

Sections 201-202 P. Yasskin

Multiple Choice: (8 points each)

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

a. $\dfrac{\sqrt{99}}{2}$

b. $\dfrac{75}{2}$

c. $\sqrt{99}$

d. 75

e. $\dfrac{\sqrt{75}}{2}$

2. A light ray travelling along the line $x = 2 - t$, $y = 3 + 2t$, $z = 4 - 2t$ strikes a mirror in the plane $x + y - z = 7$ at the point $(0,7,0)$. Find the angle of incidence, i.e. the angle between the tangent vector to the line and the normal to the plane.

a. $\arccos\left(\dfrac{1}{\sqrt{2}}\right)$

b. $\arccos\left(\dfrac{1}{2}\right)$

c. $\arccos\left(\dfrac{1}{\sqrt{3}}\right)$

d. $\arccos\left(\dfrac{\sqrt{3}}{2}\right)$

e. $\arccos\left(\dfrac{1}{3}\right)$

3. Find the arc length of the curve $\vec{r}(t) = \left(\frac{2}{3}t^3, t^2, t\right)$ for $0 \leq t \leq 1$.

HINT: Look for a perfect square.

a. $\frac{5}{6}$

b. 1

c. $\frac{5}{4}$

d. $\frac{5}{3}$

e. $\frac{5}{2}$

4. If a jet plane is travelling from East to West directly above the Equator, in which direction does the binormal $\hat{B}$ point?

a. North

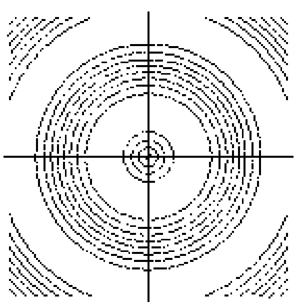
b. South

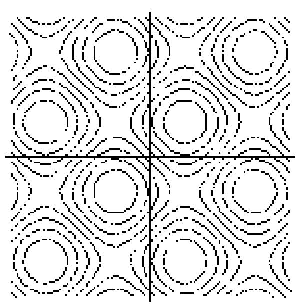
c. East

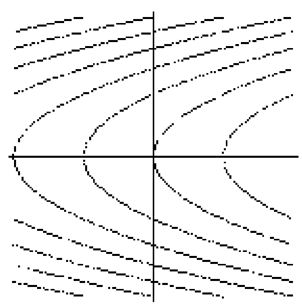
d. West

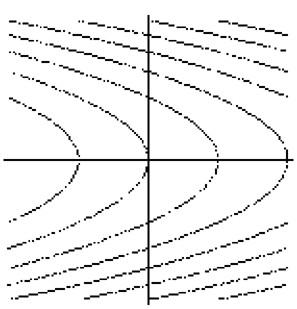
e. Down

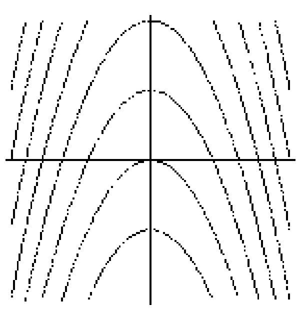
5. Which of the following is the contour plot of $z = x + y^2$?

a 

b 

c 

d 

e 

6. Compute the gradient of the function $f(x,y) = x^3 \cos 2y$ at the point $(x,y) = \left(2, \frac{\pi}{6}\right)$.

a. $\left(6, -8\sqrt{3}\right)$
b. $\left(6\sqrt{3}, -8\right)$
c. $\left(-6\sqrt{3}, 4\right)$
d. $\left(-6, 8\sqrt{3}\right)$
e. $\left(6, -4\sqrt{3}\right)$

7. Find the equation of the plane tangent to the graph of $z = xy^2$ at the point $(x,y) = (2,1)$.

a. $z = x + 4y - 6$
b. $z = x + 4y - 4$
c. $z = -x - 4y + 2$
d. $z = -x - 4y + 6$
e. $z = -x - 4y + 8$

8. If $g(3,4) = 7$ and $\frac{\partial g}{\partial x}(3,4) = 0.5$ and $\frac{\partial g}{\partial y}(3,4) = -0.2$, estimate $g(2.8, 4.3)$.

a. $.16$
b. $.54$
c. 7.16
d. 7.54
e. 6.84

9. (18 points) Suppose $f = \frac{xz}{y}$ where $x = x(u,v)$, $y = y(u,v)$ and $z = z(u,v)$.

Further suppose $x(1,2) = 4$, $y(1,2) = 6$, $z(1,2) = 3$ and

$\frac{\partial x}{\partial u}(1,2) = 3$, $\frac{\partial y}{\partial u}(1,2) = -2$, $\frac{\partial z}{\partial u}(1,2) = 5$, $\frac{\partial x}{\partial v}(1,2) = 4$, $\frac{\partial y}{\partial v}(1,2) = 3$, $\frac{\partial z}{\partial v}(1,2) = -3$

Compute $\frac{\partial f}{\partial v}(1,2)$.

10. (18 points) Find the point in the first octant on the graph of $xy^2z^3 = 2$ which is closest to the origin.