MATH 232 FINAL EXAM Spring, 2007

Name & ZID: ______________________________

(10 pts.) 1. Find the points on the curve $x = 2\sin\theta,\ y = \cos\theta$ where the tangent is horizontal or vertical.

(15 pts.) 2. Find the area of the region that lies inside the curve $r = 4\cos\theta$ and outside the curve $r = 2$.

(10 pts.) 3. A parallelogram has vertices $P(1,0,-3)$, $Q(2,1,0)$ and $R(4,2,2)$. Find the area of this parallelogram.

(15 pts.) 4. Find parametric and symmetric equations for the line through the points $(1,2,3)$ and $(4,6,8)$.

(15 pts.) 5. Find the velocity and position vectors of a particle with acceleration $\boldsymbol{a}(t) = -9\boldsymbol{k}$, initial velocity $\boldsymbol{v}(0) = \boldsymbol{i}+\boldsymbol{j}\text{-}\boldsymbol{k}$ and initial position $\boldsymbol{r}(0) = 2\boldsymbol{j}$.

(15 pts.) 6. Find the limit, if it exists, or show that the limit does not exist.

(a) $\displaystyle\lim_{(x,y)\to(0,0)} \frac{xy}{2x^2+3y^2}$

(b) $\displaystyle\lim_{(x,y)\to(0,0)} \frac{x^4-y^4}{x^2+y^2}$

(15 pts.) 7. Find the linear approximation (linearization) of $f(x, y) = \sqrt{10 - x^2 - 2y^2}$ at $(1, 2)$ and use it to approximate $f(.9, 2.1)$.

(15 pts.) 8. Find the local maximum and minimum values and saddle point(s) of the function $f(x, y) = 2x^3 + xy^2 + 5x^2 + y^2$.

(15 pts.) 9. Find the surface area of the part of the sphere $x^2 + y^2 + z^2 = 4$ that lies above the plane $z = 1$.

(15 pts.) 10. Evaluate $\iiint_E dV$, where E is the region in the first octant bounded by the plane $x + 2y + z = 2$.

(15 pts.) 11. Use the transformation $u = x - 3y$, $v = 3x - y$ to evaluate $\iint_R 4x - 4y\,dA$, where R is the parallelogram enclosed by the lines $x = 3y,\ x - 3y = 1,\ 3x = y,\ 3x - y = 2.$

(15 pts.) 12. Evaluate the line integral $\int_C xy^3\,ds$, where C is given by $x = 4\sin t$, $y = 4\cos t$, $z = 3t$, $0 \le t \le \pi/2$.

(15 pts.) 13. Evaluate $\int_C (3x^2+y)\,dx+(x+2y)\,dy$, where C is the upper half of the circle $x^2+y^2=1$, starting at $(-1,0)$ and ending at $(1,0)$.

(15 pts.) 14. Use Green's Theorem to evaluate $\displaystyle\int_C (\sqrt{x}+y)\,dx+(3x+\sin y)\,dy$, where C consists of the arc of the curve $y=\cos x$ from $(-\pi/2,0)$ to $(\pi/2,0)$ and the line segment from $(\pi/2,0)$ to $(-\pi/2,0)$.