Exam 1 **Math 208** **Fall 2007**

Name:_____ **Score:**_____

Instructions: Show your work in the spaces provided below for full credit. Use the reverse side for additional space, *but clearly so indicate.* You must clearly identify answers and show supporting work to receive any credit. Exact answers (e.g., π) are preferred to inexact (e.g., 3.14). Point values of problems are given in parentheses. Notes or text in *any* form not allowed. The only electronic equipment allowed is a calculator.

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(10) **1.** Given vectors $\mathbf{a} = \mathbf{i} - \mathbf{j} + 4\mathbf{k}$ and $\mathbf{b} = 5\mathbf{i} + \mathbf{j}$, find
$\mathbf{a} \times \mathbf{b}$ and $\|\mathbf{a} \times \mathbf{b}\|$.

(15) **2.** Given points $P = (1, 2, 1)$, $Q = (0, 1, -1)$ and vector $\mathbf{a} = \mathbf{i} - \mathbf{j} + 4\mathbf{k}$, find the following:
(a) Parametric equations for a line through the point P and parallel to $\mathbf{a}$.
(b) Equation of a plane with normal vector $\mathbf{a}$ and passing through P.
(c) Distance from the point Q to the plane in part (b).

(10) **3.** Identify this surface and roughly sketch it using traces: $x + y^2 + z^2 = 2$.

(20) **4.** Let $z = f(x, y) = x^4 - 3x^2y^3 + 5y$.
(a) Compute all first and second partials of $f(x, y)$, and the (total) differential dz.
(b) Find an equation for the tangent plane to the surface $z = f(x, y)$ at the point where $x = 1$ and $y = -2$ and give a normal vector to this plane.
(c) Use the linear approximation (or total differential) and $f(1, -2)$ to approximate $f(0.9, -1.9)$

(10) **5.** Find all points of continuity (with reasons) for the function

$$f(x, y) = \begin{cases} 0, & \text{if } (x, y) = (0, 0) \\ \frac{3xy}{x^2+2y^2}, & \text{otherwise.} \end{cases}$$

(20) **6.** Let $f(x, y, z) = 2xy + z^2 - yz$.
(a) Find $\bigtriangledown f(-1, 1, 2)$.
(b) Find the directional derivative of f in the direction of the vector $\langle 2, 0, -1 \rangle$ at the point $(-1, 1, 2)$.
(c) Find an equation for the tangent plane to the surface $f(x, y, z) = 0$ at the point $(-1, 1, 2)$.

(15) **7.** Given a function $f(x, y)$ with all continuous partials and $x = r\cos\theta$ and $y = r\sin\theta$, find $\partial f/\partial r$ and $\partial f/\partial\theta$ in terms of f, r, θ and their partials.