Sample Exam 1 **Math 208** **Fall 2009**

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). Make all obvious simplifications, e.g., 0 rather than $\sin \pi$. Point values of problems are given in parentheses. Point values of problems are given in parentheses. Notes or text in *any* form not allowed. The only electronic equipment allowed is a calculator.

---

(15) **1.** Given points $P = (1, -1, 2)$, $Q = (2, 0, -1)$, $R = (0, 2, 1)$, $\mathbf{a} = \overrightarrow{PQ}$ and $\mathbf{b} = \overrightarrow{PR}$.

(a) Find $\mathbf{a} \times \mathbf{b}$ and $|\mathbf{a} \times \mathbf{b}|$.

(b) Equation of the plane containing P, Q and R.

(c) Parametric equations for a line through the point P and parallel to $\mathbf{a}$.

(15) **2.** Let $f(x, y) = y/x^2$.

(a) Find the domain and range of f. Are these sets open or closed?

(b) Describe the contour curves of f and plot three of them.

(c) At what points is $f(x, y)$ differentiable?

(17) **3.** Find the directional derivative of $f(x, y, z) = xy+yz+zx$ in the direction of $\mathbf{A} = \langle 3, 6, -2\rangle$at the point $P_0\,(1, -1, 2)$. In what direction from P_0 is the rate of greatest decrease of f greatest?

(18) **4.** (c) Let $f\,(x, y, z) = x^3z - 2yz^2 - 2z$. Find equations for the normal line and tangent plane to the surface $f(x, y, z) = 36$ at the point $(2, -1, 3)$.

(10) **5.** Given a function $w = h(x, y, z)$ with $x = f(u, v)$, $y = g(u, v)$ and $z = k(u, v)$, write a chain rule formula for $\partial f w/\partial u$ and $\partial w/\partial v$.

(25) **6.** Let $f(x, y) = \sqrt{x^2 - y^2}$.
(a) Compute the total differential of this function.

(b) Use the differential to estimate the largest possible error in computing $f(x, y)$ at $x = 5$ and $y = 3$, given that the error in x could be as large as 0.4 and the error in y could be as large as 0.2.

(c) Compute the linearization $L(x, y)$ of f at $(5, 3)$ and use it to approximate $f(5, 2)$.