Test #1 100 points Math 200 Name:____________________________________

Show work

1) Let $\vec{a} = \langle 1,2,1 \rangle$ and $\vec{w} = \langle 2,2,1 \rangle$. (15 points)

A) Find the work done by the force $\vec{a}$ on a particle as it is displaced along the vector $\vec{w}$.

B) Find the plane parallel to $\vec{a}$ and $\vec{w}$ that passes through the origin. Use ax + by + cz = d form for your answer.

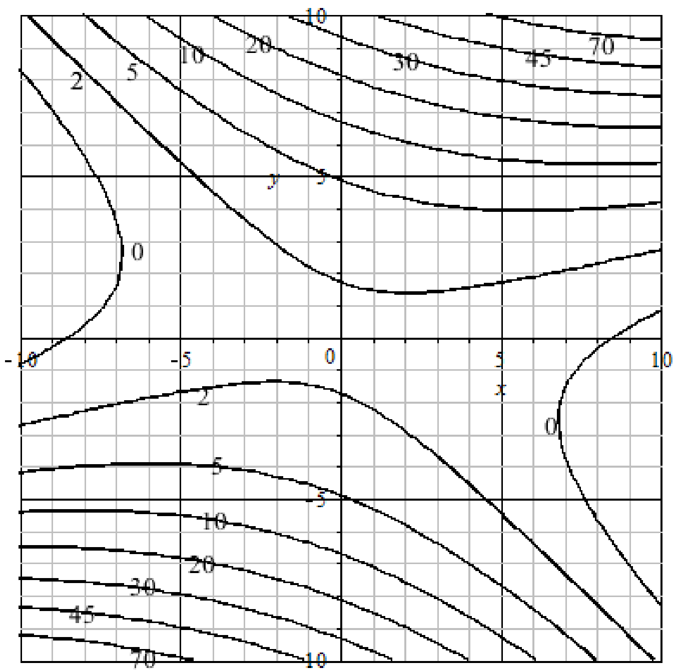
C) Find the area of the triangle determined by $\vec{a}$ and $\vec{w}$.

D) Find the flux of the force $\vec{F} = \langle 1,2,5 \rangle$ through the parallelogram determined by $\vec{a}$ and $\vec{w}$ and oriented from $\vec{a}$ to $\vec{w}$ by the right hand rule.

E) Find the projection of $\vec{a}$ on $\vec{w}$.

2) Find a parameterization for the circle that is oriented counterclockwise and lies in the plane z = 5 with radius 2 centered at (2, 5, 5). (5 points)

3) Use the contour plot of f(x, y) to estimate $f_x(5,-5)$ and $f_y(4,5)$. Show work and draw the appropriate segments on the contour plot. (8 points)



4) Find all first and second partial derivatives of $f(x,y)=\sin(x^2 y)$. (8 points)

5) Find the equation of the plane determined by the points $P=(0,1,-1)$, $Q=(2,1,3)$, and $R=(-1,2,0)$.
Write your final answer in ax + by + cz = d form. (8 points)

6) Convert the rectangular coordinates of a point P = (1, 1, 1) to cylindrical and spherical coordinates.
(8 points)

7) What is the cosine of the angle between the planes x - y + z = 6 and x + y + z = 2? (4 points)

8) Sketch $z + y^2 = x^2$. Label the axes so that the orientation is positive. (5 points)

9) Suppose the path of a particle parameterized by $\vec{r}(t)$ has the property that $\vec{v}(t) \cdot \vec{v}(t) = 3$ for all values of t. Use the product rule to prove that $\vec{v}(t)$ and $\vec{a}(t)$ are perpendicular for all values of t. (5 points)

10) Find an integral that represents the work done by the force $\vec{F}(x, y, z) = \langle z, x, y \rangle$ on a particle that moves on the helix parameterized by $\vec{r}(t) = \langle \cos t, \sin t, 3t \rangle$ from $t = 0$ to $t = 2\pi$, and then **evaluate the integral**.
(8 points)

11) Find an integral that represents the mass of the wire that lies on the line from (1, 1, 1) to (3, 5, 7) if its linear density is $\delta(x, y, z) = 8x$ grams/cm, and then **evaluate the integral.** (8 points)

12) Evaluate I = $\int_C (2x - 3y)\,dx + x\,dy$ if C is the curve that moves from $(-2, 4)$ to $(2, 4)$ on the path $y = x^2$.
(8 points)

13) The curve C is parameterized by $\vec{r}(t) = \langle \cos(2t), \sin(2t), t \rangle$.

13A) Find the curvature of C when $t = \frac{\pi}{2}$. (5 points)

13B) What is the length of C from $\vec{r}(0)$ to $\vec{r}(\pi)$? (5 points)