pages	1	2 − 3	4 − 5	6 − 7	8 − 9	10 − 11	*total*
scores							

Exam #1, October 15, Calculus III, Fall, 2008, W. Stephen Wilson

I agree to complete this exam without unauthorized assistance from any person, materials or device.

Name: ______________________________ Date: ______________

TA Name and section: ______________________

NO CALCULATORS, NO PAPERS, SHOW WORK. (22 points total)

1. (1 point) Let $f : R^3 \to R$ be given by $f(x, y, z) = x^3 + y^3 + z^3$. Compute the gradient of f.

2. (1 point) Let $f : R^3 \to R$ be given by $f(x, y, z) = x^3 + y^3 + z^3$. Compute the Laplacian of f.

3. (1 point) Let $F : R^3 \rightarrow R^3$ be given by $F(x, y, z) = (x^3, y^3, z^3)$. Compute the divergence of F.

4. (1 point) Let $F : R^3 \rightarrow R^3$ be given by $F(x, y, z) = (x^3, y^3, z^3)$. Compute the curl of F.

5. (1 point) Let $c : R \to R^3$ be given by $c(t) = (t^3, t^3, t^3)$. Compute the tangent line to c at the point $t = 1$.

6. (1 point) Let $c : R \to R^3$ be given by $c(t) = (t^3, t^3, t^3)$. Compute the length of the curve between $t = 0$ and $t = 1$. Do this by setting up and evaluating the integral.

7. (2 points) Let $f : R^3 \to R^2$ be given by $f(x, y, z) = (x^3 + y^3 + z^3, x + y + z)$. Compute the derivative of f at the point $(1, 1, 1)$.

8. (2 points) Let $f : R^3 \to R$ be given by $f(x, y, z) = x^3 + y^3 + z^3$. Let x, y, and z be functions of t such that $x(0) = y(0) = z(0) = 1$ and $x'(0) = 1$, $y'(0) = 2$, and $z'(0) = 3$. Compute df/dt at $t = 0$.

9. (2 points) Let $f : R^3 \to R$ be given by $f(x, y, z) = x^3 + y^3 + z^3$. Compute the directional derivative of f in the direction $(1, 1, 1)$ at the point $(1, 1, 1)$.

10. (2 points) Give an equation for the tangent plane of the graph of the function $f(x, y) = xy$ at the point $(1, 1)$.

11. (2 points) Give an equation for the tangent plane for the surface given by $x^3 + y^3 + z^3 = 3$ at the point $(1, 1, 1)$.

12. (2 points) Find all points on the surface given by $x^2 + y^2 - z^2 = 4$ that are closest to the origin. Use Lagrange multipliers.

13. (2 point) Consider the function $f : R^2 \to R$, $f(x, y) = sin(x)cos(y)$. There are an infinite number of critical points. Find the two critical points closest to the origin with $x \geq 0$ and $y \geq 0$.

14. (2 points) Calculate the second order Taylor approximation for the two critical points in the previous problem and determine whether each is a local maximum, minimum or saddle point.