Name____________________ ID____________ Section______

MATH 253 Honors EXAM 3 Fall 2002

Sections 201-202 P. Yasskin

1-4	/40	7	/15
5	/15	8	/15
6	/15	E.C.	/10

Multiple Choice: (10 points each) Work Out: (15 points each) Extra Credit: (10 points)

1. If $\vec{\nabla} \times \vec{F} = (2x^2y - x^2, y^2 - 2xy^2, 2xz - 2yz)$, then $\vec{\nabla} \cdot \left(\vec{\nabla} \times \vec{F}\right) =$

a. $(4xy - 2x, 4xy - 2y, 2x - 2y)$
b. $(4xy - 2x, 2y - 4xy, 2x - 2y)$
c. $8xy - 4y$
d. 0
e. $2x^2 - 2y^2$

2. If $\vec{\nabla} \times \vec{F} = (2x^2y - x^2, y^2 - 2xy^2, 2xz - 2yz)$, then $\vec{\nabla} \times \left(\vec{\nabla} \times \vec{F}\right) =$

a. $(4xy - 2x, 4xy - 2y, 2x - 2y)$
b. $(4xy - 2x, 2y - 4xy, 2x - 2y)$
c. $(-2z, -2z, -2x^2 - 2y^2)$
d. $(-2z, 2z, -2x^2 - 2y^2)$
e. $-2x^2 - 2y^2$

3. If $\vec{G} = (2x^2y - x^2, y^2 - 2xy^2, 2xz - 2yz)$, then $\vec{G} = \vec{\nabla} g$ where $g(0,1,1) - g(0,1,0) =$

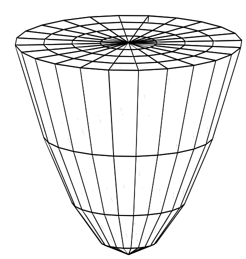
a. -2
b. -1
c. 0
d. 1
e. The scalar potential g does not exist.

4. Compute $\oint (y+z)\,dx + (x+z)\,dy + (x+y)\,dz$ clockwise around the circle $x^2 + y^2 = 9$ with $z = 5$.
HINT: Use a theorem.

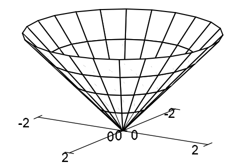
a. -18π
b. -9π
c. 0
d. 9π
e. 18π

5. Compute $\oint_{\partial T} (xy)\,dx + (xy)\,dy$ counterclockwise around the boundary of the triangle with vertices $(0,0)$, $(1,0)$ and $(0,2)$.

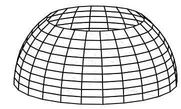
6. Compute $\iint_{\partial P} \vec{E} \cdot d\vec{S}$ for $\vec{E} = (xz, yz, z^2)$ over the **complete** surface of the solid paraboloid P given by $x^2 + y^2 \le z \le 4$ with outward normal.



7. The cone $z = \sqrt{x^2 + y^2}$ for $z \le 2$ is shown at the right. Find the mass and center of mass of the cone if its surface density is given by $\delta = x^2 + y^2$.



8. Compute $\iint_S \vec{\nabla} \times \vec{F} \cdot d\vec{S}$ for $\vec{F} = (x^2 y, -x^3, z^2)$



over the piece of the sphere $x^2 + y^2 + z^2 = 25$

for $0 \le z \le 4$ with normal pointing away from the z-axis.

Hint: Parametrize the upper and lower edges.

Extra Credit Redo #8 but compute $\iint_S \vec{\nabla} \times \vec{F} \cdot d\vec{S}$ directly as a surface integral.