NAME:________________________________ ID:_________ SECT:__

MA 174 EXAM 2

SPRING 2003

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UNSUPPORTED WORK MAY NOT RECEIVE CREDIT

YOU MAY USE ANY SIMPLE SCIENTIFIC CALCULATOR

1. Find all the local maxima, local minima, and saddle points of the function $f(x,y) = 4xy - x^4 - y^4$.

A) (1,1), (0,0) minima, (-1,-1) maxmum
B) (1,1), (-1,-1) maxima, (0,0) sad pt
C) (1,1), (-1,-1), (0,0) all maxima
D) (1,1), (-1,-1) minima, (0,0) sad pt
E) None of these.

2. Find the equations given by the method of Lagrange Multipliers for the problem of finding the points nearest to and farthest from the origin of the graph of $x^2 + xy + y^2 = 1$.

A) $2x + y = 2y\lambda, x + 2y = 2x\lambda, x^2 + xy + y^2 = 1$
B) $2x + y = -2y\lambda, x + 2y = 2x\lambda, x^2 + xy + y^2 = 1$
C) $-2x + y = 2x\lambda, x + 2y = -2y\lambda, x^2 + xy + y^2 = 1$
D) $2x + y = 2x\lambda, x + 2y = 2y\lambda, x^2 + xy + y^2 = 1$
E) None of these.

3. If $w = x^2 + y - z + \sin(t)$ and $x + y = t$, find $(\frac{\partial w}{\partial y})_{z,t}$.

A) $1 - 2x$
B) 0
C) $y + 2z$
D) $3t - y$
E) None of these.

4. *CALCULATE* $\int_{x=0}^{1}\int_{y=0}^{1}\int_{z=0}^{x}(x^2+yz)\,dz\,dy\,dx$.

A) 0
B) 1/2
C) 1/3
D) 8/3
E) None of these.

5. Use Taylor's formula for $f=\sin(x)\,\sin(y)$ at the origin to find a cubic approximation of f near the origin.

A) $y-y^3/6$
B) xy
C) $x-x^3/6+y-y^3/6$
D) $xy-xy^3/6-yx^3/6$
E) None of these.

6. Let $\int\int\int_V f(x,y,z)\,dv$ be $\int_{y=0}^{1}\int_{z=0}^{1}\int_{x=0}^{1-z} f(x,y,z)\,dx\,dz\,dy$. *EXPRESS* the integral with order of integration given by $dz\,dy\,dx$ by filling in the boxes below. (Include a sketch of the region.)

ANS: $\int_{x=\boxed{}}^{\boxed{}}\int_{y=\boxed{}}^{\boxed{}}\int_{z=\boxed{}}^{\boxed{}} f(x,y,z)\,dz\,dy\,dx$

IN THE THREE PROBLEMS BELOW ON THIS PAGE THE REGION D IS *the portion in the first octant* of the part above the plane $z = 1$ of the sphere of radius 2 with center at the origin.

7. *EXPRESS* the volume of D in CARTESIAN COORDINATES.

ANS: $V = \int_{x=\square}^{\square} \int_{y=\square}^{\square} \int_{z=\square}^{\square} \boxed{} \, dz\, dy\, dx$

8. *EXPRESS* the volume of D in CYLINDERICAL COORDINATES.

ANS: $V = \int_{\theta=\square}^{\square} \int_{r=\square}^{\square} \int_{z=\square}^{\square} \boxed{} \, dz\, dr\, d\theta$

9. *EXPRESS* the volume of D in SPHERICAL COORDINATES.

ANS: $V = \int_{\theta=\square}^{\square} \int_{\phi=\square}^{\square} \int_{\rho=\square}^{\square} \boxed{} \, d\rho\, d\phi\, d\theta$

10. *EXPRESS* the line integral $\int_C (xy)\,ds$ as an (ordinary) integral involving the parameter t, where C is the parametrized curve $\mathbf{R} = 2\cos(t)\mathbf{i} + 2\sin(t)\mathbf{j} + t\mathbf{k}$ for $-\pi \le t \le \pi$.

ANS: $W = \int_{t=\boxed{}}^{\boxed{}} \boxed{}\, dt$

11. *CALCULATE* the work W done against a force $\mathbf{F} = -y\mathbf{i} + x\mathbf{j} + 2\mathbf{k}$ moving along the parametrized curve C given by $\mathbf{R} = (-2\cos(t))\mathbf{i} + (2\sin(t))\mathbf{j} + 2\mathbf{k}$, $0 \le t \le 2\pi$.

A) 8π
B) 4π
C) 2π
D) π
E) None of these.

12. Let V be a solid sphere of radius 1 with center (0,0,1) and which has density δ which is NOT constant. *EXPRESS* the *MOMENT OF INERTIA ABOUT THE Y AXIS.*

ANS: $V = \int_{x=\boxed{}}^{\boxed{}} \int_{y=\boxed{}}^{\boxed{}} \int_{z=\boxed{}}^{\boxed{}} \boxed{}\, dz\, dy\, dx$